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CHAPTER-1 : LOGICAL REASONING

CHAPTER-II : DATA INTERPRETATION

Syllabus _____

B.Sc. I
GENERAL MENTAL ABILITY
(H-305)

Unit–I : General Mental Ability–I (Logical Reasoning)

Analogies, similarities, differences, Spatial visualization, spatial orientation. Visual memory, observation discrimination.

Unit–II : General Mental Ability–II (Numerical Ability)

Simple arithmetical computation involving numbers, number series, decimals, fraction, percentage, ratio and proportion, averages, interest, profit and loss, discount, time & distance, ratio & time, Arithmetical reasoning Mensuration.

Unit–III : General Mental Ability–III (Data Interpretation)

Tables and graphs. Simple statistical analysis for drawing conclusions from information presentation in statistical graphical or diagramatic form and to interpret them.

Unit–IV : General Mental Ability–IV (Analytical Ability)

Relationship concepts, verbal and figure classification, non-verbal series. Coding and decoding, Statement conclusion, syllogistic reasoning, abstract ideas. Sense of order or magnitude, Prediction for solution to real life problems. Alternative computation procedure.

CHAPTER

I

LOGICAL REASONING

Knowledge of a subject is said to be systematic and scientific when the different parts of knowledge are related together in a particular way to make a system. This particular way of relationship between the elements, objects or subjects leads our mind towards the formulation of thoughts which is expressed in language. This process is known as logic. So, logic can be defined as the science of thought. Reasoning is the function of the mind passing through known to unknown by establishing a systematic relationship between the elements. Logic is always concerned with reasoning as expressed in language and with certain subsidiary process of transition. If we combine the terms Logic and Reasoning as expressed above we can define logical reasoning as the process of knowledge, involving transition from known to unknown.

CHAPTER

1

ANALOGY (SIMILARITY)

STRUCTURE

* Analogy
* Rules for Analogy
* Kinds of Relationship
□ Test Yourself
* Alphabet Analogies
□ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
* Questions based on analogy for practice.
* Rules of alphabet analoges and questions for practic based on it.
* Qustions based on relationship for practice.

• 1.1. ANALOGY

Analogy literally means similarity, bearing a resemblance. An analogy expresses a similarity or the relationship of things to one another.

The analogy questions help you to see a relationship between words and to apply it to other words. Some may consider it to be a test of vocabulary but actually it judges the ability to think clearly and to side-step confusion.

"OR

Analogy questions ask you to determine the relationship between a pair of words and then recognize a similar or parallel relationship between a different pair of words. You are given one pair of words and must choose from the five answer choices another pair that is related in the same way. The relationship between the words in the original pair will always be specific and precise, as will the relationship between the words in the correct answer pair.

• 1.2. RULES FOR ANALOGY

In dealing with an analogy question, an analysis must be made of the established relationship between the pair of word or alphabets. The following steps may be kept in mind :

1. Analyse the relationship between the question pair.

2. Look among the given alternatives for the pair of words with a similar relationship.

3. If more than one pair of words seem to fit, return to the question pair.

4. Refine and expand the relationship in the question pair.

5. Eliminate answers that do not appear to be the best answer.

6. For clarification always return to the question pair.

Note : *Always remember that parts of speech must be the same in the related words/phrases.*

• 1.3. KINDS OF RELATIONSHIP

Working with verbal relationships in vowels a kind of reasoning similar to mathematical thinking. There are many possibilities in establishing a relationship. Some of the more common ones are briefly illustrated here.

1. *Purpose relationship.* Example-Glove : Ball as :
   (a) Hook : Fish
   (b) Winter : Weather
   (c) Game : Pennat
   (d) Stadium : Seats

   The purpose of *glove* is to help in catching the ball and the purpose of *hook* is to eatch *fish.* So correct answer is (a).

2. *Cause and effect relationship.*
   GERAM : DISEASE as :
   (a) Carelessness : Accident
   (b) Brake : Car
   (c) Insect : Grasshopper
   (d) Dog : Bark

   Germ is the cause of disease or disease is the effect of a germ. Similarly carelessness is the cause of accident. So choice (a) is correct.

3. *Part—Whole relationship.* Example : Snake : Reptile *as :*
   (a) Patch : Thread
   (b) Removal : Snow
   (c) Struggle : Wrestle
   (d) Hand : Clock

   (d) is the correct answer, *Reptile* constitutes a class and *snake* is one of them. Similarly *hands* of a clock are a part of it.

4. *Actions to object an dobject to Action relationship.* Example :
   Kick : Football
   (a) Kill : Bomb
   (b) Break : Pieces
   (c) Question : Team
   (d) Smoke : Pipe

   Kick shows actions and *Football* the object of action. This very relationship is represented in (d) i.e., *smoking* is action and *pipe* is the object. For *B* answer is (a).

5. *Place relationship.* Example, Red Ford : Delhi as :
   (a) Red Square : Moscow
   (b) Albany : New York
   (c) India : Madras
   (d) Pakistan : Nepal

   Red Fort is situated in New Delhi so is Albany in New York.

6. *Degree relationship.* Example — Warm : Hot as
   (a) Glue : Paste
   (b) Climate : Weather
   (c) Bright : Genius
   (d) Frown : Anger

   Warm is less *hot* and *frown* is less *anger.*

7. *Association relationship.* Example – Devil : Wrong as :
   (a) Colour : Sidewalk
   (b) Slipper : State
   (c) Ink : Writing
   (d) Picture : Bed

   As *devil* is associated with wrongs so *ink* is associated with *writing.*

8. *Grammatical relationship.* Example – Restore : Climb as :
   (a) Segregation : Seen
   (b) Nymph : In
   (c) Room : Although
   (d) Run : See

   Restore and *Climb* are verbs so are *Run* and *See.*

9. *Procedure and product relationship. Consider the given example :*
   ARCHITECT : BUILDING
   (a) Producer : Distributor
   (b) Consumer : Goods
   (c) Civil Engineer : Dam
   (d) Demand : Supply

   A building is the creation of an architect. Similarly, a dam is the product of a civil engineer.

10 *Worker and tool relationship. Consider the example :*

Carpenter	:	Saw
Writer	:	Pen
Blacksmith	:	Halmer

• 1.4. ALPHABET ANALOGIES

Introduction : *There* exist certain types of relationship between the alphabets even if they are jumbled together. Observing the pattern of alphabets in a set of letters, the candidate should try to establish the same pattern or relationship among the required questions. For example :

KILM : MILK :: EAMK : ?

(a) KAME	(b) MAKE
(c) EMKA	(d) MEKA

The relationship between KILM and MILK is that the first letter becomes the last letter, while IL remains constant in both the cases. If we interchange the position of first and last letter in EAKM; it will read MAKE. So (b) is correct.

Rules of alphabet analogies : Some of the common factors are denoted over here:

(1) The letters in each group may have the same number of intervening letters of the alphabet left out.

(2) The letters may be consonants followed by voewls or *vice-versa*.

(3) The letters may be in a pattern which reverse their position in the alphabetical order.

In any case, keep the alphabet and its respective order in your mind.

• TEST YOURSELF

Directions : Each of the following analogy questions presents a related pair of words linked by a colon. Five lettered pairs of words follow the linked pair. Choose the lettered pair of words whose relationship is most like the relationship expressed in the original linked pair.

1. MASON : WALL ::
   - (a) Artist : easel
   - (b) wood : splinters
   - (c) water : waves
   - (d) regret : melancholy
   - (e) event : memories
2. FIRE : ASHES ::
   - (a) accident : delay
   - (b) wood : splinters
   - (c) water : waves
   - (d) regret : melancholy
   - (e) eent : memories
3. GOOSE : GANDER ::
   - (a) duck : drak
   - (b) hen : chicken
   - (c) sheep : flock
   - (d) dog : kennel
   - (e) horse : bridle
4. CARPENTER : SAW ::
   - (a) stenographer : typewriter
   - (b) painter : brush
   - (c) lawyer : brief
   - (d) seamstress : scissors
   - (e) runner : sneakers
5. CAPTAIN : SHOAL ::
   - (a) lawyer : litigation
   - (b) pilot : radar
   - (c) soldier : ambush
   - (d) doctor : hospital
   - (e) corporal : sergeant

Directions : Each of the following analogy questions presents a related pair of words linked by a colon. Five lettered pairs of words follow the linked pair. Choose the lettered pair of words whose relationship is most like the relationship expressed in the original linked pair.

6. MUSTER : CREW ::
   - (a) convene : committee
   - (b) demobilize : troops
   - (c) dominate : opposition
   - (d) cheer : team
   - (e) dismiss : jury

7. DWELL : DENIZEN ::
   (a) shun : outcast
   (c) squander : miser
   (e) patronize : protege
   (b) inherit : heir
   (d) obey : autocrat

8. MEANDERING : DIRECTNESS ::
   (a) menacing : ambition
   (c) digressive : conclseness
   (e) aboveboard : openness
   (b) affable : permissiveness
   (d) circuitous : rotation

9. CEMENT : TROWEL ::
   (a) lawn : rake
   (c) paint : brush
   (e) wallpaper : ladder
   (b) conflagration : match
   (d) floor : polish

10. PIGHEADED : YIELD ::
    (a) lionhearted : retreat
    (c) dogged : pursue
    (e) eagle-eyed : discern
    (b) lily-livered : flee
    (d) featherbrained : giggle

Directions : Each of the following analogy questions presents a related pair of words linked by a colon. Five lettered pairs of words follow the linked pair. Choose the lettered pair of words whose relationship is most like the relationship expressed in the original linked pair.

11. MYTH : LEGENDARY ::
    (a) sermon : lengthy
    (c) fable : didactic
    (e) allegory : obscure
    (b) anecdote : witty
    (d) epic : comic

12. TIRADE : ABUSIVE ::
    (a) monologue : lengthy
    (c) prologue : conclusive
    (e) critique : insolent
    (b) aphorism : boring
    (d) encomium : laudatory

13. EXPEDITOUS : SPEED ::
    (a) astute : wisdom
    (c) thoughtful : inanity
    (e) portable : frilty
    (b) decorous : impropriety
    (d) haggard : sturdiness

14. ANNOTATE : TEXT ::
    (a) enact : law
    (c) caption : photograph
    (b) prescribe : medication
    (d) abridge : novel   (e) censor : film

15. DRUDGENRY : IRKSOME ::
    (a) encumbrance : burdensome
    (c) ambivalence : suspicious
    (e) dissonance : harmonious
    (b) journey : wearisome
    (d) compliance : forced

Directions : Each of the following analogy questions presents a related pair of words linked by a colon. Five lettered pairs of words follow the linked pair. Choose the lettered pair of words whose relationship is most like the relationship expresed in the original linked pair.

16. INFRACTION : LAW ::
    (a) interruption : continuity
    (c) establishment : order
    (e) punishment : crime
    (b) renovation : structure
    (d) enactment : amendment

17. LACHRYMOSE : TEARS ::
    (a) effusive : requests
    (c) morose : speches
    (e) verbose : words
    (b) ironic : jests
    (d) profound : sighs

18. MOISTEN : DRENCH ::
   (a) enclose : confine   (b) prick : stab
   (c) disregard : ignore   (d) scrub : polish
   (e) heat : chill

19. WITCH : COVEN ::
   (a) ogre : eastle   (b) seer : prophecy
   (c) actor : troupe   (d) fairy : spell
   (e) doctor : medicine

20. CONTINENT : ISLAND ::
   (a) ocean : lake   (b) isthmus : peninsula
   (c) cape : cove   (d) river : canal
   (e) plateau : plain

Directions : Each of the following analogy questions presents a related pair of words linked by a colon. Five lettered pairs of words follow the linked pair. Choose the lettered pair of wordds whose relationship is most like the relationship expressed in the original linked pair.

21. WHISPER : SPEAK ::
   (a) brush : touch   (b) skip : walk
   (c) listen : hear   (d) request : ask
   (e) whimper : whine

22. ELUSIVE : CAPTURE ::
   (a) persuasive : convince   (b) elastic : stretch
   (c) headstrong : control   (d) sensible : decide
   (e) gullible : trick

23. LINEAGE : PERSON ::
   (a) foliage : tree   (b) derivation : word
   (c) adolescence : child   (d) title : book
   (e) landscape : portrait

24. IMPANEL : JUROR ::
   (a) accuse : defendant   (b) convict : culprit
   (c) testify : witness   (d) enroll : student
   (e) involve : bystander

·25. PECCADILLO : TRIFLING ::
   (a) pariah : popular   (b) diagonosis : accurate
   (c) notion : farfetched   (d) squable : petty
   (e) pursuit : trivial

Instructions : *In each of the following questions, a pair groups of words are given which have a certain relationship among them. Select the pair group from the choices given below that shows the same relationship.*

26. Child : Mother : Father : Family
   (a) Aunt : Uncle : Brother : Niece
   (b) Aryans : Caucasians : Mongoloids : Race
   (c) Hand : Ear : Nose : Face
   (d) Cooking : Food : Servant : Mess

27. Tehsil : District : State : Country
   (a) Block : Colony : Zone : City
   (b) Province : District : State : Country
   (c) Madhya Pradesh : Maharashtra : Mumbai : V.T.
   (d) Metropolitan : Megalopolis : Town : City

28. Hinduism : Christianity : Islam : Religion
   (a) Ear : Nose : Eyesight : Vision   (b) Plus : Minus : Multiple : Division
   (c) Humid : Hot : Tundra : Region   (d) Winter : Spring : Summer : Season

29. Abjure : Renounce : Alleviate : Relieve
  (a) Abstruse : Obscure : Give : Receive
  (b) Allay : Noisy : Defend : Deceive
  (c) Appease : Soft : Apprehend : Perceive
  (d) Atrocity : Denounce : Aptitude : Believe
30. Orange : Apple : Grape : Fruit
  (a) Window : Door : Apartment : Suit
  (b) Job : Employer : Employment : Recruit
  (c) Description : Analysis : Statement : Report
  (d) Ship : Lead : Basement : Port

Instructions : *Find out the correct one from the alternatives given below to denote the same relatiohship among the group of letters as established between the sets at the top.*

31. BAC : FEG ::
  (a) ABC : EFG (b) DK : MNO
  (c) JIK : NMO (d) KIJ : NOM·
32. RACE : FACE : CARE : ?
  (a) FARE (b) CAFE
  (c) CEAF (d) ACRE
33. UMBRELLA : ALLERBMU :: ? : REBMUN
  (a) UNBMRE (b) BURMIN
  (c) NUMBER (d) BENDRUM
34. POST : ? :: JIMNOP : KILMN
  (a) GEDHIJ (b) JIHDEG
  (c) DHUGE (d) HOJGIE
35. DRIVEN : EIDRVN :: BEGUM : ?
  (a) EUBGM (b) BEFORE
  (c) BGMEU (d) UEBGM
  (e) BGMUE

ANSWERS

1. (c) 2. (e) 3. (a) 4. (d) 5. (c) 6. (a) 7. (b) 8. (c) 9. (c) 10. (a)
11. (c) 12. (d) 13. (a) 14. (c) 15. (a) 16. (a) 17. (e) 18. (b) 19. (c) 20. (a)
21. (a) 22. (c) 23. (b) 24. (d) 25. (d) 26. (b) 27. (a) 28. (d) 29. (c) 30. (c)
31. (c) 32. (b) 33. (c) 34. (a) 35. (d)

UNIT

2

SPATIAL VISUALIZATION

STRUCTURE

- Spetial Visualisation
- Visual Memory Based Questions
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on figures in which cut-out pieces are given alongwith complete figure for identification.
- Visual memory based questions for practice.

2.1. VISUAL VISUALIZATION

In this type of questions, cut-out pieces are given alongwith complete figure, that is the figure out of which the figures have been cut. By looking at the cut-out figures, one has to find out he figure which may be constituted by putting the pieces together, *i.e.,* one has to find out the figure of which the pieces have been cut. One has to be very imaginative and has to use space perception in finding out the solution. The process is mental and requires special skill in visualising different spatial patterns.

Example 1. Five diagrams are given below. Three of these when put together form a square. Find the correct alternative :
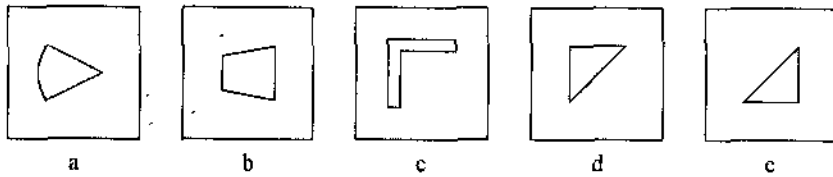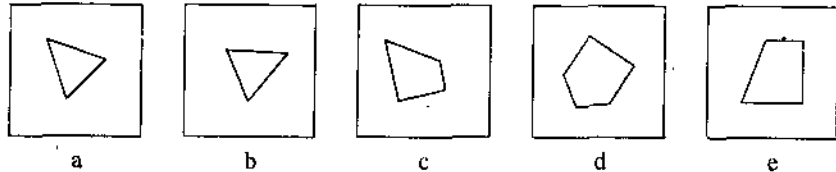

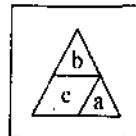(a) abd   (b) cde   (c) bde   (d) cab

Ans. (b)
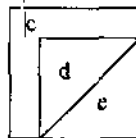
Example 2. Five diagrams are given below. Three of these when put together form an equilateral triangle. Find the correct alternative :
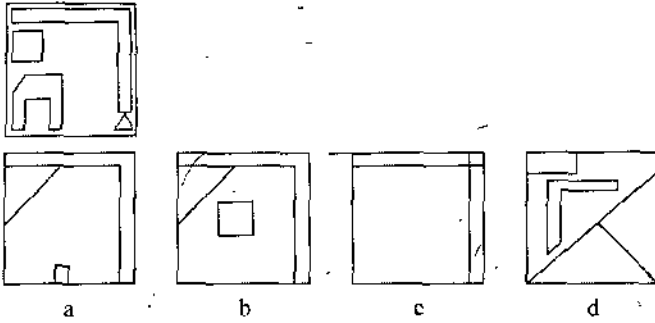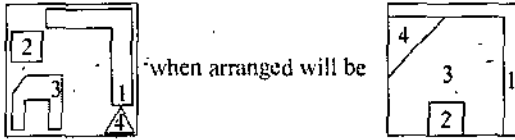

(a) bca   (b) abc   (c) cde   (d) bce

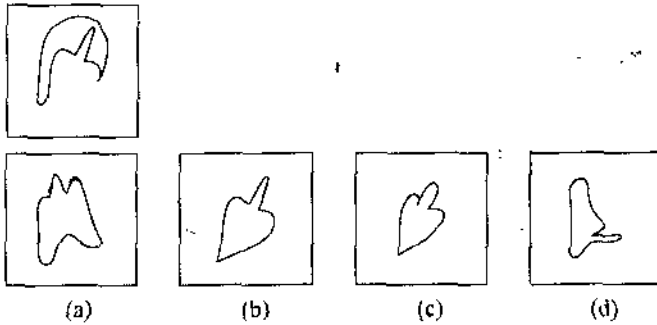**Ans. (b) :** The three pieces when put together form this equilateral triangle.

Example 3. Which one figure can be made out of given paper cut-outs ?

a   b   c   d

Ans. (a) : The cut-outs when arranged will form figure (a) in this manner.

when arranged will be

Example 4. Which of the cut-piece of paper given as option figure will fit the irregular piece of paper ?

(a)   (b)   (c)   (d)

Ans. (b) : The complete figure will be

## • 2.2. VISUAL MEMORY BASED QUESTIONS

In visual memory based questions, a figure form is given followed by alternative figures. In these fig. options, the given figure form is embedded. Practice of visualisation comes handy in attempting such easy questions.

Example 1. Which one of these figures has a pattern which is embedded in the stem figure ?

Pattern
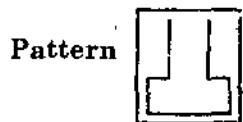

Answer figures

(a)   (b)   (c)   (d)
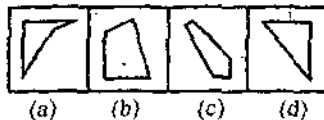
Ans. (d) : The option figure pattern when tilted a little is found to be embedded in the given figure in the mannr given below.
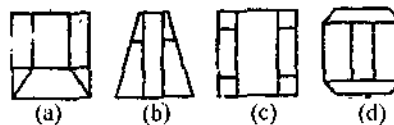
In certain cases, the figure pattern may need to be rotated to fit the figure in which it is hidden.

Example 2. Select the answer figure in which the question figure is hidden.

Pattern

Answer figures

**Ans. (a)** : The question figure form is hidden in the option figure (a) as depicted below :

A quick look at all pattern the figures enables one to pick out the correct option.

In another type of problem, a complete figure is given followed by four alternative figures. One of the given option figure pattern is embedded in the given.

• TEST YOURSELF

Direction (Q. 1–6) : Which one figure can be made out of given paper cut-outs ?

1.

2.

3.

4.

   (a)   (b)   (c)   (d)

5.

   (a)   (b)   (c)   (d)

6.

   (a)   (b)   (c)   (d)
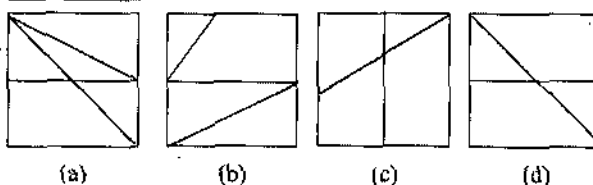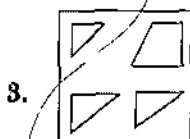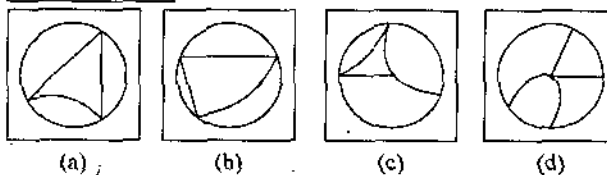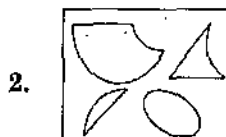
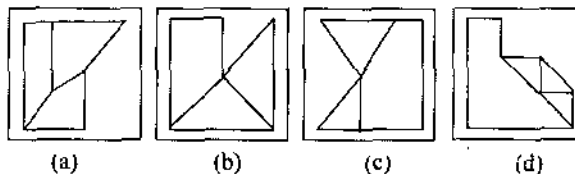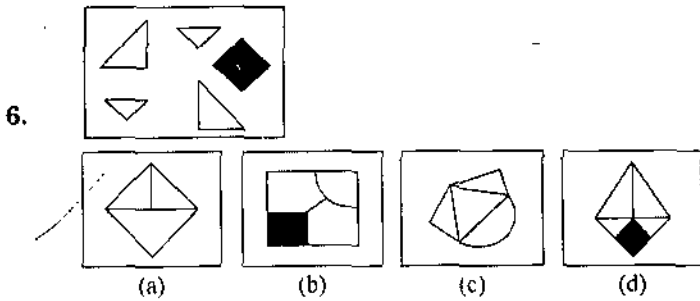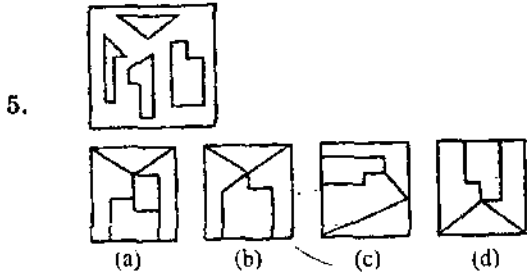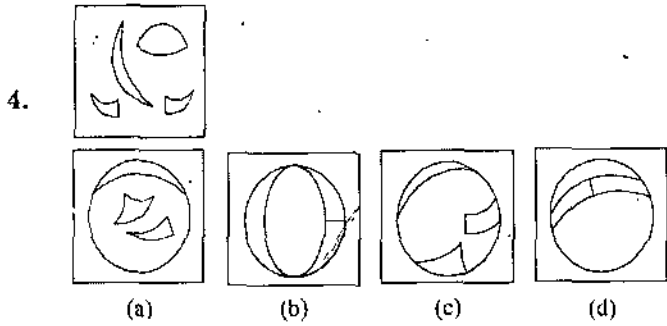**Directions (Qs. 7–14)** : In each of the following questions, five diagrams marked A to E are given. Three of these when put together form an equilateral triangle and have been given as one of the four alternatives under the question. Find the correct alternative in each case.

7.

(a) ABE   (b) BCE   (c) ADE   (d) BDE

8.

(a) ABC   (b) BCD   (c) CDE   (d) BDE

9.

(a) BCD   (b) CDE   (c) ABD   (d) ABE

10.

(a) ABD   (b) ACD   (c) BDE   (d) CDE

11.

(a) ABC   (b) ACE   (c) BDE   (d) CDE

12.
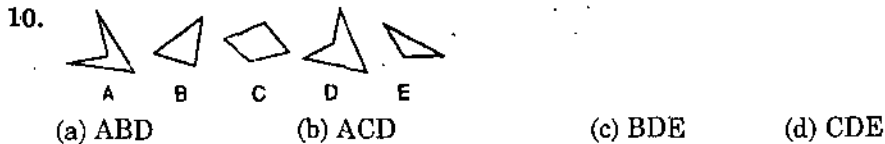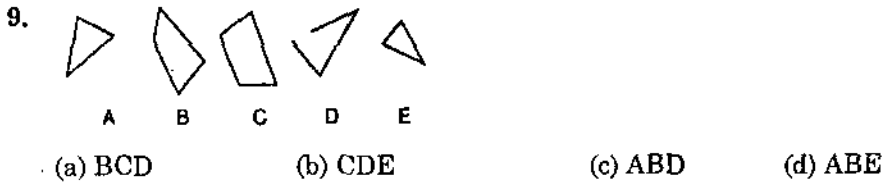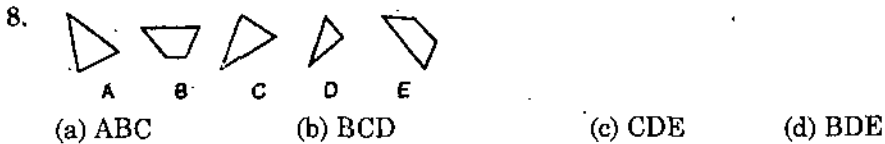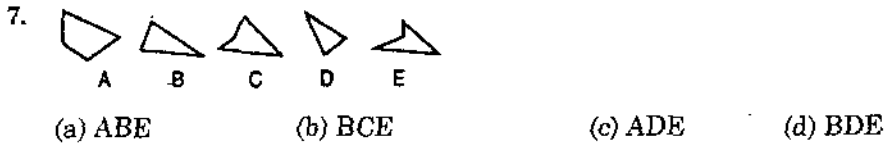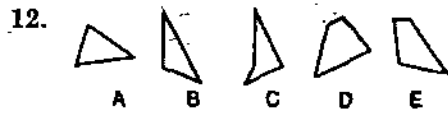
(a) BCD   (b) ACD   (c) CDE   (d) BDE

13.
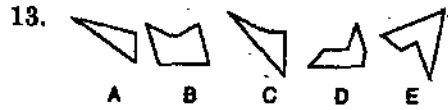
(a) ACE   (b) ABD   (c) BDE   (d) CDE

14.

(a) ABC   (b) ACE   (c) BCD   (d) BDE

Directions (Qs. 15–20) : In each of the following questions, five diagrams A, B, C, D and E have been given. Three of these diagrams make a complete square which have been given as one of the four alternatives under it. Find the correct alternative in each case.

15.

(a) ABC   (b) BDE   (c) CDE   (d) BCD

16.
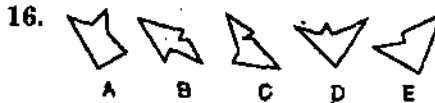
(a) ACD   (b) BDE   (c) BCE   (d) CDE

17.
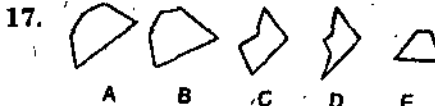
(a) ABC   (b) ACE   (d) ADE   (d) CDE

18.
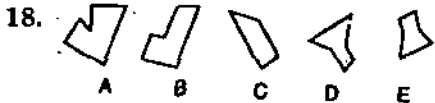
(a) BDE   (b) ABC   (c) ACD   (d) BCD

19.
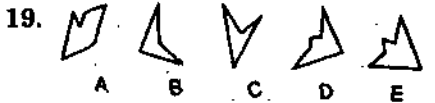
(a) ABD   (b) BCE   (c) ACD   (d) BDE

20.
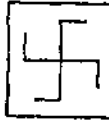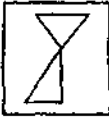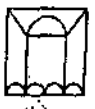
(a) ABD   (b) BCD   (c) CDE   (d) BCE

Directions (21–40): In the questions given below a figure is given. From the given options, select the one in which the given figure is embedded.

21.

22.

(a)   (b)   (c)   (d)

23.

(a)   (b)   (c)   (d)

24.

(a)   (b)   (c)   (d)

25.

(a)   (b)   (c)   (d)

26.

(a)   (b)   (c)   (d)

27.

(a)   (b)   (c)   (d)

28.
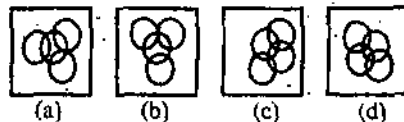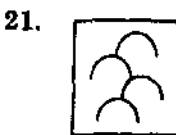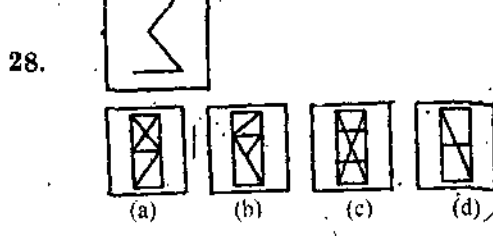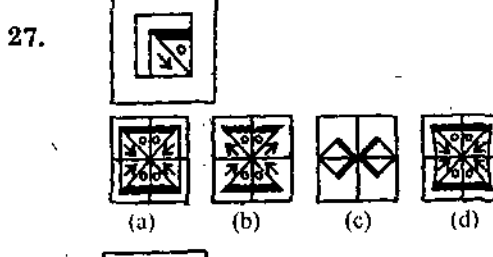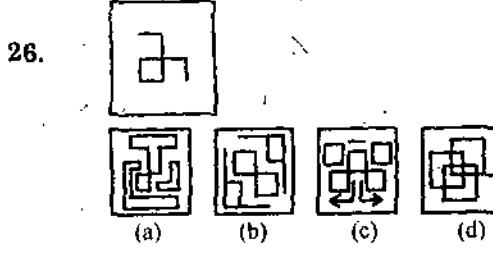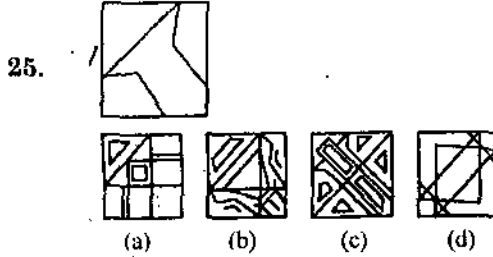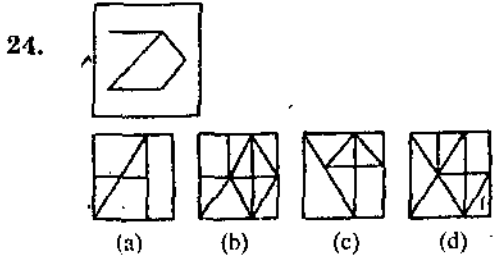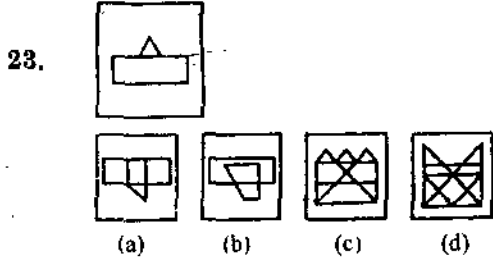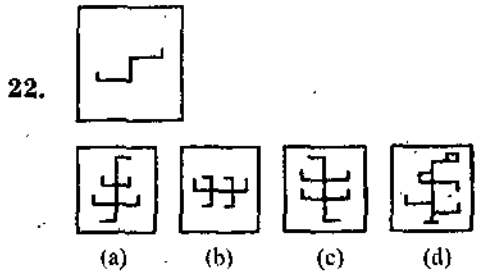
(a)   (b)   (c)   (d)

29.

(a)   (b)   (c)   (d)

30.

(a)   (b)   (c)   (d)

31.

(a)   (b)   (c)   (d)

32.

(a)   (b)   (c)   (d)

33.

(a)   (b)   (c)   (d)

34.

(a)   (b)   (c)   (d)

35.

(a)   (b)   (c)   (d)

36.

(a)   (b)   (c)   (d)

37.

(a)   (b)   (c)   (d)

38.

(a)   (b)   (c)   (d)

39.

(a)   (b)   (c)   (d)

40.

(a)   (b)   (c)   (d)
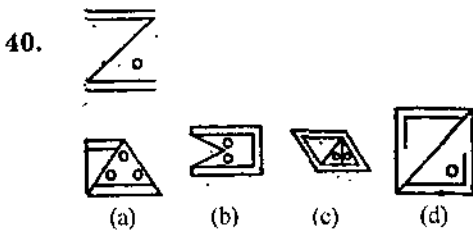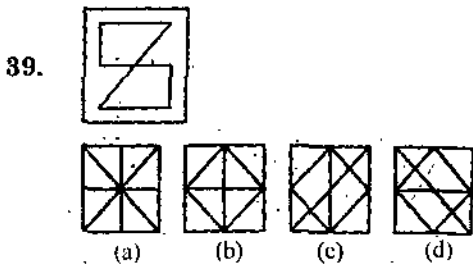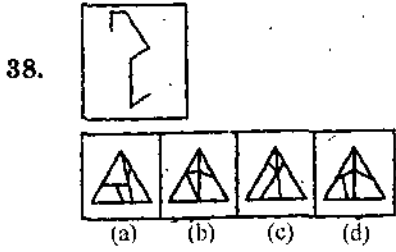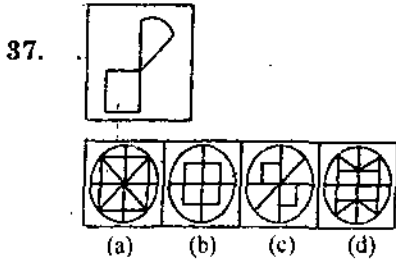
ANSWERS

1. (b)　2. (c)　3. (b)　4. (b)　5. (d)　6. (d)　7. (c)　8. (d)　9. (d)　10. (b)
11. (b)　12. (c)　13. (a)　14. (d)　15. (b)　16. (b)　17. (c)　18. (d)　19. (a)　20. (c)
21. (c)　22. (c)　23. (c)　24. (b)　25. (d)　26. (d)　27. (a)　28. (b)　29. (b)　30. (a)
31. (a)　32. (b)　33. (c)　34. (b)　35. (b)　36. (c)　37. (a)　38. (a)　39. (a)　40. (d)

U N I T

3

LOGICAL DIAGRAMS

STRUCTURE

- Logical Diagrams
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Logical figure based questions for practice.

• 3.1. LOGICAL DIAGRAMS

In these type of questions, a set of five different figures is given as options. Each figure represents a logical pattern of certain groups of related words wherein each word represents a class. One has to identify the most appropriate logical figure for the set of words given.

Ex. 1. The given classes have nothing in common.
Example : Water, Eggs.
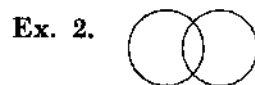
Ex. 2. The given classes have something in common, but neither of them is completely contained in the other.
Example : Colour, Blue
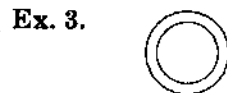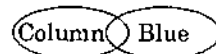
Ex. 3. Of the two given classes, one is wholly contained in the other, but not *vice-versa*.
Example : Vegetables, Cabbage
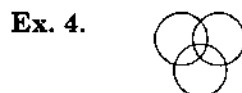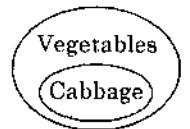
Ex. 4. Same logic as figure 2.
Example : Tall, Men, Educated.
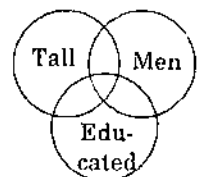
Ex. 5. Of the three given classes, one is completely contained in the other and not *vice-versa* while the third class has nothing in common with either of the two classes.
Example : Stone, Solids, Liquids.
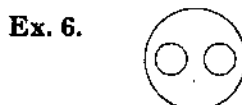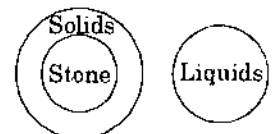
Ex. 6. Two classes are wholly contained in the third class, but not *vice-versa*, also the two contained classes have nothing in common.
Example : Gova, Indore, India
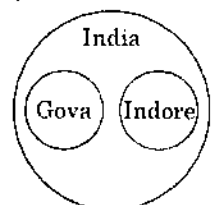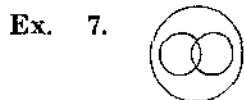
Ex. 7. Two classes are wholly contained in the third class but not *vice-versa*, and the two contained classes also have something in common though neither class is wholly contained in the other.
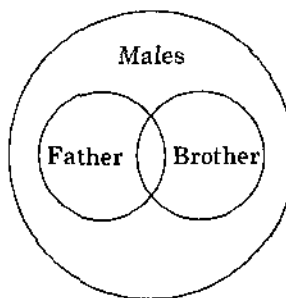
Example : Father, Brother, Males.
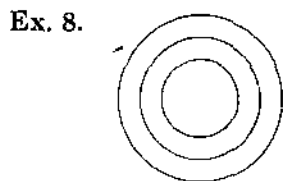
Ex. 8. The first class is contained wholly in the other two classes, but not *vice-versa*. The second is wholly contained in the third and partially in the first. A part of third class is contained *in the second of which some* is contained in the first.
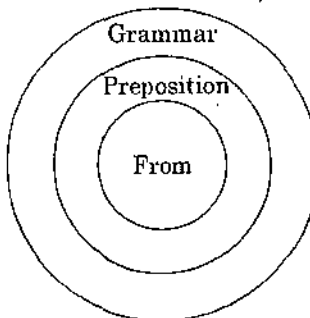
Example : Preposition, From, Grammer.
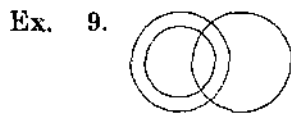
Ex. 9. First class is wholly contained in the second and not *vice-versa*. The third class is partially contained in the other two classes.
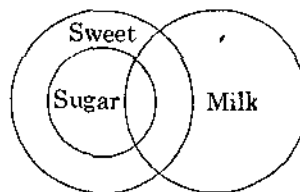
Example : Sugar, Sweet, Milk.

Note : Some people drink milk without sugar.

Ex. 10. The first and second class have some part in common, and so have the second and third class, but the first and third class have nothing in common.
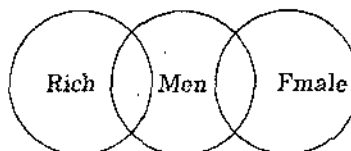
Example : Rich, Men, Famous

• TEST YOURSELF

Directions : From the five logical diagrams, select one which best illustrates the relationship among three given classes in the questions 1 to 5.

(a)   (b)   (c)   (d)   (e)
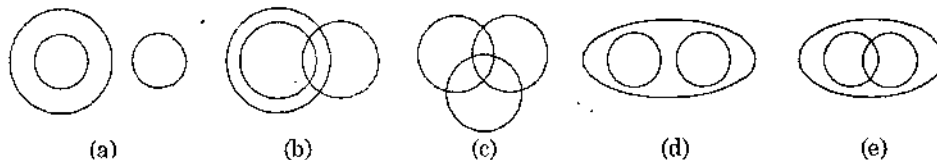
1. Parrots, fruits, oranges.
2. Crimainals, lawyers, bandits.
3. Cricketers, bachelors, men.
4. Beautiful, doctors, women.
5. Vegetables, potatoes, brinjals.

Directions : From the five logical diagrams select one which best illustrates the. relationship among three given classes in questions 6 to 10.

(a) (b) (c) (d)
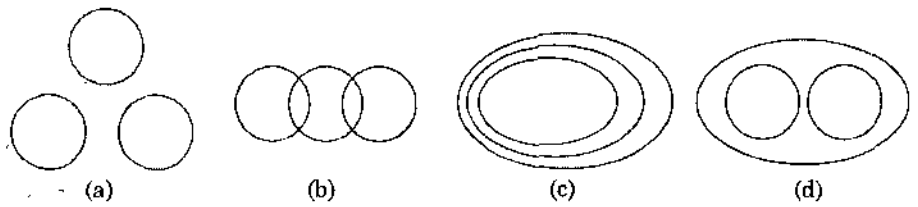
6. Cars, trains, means of conveyance.
7. Age, number, fourteen.
8. Country, state, cities.
9. Father, parent, mother.
10. Iron, metal mercury

Directions : From the five logical diagrams select one which best illustrates the relationship among three given classes in the questions 11 to 15.

(a) (b) (c) (d) (e)
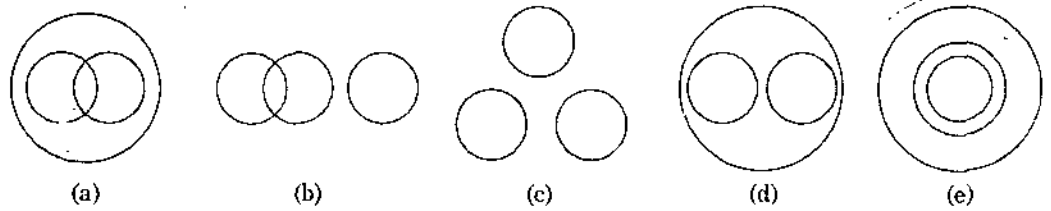
11. Lizards, reptiles, crocodiles.
12. Whales, tortoise, fishes.
13. Birds, sparrow, peacock.
14. Sisters, women, mothers.
15. Plants, scientists, men.

Directions : From the five logical diagrams select one which best illustrates the relationship among three given classes in the questions 16 to 20.

(a) (b) (c) (d) (e)
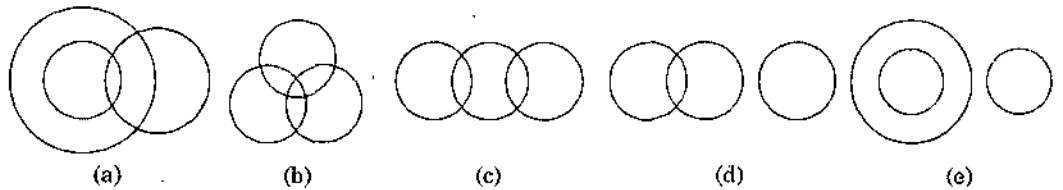
16. Cloth, hair, black.
17. Garment, chair, shirts.
18. Wood, watch, tables.
19. Physics, biology, zoology
20. Police, criminal, thief.

Directions : From the five logical diagrams select one which best illustrates the relationship among three given classes in the questions 21 to 25.

(a) (b) (c) (d) (e)
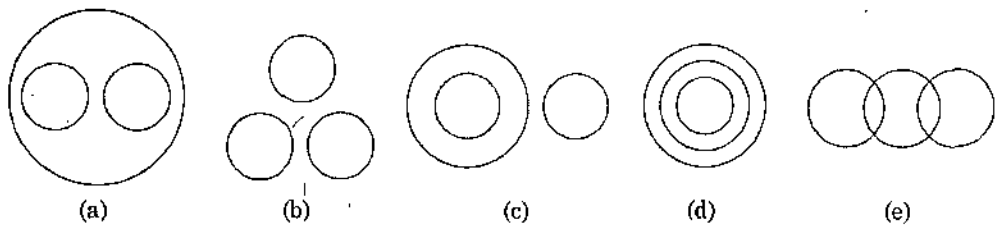
21. Country, China, India
22. Body, blood, veins
23. Chess, games, hockey
24. Tractor, aircraft, cart
25. Delhi, Lucknow, Uttar Pradesh

ANSWRES

1. (a) : All oranges are fruits, but neither fruits nor oranges can be parrots.

2. (a) : All bandits are criminal, but neither criminals nor bandits can be lawyers.

3. (b) : All bachelors are men and some men and bachelors can be cricketers.

4. (c) : Some women can be beautiful and some women can be doctors and *vice-versa*. Some doctors can be women and some doctors can be beautiful and *vice-versa*.

5. (d) : Potatoes and brinjals are vegetables but they have nothing in common. Some vegetables are potatoes and some are brinjals.

6. (d) : All cars and all trains are means of conveyance, but neither is contained in the other. Some means of conveyance are cars and some trains.

7 (b) : Some are aged fourteen and some numbers are fourteen. Some fourteen units are numbers and some ages. Age and number have nothing in common.

8. (c) : All countries contain states within it and each state contains cities within it.

9. (d) : All fathers and mothers are parents, but they are two separate classes. Some of the parents are fathers and some are mothers.

10. (d) : Iron and mercury are metals, but they have nothing in common. Some metals are iron and some mercury.

11. (d) : All lizards and crocodiles are reptiles, but neither is contained in the other. Some reptiles are lizards and some crocodiles.

12. (c) : All three are different classes.

13. (d) : All sparrows and peacocks are birds but neither is contained in the other. *Some birds are sparrows and some peacocks.*

14. (a) : Some sisters can be mothers and some mothers can be sisters. All sisters and mothers are women.

15. (b) : Some scientists can be men and some men can be scientists, but neither scientists nor men can be plants.

16. (c) : Some cloths and some hair can be black (all clothes and all thair are not black). Some black colour is used in clothes and some is the colour of hair. Cloth and hair are different classs.

17. (c) : All shirts are garments. Some garments are shirts. Chairs are in different class.

18. (d) : Some wood is used for making table. Some tables are made of wood. Watches are different class.

19. (c) : Zoology is a part of Biology, Biology contains the study Zoology. Physics is a different field of science.

20. (e) :

21. (a) : China and India are countries but neither is contained in the other.

22. (d) : Body contains veins within it and all veins contain blood within it.

23. (a) : Both chess and hockey are games but neither is contained in the other.

24. (b) : All three are different classes.

25. (c) : Lucknow is in Uttar Pradesh. One of the part of Uttar Pradesh is Lucknow. Delhi is a different/separate place.

1. (c)	2. (c)	3. (c)	4. (b)	5. (d)	6. (d)	7. (a)	8. (b)	9. (b)	10. (a)
11. (a)	12. (b)	13. (c)	14. (b)	15. (b)	16. (c)	17. (a)	18. (a)	19. (a)	20. (d)
21. (a)	22. (b)	23. (a)	24. (b)	25. (c)	26. (a)	27. (b)	28. (d)	29. (c)	30. (d)
31. (a)	32. (a)	33. (c)	34. (d)	35. (a).					

U N I T

4

SPATIAL ORIENTATION

• 4.1. SPATIAL ORIENTATION

In these type of questions, directions need to be perceived. Different directions are guided by the left and right turns or angular turns in these questions. Such questions are based on the direction chart. The direction charts are :
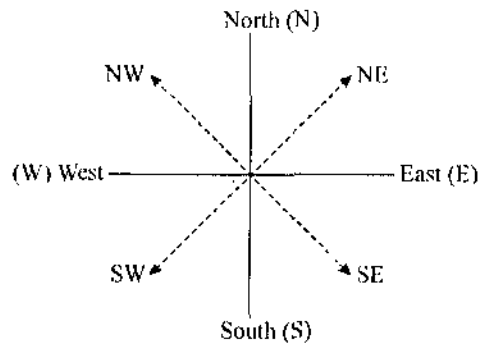
Example 1. A person is walking in the south direction. He turns right two times and continues to walk. In which direction is he walking now ?

Ans. In north direction.
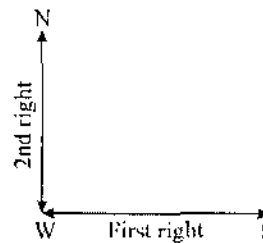
Example 2. A person is walking in the East direction. He turns 45° left and then 90° right. In whcih direction is he now ?

Ans. The 45° turn escapes from the straight direction to the coupled direction. 90° turn also follows the coupled direction from North-West to North-East.
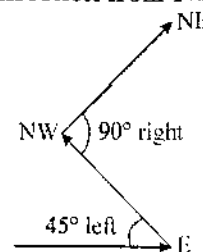
Example 3. Shalini is travelling towards South. Which of the following directions should she take in order to travel towards North ?

(a) right, left, right, right   (b) left, right, right

(c) right, right, left   (d) left, left, left, left

Ans. (a) : Shalini's first right turn is towards West, second turn to the left turns her to South again. The third turn to the right takes her to the West once again, but by taking the final right turn, she is going towards North.
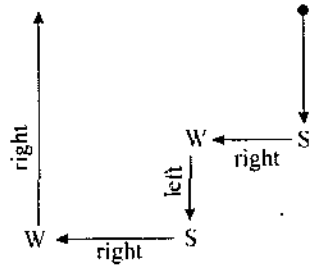
Example 4. Shavi was facing East. She walked 20 metre. Turning left she movd 15 metre and then turning right moved 25 metre. Finally, she turned right and moved 15 metre more. How far is she form her starting point ?

(a) 25 metre   (b) 35 metre   (c) 50 metre   (d) 45 metre

Ans. (d) : Shavi turns left after walking 20 metre towards East. Now she walks 15 metre towards North. She turns right towards East again and walks 25 metre further. Finally turning right towards South, she walks 15 metre. The distance moved towards North and towards South is same, *i.e.,* 15 metre. So, Shavi is 20 + 25 metre = 45 metre away from her starting point.
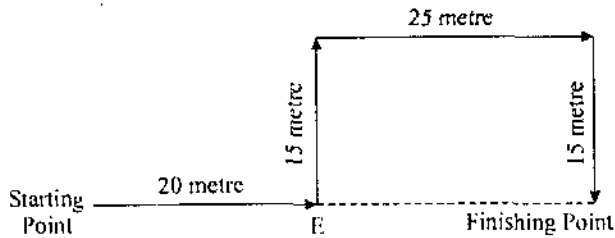
• TEST YOURSELF

1. Vishal is walking towards West. He takes three turns while walking, all at an angle of 45° towards right, right and left. What direction is he facing now ?

(a) North-East   (b) South-East   (c) East   (d) West

2. Rishu leaves his house and walks 12 km towards North. He turns right and walks another 12 km. He turns right again, walks 12 km more and turns left to walk 5 km. How far is he from his home and in which direction ?

(a) 7 km East   (b) 10 km East   (c) 17 km East   (d) 24 km East

3. A lady runs 12 km towards North, then 6 km towards South and then 8 km East. How far is the from her starting point and in which direction ?

(a) 5 km North-East   (b) 5 km East

(c) 10 km North-East   (d) 10 km West

4. Akshi journeys 10 km to East then 10 km to South-West. She turns again and journeys 10 km to North-West. Which direction is she in from the starting point ?

(a) South   (b) West   (c) North   (d) East

5. Mikku walks towards East then towards North and turning 45° right walks for a while and lastly turns towards left. In which direction is he walking now ?

(a) North   (b) East   (c) South-East   (d) North-West

6. If North is called North-West, North-West is called West, West is called South-West and so on. What will South-east be called ?

(a) East   (b) West   (c) North-East   (d) South-East

7. A person is driving towards West. What sequenc of directions should be follow so that he is driving towards South ?
   (a) left, right, right
   (b) right, right, left
   (c) lfeft, left, left
   (d) right, right, right

8. Richa drives 8 km to the South, turns left and drives 5 km. Again, the turns left and drives 8 km. How far is she from her starting point ?
   (a) 3 km
   (b) 5 km
   (c) 8 km
   (d) 13 km

9. Vikky runs 40 km towards North then turns right and runs 50 km. He runs right and runs 30 km. and once again turns right and runs 50 km. How far is he from his starting point ?
   (a) 90 km
   (b) 50 km
   (c) 10 km
   (d) 5 km

10. If a person is walking towards North, what direction should he follow so that he is walking towards West ?
    (a) right, right, left
    (b) left, left, right
    (c) left, right, left
    (d) left, left, left

11. If all the directions are changed in the manner that North becomes South and *vice-versa*, then North-West will be :
    (a) South-East
    (b) North-East
    (c) South-West
    (d) None of the above

12. I was walking in South-East direction. After a while I turned 90° to the right and walked ahead. Later I turned 45° to the right. In which direction am I walking now?
    (a) North
    (b) North-East
    (c) South-West
    (d) East

13. Maria crawls 10 ft. turns right and crawls another 10 ft. then turns left two times and crawls 15 ft each time. If she started crawling in the western direction, towards which direction is she crawling now ?
    (a) East
    (b) South
    (c) North
    (d) West

14. A man travels 100 km towards South. From there, he turns right and travels 100 km and again turns right to travel 50 km. Which direction is he in from his starting point ?
    (a) North
    (b) North-East
    (c) East
    (d) South-West

15. A train runs 120 km in West direction, 30 km in South direction and then 80 km in east direction before reaching the station. In which direction is the station from the train's starting point ?
    (a) South-West
    (b) North-West
    (c) South-East
    (d) South-East

16. Facing the West direction, Priya jogs for 20 m, turns left and goes further 40 m. She turns left again and jogs for 20 m. Then she turns right to go 20 m to reach the park. How far is the park from her starting point and in which direction ?
    (a) 20 m South
    (b) 40 m West
    (c) 60 m South
    (d) 100 m East

17. Ravi travelled four km straight towards south. He turned left and travelled six km straight then turned right and travelled four km straight. How far is he form the starting point ?
    (a) 8 km
    (b) 10 km
    (c) 12 km
    (d) 18 km

18. One day John left home and cycled 10 km Southwards, turned right and cycled 5 km and turned right and cycled 10 km and turned left and cycled 10 km and turned left and cycled 10 km. How many km will be have to cycle to reach his home straight?
    (a) 10 km
    (b) 15 km
    (c) 20 km
    (d) 25 km

19. Sub-Inspector Jatin travelled from his Police-post straight for 400 metre. He then turned left and travelled 500 metre straight after which the turned left again and travelled for 400 metre straight. He then turned right and walked for another 600 metre straight. How far is he from the Police-post ?

(a) 1.1. km   (b) 1.0 km   (c) 1.4 km   (d) 1.8 km

20. Starting from a point, Raju walked 12 metre towards North, he turned right and walked 10 metre, he again turned right and walked 12 metre, then he turned left and walked 5 metres. How far is he now and in which direction from the starting point ?

   (a) 27 metre towards East   (b) 5 metre towards East

   (c) 10 metre towards West   (d) 15 metre towards East

21. Raj's car is facing towards West. he turns left and drives 10 km and turns left again and drives 10 km. Then he turns right and drives 40 km. He turns right again and drives 30 km. Lastly, he turns right and drives 50 km. How far is Raj from the starting point ?

   (a) 10 km   (b) 20 km   (c) 40 km   (d) 60 km

22. *A* and *B* start together from one point. They walk 10 km towards North. *A* turns left and covers 5 km whereas *B* turns right and covers 3 km. *A* turns left again and covers 15 km whereas *B* turns right and covers his 15 km. How far is *A* from *B* ?

   (a) 18 km   (b) 10 km   (c) 5 km   (d) 8 km

23. Tarun is walking towards East. What direction he should not follow if he should walk towards North ?

   (a) right, left, right, left   (b) right, right, left, left, left

   (c) right, right, right   (d) right, left, left, right

24. In an open ground, Maithili starts walking towards east and stops after 35 metre and turns right and walks another 15 metre and again turns right and walks 15 metre and then stops. What is the minimum distance she has to walk to reach the starting point ?

   (a) 25 metre   (b) 20 metre   (c) 30 metre   (d) 35 metre

25. Vijayan started walking towards South. After walking 15 metre he turned in the left and walked 15 metre. He again turned to his left and walked 15 metre. How far is he from his original position and in which direction ?

   (a) 15 metre, North   (b) 15 metre, East

   (c) 30 metre, South   (d) 15 metre, West

26. I walked 18 km towards North, then turned left and having walked another 4 km. I *turned right and walked* for 12 km more. How far have I walked from the starting point and in which direction ?

   (a) 8 km North   (b) 10 km West   (c) 16 km South   (d) 34 km North

27. Ravi drives 12 km *towards West. he turns South and drives 3 km. He again turns* East and drives 8 km. How far is he from his starting point ?

   (a) 3 km   (b) 5 km   (c) 7 km   (d) 11 km

28. Suman is 40 metre South-West of Ashok. Prakash is 40 metre South-East of Ashok, Prakash is in which direction of Suman ?

   (a) South   (b) West   (c) East   (d) North-East

29. I go 10 m to the East, then I turn left and go 5 m, I turn left again and go 10 m and then again I turn left and go 10 m. In which direction am I from the starting point?

   (a) East   (b) West   (c) North   (d) South

30. Mohan started from point 'A' and proceeded 7 km straight towards East, then he turned left and proceeded straight for a distance of 10 km. He then turned left again and proceeded straight for a distance of 6 km, and then turned left again and proceeded straight for another 10 km. In which direction is Mohan from his starting point ?

   (a) East   (b) West   (c) North   (d) South

ANSWERS

1. (a)   2. (c)   3. (c)   4. (b)   5. (d)   6. (a)   7. (d)   8. (b)   9. (c)   10. (b)

11. (a)   12. (a)   13. (b)   14. (d)   15. (a)   16. (c)   17. (b)   18. (b)   19. (a)   20. (d)

21. (a)   22. (d)   23. (a)   24. (a)   25. (b)   26. (d)   27. (b)   28. (c)   29. (d)   30. (a).

U N I T

5

OBSERVATION

STRUCTURE

- Identical Components
- Common Characteristics
- Mirror Images or Reflectin of Figures
  □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on figures matching with the components of the alternative figure.
- Horizontal mirror images of some geometrical shapes.
- Vertical mirror images of some geometrical shapes.
- Horizontal and vertical mirror images of some signs and symbols.

• 5.1. IDENTICAL COMPONENTS

This form of reasoning is very simple. All one is required to do is to match the given figures with the components of the alternative figure. We can say that it is a kind of tally work and very simple too.

Example 1. Here a figure is given, its components are given in one of the four alternative figures. Find this one.
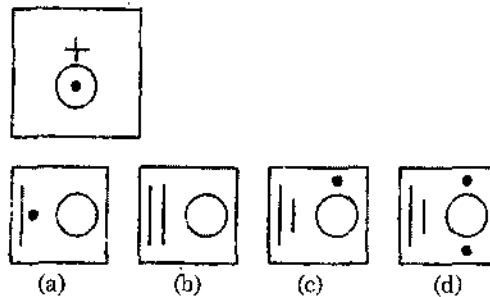
Ans. (c) : A quick observation reveals that the given figure has a dot; a circle; and two line segments of different lengths that form a cross. Similarly, in alternative figure (C) there is a dot, a circle and two line segments of different lengths.

Example 2. In which figure, the specified components of the key figure are found ?
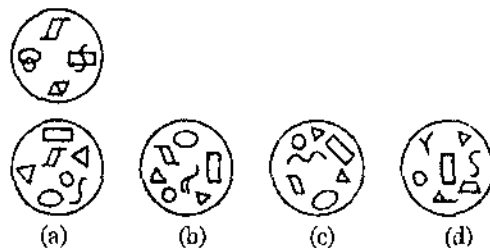
Ans. (a) : Observe the key figure closely. When each component is to be placed separately, the figure shall contain a rectangle with two extended sides, an oval, a

circle, a rectangle, one 'S' shape and two triangles. Answer figure (a) matches perfectly containing all the components.

• 5.2. COMMON CHARACTERISTICS

In this form of reasoning, the two given figures share common characteristic features or the problem figure consists of the elements given in one of the answer figures.

Example 3. Find the figure which has the same common features as the two problem figures.

(a)   (b)   (c)   (d)   (e)
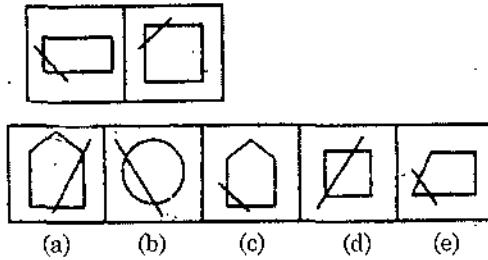
Ans. (e) : Each figure is a quadrant and the line segment cuts through its two adjacent sides based on this common feature shared by the two problem figures. It is clear that option (e) is the right answer.

Example 4. Find the figure which has the same common characteristic features as the two problem figures.

(a)   (b)   (c)   (d)   (e)
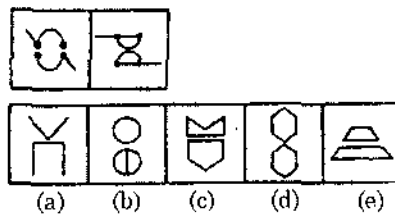
Ans. (d) : The figure on the top can be rotated onto the figure at the bottom (by 180°).

Example 5. Find the figure which has the same common features according to the given two problem figures.

(a)   (b)   (c)   (d)   (e)
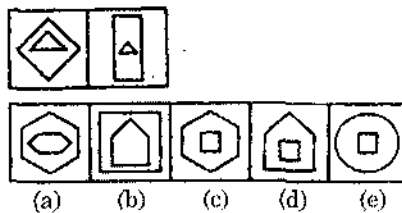
Ans. (b) : The number of lines making the outer figure is one more than the number of lines making the inner figure.

• 5.3. MIRROR IMAGES OR REFLECTION OF FIGURES

In these type of questions, one must be able to visualise clearly the questioned reflections, be they one vertical plane or on horizontal plane. The visualization of figures is difficult because figures have many forms and all cannot be summed up. Let us know about some horizontal and vertical mirror images of some shapes, signs and symbols :

Horizontal Mirror Images of Some Geometrical Shapes.

Vertical Mirror Images of Some Geometrical Shapes

Gs :
VMI:

Gs :
VMI:

Horizontal and Vertical Mirror Images of some Signs and Symbols (SS).

• TEST YOURSELF

Directions : In question number 1 to 10, one questioning figure is given. Its components are given in one of the four alternative figures. Find this one.

1.

(a)   (b)   (c)   (d)

2.

(a)　　(b)　　(c)　　(d)

3.

(a)　　(b)　　(c)　　(d)

4.
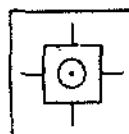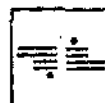
(a)　　(b)　　(c)　　(d)

5.

(a)　　(b)　　(c)　　(d)

6.

(a)　　(b)　　(c)　　(d)

7.
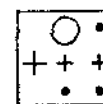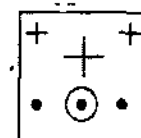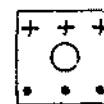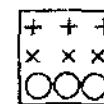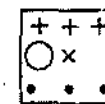
(a)　　(b)　　(c)　　(d)

8.

(a)   (b)   (c)   (d)

9.
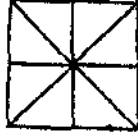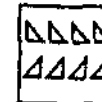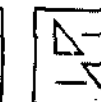
(a)   (b)   (c)   (d)

10.
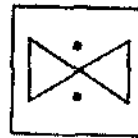
(a)   (b)   (c)   (d)

Directions : In each question below (11 to 20) two problems figures are given. These are followed by five answer figures. The two Problem Figures have some common characteristic features. You have to find out the Figure out of the five given Answer Figures which has the same commonlity. The letter of that figure is the answer.

11.

(a)   (b)   (c)   (d)   (e)

12.

(a)   (b)   (c)   (d)   (e)

13.

(a)   (b)   (c)   (d)   (e)

14.

(a)   (b)   (c)   (d)   (e)

15.

(a)   (b)   (c)   (d)   (e)

16.

(a)   (b)   (c)   (d)   (e)

17.

(a)   (b)   (c)   (d)   (e)

18.

(a)   (b)   (c)   (d)   (e)

19.

(a)   (b)   (c)   (d)   (e)

20.
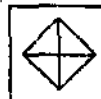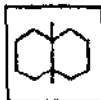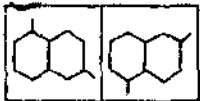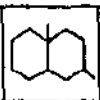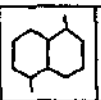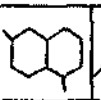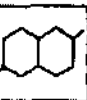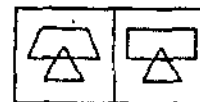
(a)   (b)   (c)   (d)   (e)
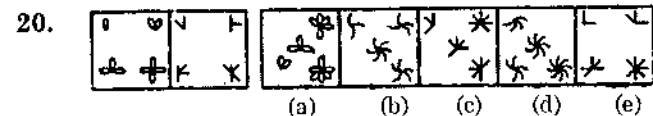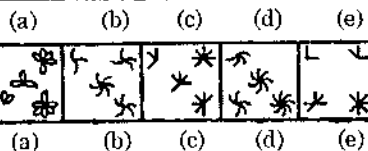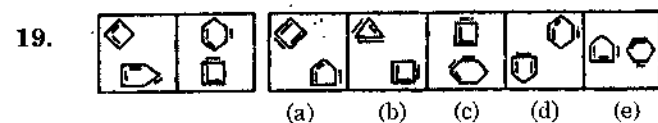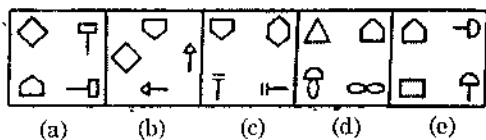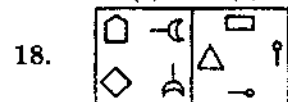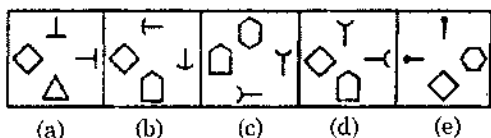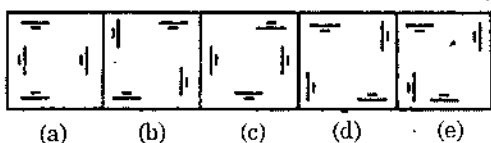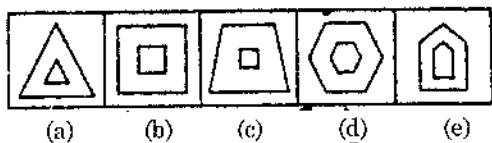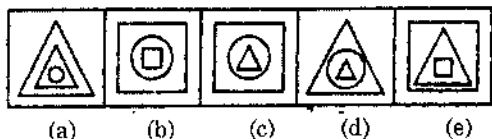
Directions (Qs. 21 to 30) : In each question given below which one would be the mirror image of the given figure when the mirror is placed along the line shown in each figure.

21. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
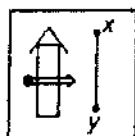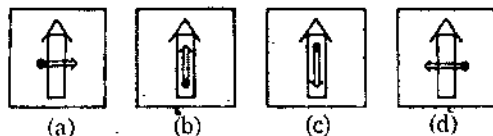
22. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
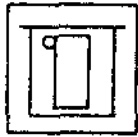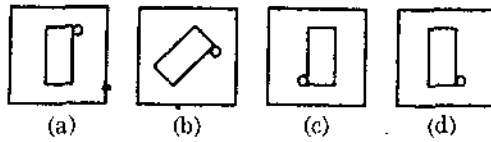
23. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
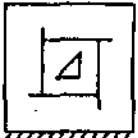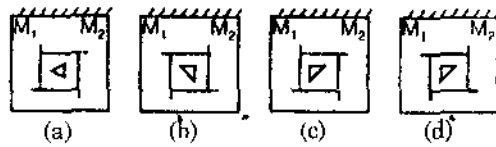
24. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
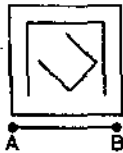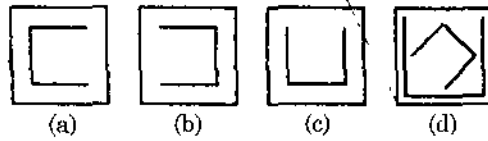
25. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
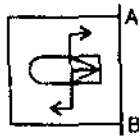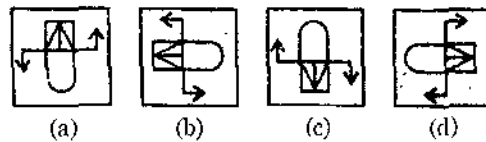
26. Problem Figure

Answer Figures

(a)   (b)   (c)   (d)
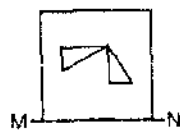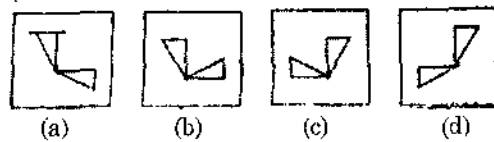
27. Problem Figure

Answer Figures

   (a)   (b)   (c)   (d)
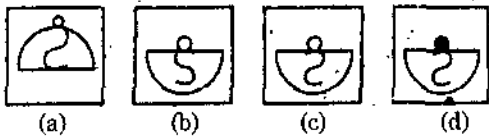
28. Problem Figure

Answer Figures

   (a)   (b)   (c)   (d)
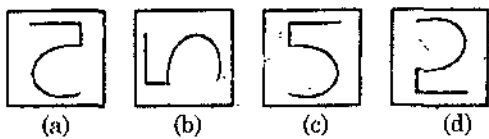
29. Problem Figure

Answer Figures

   (a)   (b)   (c)   (d)
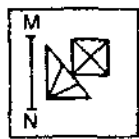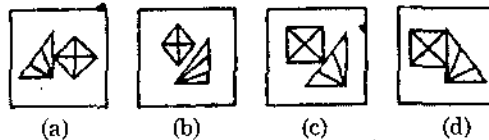
30. Problem Figure

Answer Figures

   (a)   (b)   (c)   (d)
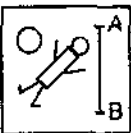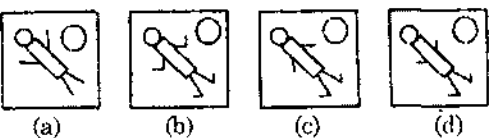
ANSWERS

1. (b)	2. (b)	3. (c)	4. (a)	5. (a)	6. (b)	7. (a)	8. (c)	9. (b)	10. (a)
11. (a)	12. (d)	13. (a)	14. (c)	15. (c)	16. (b)	17. (a)	18. (c)	19. (e)	20. (b)
21. (d)	22. (c)	23. (b)	24. (d)	25. (b)	26. (c)	27. (c)	28. (d)	29. (c)	30. (b)

U N I T

6

NUMBERS AND NUMBER SERIES

STRUCTURE

- Natural Numbers
- Signed Numbers
- Rules of Divisibility
- H.C.F. and L.C.M.
- Number Series
- □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Face value.
- Integers : Even and odd integers.
- Prime numbers and rules of divisibility.
- Questions based on number series and HCF/LCM for practice.

A particular value or sum of single things or units is called number.

• 6.1. NATURAL NUMBERS

Counting numbers 1, 2, 3 ..... are known as natural numbers.

Face Value : The face value of a digit in a numeral is the value of the digit itself at whatever place it may be *e.g.*,

In the numerical of 2 8 5 8 3, we have

The place value of 3 is 3 units = 3

The place value of 8 is 8 tens = 80

The place value of 5 is 5 hundred = 500

The place value of 8 thousand = 8000

The place value of 2 is 2×10 Thousands = 20,000

• SIGNED NUMBERS

The numbers to the right of 0 on the number line are called positive and those to the left of 8 are called negative. Negative numbers must be written with a negative sign (– 2); positive numbers can be written with a plus sign (+ 2) but are usually written without a sign (2). All numbers can be called signed numbers.

Integers : Any number in the set (..., – 3, – 2, – 1, 0, 1, 2, 3 ...) is an integer. Let x and y be two integers and $x \neq 0$, x is a divisor (factor) of provided that $y = xn$ for some integer n. In this case y is also said to be divisible by x or be a multiple of x. For example, 9 is a divisor of or factor of 27 since = 9×3 but 5 is not a divisor of 27. Since there is no integer in n such that 27 = 5n.

Even Integer : Is any integer which is divisible by 2. The set of integers is (..., – 4, –2, 0, 2, 4, 6, 8, ...).

Odd Integers : Integer that are not divisible by 2 are called odd integers. The set of odd integers are (..., –3, –1, 1, 3, 5, ...).

If one factor of an integer is *even* then the product is even otherwise the product is *odd*.

Consecutive integers are represented by n, $n + 1$, $n + 2$, $n + 3$ ... where n is an integer. The numbers are –2, –1, 0, 1, 2, 3, 4, 5.

Consecutive even integers : 0, 2, 4, 6, 8, they are represented by $2n$, $2n + 2$, $2n + 4$, ..., where n is an integer.

Consecutive odd integers : 1, 3, 5, 7, 9, they can represented by $2n + 3$, $2n + 5$, ..., where n is an integer.

Note : The integer 0 is neither positive nor negative.

Even numbers : Numbers which are exactly divisible by 2 are even number.

Odd numbers : which are not exactly divisible by 2.

Prime Numbers : Every number larger than 1 having exactly two factors is called a prime number, *e.g.,* 3, 5, 11, 19 etc. .

Ex. 1. Find the unit's digit in the product $(336 \times 87 \times 119)$.

Sol. Product of unit's digits in given number = $(6 \times 7 \times 9) = 378$.

∴ Unit digit in the given product is 8.

Ex. 2. If the sum of three consecutive integers is less than 75, what is the greatest possible value of the smallest one ?

Sol. Let the numbers be n, $n + 1$, and $n + 2$. Then

$$n + (n + 1) + (n + 2) = 3n + 3 \Rightarrow 3n + 3 < 75 \Rightarrow 3n < 72 \Rightarrow n < 24.$$

Ex. 3. If $2 < x < 4$ and $3 < y < 7$, what is the largest integer value of $x + y$?

Sol. If x and y are integers, the largest value is $3 + 6 = 9$. However, although $x + y$ is to be an integer, neither x nor y must be. If $x = 3.8$ and $y = 8.2$, then $x + y = 10$.

Ex. 4. Which of the following are prime numbers ?

(i) 241   (ii) 337   (iii) 391

Sol. (i) Clearly, $16 < \sqrt{241}$.

Prime numbers less than 16 are 2, 3, 5, 7, 11, 13. 241 is not divisible by any of them.

∴ 241 is a prime number.

(ii) Clearly, $19 > \sqrt{337}$.

Prime numbers less than 19 are 2, 3, 5, 7, 11, 13, 17. 837 is not divisible by any of them.

∴ 337 is a prime number.

(iii) Clearly, $20 > \sqrt{391}$.

Prime numbers less than 20 are 2, 3, 5, 7, 11, 13, 17, 19. We find that 391 is divisible by 17.

∴ 391 is not prime.

• RULES OF DIVISIBILITY

(1) *Divisibility by 2 :* A number is divisible by 2 when the units digit is 0 or even (2, 4, 6, 8).

(2) *Divisibility by 4 :* A number is divisible by 4 when two right hand digits are zeros or the number of formed by them is divisible by four.

(3) *Divisibility by 8 :* When the three right hand digits (units, tens and hundreds) are 000 or the numbers formed by them is divisible by 8 then the number of divisible by 8.

(4) *Divisibility by 5 :* When a number has 0 or 5 in the units place.

(5) *Divisibility by 3 :* If the sum of the digits in the number is exactly divisibile by 3.

(6) *Divisibility by 9 :* When the sum of digits is exactly divisible by 9.

(7) *Divisibility by 11 :* First add the alternative digits in the odd places beginning with the digit in the units place then add the digits in the even places. If the difference between these sums is zero or exactly divisible by 11 then the number is divisible by 11.

(8) *Divisibility by 6 :* If the number is divisible by 2 and 3 then it is divisible by 6 also.

(9) *Divisibility by* 12 : If a number is divisible by both 3 and 4 it will be divisible by 12 also.

Ex. 5. Which of the following numbers is not divisible by 2 ?

(i) 9130525   (ii) 7870832

Sol. (i) Clearly, the unit's digits of 9130525 is 5, which is not divisible by 2. So, 9130525 is not divisible by 2.

(ii) 7870832 has a unit digit divisible by 2.

Ex. 6. Which of the following numbers is divisible by 3 ?

(i)   541326   (ii) 5967013

Sol. (i) Sum of digits in 541326 is 21, which is divisible by 3. So, 541326 is divisible by 3.

(ii) Sum of digits in 5967013 is 31, which is not divisible by 3. Hence, 5967013 is not divisible by 3.

Ex. 7. Which of the following numbers is divisible by 9 ?

(i) 19725462   (ii) 36870521

Sol. (i) Sum of digits in 19725462 is 36, which is divisible by 9. So the given number is divisible by 9.

(ii) Sum of digits in 36870521 is 32, which is not divisible by 9. So, the given number is not divisible by 9.

Ex. 8. Which of the following numbers is divisible by 4 ?

(i) 67920594   (ii) 618703572

Sol. (i) The number formed by the last 2 digits in the given number is 94, which is not divisible by 4.

∴ 67920594 is not divisible 4.

(ii) The number formed by the last 2 digits in the given number is 72, which is divisible by 4.

∴ 618703572 is divisible by 4.

Ex. 9. Which of the following numbers is divisible by 8 ?

(i) 98016542   (ii) 106598304

Sol. (i) The number formed by the last 3 digits of the given number is 542, which is not divisible by 8.

∴ 98016542 is not divisible by 8.

(ii) The number formed by the last 3 digits of the given number is 304, which is divisible by 8.

∴ 106598304 is divisible by 8.

Ex. 10. Show that 4832718 is divisible by 11.

Sol. (Sum of digits at odd places) – (Sum of digits at even places)

= [(8 + 7 + 3 + 4) – (1 + 2 + 8)] = 11, which is divisible by 11.

∴ 4832718 is divisible by 11.

• H.C.F. AND L.C.M.

H.C.F of a set of numbers is the greatest one that will divide that number exactly.

L.C.M. of a set of numbers is the number which is the smallest and in divisible by all the numbers.

H.C.F. and L.C.M. of proper function $\dfrac{a}{b}$, $\dfrac{c}{d}$. $\dfrac{e}{f}$ are worked out

$$H.C.F. = \frac{H.C.F. \text{ of } a\,c\,e}{L.C.M. \text{ of } a\,d\,f}$$

$$L.C.M. = \frac{L.C.M. \text{ of } a\,c\,e}{H.C.F. \text{ of } b\,d\,f}$$

Ex. 11. The H.C.F. and L.C.M. of two numbers are 123 and 8856 respectively. If one number is 1107 find the other one.

Sol. Product of number = L.C.M. and H.C.F.

$\therefore$ One number $= \dfrac{\text{H.C.F.} \times \text{L.C.M.}}{\text{Second number}}$

$\quad\quad\quad\quad = \dfrac{123 \times 8856}{1107} = 984$ **Ans.**

Ex. 12. The product of two numbers is 2352 and their LCM is 168. Find all the possible pairs of such numbers.

Sol. Product of numbers = L.C.M. × H.C.F.

$\therefore$ H.C.F. = 2352 + 168 = 14

$\quad\quad$ 168 + 14 = 12 = 1 × 12, 3 × 4

$\therefore$ The numbers are

(i) 14 × 1, 14 × 12 = 14, 168

(ii) 14 × 3, 14 × 4 = 42, 56 **Ans.**

• NUMBER SERIES

Let '*a*' and '*b*' be any two numbers then :

(i) $(a + b)^2 \quad\quad = a^2 + b^2 + 2ab$

(ii) $(a - b)^2 \quad\quad = a^2 + b^2 - 2ab$

(iii) $(a + b)(a - b) \quad = a^2 - b^2$

(iv) $(a - b) \quad\quad\quad = \dfrac{a^2 - b^2}{a + b}$

(v) $(a + b)^3 \quad\quad = a^3 + b^3 + 3a^2b + 3ab^2$

(vi) $(a - b)^3 \quad\quad = a^3 - b^3 + 3a^2b + 3ab^2$

(vii) $\dfrac{a^3 - b^3}{a^2 - ab + b^2} = a - b$

(viii) $\dfrac{a^3 + b^3}{a^2 - ab + b^2} = a + b$

(ix) $(a + b + c) = \dfrac{a^3 + b^3 + c^3 - 3abc}{a^2 + b^2 + c^2 - ab - bc - ca}$

Ex. 13. Multiply 1014 by 986 by short cut method.

Sol. $\quad 1014 \times 986 = (1000 + 14) \times (1000 - 14)$

$\quad\quad\quad\quad\quad\quad = (1000)^2 - (14)^2 \quad\quad [\because \ a^2 - b^2 = (a + b) \times (a - b)]$

$\quad\quad\quad\quad\quad\quad = 1000000 - 196$

$\quad\quad\quad\quad\quad\quad = 999804$

Ex. 14. Evaluate :

(i) $921 \times 137 + 921 \times 863$

(ii) $425 \times 65 + 425 \times 35$

Sol. (i) $921 \times 137 + 921 \times 863$

$\quad\quad\quad\quad = 921 (137 + 863) = 921 (1000) = 921000$

(ii) $425 \times 65 + 425 \times 35$

$\quad\quad\quad\quad = 425 (65 + 35) = 425 \times 100 = 42500$

Ex. 15. Evaluate :

(i) $\dfrac{527 \times 527 \times 527 + 183 \times 183 \times 183}{527 \times 527 - 527 \times 183 + 183 \times 183}$

(ii) $\dfrac{458 \times 458 \times 458 - 239 \times 239 \times 239}{458 \times 458 + 458 \times 239 + 239 \times 239}$

(iii) $\dfrac{(614+168)^2 + (614-168)^2}{614 \times 168}$

(iv) $\dfrac{(832+278)^2 + (832-278)^2}{832 \times 832 + 278 \times 278}$

Sol. (i) Given Expression $= \dfrac{(527)^3 + (183)^3}{(527)^2 - 527 \times 183 + (183)^2}$

$= \dfrac{a^3 + b^3}{a^2 - ab + b^2} = (a+b) = (527+183) = 710.$

(ii) Given Expression $= \dfrac{(458)^3 - (239)^3}{(458)^2 + 458 \times 239 + (239)^2}$

$= \dfrac{a^3 - b^3}{a^2 + ab + b^2} = (a-b) = (458 - 239) = 219.$

(iii) Given Expression $= \dfrac{(a+b)^2 - (a-b)^2}{ab} = \dfrac{4ab}{4} = 4.$

(iv) Given Expression $= \dfrac{(a+b)^2 + (a-b)^2}{(a^2 + b^2)} = \dfrac{2(a^2 + b^2)}{(a^2 + b^2)} = 2.$

Ex. 16. Solve : (i) 1210×1210 (ii) 1396×1396

Sol. (i) $1210 \times 1210 = (1210)^2 = (1200+10)^2$

$= (1200)^2 + (10)^2 + 2 \times 1200 \times 10$

$= 1440000 + 100 + 24000 = 1464100$

(ii) $1396 \times 1396 = (1396)^2 = (1400-4)^2$

$= (1400)^2 + (4)^2 - 2 \times 1400 \times 4$

$= 1960000 + 16 - 11200 = 1948816$

Ex. 17. Simplify :

(i) $896 \times 896 - 204 \times 204 = ?$

(ii) $57 \times 57 + 43 \times 43 + 2 \times 57 \times 43 = ?$

Sol. (i) Given Exp. $= (896)^2 - (204)^2$

$= (896 + 204)(896 - 204) = 1100 \times 692 = 761200.$

(ii) Given Exp. $= (57)^2 + (43)^2 + 2 \times 57 \times 43$

$= a^2 + b^2 + 2ab,$ where $a = 57, b = 43$

$= (a+b)^2 = (57+43)^2 = (100)^2 = 1000.$

Ex. 18. Evaluate : $(313 \times 313 + 287 \times 287)$

Sol. $(a^2 + b^2) = \dfrac{1}{2}[(a+b)^2 + (a-b)^2]$

$\therefore$ $(313)^2 + (287)^2 = \dfrac{1}{2}[(313+287)^2 + (313-287)^2]$

$= \dfrac{1}{2}[(600)^2 + (26)^2] = \dfrac{1}{2}(360000 + 676) = 180338.$

Note : If we divide a given number by another number, then :

Dividend = (Divisor × Quotient) + Remainder

Ex. 19. On dividing 13968 by a certain number, the quotient is 93 and the remainder is 18. Find the divisor.

Sol. $\text{Divisor} = \dfrac{\text{Dividend} - \text{Remainder}}{\text{Quotient}} = \dfrac{13968 - 18}{93} = 150$

Ex. 20. What least number must be subtracted from 1000 to get a number exactly divisible by 13 ?

Sol. On dividing 1000 by 13, we get 12 is remainder

$\therefore$ Required number to be subtracted = 12.

Ex. 21. What least number must be added to 2000 to obtain a number exactly divisible by 17 ?

Sol. On dividing 2000 by 17, we get 11 as remainder.

∴ Number to be added = 17 – 11 = 6.

Ex. 22. Find the number which is nearest to 3105 and exactly divisible by 21.

Sol. On dividing 3105 by 21, we get 18 as remainder.

∴ Number to be added to 3105 is (21 – 18) = 3.

∴ 3108 is the required number.

Ex. 23. A number when divided by 342 gives a remainder 47. Whn the same number is divided by 19, what would be the remainder ?

Sol. On dividing the given number by 342, let k be the quotient and 47 as remainder.

Then, number = $342k + 47 = (19 \times 18k + 19 \times 2 + 9) = 19(18k + 2) + 9$

∴ The given number when divided by 19, gives $(18k + 2)$ as quotient and 9 as remainder.

Ex. 24. Find : (i) ? ÷ 137 = 19   (ii) ? × 144 = 12528

Sol. Let $P = x$ so (i) $x \div 137 = 19$

or $\dfrac{x}{137} = 19$

∴ $x = 19 \times 137 = 2603$

(ii) $x \times 144 = 12528$

∴ $x = \dfrac{12528}{144} = 87$

• TEST YOURSELF

1. What is the difference between the place values of 9 in the numerical value of 96390?

2. Find the missing value :

   (i) 6581 – (30 + 288 + 1493 + 2874) = ?

   (ii) 35720 – (?) = 2835

   (iii) (?) – 935421 = 1635775

   (iv) 35899 – 15105 – 6799 = ?

3. Multiply 5793405 by 99999 by short cut method.

4. Evaluate (i) 986 × 137 + 986 × 863

   (ii) 983 × 207 – 983 × 107

5. Evaluate : (i) $\dfrac{321 \times 321 \times 321 + 113 \times 113 \times 113}{321 \times 321 - 321 \times 113 + 113 \times 113}$

   (ii) $\dfrac{685 \times 685 \times 685 - 375 \times 375 \times 375}{685 \times 685 + 685 \times 375 + 375 \times 375}$

6. Simplify : (i) 1605 × 1605   (ii) 1398 × 1398

7. Find the unit digit in the product (529 × 325 × 176).

8. In a cricket match A, B and C together scores 108 runs, B and C together 90 and A and C together 51. Find the number of runs scored by each.

9. What is the sum of prime numbers between 60 and 90 ?

10. What least number must be subtracted from 13294 so that the remainder is exactly divisible by 97 ?

11. A number is divided by 999, the quotient is 366 and the remainder is 103. What is the number ?

12. The H.C.F. of two numbers is 11 and their L.C.M. is 693. If one of the numbers is 77, find the other.

13. The product of 469157 × 9999 is :

    (a) 4586970843   (b) 4686970743   (c) 4691100843   (d) 584649125

14. The product of 935421 × 625 is :

(a) 575648125   (b) 584638125   (c) 585628125   (d) 584649125

15. The product of $(384 \times 387 + 114 \times 114 + 2 \times 387 \times 114) =$
    (a) 250001   (b) 251001   (c) 260110   (d) 261001

16. The product of 1014×986 is :
    (a) 998904   (b) 999804   (c) 998814   (d) 998804

17. The product of 1299×1299 is :
    (a) 1585301   (b) 1684701   (c) 1685401   (d) 1687401

18. The product of $106 \times 106 + 94 \times 94$ is :
    (a) 21032   (b) 20032   (c) 23032   (d) 20072

19. $(475 + 425)^2 - 4 \times 475 \times 425$ is equal to :
    (a) 3600   (b) 3500   (c) 2500   (d) 3160

20. The product of 5358×51 is :
    (a) 273358   (b) 273258   (d) 273348   (d) 273268

21. The product of 1307×1307 is :
    (a) 1601249   (b) 1607249   (c) 1701249   (d) 1708249

22. What is the total number of prime numbers less than 70 ?
    (a) 17   (b) 18   (c) 19   (d) 20

23. If $\dfrac{a}{b} = \dfrac{4}{3}$, then $\dfrac{3a + 2b}{3a - 2b} = ?$
    (a) – 1   (b) 3   (c) 5   (d) 6

24. $8756 \times 99999 = ?$
    (a) 815491244   (b) 796491244   (c) 875591244   (d) None of these

25. $9787 \times 123 + 9787 \times 77 = ?$
    (a) 1867400   (b) 1957400   (c) 1967600   (d) 1887400

26. $1399 \times 1399 = ?$
    (a) 1687401   (b) 1901541   (c) 1943211   (d) 1957201

27. $\dfrac{(856 + 167)^2 + (856 - 167)^2}{856 \times 856 + 167 \times 167}$ is equal to :
    (a) 1   (b) 2   (c) 689   (d) 1023

28. $\dfrac{(469 + 174)^2 - (469 - 174)^2}{469 \times 174}$ is equal to :
    (a) 2   (b) 4   (c) 643   (d) 295

29. $(186 \times 186 + 159 \times 159 - 2 \times 186 \times 159)$ is equal to :
    (a) 7029   (b) 1039   (c) 2019   (d) 729

30. $\left(\dfrac{147 \times 147 + 147 \times 143 + 143 \times 143}{147 \times 147 \times 147 - 143 \times 143 \times 143} \right)$ is equal to :
    (a) 4   (b) $\dfrac{1}{4}$ (c) 290   (d) $\dfrac{1}{290}$

ANSWERS

1. 89910   2. (i) 4685 (ii) 32885 (iii) 2571196 (iv) 13995   3. 579334706595
4. (i) 986000 (ii) 98300   5. (i) 434 (ii) 98300   6. (i) 2576025 (ii) 1954404   7. 0
8. $A = 18$, $B = 57$, $C = 33$ 9. 523   10. 5   11. 365737   12. 99
13. (c)   14. (b)   15. (b)   16. (b)   17. (d)   18. (d)   19. (c)   20. (b)
21. (d)   22. (c)   23. (b)   24. (c)   25. (b)   26. (d)   27. (b)   28. (b)   29. (d)   30. (b)

UNIT

7

DECIMAL FRACTIONS

STRUCTURE

- Fractions
- Mixed Numbers
- Addition and Subtraction of Decimal Fractions
- Multiplication of a Decimal Fraction by a Power of 10
- Multiplication of Decimal Fractions
- Dividing a Decimal Fraction by a Counting Number
- Dividing Decimal Fraction by a Decimal Fraction
- H.C.E. and L.C.M. of Decimal Fractions
- *Comparison of Fractions*
- Recurring Decimal
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Rule for converting a decimal into vulgar fraction.
- Addition, multiplication and division of fraction.
- *Converting a pure recurring decimal into vulgar fraction.*
- Mixed recurring decimal.
- Converting a mixed recurring decimal into vulgar fraction.

• 7.1. FRACTIONS

In a fraction $\frac{a}{b}$, a is the *numerator* and b is the denominator. The denominator of a fraction cannot be zero, because division by zero cannot be defined.

Equivalent fractions : Two fractions are equivalent if they represent the same number. For example $\frac{1}{3}, \frac{3}{9}, \frac{9}{27}$ are equivalent as they represent the number $\frac{1}{3}$.

Decimal Fractions : Fractions are known as decimal fractions if denominators are present in powers of 10, like $\frac{2}{100} = 0.02$, $\frac{9}{1000} = 0.009$.

Rule for Converting a Decimal into Vulgar Fraction : You can put 1 in the denominator under the decimal point and annex with it as many zeros as is the number of digits after the decimal point. Now you can remove the decimal point and reduce the fraction to its lowest terms, *e.g.*, $0.25 = \frac{25}{100} = \frac{1}{4}$.

$$0.085 = \frac{85}{1000} = \frac{17}{200}$$

Note : (i) Annexing zeros to the extreme right of a decimal fraction does not change its value *e.g.*, $0.8 = 0.80 = 0.800$.

(ii) If the decimal places are same in numerator and denominator of a fraction we can remove the decimal sign *e.g.*,

$$\frac{1.84}{2.99} = \frac{184}{299} = \frac{8}{13}, \quad \frac{0.625}{0.225} = \frac{625}{225} = \frac{25}{9}$$

Addition of fractions : To add $\frac{3}{5}$ and $\frac{7}{2}$ multiply the numerator and denominator of the first fraction by 2 and the numerator and denominator of the second fraction by 5, obtaining $\frac{6}{10}$ and $\frac{35}{10}$ respectively.

$$\frac{6}{10} + \frac{35}{10} = \frac{41}{10}$$

Multiplication and division of fraction : To multiply two fractions, simply multiply the two numerators and multiply the two denominators. For example,

$$\frac{7}{3} \times \frac{6}{4} = \frac{7 \times 6}{3 \times 4} = \frac{42}{12} = \frac{21}{6}$$

• 7.2. MIXED NUMBERS

A number which consists of a whole number and a fraction *e.g.*, $5\frac{2}{3}$ is a mixed number. $5\frac{2}{3}$ means $5 + \frac{2}{3}$. → To change a mixed number into fraction

$$5\frac{2}{3} = \frac{(3 \times 5) + 2}{3} = \frac{17}{3}$$

• 7.3. ADDITION AND SUBTRACTION OF DECIMAL FRACTIONS

The given numbers are so placed under each other that the decimal points lie in one column. The numbers so arranged can now be added or subtracted in a usual way, *e.g.*,

(i) 621 + 5.0128 + 0.325 + 6.0017 = ?   (ii) 13 − 5.1967 = ?

$$\begin{array}{r} 617.0 \\ 5.0128 \\ 0.325 \\ + 6.0017 \\ \hline 628.3395 \end{array}$$

$$\begin{array}{r} 13.0000 \\ - 5.1967 \\ \hline 7.8033 \end{array}$$

• 7.4. MULTIPLICATION OF A DECIMAL FRACTION BY A POWER OF 10

Shift the decimal point to the right by as many places of decimal as is the power of 10, *e.g.*, $5.2829 \times 100 = 528.29$ and $0.057 \times 10000 = 570$

• 7.5. MULTIPLICATION OF DECIMAL FRACTIONS

Multiply the given numbers considering them without the decimal point. Now, in the product, the decimal point is marked off to obtain as many places of decimal as is the sum of the number of decimal places in the given numbers, *e.g.*,

$$0.5 \times 0.04 \times 0.006 \times 30$$

Sol. $5 \times 4 \times 6 \times 30 = 3600$

Sum of decimal places = (1 + 2 + 3 + 0) = 6

∴ product = 0.003600 = 0.0036.

• 7.6. DIVIDING A DECIMAL FRACTION BY A COUNTING NUMBER

Divide the given number without considering the decimal point by the given counting number. Now, in the quotient, put the decimal point to give as many places of decimal as are there in the dividend, *e.g.*,

$$0.72 \div 9 = 0.08$$

$$0.0204 \div 12 = 0.0017$$

• 7.7. DIVIDING A DECIMAL FRACTION BY A DECIMAL FRACTION

Multiply both the dividend and the divisor by a suitable power of 10 to make divisor a whole number, *e.g.*,

$$\frac{45}{0.05} = \frac{45 \times 100}{0.05 \times 100} = \frac{4500}{5} = 900$$

• 7.8. H.C.F. AND L.C.M. OF DECIMAL FRACTIONS

In given numbers, make the same number of decimal places by annexing zeros in some numbers, if necessary. Considering these numbers without decimal point, find H.C.F. or L.C.M. as the case may be. Now, in the result, mark off as many decimal places as are there in each of the given numbers.

• 7.9. COMPARISON OF FRACTIONS

Convert each one of the given fractions in the decimal form. Now, arrange them in ascending order, as per requirements, *e.g.*,

Ex. Arrange the fractions $\frac{5}{6}$, $\frac{7}{12}$ and $\frac{3}{7}$ in ascending order.

Sol. Converting each fraction into decimal form

$$\frac{5}{6} = 0.833; \quad \frac{7}{12} = 0.5833 \quad \text{and} \quad \frac{3}{7} = 0.4285$$

Now, $0.4285 < 0.5833 < 0.833$

$$\frac{3}{7} < \frac{7}{12} < \frac{5}{6}.$$

• 7.10. RECURRING DECIMAL

If in a decimal fraction, a figure or a set of figures is repeated continuously, then such a number is called a recurring decimal, *e.g.*,

$$\frac{1}{3} = 0.33 \text{ and } \frac{2}{3} = 0.666 = 0.6 \text{ (pure recurring decimal)}$$

Converting a Pure Recurring Decimal into Vulgar Fraction :

Rule : Write the repeated figures only once in the numerator and take as many nines in the denominator as is the number of repeating figures, *e.g.*,

$$0.\overline{37} = \frac{37}{99}; \quad 3.\overline{0534} = 3 + 0.\overline{0534} = 3\frac{534}{9999}$$

Mixed Recurring Decimal : A decimal fraction in which some figures do not repeat and some of them are repeated, is called a mixed recurring decimal, *e.g.*,

$$0.173333 \ldots = 0.17\overline{3}.$$

Converting a Mixed Recurring Decimal into Vulgar Fraction : In the numerator, take the difference between the number formed by all the digits after decimal point (taking repeated digits only once) and that formed by the digits which are not repeated. In the denominator, take the number formed by as many nines as there are repeating digits followed by as many zeros as is the number of non-repeating digits.

Ex. Express the following as vulgar Fractions :

(i) $0.1\overline{7}$ (ii) $0.12\overline{54}$ (iii) $2.5\overline{36}$

Sol. (i) $0.1\overline{7} = \frac{17-1}{90} = \frac{16}{90} = \frac{8}{45}$

(ii) $0.12\overline{54} = \frac{1254-12}{9900} = \frac{1242}{9900} = \frac{69}{550}.$

(iii) $2.5\overline{36} = 2 + 0.5\overline{36} = 2 + \frac{536-53}{900} = 2 + \frac{483}{900} = 2 + \frac{161}{300} = 2\frac{161}{300}.$

• TEST YOURSELF

1. Change the following decimals into Vulgar fractions :

    (i) 0.25   (ii) 0.075   (c) 2.75   (d) 0.645

2. Add these fractions : $\frac{7}{9}$, $\frac{3}{5}$, $\frac{6}{7}$.

3. What is the total of $(5.064 + 3.98 + 0.7036 + 7.6 + 0.3 + 2)$?

4. Evaluate the value of x :
   (i) $67.32 + x = 431.146$.
   (ii) $107.07 - x = 63.932$.

5. Arrange the given fractions in ascending order : $\dfrac{5}{6}, \dfrac{6}{8}, \dfrac{7}{9}$ and $\dfrac{11}{13}$.

6. Arrange the given fractions in descending order $\dfrac{7}{12}, \dfrac{5}{6}, \dfrac{8}{9}, \dfrac{3}{4}$.

7. If $2.5x = 0.08\,y$ then what is the value of $\dfrac{y-x}{y+x}$?

8. What is the value of $0.\bar{6} + 0.\bar{7} + 0.\bar{8} + 0.\bar{3}$?

9. What is the value of $(3.\overline{87} - 2.\overline{59})$?

10. What is the LCM of 3, 2.7 and 0.09 ?

11. $0.7683 + 0.369 + 0.05 + 0.8 = ?$
    (a) 0.8065 (b) 1.9873 (c) 0.8110 (d) None

12. $3.1469 + 6.837 + ? = 15$.
    (a) 24.9839 (b) 5.7634 (c) 5.0161 (d) None

13. $1.086 - 0.3983 - 0.669 = ?$
    (a) 0.6208 (b) 1.3948 (c) 0.0048 (d) 0.0187

14. $14.3 + 16.78 - ? = 9.009$.
    (a) 40.089 (b) 22.071 (c) 21.810 (d) None of these

15. $852.2109 + 106.78 - 59.157 = ?$
    (a) 899.8339 (b) 889.8339 (c) 899.9833 (d) 804.5879

16. $5463 + 546.3 - 54.63 + ? = 5999.3$
    (a) 0.05463 (b) 0.5463 (c) 5.463 (d) None of these

17. Which of the following fractions is the smallest ?
    (a) $\dfrac{13}{16}$ (b) $\dfrac{15}{19}$ (c) $\dfrac{17}{21}$ (d) $\dfrac{7}{8}$

18. Which of the following fractions is less than $\dfrac{7}{8}$ and greater than $\dfrac{1}{3}$?
    (a) $\dfrac{1}{4}$ (b) $\dfrac{23}{24}$ (c) $\dfrac{11}{12}$ (d) $\dfrac{17}{24}$

19. $(25.025 + 0.025)$ is equal to :
    (a) 10.01 (b) 100.1 (c) 1001 (d) 0.1001

20. $\dfrac{86.04}{4000}$ is equal to :
    (a) 0.10215 (b) 0.02151 (c) 0.15201 (d) 0.21015

21. $4.8438 \div 0.069 = ?$
    (a) 60.2 (b) 70.2 (c) 69.2 (d) 71.2

22. The value of $(3.75 \times 3.75 - 2 \times 3.75 \times 2.75 + 2.75 \times 2.75)$ is :
    (a) 1 (b) 1.75 (c) 4.75 (d) 6.50

23. The value of $(25.732)^2 - (15.732)^2$ is :
    (a) 414.64 (b) 41.464 (c) 4146.4 (d) 4.1464

24. The H.C.F. of 1.75, 5.6 and 7 is :
    (a) 0.07 (b) 0.7 (c) 3.5 (d) 0.35

25. If $1.5x = 0.04y$, then the value of $\left(\dfrac{y-x}{y+x}\right)$ is :
    (a) $\dfrac{730}{77}$ (b) $\dfrac{73}{77}$ (c) $\dfrac{7.3}{77}$ (d) None of these

26. $(7.5 \times 0.9 \times 14.4)$ is equal to :
    (a) 48.6 (b) 91.44 (c) 97.2 (d) 94.95

27. $1.\overline{34}$ expressed as a fraction is :

(a) $\dfrac{134}{100}$ (b) $\dfrac{134}{99}$ (c) $\dfrac{133}{99}$ (d) None of these

28. The value of $4.\overline{12}$ is :

(a) $4\dfrac{11}{90}$ (b) $4\dfrac{11}{99}$ (c) $\dfrac{371}{900}$ (d) None of these

ANSWERS

1. (i) $\dfrac{1}{4}$ (ii) $\dfrac{3}{40}$ (iii) $\dfrac{11}{4}$ (iv) $\dfrac{129}{200}$ 2. $\dfrac{704}{315}$ 3. 19.6476   4. (i) 363.826 (ii) 43.138

5. $\dfrac{6}{8} < \dfrac{7}{9} < \dfrac{5}{6} < \dfrac{11}{13}$ 6. $\dfrac{8}{9} > \dfrac{5}{6} > \dfrac{7}{12} > \dfrac{3}{4}$ 7. $\dfrac{47}{53}$ 8. $\dfrac{8}{3}$ 9. $1.\overline{28}$ 10. 27   11. (b)   12. (c)

13. (d)   14. (b)   15. (a)   16. (c)   17. (b)   18. (d)   19. (c)   20. (b)   21. (b)   22. (a)

23. (a)   24. (d)   25. (b)   26. (c)   27. (c)   28. (a)

UNIT

8

PERCENTAGE

STRUCTURE

- Some Important Rules and Formulae related to Percentage
  □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Formulae of percentage and questions based on it for practice.

• 8.1. SOME IMPORTANT RULES AND FORMULAE RELATED TO PERCENTAGE

1. Percentage can be expressed as "per cent" by multiplying the fraction by 100. It is represented by the sign %. In other word, percentage means for every hundred. Five per cent means five for every hundred. So, 100% means 1.

$$50\% \text{ means} \Rightarrow \frac{50}{100} = \frac{1}{2}$$

$$25\% \text{ means} \Rightarrow \frac{25}{100} = \frac{1}{4}$$

$$75\% \text{ means} \Rightarrow \frac{75}{100} = \frac{3}{4}$$

$$37\frac{1}{2} \text{ means} \Rightarrow \frac{3}{8}.$$

2. If X is $r\%$ more than Y then Y is less than X by $\left\{\frac{r}{100+r} \times 100\right\}\%$.

3. If X is $r\%$ less than Y, then Y is more than X by $\left\{\frac{r}{100-r} \times 100\right\}\%$.

4. Population after n years $= P\left(1 + \frac{r}{100}\right)^n$

Population n years ago $= \dfrac{P}{\left(1 + \dfrac{r}{100}\right)^n}$

where P = per cent population, n = time, r = rate per annum.

5. Results on depreciation :

(i) Value of machine after n years $= P\left(1 - \frac{r}{100}\right)^n$

(ii) Value of machine after n years ago $= \dfrac{P}{\left(1 - \dfrac{r}{100}\right)^n}$

Ex. 1. Express each of the following as a fraction :

(a) 8%   (b) 20%   (c) 20.5%   (d) $22\frac{1}{2}\%$ (e) $16\frac{2}{3}\%$

Sol. (a) $8\% = \dfrac{8}{100} = \dfrac{2}{25}$ (b) $20\% = \dfrac{20}{100} = \dfrac{1}{5}$

(c) $20.5\% = \dfrac{20.5}{100} = \dfrac{205}{100 \times 10} = \dfrac{41}{200}$ (d) $22\dfrac{1}{2}\% = \dfrac{45}{2 \times 100} = \dfrac{9}{40}$

(e) $16\dfrac{2}{3}\% = \dfrac{50}{3 \times 100} = \dfrac{1}{6}$

Ex. 2. Express each of the following in decimal form :

(a)   12%   (b) 23%   (c) 2.62%   (d) 0.1%   (e) 0.01%

Sol. (a) $12\% = \dfrac{12}{100} = 0.23$ (b) $23\% = \dfrac{23}{100} = 0.23$

(c) $2.62\% = \dfrac{2.62}{100} = 0.0262$ (d) $0.1\% = \dfrac{0.1}{100} = 0.001$

(e) $0.01\% = \dfrac{0.01}{100} = 0.0001$

Ex. 3. Express each of the following fraction in 'percent form"

(a) $\dfrac{2}{5}$ (b) $\dfrac{1}{2}$ (c) $\dfrac{3}{25}$ (d) $\dfrac{5}{2}$ (d) $\dfrac{1}{125}$

Sol. (a) $\dfrac{2}{5} \times 100\% = 40\%$ (b) $\dfrac{1}{2} = \dfrac{1}{2} \times 100\% = 50\%$

(c) $\dfrac{3}{25} = \dfrac{3}{25} \times 100\% = 12\%$ (d) $\dfrac{5}{2} = \dfrac{5}{2} \times 100\% = 250\%$

(e) $\dfrac{1}{125} = \dfrac{1}{125} \times 100\% = 0.8\%.$

Ex. 4. Find :

(a)   30% of 5   (b) 25% of 11   (c) 8% of 1.25 kg   (d) 20% of 20 m

(e)   45% of 10 lit.

Sol. (a) 30% of $5 = \dfrac{30}{100} \times 5 = \dfrac{3}{5} = 1.5$

(b) 25% of $5 = \dfrac{25}{100} \times 11 = \dfrac{11}{4}$

(c) 8% of 1.25 kg $= \dfrac{8}{100} \times 1.25 = \dfrac{1}{10} = 0.1$

(d) 20% of 20 m $= \dfrac{20}{100} \times 20$ m $= 4$ m

(e) 45% of 10 lit. $= \dfrac{45}{100} \times 10$ lit. $= 4.5$ lit.

Ex. 5. What percent is :

(a)   Rs. 20 of Rs. 150   (b) 500 gm. of 3 kg

(c)   Rs. 12.50 of Rs. 200   (d) 35 cms. of 1 metre

Sol. (a) Rs. 20 of Rs. 150 $=$ Rs. $\dfrac{20}{150} \times 100\% = 13\dfrac{1}{3}\%$

(b)   Let $x = \dfrac{500}{3 \times 1000} \times 100\% = \dfrac{50}{3}\%$

(c)   Let $x = \dfrac{12.50}{200} \times 100\% = 6.25\%$

(d)   Let $x = \dfrac{35}{100} \times 100\% = 35\%$

Ex. 6. Find 0.5% of Rs. 350.

Sol. Let $x = \dfrac{0.5}{100} \times 350 = 1.75$

Ex. 7. Find 8% of 3 kg.

Sol. Let $x = \dfrac{8}{100} \times 3 \times 1000 = 240$ gm.

Ex. 8. There are 800 students in a school. If 12% of the students failed, then find the number of these students who passed in the examination.

Sol. Let x is the number of these students, who passed in the examination, then

$$x = (100 - 12)\% \text{ of } 800 = \frac{88}{100} \times 800 = 704$$

Ex. 9. 5% of a number is the same as 22% of 500, find the number.

Sol. Let x is the required number, then according to the problem, 5% of x = 22% of 500.

or $$\frac{5}{100} \times x = \frac{22}{100} \times 500 \quad \Rightarrow \quad x = 2200$$

Ex. 10. A number when increased by 20% gives 45, find the number.

Sol. Let the required number is x, then according to the problem

$$x + 20\% \text{ of } x = 45 \quad \Rightarrow \quad x + \frac{x}{5} = 45 \quad \Rightarrow \quad x = 37\frac{1}{2}.$$

Ex. 11. In certain school 5% students were absent. If 570 students were present in the school, find the number of students.

Sol. Let x is the number of students in the school then according to the problem,

$$(100 - 5)\% \text{ of } x = 570 \quad \text{or} \quad 95\% \text{ of } x = 570$$

or $$\frac{95}{100} . x = 570 \quad \Rightarrow \quad x = 600 \text{ students.}$$

Ex. 12. If 17% increased salary of a man is Rs. 780, find his initial salary.

Sol. Let Rs. x is the initial salary, then

$$x + 17\% \text{ of } x = 780 \quad \Rightarrow \quad x = \frac{17x}{100} = 780$$

$$\therefore \qquad x = \frac{780 \times 100}{117} = \text{Rs. } 666\frac{2}{3}.$$

Ex. 13. If A's income is 35% more than that of B, then how much percent is B's income less than that of A ?

Sol. Required percentage $= \left\{ \frac{35}{(100 + 35)} \times 100 \right\}\% = 25.9\%$

Ex. 14. If A's height is 20% less than that of B, then how much percent is B's height more than that of A ?

Sol. Required percentage $= \left\{ \frac{20}{(100 - 20)} \times 100 \right\}\% = \left(\frac{20}{80} \times 100 \right)\% = 25\%.$

Ex. 15. The population of a town is 176400. If it increases at the rate of 5% per annum, what will be its population 2 years hence ?

What was it 2 years ago ?

Sol. Population after 2 years $= 176400 \times \left(1 + \frac{5}{100} \right)^2$

$$= \left(176400 \times \frac{21}{20} \times \frac{21}{20} \right) = 194481.$$

Population 2 years ago $= \dfrac{176400}{\left(1 + \dfrac{5}{100} \right)^2} = \left(176400 \times \frac{20}{21} \times \frac{20}{21} \right) = 160000$

Ex. 16. The value of a machine depreciates at the rate of 10% per annum. If its present value is Rs. 162000, what will be its worth after 2 years ? What was the value of the machine 2 years ago ?

Sol. Value of the machine after 2 years

$$= \text{Rs.} \left[162000 \times \left(1 - \frac{10}{100} \right)^2 \right] = \text{Rs.} \left(162000 \times \frac{9}{10} \times \frac{9}{10} \right) = \text{Rs. } 131220.$$

Value of the machine 2 years ago

$$= \text{Rs.} \left\{ \frac{162000}{\left[\left(1 - \frac{10}{100}\right)^2 \right]} \right\} = \text{Rs.} \left(162000 \times \frac{10}{9} \times \frac{10}{9} \right) = \text{Rs. } 200000.$$

Ex. 17. 1 litre of water is added to 5 litre of a 20% solution of alcohol in water. Find the strength of alcohol in the new solution.

Sol. Alcohol in 5 litre $= (20\% \text{ of 5 litre}) = \left(\frac{20}{100} \times 5 \right) = 1$ litre.

Alcohol in 6 litre of new mix. $= 1$ litre.

$\therefore$ Percentage of alcohol $= \left(\frac{1}{6} \times 100 \right)\% = 16\frac{2}{3}\%$.

Ex. 18. From the salary of an officer, 10% is deducted as house rent, 15% of the rest he spends on children's education and 10% of the balance, he spends on clothes. Then, he is left with Rs. 4131. Find his total salary.

Sol. Let his total salary be Rs. x. Then,

$$90\% \text{ of } 85\% \text{ of } 90\% \text{ of } x = 4131$$

or $$\frac{90}{100} \times \frac{85}{100} \times \frac{90}{100} x = 4131$$

$\therefore$ $$x = \frac{4131 \times 100 \times 100 \times 100}{90 \times 85 \times 90} = 6000.$$

Hence, the salary of the officer is Rs. 6000.

Ex. 19. Due to a reduction of $5\frac{5}{4}\%$ in the prices of sugar, a man is able to buy 1 kg more for Rs. 150. Find the original and reduced rate of sugar.

Sol. Let original rate of Rs. x per kg.

Reduced Rate $= \text{Rs.} \left(100 - \frac{25}{4} \right) . \frac{1}{100} x = \frac{15x}{16}$ per kg.

$\therefore$ $\dfrac{150}{\frac{15x}{16}} - \dfrac{150}{x} = 1$ or $\dfrac{160}{x} - \dfrac{150}{x} = 1$ or $x = 10$

$\therefore$ Original rate = Rs. 10 per kg.

Reduced rate $= \text{Rs.} \left(\frac{15}{16} \times 10 \right)$ per kg = Rs. 9.38 per kg.

• TEST YOURSELF

1. What is the value of $15\frac{1}{3}\%$?

2. 15 out of 2575 parts of water on earth is durty. What is the percentage of durty water on earth ?

3. If $45 \times x = 25\%$ of 900, what is the value of x ?

4. One fourth of one third of two fifth of a number is 15. What will be 40% of that number?

5. If 20% of 40 is greater than 25% of a number by 4 then what is the number ?

6. What percent of 7.2 kg is 18 gm ?

7. What will be 160% of a number whose 200% is 140 ?

8. 5 out of 2250 parts of the earth is sulphur what is the percentage of sulphur in the earth ?

9. A's income is 25% more than B's income. What is the percentage of B's income in terms of A's income ?

10. The population of a city is 154250. If it increases at the rate of 10% per annum what will be population 2 years hence ?

11. The value of a machine depreciates at the rate of 5% per annum. If its present value is Rs. 4,50000 then what will be its worth after 2 years ? What was the value of machine 2 years ago ?

12. Which of the following is true or false ?
    (i) 6 is % of 200   (ii) 0.05 is 5% of 100
    (iii) 8% of 1.25 kg is 0.25 kg.

13. If a man saves 15% of his salary and his savings Rs. 37.50, find his salary.

14. There are 500 students in a school, 6% did not appear in the examination and 10% of the rest failed. Find the number of successful students.

15. Population of certain village is 1500. There are 40% male, 30% female and rest and children. Find the number of male, females and children.

16. A man saves Rs. 50 after spending 80% of his salary. Find his salary.

17. A man gives 30% of his property to his wife, 50% of the rest to his son and divides equally rest of his property among his two daughters. If each of his daughter receives Rs. 49000 find his property.

18. Salary of a man, who saves Rs. 120 after spending 80% of salary is ....

19. If a number increased by $37\frac{1}{2}$ % gives 44, then the number is ....

20. In an examination, Ram scores 49% marks and his total is 294. In the same examination, his sister scored 372 marks. Find the percentage of marks scored by his sister.

21. The number which when decreased by $27\frac{1}{2}$ % gives 87, is :
    (a) 120   (b) 110   (c) 135   (d) 58

22. If 70% of students in a school are boys and the number of girls is 504, the number of boys is :
    (a) 1680   (b) 1176   (c) 1276   (d) None of these

23. 30% of A's salary is equal to 20% of $\frac{3}{5}$th of B's salary. If B's salary is Rs. 2400, what is A's salary ?
    (a) Rs. 1880   (b) Rs. 1000   (c) Rs. 960   (d) Rs. 2160

24. A man spends 35% of his income on house rent, 75% of the remaining on other items. What percentage of income does he save ?
    (a) 16.25   (b) 34.50   (c) 48.75   (d) None

25. The boys and girls in a college are in the ratio 3 : 2. If 20% of the boys and 25% of the girls are adults, the percentage of students who are not adults is :
    (a) 58%   (b) 67.5%   (c) 78%   (d) 82.5%

ANSWERS

1. 0.153   2. $\frac{60}{103}$%   3. 5   4. 180   5. 16   6. 0.25%   7. 112   8. $\frac{2}{9}$%   9. 80%

10. 186642; 127479   11. 406125; 498615   12. (i) True (ii) False (iii) False

13. Rs. 250   14. 423   15. 600, 450, 450   16. Rs. 250   17. Rs. 2,80,000   18. 600   19. 32

20. 62%   21. 120   22. 1176   23. Rs. 960   24. 16.25   25. 78%.

UNIT

9

RATIO AND PROPORTION

STRUCTURE

- Ratio
- Proportion
- Mean Proportional
- Comparison of Ratios
- Compounded Ratio
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on ratio and compound ratio for practice.
- Questions based on proportion and mean-proportion for practice.

• 9.1. RATIO

Ratio is the relation which two quantities bear to each other with regard to its magnitude. For example, the ratio of 30 paise and 50 paise is 3 : 5.

• 9.2. PROPORTION

Proportion is the equality of ratios. For example, $2 : 5 = \dfrac{2}{5}, \dfrac{8}{20}$, the terms 2, 5, 8, 20 are called proportionals. When the four numbers are in proportion the rule is product of the extremes = Product of Means.

• 9.3. MEAN PROPORTIONAL

Mean proportional between a and b is $\sqrt{ab}$.

• 9.4. COMPARISON OF RATIOS

If $(a : b) > (c : d)$ then we can say that $\dfrac{a}{b} > \dfrac{c}{d}$.

• 9.5. COMPOUND RATIO

The compounded ratio of the ratios $(a : b)$, $(c : d)$, $(e : f)$ is $(ace : bdf)$.

Ex. 1. If $m : n = 2 : 3$, find the value of $\dfrac{3m + 5m}{6m - n}$.

Sol. Given $\dfrac{m}{n} = \dfrac{2}{3}$

$\therefore \quad \dfrac{3m + 5n}{6m - n} = \dfrac{3\left(\dfrac{m}{n}\right) + 5}{6\left(\dfrac{m}{n}\right) - 1}$ (Dividing Nr and Dr by n)

$= \dfrac{3 \times \dfrac{2}{3} + 5}{6 \times \dfrac{2}{3} - 1} = \dfrac{7}{3}$

Ex. 2. If $a : b = 5 : 9$ and $b : c = 4 : 7$, find $a : b : c$ and $a : c$.

Sol. $a : b = 5 : 9$

$$b : c = 4 : 7 = 4 \times \frac{9}{4} : 7 \times \frac{9}{4} = 9 : \frac{63}{4}.$$

$$\therefore \quad a : b : c = 5 : 9 : \frac{63}{4} = 20 : 36 : 63,$$

Also, $\frac{a}{c} = \frac{a}{b} \times \frac{b}{c} = \frac{5}{9} \times \frac{4}{7} = \frac{20}{63}$. So, $a : c = 20 : 63$.

Ex. 3. Divide Rs. 672 in the ratio 5 : 3.

Sol. Sum of the terms of the ratio = (5 + 3) = 8.

$$\therefore \quad \text{First part} = \text{Rs.} \left(672 \times \frac{5}{8}\right) = \text{Rs. } 420.$$

$$\text{Second part} = \text{Rs.} \left(672 \times \frac{3}{8}\right) = \text{Rs. } 252.$$

Ex. 4. Divide Rs. 1162 among A, B, C in the ratio 35 : 28 : 20.

Sol. Sum of the terms of the ratio = (35 + 28 + 20) = 83.

$$\therefore \quad A\text{'s share} = \text{Rs.} \left(1162 \times \frac{35}{83}\right) = \text{Rs. } 490.$$

$$B\text{'s share} = \text{Rs.} \left(1162 \times \frac{28}{83}\right) = \text{Rs. } 3.92.$$

$$C\text{'s share} = \text{Rs.} [1162 - (490 + 392)] = \text{Rs. } 280.$$

Ex. 5. A bag contains 50 paise, 25 paise and 10 paise coins in the ratio 5 : 9 : 4, amounting to Rs. 206. Find the number of coins of each type.

Sol. Ratio of values $= \frac{5}{2} : \frac{9}{4} : \frac{4}{10} = 50 : 45 : 8.$

$$\text{Value of 50-paise coins} = \text{Rs.} \left(206 \times \frac{50}{103}\right) = \text{Rs. } 100.$$

$$\text{Value of 25-paise coins} = \text{Rs.} \left(206 \times \frac{45}{103}\right) = \text{Rs. } 90.$$

$$\text{Value of 10-paise coins} = \text{Rs.} \left(206 \times \frac{8}{103}\right) = \text{Rs. } 16.$$

$\therefore$ Number of 50-paise coins = (100 × 2) = 200.

Number of 25-paise coins = (90 × 4) = 360.

Number of 10-paise coins = (16 × 10) = 160.

Ex. 6. Which one of 2 : 3, 4 : 5, 7 : 9 and 11 : 13 is the largest ratio ?

Sol. $2 : 3 = \frac{2}{3} = 0.666$; $4:5 = \frac{4}{5} = 0.8$ and $7 : 9 = \frac{7}{9} = 0.777$; $11 : 13 = \frac{11}{13} = 0.846.$

Clearly, 0.846 > 0.8 > 0.777 > 0.666.

Hence, 11 : 13 is the largest ratio.

• TEST YOURSELF

1. A man divides his property among his sons so that one gets half, another gets quarter, third gets 1/5 and the fourth Rs. 9000. What is the value of the total property.

2. If $x : y = 3 : 4$, find the value of $(4x + 5y) : (5x - 2y)$.

3. A man had property worth Rs. 26,540. He gave Rs. 9,200 to his wife and divided the remaining amount among his three sons in the ratio of 1 : 2 : 3. How much did the first son get ?

4. A man divides Rs. 10,290 between his son and his daughter in the ratio of 11 : 10. How much did the son get.

5. The ages of A and B are in the ratio of 6 : 5 and the sum of their ages is 44 years. What will be the ratio of their ages after 8 years ?

6. Rs. 5,100 is to be divided among A and B in the ratio of 8 : 9. The share of B exceeds that of A by.
7. A amount of Rs. 900 is to be distributed among A, B, and C in the proportion 4 : 5 : 6 respectively. What will be the difference between A's and C's amount.
8. In a factory the ratio of male workers to female workers was 5 : 3. If the number of female workers was less by 40, what was the total number of workers in the factory.
9. If $A : B = 7 : 9$ and $B : C = 3 : 5$ then what is the ratio of $A : B : C$?
10. A profit of Rs. 84 is divided between A and B in the ratio of $\frac{1}{3} : \frac{1}{4}$. What will each of A and B get ?
11. If $P : Q = 3 : 4$ and $Q : R = 8 : 9$, then $P : R$ is :
    (a) 3 : 2 (b) 1 : 3 (c) 2 : 3 (d) 1 : 2
12. If 15% of x is the same as 20% of y, then $x : y$ is :
    (a) 3 : 4 (b) 4 : 3 (c) 17 : 16 (d) 16 : 17
13. If $7 : x = 17.5 : 22.5$, then the value of x is :
    (a) 9 (b) 7.5 (c) 6 (d) 5.5
14. If $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} . \frac{1}{1.25}$, the value of x is :
    (a) 1.5 (b) 2 (c) 2.5 (d) 3.5
15. If $x : y = 5 : 2$, then the value of $(8x + 9y) : (8x + 2y)$ is :
    (a) 26 : 61 (b) 61 : 26 (c) 29 : 22 (d) 22 : 29
16. If $x : y = 2 : 1$, then $(x^2 - y^2) : (x^2 + y^2)$ is :
    (a) 3 : 5 (b) 5 : 3 (c) 1 : 3 (d) 3 : 1
17. If $\frac{x}{5} = \frac{y}{8}$, then $(x + 5) : (y + 8)$ is equal to :
    (a) 3 : 5 (b) 13 : 8 (c) 8 : 5 (d) 5 : 8
18. If $x . y = 6 : 5$, then $(5x + 3y) : (5x - 3y)$ is equal to :
    (a) 2 : 1 (b) 3 : 1 (c) 5 : 3 (d) 5 : 2
19. Two numbers are in the ratio 3 : 5. If each number is increased by 10, the ratio becomes 5 : 7. The numbers are :
    (a) 3, 5 (b) 12, 20 (c) 15, 25 (d) 18, 30
20. What same number must be added to each term of the ratio 7 : 13 so that the ratio becomes 2 : 3 ?
    (a) 1 (b) 2 (c) 3 (d) 5
21. What number should be subtracted from both the terms of the ratio 15 : 19 so as to make it as 3 : 4 ?
    (a) 3 (b) 5 (c) 6 (d) 9
22. The ratio between two numbers is 3 : 4. If each number is increased by 6, the ratio becomes 4 : 5. The difference between the numbers is :
    (a) 1 (b) 3 (c) 6 (d) 8
23. Which of the following ratios is the greatest ?
    (a) 7 : 15 (b) 15 : 23 (c) 17 : 25 (d) 21 : 29
24. The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ and its perimeter is 104 cm. The length of longest side is :
    (a) 52 cm (b) 48 cm (c) 32 cm (d) 26 cm
25. In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls, the total number of students in the college is :
    (a) 100 (b) 250 (c) 260 (d) 416

ANSWERS

1. Rs. 1,80,000 2. $\frac{32}{7}$ 3. Rs. 2890 4. Rs. 5390 5. 8 : 7 6. Rs. 300 7. Rs. 120

8. 160 9. 7 : 9 : 15 10. Rs. 48; Rs. 36 11. 2 : 3 12. (b) 13. (a) 14. (c) 15. (c)
16. (a) 17. (d) 18. (b) 19. (c) 20. (d) 21. (a) 22. (c) 23. (d) 24. (b) 25. (d)

U N I T

10

AVERAGE

LEARNING OBJECTIVES

After going through this unit you will learn :
- Simple average and questions based on it for practice.
- Compound average and questions based on it for practice.

• 10.1. AVERAGE

$$\text{Simple Average} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$\textbf{Compound Average} = \frac{ax + by}{x - y}, \text{ where average of } x \text{ numbers of items is } 'a' \text{ and}$$

average of y number of items is b.

Ex. 1. Find the average of all prime numbers between 20 and 40.

Sol. There are five prime numbers between 20 and 40.

They are 21, 27, 31, 33 and 37.

∴ Required average $= \frac{(21 + 27 + 31 + 33 + 37)}{5} = \frac{149}{5} = 29.8.$

Ex. 2. Find the average of first 40 natural numbers.

Sol. Sum of first 30 natural numbers $= \frac{40 \times 41}{2} = 820$

∴ Required average $= \frac{820}{40} = 20.5$

Ex. 3. First the average of first 25 multiples of 3.

Sol. Required average $= \frac{3(1 + 2 + 3 + ... + 25)}{25} = \left(\frac{3 \times 25 \times 26}{2 \times 25} \right) = 39.$

Ex. 4. The average age of a class of 35 students is 20 years. If the age of the teacher be included, then the average increases by 3 months. Find the age of the teacher.

Sol. Total age of 35 persons = (35 × 20) years = 700 years.

Average age of 36 persons = 20 years 3 months $= \frac{81}{4}$ years.

Total age of 40 persons $= \left(\frac{81}{4} \times 36 \right)$ years = 729 years.

∴ Age of the teacher = (729 − 700) years = 29 years.

Ex. 5. The average weight of 10 oarsmen in a boat is increased by 2.5 kg when one of the crew, who weight 43 kg is replaced by a new man. Find the weight of the new man.

Sol. Total weight increased = (2.5 × 10) kg = 25 kg.

∴ Weight of the new man = (43 + 25) kg = 68 kg.

Ex. 6. The average of 11 results is 60. If the average of first six results is 58 and that of the last six is 63, find the sixth result.

Sol. Sixth result = (6 × 58 + 6 × 63 − 11 × 60) = 66.

Ex. 7. The average weight of A, B, C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, find the weight of B.

Sol. $A + B + C = (45 \times 3) \text{ kg} = 135 \text{ kg}.$

$A + B = (40 \times 2) = 80 \text{ kg} \text{ and } B + C = (43 \times 2) = 86 \text{ kg}.$

$\therefore B = (A + B) + (B + C) - (A + B + C) = (80 + 86 - 135) \text{ kg} = 31 \text{ kg}.$

Ex. 8. There are two sections A and B of a class, consisting of 36 and 44 students respectively. If the average weight of section A is 40 kg and that of section B is 35 kg, find the average weight of the whole class.

Sol. Total weight of (36 + 44) students = $(36 \times 40 + 44 \times 35)$ kg = 2980 kg.

$\therefore$ Average weight of the whole class = $\left(\dfrac{2980}{80}\right) \text{kg} = 37.25 \text{ kg}.$

Ex. 9. A batsman makes a score of 68 runs in the 14th inning and thus increases his average by 4. Find his average after 14th inning.

Sol. Let the average by after 14th inning = x.

Then, average after 13th inning = $(x - 4)$.

$\therefore 13(x - 4) + 68 = 14x \text{ or } 13x - 52 + 68 = 14x$

$\therefore \qquad\qquad\qquad\qquad x = 68 - 52 = 16.$

Ex. 10. There were 35 students in a hostel. Due to the admission of 7 new students, the expenses of the mess were increased by Rs. 42 per day while the average expenditure per head diminished by Re. 1. What was the original expenditure of the mess ?

Sol. Let the original average expenditure be Rs. x. Then,

$\qquad 42(x - 1) - 3x = 42$

$\Rightarrow \qquad 7x = 84 \qquad \Rightarrow \quad x = 12$

$\therefore$ Original expenditure = Rs. (35×12) = Rs. 420.

• TEST YOURSELF

1. The average marks obtained by 22 candidates in an examination is 45. The average of the first ten is 55, while that of th last eleven is 40. How many marks obtained by the 11 candidates ?

2. In a class of 22 students, 21 students get an average of 44 marks. If the remaining students get 66 marks, what is the average marks of the whole class ?

3. In an examination, a batch of 60 students made an average score of 55 and another batch of 40 made it only 45, what is the overall average score ?

4. In a certain class the first mark was 67 and the last was 32 and by mistake these were written as 76 and 23. Then, what is the average marks of the class ?

5. The average marks of a student in four subjects is 75. If the student obtains 80 marks in the 5th subject then the what is new average ?

6. In a class of 20 students in an examination in maths 2 students scored 100 marks each, 3 got zero each and the average of the rest was 40. What is the average of the whole class ?

7. The average of first fifty natural numbers is ....

8. A library has an average number of 510 visitors on Sunday and 240 on other days. What is the average number of visitors per day in a month of 30 day beginning with Sunday ?

9. The average age of 32 students is 10 years. If the teachers age is also included, the average age increases by one year. What is the age of the teacher ?

10. The average weight of 50 balls is 2 lbs/ball. If the weight of the container be included the average weight will increase by 0.05 lbs. What is the weight of the container ?

11. The average height of 30 boys out of a class of 50 is 160 cm. If the average height of the remaining boys is 165 cm the average height of the whole class (in cm) is ....

12. The average of 5 numbers is 42.2 and the average of 4 numbers is 35.5. What is the average of all the numbers taken together ?

13. In a class of 20 students the average age is 12 years. By the inclusion of the teachers age the average age increases by 2 years. What is the age of the teacher ?

14. If Vinay was 1/3rd as old as Vikas 5 years back and Vinay is 17 years as old now. How old is Vikas now ?

15. The average of first five prime number is :
    (a) 4.5   (b) 5   (c) 5.6   (d) 7.5

16. The average of first five multiples of 3 is :
    (a) 3   (b) 9   (c) 12   (d) 15

17. The average of three numbers is 20. If two numbers are 16 and 22, the third is :
    (a) 22   (b) 20   (c) 19   (d) 18

18. The average of two numbers is *M*. If one number is *N*, then the other number is :
    (a) $2N$ (b) $2M$ (c) $M - N$ (d) $2M - N$

19. The average height of 30 boys out of a class of 50, is 160 cm. If the average height of the remaining boys is 165 cm, the average height of the whole class (in cm) is :
    (a) 161   (b) 162   (c) 163   (d) 164

20. The average of all odd numbers upto 100 is :
    (a) 51   (b) 50   (c) 49.5   (d) 49

21. The average of Kanchan's marks in 7 subjects is 75. His average in six subjects excluding Science is 72. How many marks did he get in Science ?
    (a) 72   (b) 90   (c) 93   (d) None of these

22. The average price of three items of furniture is Rs. 15000. If their prices are in the ratio 3 : 5 : 7, the price of the cheapest item is :
    (a) Rs. 9000 (b) Rs. 15000   (c) Rs. 18000   (d) Rs. 21000

23. The average of ten numbers is 7. If each number is multiplied by 12, then the average of new set of number is :
    (a) 7   (b) 19   (c) 82   (d) 84

24. A man spends Rs. 18000 monthly on an average for the first four months and Rs. 2000 monthly for the next eight months and saves Rs. 5600 a year. His average monthly income is :
    (a) Rs. 2000 (b) Rs. 2200   (c) Rs. 2400   (d) Rs 2600

ANSWERS

1. Zero 2. 45 3. 51 4. 99 5. 76 6. 40 7. 25.5 8. 285 9. 43 years

10. 4.55 11. 160 12. $39\frac{2}{9}$ 13. 54 years 14. 41 years 15. (c) 16. (b) 17. (a)

18. (d) 19. (b) 20. (b) 21. (c) 22. (a) 23. (d) 24. (c).

U N I T

11

SIMPLE AND COMPOUND INTEREST

STRUCTURE

- Definition and Formulae
  - Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Formulae of time, interest, rate, amount and present worth.
- Questions based on these formulae for practice.

A man sometime borrows some money from a bank or some **money-lender.** These agencies (Bank or money lender) give him money on condition that the man will pay some **more money than the money he borrowed** from them. This extra money is known as **interest.**

• 11.1. DEFINITIONS AND FORMULAE

Principal : The amount which is borrowed (denoted by *P*).

Time : Time for which money is borrowed (denoted by *T*)

Interest : Extra amount paid by the borrower (denoted by *I*)

Rate : Per hundred extra amount, which is paid by the borrower (denoted by *r*) or *r*%.

Amount = Principal + Interest

Formulae

Simple Interest (*I*) $= \dfrac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} = \dfrac{P \times r \times T}{100}$

Principal $= \dfrac{\text{Simple Interest} \times 100}{\text{Rate} \times \text{time}} = \dfrac{I \times 100}{r \times T}$

Rate $= \dfrac{\text{Simple Interest} \times 100}{\text{Principal} \times \text{Rate}} = \dfrac{I \times 100}{P \times r}$

Time $= \dfrac{\text{Simple Interest} \times 100}{\text{Principal} \times \text{Rate}} = \dfrac{I \times 100}{P \times r}$

Simple Interest : If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called simple interest.

Compound Interest : Sometimes it so happens that the borrower and the leader agree to fix up a certain unit of time, say *yearly* or *half-yearly* or *quarterly* to settle the previous account. In other words, interest is compounded annually, semi-annually or quarterly.

In such cases, the amount after first unit of time becomes the principal for the second unit, the amount after second unit becomes the principal for the third unit and so on.

The difference between the original principal and the amount at the nd of the last period is known as *compound interest.*

FORMULAE :

Let, **Principal** = *P*, **Rate** = *R*% per annum, **Time** = *n years.*

I. When interest is compound annually :

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^n$$

II. When interest is compounded Half-yearly :

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

III. When interest is compounded Quarterly :

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

IV. When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

V. When Rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively.

Then, amount $P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_2}{100}\right)$

VI. Present worth of Rs. x due n years hence is given by :

$$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)^n}$$

Ex. 1. Find the unknown in the following :

(a) Principal = Rs. 1000, Rate = 4%, Time = 5 years, Simple interest = ?

(b) Amount = Rs. 3000, rate = 10%, Interest = 300, Time = ?

(c) Principal = Rs. 125, Rate = 9%, Time = 25 Feb. 1965 to 9th Nov. 1965, Interest = ?

Sol. (a) Interest $= \frac{P \times r \times t}{100} = \frac{1000 \times 4 \times 5}{100} = $ Rs. 200

(b) Time $= \frac{100 \times \text{Interest}}{P \times r} = \frac{100 \times 300}{3000 \times 10} = 1$ year

(c) Time $\begin{array}{ccccc} \text{Feb} & \text{March} & \text{April} & \text{May} & \text{Total} \\ 3 & 31 & 30 & 9 & 73 \text{ days} \end{array} = \frac{1}{5}$ year

$$\text{Interest} = \frac{Prt}{100} = \frac{125 \times 9 \times 1}{5 \times 100} = \text{Rs. } 2.25$$

(d) Let x is the amount then $x = \frac{100 \times SI}{r \times t} = \frac{100 \times 210}{7 \times 1} = $ Rs. 3000.

Ex. 2. A man deposited Rs. 2000 in a bank at 8% rate and Rs. 1400 in post office at 5% rate. Find the rate of interest on whole sum.

Sol. Interest from bank $= \frac{2000 \times 8 \times 1}{100} = $ Rs. 160

Interest from the post office $= \frac{1400 \times 5 \times 1}{100} = $ Rs. 70

Total interest received = Rs. (160 + 70) = Rs. 230

Total principal amount = Rs. 2000 + Rs. 1400 = Rs. 3400

If 'r' is the average rate then rate $= \frac{100 \times 230}{3400} = \frac{115}{17}\% = 6\frac{13}{17}\%$.

Ex. 3. If simple interest on certain amount is $\frac{2}{5}$ of the sum is 1 year and nine months. Find the rate prercent per annum of interest.

Sol. Let principal is Rs. x, thn interest $= \frac{2x}{5}$

$$\text{Time} = 1\frac{3}{4} \text{ years} = \frac{7}{4} \text{ years}$$

Let r is the rate of interest then

$$\frac{2x}{5} = \frac{x \times r \times 7}{4 \times 100} \Rightarrow \frac{2}{5} = \frac{7r}{400} \quad \therefore r = 22.85\%.$$

Ex. 4. Divide Rs. 11400 in two such parts that the simple interest on first part for 4 years at the rate of 4% per annum may be equal to that on second part for $2\frac{1}{2}$ years as 5% per annum.

Sol. Let one part is Rs. x, then the second part is Rs. $11400 - x$, then according to the problem,

$$\frac{x \times 4 \times 4}{100} = \frac{(11400 - x) \times 5 \times 5}{2 \times 100}$$

or $\quad 32x = 25(11400 - x) \quad$ or $\quad 57x = 25 \times 11400 \quad \therefore \quad x = $ Rs. 5000

Hence first part is Rs. 5000 and the second part

$$= \text{Rs. } (11400 - 5000) = \text{Rs. } 6400.$$

Ex. 5. If Rs. 5000 amount to Rs. 5875 in $3\frac{1}{2}$ years, what will Rs. 9000 amount in $5\frac{1}{2}$ years at the same rate of interest ?

Sol. Amount = Rs. 5875, Principal = Rs 5000

$\therefore \quad$ Interest = Rs $(5875 - 500)$ = Rs. 875

Time = $\frac{7}{2}$ years. Let r is the rate of interest, then $r = \dfrac{100 \times 875}{5000 \times 7} = 5\%$.

Interest on Rs. 9000 $= \dfrac{9000 \times 5}{100} \times \dfrac{11}{2} = $ Rs. 2475

Hence, amount = Rs. 9000 + Rs. 2475 = Rs. 11475.

Ex. 6. Find the compound interest when :

(a) $P = $ Rs. 4000, $r = 8\%$ p.a., $n = 3$ years.

(b) $P = $ Rs. 10000, $r = 10\%$ p.a., $n = 3$ years.

Sol. (a) According to problem

$$A = 4000 \left(1 + \frac{8}{100}\right)^3 = 4000 \left(1 + \frac{2}{25}\right)^3 = 4000 \times \left(\frac{27}{25}\right)^3$$

$$= \frac{32 \times 27 \times 27 \times 27}{125} = \text{Rs. } 5038.84$$

Hence, compound interest = Rs $(5038.84 - 4000)$ = Rs. 1038.84

(b) According to the problem,

$$A = 10000 \left(1 + \frac{10}{100}\right)^3 = 10000 \left(\frac{11}{10}\right)^3$$

$$= 10000 \times \frac{11 \times 11 \times 11}{10 \times 10 \times 10} = \text{Rs. } 13310$$

Hence compound interest = Rs. $(13310 - 10000)$ = Rs. 3310.

Ex. 7. Find the amount when $P = $ Rs. 200, $r = 10\%$ p.a., $n = 2$ years.

Sol. According to the problem,

$$A = 200 \left(1 + \frac{10}{100}\right)^2 = 200 \left(\frac{11}{10}\right)^2 = \text{Rs. } 242$$

Ex. 8. If the compound interest on a certain sum of money for 2 years @ 4% p.a. is Rs. 102, what will be the S.I. at the same rate for 2 years ?

Sol. We have

$$\text{C.I.} = A - P = P\left|\left(1 + \frac{r}{100}\right)^2 - 1\right|$$

or $\qquad 102 = P\left|\left(1 + \frac{4}{100}\right)^2 - 1\right| = P\left(\frac{51}{25}\right)\left(\frac{1}{25}\right)$

$$\Rightarrow \qquad P = \frac{102 \times 25 \times 25}{51} = \text{Rs. } 1250$$

$$\text{S.I.} = \frac{1250 \times 4 \times 2}{100} = \text{Rs. } 100$$

Hence, principal = Rs. 1250 and S.I. = 100.

Ex. 9. Find the sum which raises to Rs. 1352 in two years at 4% per annum compounded annually.

Sol. Here $A = 1352$, P = unknown, $r = 4\%$ and $n = 2$ years.

$$\therefore \qquad 1352 = P\left(1 + \frac{4}{100}\right)^2 = P\left(\frac{26}{25}\right)^2$$

$$\text{or} \qquad P = \frac{1352 \times 25 \times 25}{26 \times 26} = \text{Rs. } 1250$$

Ex. 10. Find the time in which he sum Rs. 2550 will raise to Rs. 2890 at $6\frac{1}{4}\%$ p.a. rat, compounded annually.

Sol. Let n is the number of years. A = Rs. 2890, P = Rs. 2560, $r = 6\frac{1}{4}\%$

$$\therefore \qquad 2890 = 2560\left(1 + \frac{25/4}{100}\right)^n$$

$$\text{or} \qquad \frac{289}{256} = \left(\frac{17}{16}\right)^n \quad \text{or} \quad \left(\frac{17}{16}\right)^n = \left(\frac{17}{16}\right)^2 \quad \Rightarrow \quad n = 2 \text{ years.}$$

Ex. 11. I lent Rs. 10,000 on simple interest for three years at 10% p.a. How much more much should have I gained, had I given it at compound interest at the same rate and same time ?

Sol. Simple interest $= \frac{Prt}{100} = \frac{10,000 \times 10 \times 3}{100} = \text{Rs. } 3000$

and compound interest $= 10,000\left(1 + \frac{10}{100}\right)^3 = 10,000 \times \left(\frac{11}{10}\right)^3 = \text{Rs. } 13310$

Compound interest = Rs. 13310 – Rs. 10,000 = Rs. 3310

$\therefore \qquad$ Gain = C.I. – S.I. = Rs. (3310 – 3000) = Rs. 310.

• TEST YOURSELF

1. Find :
   (i) S.I. on Rs. 68000 at $16\frac{2}{3}\%$ per annum for 9 months.

   (ii) S.I. on Rs. 6250 at 14% per annum for 146 days.

   (iii) S.I. on Rs. 3000 at 18% per annum for the period from 4th Feb. 1995 to 18th April 1995.

2. A sum at simple interest at $13\frac{1}{2}\%$ per annum amounts to Rs. 2502.50 after 4 years. Find the sum.

3. A certain sum of money amounts to Rs. 1008 in 2 years and to Rs. 1164 in $3\frac{1}{2}$ years. Find the sum and the rate of interest.

4. At what rate percent per annum will a sum of money double in 8 years ?

5. A sum was put at simple interest at a certain rate for 3 years. Had it been put at 2% higher rate, it would have fetched Rs. 360 more. Find the sums.

6. Simple interest on a certain sum is $\frac{16}{25}$ of the sum. Find the rate percent and time, if both are numerically equal.

7. A man borrowed Rs. 24000 from two money lenders. For one loan, he paid 15% per annum and for the other 18% per annum. At the end of one year, he paid Rs. 4050. How much did he borrow at each rate ?

8. What annual instalment will discharge a debt of Rs. 1092 due in 3 years at 12% simple interest ?
9. Find compound interest on Rs. 6250 at 16% per annum for 2 years, compounded annually.
10. Find compound interest on Rs. 5000 at 12% per annum for 1 year, compounded half-yearly.
11. Find compound interest on Rs. 16000 at 20% per annum for 9 months, compounded quarterly.
12. The difference between the compound interest and simple interest on a certain sum at 10% per annum for 2 years is Rs. 631. Find the sum.
13. If the compound interest on a certain sum for 2 years at 12% per annum is Rs. 1590, what would be the simple interest ?
14. A sum of money amounts to Rs. 6690 after 3 years and to Rs. 10035 after 6 years on compound interest. Find the sum.
15. A sum of money doubles itself at compound interest in 15 years. In how many years will it become eight times ?
16. A certain sum amounts to Rs. 7350 in 2 years and to Rs. 8575 in 3 years. Find the sum and rate per cent.
17. At the rate of 6% p.a. simple interest, a sum of Rs. 2500 will earn how much interest by the end of 5 years ?
   (a) Rs. 150   (b) Rs. 700   (c) Rs. 750   (d) Rs. 3250
18. A person borrowed Rs. 500 at the rate of 5% per annum S.I. What amount will he pay to clear the debt after 4 years ?
   (a) Rs. 200   (b) Rs. 550   (c) Rs. 600   (d) Rs. 700
19. Ashok took a loan of Rs. 15000 for 3 years at simple interest. If the total interest paid in Rs. 2700, what is the rate of interest per annum ?
   (a) 5.4%   (b) 6%   (c) 9%   (d) 18%
20. Satish took a loan at 10% p.a. S.I. After 4 years, he returned the principal along with the interest. If he returns in all Rs. 3500, what is the principal amount ?
   (a) Rs. 3250   (b) Rs. 2500   (c) Rs. 3150   (d) Rs. 2100
21. The simple interest on a sum of money at 5% is Rs. 48 for 4 years. The simple interest on the same sum for 5 years at 4% will be :
   (a) Rs. 40   (b) Rs. 48   (c) Rs. 50   (d) Rs. 60
22. The amount of Rs. 7500 at compound interest at 4% per annum for 2 years, is :
   (a) Rs. 7800   (b) Rs. 8100   (c) Rs. 8112   (d) Rs. 8082
23. The compound interest on Rs. 20480 at $6\frac{1}{2}$% per annum for 2 years 73 days, is :
   (a) Rs. 3000   (b) Rs. 3131   (c) Rs. 2929   (d) Rs. 3636
24. A sum of money at compound interest amounts to Rs. 5290 in 2 years and to Rs. 6083.50 in 3 years. The rate of iterest per annum is :
   (a) 12%   (b) 14%   (c) 15%   (d) $16\frac{2}{3}$%
25. A sum of money amounts to Rs. 4624 in 2 years and to Rs. 4913 in 3 years at compound interest. The sum is :
   (a) Rs. 4096   (b) Rs. 4260   (c) Rs. 4335   (d) Rs. 4360

ANSWERS

1. (i) Rs. 8500 (ii) Rs. 350 (iii) Rs. 108 2. Rs. 1625 3. 13% 4. 12.5% 5. Rs. 6000
6. 8% and 8 years 7. Rs. 9000 at 15%, Rs. 15000 at 18% 8. Rs. 325 9. Rs. 2160
10. Rs. 618 11. Rs. 2522 12. Rs. 63100 13. Rs. 1500 14. Rs. 4460
15. 45 years 16. Rs. 5400, $16\frac{2}{3}$% 17. (c) 18. (c) 19. (b) 20. (b) 21. (b) 22. (c)
23. (c) 24. (c) 25. (a) .

U N I T

12

PROFIT, LOSS AND DISCOUNT

STRUCTURE
• Points of Remember
• List of Formulae
• Present Value and Discount
�‍ Test Yourself

LEARNING OBJECTIVES
After going through this unit you will learn :
• Cost price (C.P.) and Selling price (S.P.)
• Formulae of profit and loss.
• Questions based on profit, loss and discount for practice.

• 12.1. POINTS OF REMEMBER

(1) **Cost Price (C.P.)** : The price at which an articly is purchased. This also include "over head charges (if any).

(2) **Selling Price (S.P.)** : The price which an article is sold.

(3) **Profit** : If S.P. exceed C.P. then there is profit and profit = S.P. – C.P.

(4) **Loss** : If C.P. exceed S.P., then there is loss and loss = C.P. – S.P.

Note : (i) If S.P. = C.P. then there is neither loss nor profit.

(ii) Profit and loss is always represented in percent.

(iii) Profit and loss is always calculated on the basis of C.P.

• 12.2. LIST OF FORMULAE

(i) $\text{Profit} = \dfrac{100 \times \text{Profit}}{\text{C.P.}}$　　　　(ii) $\text{Loss \%} = \dfrac{100 \times \text{Loss}}{\text{C.P.}}$

(iii) $\text{S.P.} = \left(\dfrac{100 + \text{Profit \%}}{100}\right) \times \text{C.P.}$　　(iv) $\text{C.P.} = \left(\dfrac{100}{100 + \text{Profit \%}}\right) \times \text{S.P.}$

(v) $\text{S.P.} = \left(\dfrac{100 - \text{Loss \%}}{100}\right) \times \text{C.P.}$　　(vi) $\text{C.P.} = \left(\dfrac{100}{100 - \text{Loss \%}}\right) \times \text{S.P.}$

• 12.3. PRESENT VALUE AND DISCOUNT

Technical Terms and Important Formulae

(1) True Discount (T.D.) = Interest on the present worth.

(2) Net amount = Present worth + Discount.

Note : True discount is also known as **Mathematical, or Arithmetical or Theoretical or Equitable discount.**

(3) $\text{T.D.} = \dfrac{PW \times R \times T}{100} \Rightarrow PW = \dfrac{TD \times 100}{R \times T}$

$\text{Amount } A = PW + TD = PW + \dfrac{PW \times R \times T}{100} = PW\left(\dfrac{100 + R \times T}{100}\right)$

$$PW = \dfrac{100 \times A}{100 + R \times T}$$

$$TD = \frac{A \times R \times T}{100 + R \times T}$$

(4) When the sum is paid on compound interest

$$PW = \frac{\text{Amount}}{\left(1 + \dfrac{R}{100}\right) T}$$

Ex. 1. Find the gain or loss % if

(a) C.P. = Rs. 300, S.P. = Rs. 345

(b) C.P. = Rs. 80, S.P. = Rs. 60

Sol. (a) Gain = S.P. – C.P. = Rs. (345 – 300) = Rs. 45

$\therefore$ Gain % = $\frac{45 \times 100}{300}$ % = 15%

(b) Loss = (C.P. – S.P.) = Rs. (80 – 60) = Rs. 20

$\therefore$ Loss % = $\frac{20 \times 100}{80}$ % = 25%

Ex. 2. Find the unknown term in the following :

(i) C.P. = Rs. 48, Gain = 25%, S.P. = ?

(ii) S.P. = Rs. 90, Loss = 10%, C.P. = ?

Sol. (i) S.P. = $\left(\frac{100 + 25}{100}\right) 48 = $ Rs. 60

(ii) C.P. = $\left(\frac{100}{100 - 10}\right) \times 90 = \frac{100}{90} \times 90 = $ Rs. 100.

Ex. 3. A shopkeeper purchased a box centering 140 oranges for Rs. 28. If 16 oranges are rotten and he sold 5 dozen oranges at the rate of Rs. 4.20 per dozen and remaining four for Rs. 1.25. Find his gain percent.

Sol. C.P. of oranges   = Rs. 28

Number of rotten oranges   = 16

Saleable orange   = 140 – 16 = 124

He sold 5 dozens oranges for Rs. 5 × 4.20 = Rs. 21.

Ex. 4. A watch was purchased for Rs. 360 and sold at 10% gain. Find the selling price.

Sol. According to the question C.P. = Rs. 360

Gain 10%, hence

$$S.P. = \left(\frac{100 + \text{Profit \%}}{100}\right) \times C.P. = Rs. \left(\frac{100 + 10}{100}\right) \times 360 = Rs. 396.$$

Ex. 5. Selling a watch for Rs. 1140 a man loses 5%. What should be the selling price of gain is 5% ?

Sol.   S.P. = Rs. 1140, Loss = 5%

$\therefore$ C.P. = $\left(\frac{100}{100 - \text{Loss \%}}\right)$ S.P. = $\left(\frac{100}{100 - 5}\right) 1140$

C.P. = Rs. 1200

Again to find S.P. of gain = 5%

$\therefore$ S.P. = $\left(\frac{100 + \text{gain \%}}{100}\right) \times C.P. = \left(\frac{100 + 5}{100}\right) \times 1200 = $ Rs. 1260

Ex. 6. A sells a radio to B on 20% profit, B sells it to C on 25% profit. If 'C' paid Rs. 225, then find cost price of A.

Sol. Let cost price of A = Rs. 100

Then selling price of A = Rs. 120

Cost price of B = Rs. 120

Selling price of B = Rs. 120 + 25% of Rs. 120 = Rs. 150

$\therefore$ Cost price of C = Rs. 150

If cost price of C is Rs. 150, then C.P. of A = Rs. 100

If cost price of C is Rs. 225, then C.P. of A = Rs. $\dfrac{100}{150} \times 225$ = Rs. 150

Ex. 7. A merchant sells two horses for Rs. 990 each. He gains 10% on one and loses 10% on the other. Find his gain or loss percent in this transaction.

Sol. Selling price of two horses = Rs. (990 + 990) = Rs. 1980

Cost price of the horsse on which he earns 10% = $\dfrac{100}{110} \times 990$ = Rs. 900

and cost price of the horse on which he loses 10% = Rs. $\dfrac{100}{90} \times 990$ = 1100

Total cost price = Rs. (990 + 1100) = Rs. 2000

Total loss = Rs. (2000 – 1980) = Rs. 20

∴ Loss % = $\dfrac{100 \times 20}{2000}$ = 1%.

Ex. 8. A man sells a cow for Rs. 900, bearing some loss. If selling price of the cow would have been Rs. 1075 then he profit would have been $\dfrac{3}{4}$th of his previous loss. Find cost price of the cow.

Sol. Let the man loses Rs. x, then

$$900 + x = 1075 - \frac{3}{4}x$$

or $$x + \frac{3}{4}x = 1075 - 900$$

or $$\frac{7}{4}x = 175 \text{ or } x = \frac{175 \times 4}{7} \qquad \therefore \ x = \text{Rs. } 100$$

Hence cost price = Rs. (900 + 100) = Rs. 1000.

Discount

Ex. 9. Find the present worth of Rs. 484, due to $3\dfrac{1}{2}$ years hence reckoning simple interest at 6 p.c. per annum. What is the discount ?

Sol. Let the sum = Rs. 100, rate 6%, time = $3\dfrac{1}{2}$ years

$$\text{Interest} = \frac{Prt}{100} = \frac{100 \times 6 \times 7}{2 \times 100} = \text{Rs. } 121$$

∴ Rs. 100 today = Rs. 121 after $3\dfrac{1}{2}$ years

∴ Rs. 484 today = $\dfrac{100}{121} \times 484$ = Rs. 400

Discount = Rs. (484 – 400) = Rs. 84.

Ex. 10. Find the present worth of Rs. 264 due in 2 years reckoning simple interest at 5 p.c. per annum.

Sol. PW = $\dfrac{100 \times A}{100 + R \times T}$ (formula) = $\dfrac{100 \times 264}{100 + 5 \times 2}$ = Rs. 240

and T.D. = $\dfrac{A \times R \times T}{100 + R \times T}$ (formula)

or T.D. = $\dfrac{264 \times 5 \times 2}{100 + 5 \times 2}$ = Rs. 24.

Find 11. Find the present worth and the true discount on Rs. 1575.90 P due in 146 days hence at $7\dfrac{1}{2}$ p.c. per annum.

Sol. Let the sum = Rs. 100, rate = $\dfrac{15}{2}$%, time = 146 days = $\dfrac{2}{5}$ years

$$\text{S.I.} = \frac{100 \times 15 \times 2}{2 \times 100 \times 5} = \text{Rs. } 3$$

Hence sum = Rs. (100 + 3) = Rs. 103.
Hence *Rs. 100 now = Rs. 103 after 146 days.*
∴ If the sum is Rs. 103 then the present sum = Rs. 100

If the sum is Rs. 1575.90 then the present sum = Rs. $\frac{100}{103}$ × 1575.90 = Rs. 1530.

True discount = Rs. 1575.90 – Rs. 1530 = Rs. 45.90
Hence present value = *Rs. 1530*
Discount = Rs. 45.90.

Ex. 12. *A* owes *B* Rs. 1350 due in 3 months hence and *B* owes *A* Rs. 1078 due 5 months hence. What should be paid over to settle their account reckoning the rate of true discount at 5% per annum ?

Sol. Sum = Rs 1350, time = 3 months = $\frac{1}{4}$ years, Rate = 5%

Let the sum = Rs. 100 Interest = Rs. $5 \times \frac{1}{4}$ = Rs. $\left(\frac{5}{4}\right)$

Amount = Rs. $\left(100 + \frac{5}{4}\right)$ = Rs. $\frac{405}{4}$

PW = Rs. 13.50 + Rs. $\frac{405}{4} \times 100$ = Rs. $\frac{1350 \times 4}{405} \times 100$ = Rs. $\frac{4000}{3}$

Again sum Rs. 1078, time = 5 months = $\frac{5}{12}$ years

Interest = Rs. $5 \times \frac{5}{12}$ = Rs. $\frac{25}{12}$

PW = Rs. 1078 + Rs. $\frac{25}{12} \times 100$ = Rs. $\frac{178 \times 12}{25}$ = Rs. 1056

Hence the required sum to be paid to *B* = Rs. $\left(\frac{4000}{3} - 1056\right)$ = Rs. $277\frac{1}{3}$.

Ex. 13. A chair was bought for Rs. 40 and was sold for Rs. 45 at a credit of 8 months. What was the gain percent reckoning money worth 6% ?

Sol. Interest on Rs. 100 for eight months = $6 \times \frac{2}{3}$ = Rs. 4

P.W. of Rs. 100 = Rs. (100 + 4) = Rs. 104
If P.W. of Rs. 104 then the amount = Rs. 100
If. P.W. of Rs. 45 then the amount = Rs. $\frac{100}{104} \times 45$ = Rs. $\frac{25 \times 45}{26}$

Gain = Rs. $\left(\frac{25 \times 45}{26} - \text{Rs. } 40\right)$ = Rs. $\frac{85}{26}$

Gain on Rs. 40 = Rs. $\frac{85}{26}$

∴ Given on Rs. 100 = Rs. $\left(\frac{85}{26} \times \frac{1}{40} \times 100\right)$% = $\frac{425}{52}$% = $8\frac{9}{52}$%

Ex. 14. What is the sum due $8\frac{1}{3}$ years hence whose discount at 4% is Rs. 192.24 ?

Sol. Let the sum = Rs. 100

Interest on Rs. 100 for $\frac{25}{3}$ years at 4% p.a. = Rs. $\frac{25}{3} \times 4$ = Rs. $\frac{100}{3}$

P.W. of Rs. 100 = Rs. $100 + \frac{100}{3}$ = Rs. $\left(\frac{400}{3}\right)$

If the discount is Rs. $\frac{100}{3}$ then the amount = Rs. $\frac{400}{3}$

If discount is Rs. 192.24 P, then the amount = Rs. $\left(\frac{400}{3} \times \frac{3}{100} \times 192.24\right)$ = Rs. 768.96 P

Ex. 15. What must be the rate of interest in order that the discount on Rs 7747.60 P payable at the end of three years may be Rs. 830.10 P ?

Sol. P.W. = Rs. 7747.60 P – Rs. 830.10 P = Rs. 6917.50 P

Interest on Rs. 6917.50 for 3 years Rs. 830.10

∴   Interest on Rs. 100 for one year = rate = Rs. $\left(\frac{830.10}{6917.50} \times \frac{100}{3}\right)$ = 4%

Ex. 16. If the discount on Rs. 2550 be equal to the simple interest on Rs. 2500 for the same time, the rate of interest is 5% per annum.

Sol. Interest = Rs. 2550 – Rs. 2500 = Rs. 50

If T is the time, then $T = \dfrac{100 \times S.I.}{A \times r} = \dfrac{100 \times 50}{2500 \times 5}$ years $= \dfrac{2}{5}$ years.

• TEST YOURSELF

1. A man buys an article for Rs. 27.50 and sells it for Rs. 28.60. Find his gain prcent.
2. If a radio is purchased for Rs. 490 and sold for Rs. 465.50, find the loss percent.
3. Find S.P., when :
   (i) C.P. = Rs. 56.25, gain = 20%   (ii) C.P. = Rs. 80.40, loss = 15%.
4. Find C.P., when
   (i) S.P. = Rs. 40.60, gain = 16%   (ii) S.P. = Rs. 51.70, loss = 12%.
5. By selling a book for Rs. 115.20, a man loses 10%. At what price should he sell it to gain 5% ?
6. A trader lost 20% by selling a watch for Rs. 1024. What percent shall he gain or lose by selling it for Rs. 1472 ?
7. Ashok purchased a radio set and sold it to Shyam at a profit of 25% and Shyam sold it to Mohan at a loss of 10% and Mohan paid Rs. 675 for it. For how much did Ashok purchase it ?
8. A man sold two houses for Rs. 675958 each. On one he gains 16% while on the other he loses 16%. How much does he gain or lose in the whole transaction ?
9. The original price of a T.V. set is Rs. 9000. The price is discounted by 20% and then raised by 10%. What is its new price ?
10. The C.P. of 12 articles is equal to S.P. of 9 articles. Find the gain percent.
11. By selling 33 metres of cloth, one gains the selling price of 11 metres. Find the gain percent.
12. A reduction of 20% in the price of sugar enables a purchaser to obtain 2.5 kg more for Rs. 160. Find the original rate and the reduced price per kg.
13. A grover purchased 80 kg of rice at Rs. 13.50 per kg and mixed it with 120 kg rice at Rs. 16 per kg. At what rate per kg should he sell the mixture to gain 16% ?
14. A vendor bought lemons at 6 for a rupee. How many for a rupee must he sell to gain 20% ?
15. A vendor bought a number of bananas at 6 for 5 rupees and sold at 4 for 3 rupees. Find his gain percent.
16. If a commission of 10% is given on the marked price of an article, the gain is 25%. Find the gain percent, if the commission is increased to 20%.
17. A shopkeeper allows a discount of 10% on the marked price. How much above cost price must he mark his goods to gain 8% ?
18. After getting two successive discounts, a shirt with a list price of Rs. 150 is available at Rs. 105. If the second discount is 12.5% find the first discount.
19. What sum will discharge a debt of Rs. 5300 due a year and a half hence at 4 p.c. per annum ?
20. What is the present worth of Rs. 272.61 P due in 2 years 73 days at $7\frac{1}{2}$ p.c. ?
21. Allowing interest at $5\frac{1}{2}$% per annum, what sum of money now will discharge a debt of Rs. 8175 P. which becomes due in 5 months hence ?
22. A dealer bought a table for Rs. 900 and sold it for Rs. 1014 allowing the buyer 8 months credit, money being worth $4\frac{1}{2}$% per annum. What was his gain percent ?
23. A tradesman puts two prices on his goods, one for ready money and other for six months credit, interest being calculated at $12\frac{1}{2}$% per annum. If the credit price on the article be Rs. 53.04 P, what is the cash price ?

24. If the difference between the interest and the amount of discount, on a certain sum of money for six months at 6% be Rs. 2.25 P. Find the sum.
25. The difference between the interest on a certain sum for 10 months at 10% and the discount on the same sum due 10 months hence at the same rate of interest is Rs. 12.50 P. Find the sum.
26. If the discount on Rs. 1700.40 P at 4% be Rs. 140.40 P when is the sum due ?
27. If the interest on Rs. 100 at $4\frac{1}{2}$% be equal to the discount on Rs. 118 for the same time and at the same rate. When the latter sum due ?
28. The true discount on a bill due ten months hence at 12% per annum is Rs. 78.75. Find the amount of the bill.
29 A man sells 320 mangoes at the cost price of 400 mangoes. His gain percent is :
(a) 10% (b) 15% (c) 20% (d) 25%
30. If the cost price of 12 tables is equal to the selling price of 16 tables, the loss percent is :
(a) 15% (b) 20% (c) 25% (d) 30%
31. A shopkeeper sold an article for Rs. 2564.36. Approximately what was his profit percent if the cost price of the article was s. 2400 ?
(a) 7 (b) 8 (c) 12 (d) 60
32. By selling an article for Rs. 19.50, a dealer makes a profit of 30%. By how muh should he increase his selling price so as to make a profit of 40% ?
(a) Rs. 1.50 (b) Rs. 1.75 (c) Rs. 2 (d) Rs. 3
33. A vendor loses the S.P. of 4 orange son selling 36 oranges. Hill loss percent is :
(a) $12\frac{1}{2}$% (b) $11\frac{1}{9}$% (c) 10% (d) None of these
34. By selling a pen for Rs. 15, a man loses one-sixteenth of what it costs him. The cost price of the pen is :
(a) Rs. 18 (b) Rs. 20 (c) Rs. 21 (d) Rs. 16
35. If I purchased 11 books for Rs. 10 and sold all the books at the rate of 10 books for Rs. 11, the profit percent is :
(a) 10% (b) 11% (c) 21% (d) 100%
36. A man sold an article for Rs. 247.50, thereby gaining $12\frac{1}{2}$ %. The cost of the article was :
(a) Rs. 225 (b) Rs. 224 (c) Rs. 220 (d) Rs. 210
37. A shopkeeper gives a discount of 10% on the marked price of a transistor but in the bargain makes a profit of 10%. if the marked price of the transistor be Rs. 330, the cost price is :
(a) 270 (b) 360 (c) 218 (d) None of these
38. A single discount equivalent to a discount series of 40% and 20% is :
(a) 49% (b) 52% (c) 53% (d) None of these
39. Find the present worth of Rs. 920 due at the end of 3 years at 5 percent per annum :
(a) Rs. 800 (b) Rs. 780 (c) Rs. 900 (d) None of these
40. Find the discount on Rs. 510 due 6 months hence at 4 percent.
(a) Rs. 10 (b) Rs. 15 (c) Rs. 20 (d) None of these

ANSWERS

1. 4% 2. 5% 3. (i) Rs. 67.50 (ii) Rs. 68.34 4. (i) Rs. 35 (ii) Rs. 58.75 5. Rs. 134.40
6. 15% 7. Rs. 600 8. 2.56% 9. Rs. 7920 10. $33\frac{1}{3}$% 11. 50% 12. Rs. 12.80 per kg.
13. Rs. 17.40 per kg 14. Rs. 5 15. 10% 16. $11\frac{1}{9}$% 17. Rs. 120 18. 20%
19. Rs. 5000 20. Rs. 234 21. Rs. 8000 22. Rs. 60 23. Rs. 49.82 24. Rs. 2575
25. Rs. 1950 26. $2\frac{1}{4}$ years 27. 4 years 28. Rs. 866.25 29. (d) 30. (b) 31. (a)
32. (a) 33. (c) 34. (d) 35. (c) 36. (c) 37. (a) 38. (b) 39. (a) 40. (a) 41. (b).

UNIT

13

MENSURATION

LEARNING OBJECTIVES

After going through this unit you will learn :
- Formulae of cuboid, cube, prism, cone and area.
- Questions based on these formulae for practice.

• 13.1. VOLUME, SURFACE AND AREA

Volume of cuboid = length × breadth × thickness

Length of a cuboid = $\dfrac{\text{Volume}}{\text{breadth} \times \text{thickness}}$

Breadth of a cuboid = $\dfrac{\text{volume}}{\text{length} \times \text{thickness}}$

Thickness of a cuboid = $\dfrac{\text{Volume}}{\text{length} \times \text{breadth}}$

Other formula of cuboid

Volume of cuboid = Area of the base × height

Height of cuboid = $\dfrac{\text{Volume}}{\text{Area of the base}}$

Volume of cube = $(\text{Edge})^3$

Edge of a cube = $3\sqrt{\text{Volume}}$

Area of surface of a cuboid = $2\,(lb + lh + bh)$

where 'l' is the length, 'b' is the breadth and 'h' is the thickness of a cuboid.

Area of surface of a cube = $6\,(\text{edge})^2$

Diagonal of a cuboid = $\sqrt{\text{length}^2 + \text{breadth}^2 + \text{height}^2}$

Diagonal of a cube = $3\sqrt{\text{edge}}$

Volume of a cylinder = Base of the cylinder × height = $\pi r^2 \times h$
(where r is the radius of the base and h is the height of the cylinder).

Area of the curved surface of a cylinder

= Circumference of the base × height = $2\pi rh$

(where r = radius of the base and h = height of the cylinder).

Both the ends are circles are circles are the area of each circle is πr^2 •

Hence the total surface = $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

Prism :

Volume of a prism = Area of the base × height

Surface of the sides of a prism = perimeter of the base × heiht.
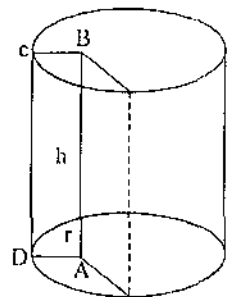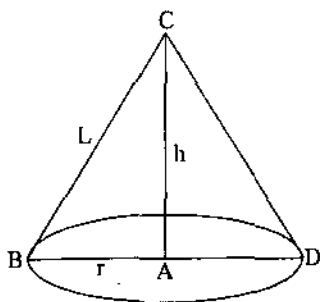
Cone

Volume of a cone $= \dfrac{1}{3} \times$ area of the base $\times$ height $= \dfrac{1}{3}\pi r^2 h$

Area of curved surface of cone

$$= \dfrac{1}{2} \times \text{circumference of the base} \times \text{slant height}$$

$$= \dfrac{1}{2} \times 2\pi r \times L = \pi r L$$

Slant height $= \sqrt{r^2 + h^2}$

Volume of the sphere $= \dfrac{4}{3}\pi r^3$ where r is the radius.

Surface of sphere $= 4\pi r^2$.

Area

1. Area of a rectangle = length × breath
2. Primeter of a rectangle = 2 (length | breath)
3. Diagonal of a rctangle $= \sqrt{(\text{length})^2 + (\text{breadth})^2}$
4. Diagonal of a square $= \sqrt{2} \times$ side
5. Area of a square $= (\text{side})^2 = \dfrac{(\text{diagonal})^2}{2}$
6. Area of parallelogram = base × height
7. Area of a rhombus = base × height $= \dfrac{1}{2}$ (product of diagonals)
8. Area of trapezium $= \dfrac{1}{2}$ height (sum of parallel sides)
9. Area of a triangle $= \dfrac{1}{2}$ base × height $= \sqrt{s(s-a)\,(s-b)\,(s-c)}$

where $s = \dfrac{a+b+c}{2}$ and a, b, c are the sides of the triangle.

10. Area of a right angled triangle $= \dfrac{1}{2}$ base × height $= \dfrac{1}{2}$ product of the sides other than the hypotenuse.
11. Hypotenuse of a right angled triangle $= \sqrt{\text{sum of squares of the other sides}}$
12. Area of an equilateral triangle $= \dfrac{\sqrt{3}}{4}(\text{side})^2$
13. Altitude of an equilateral triangle $= \dfrac{\sqrt{3}}{2}(\text{side})$
14. Area of an quadrilateral $= \dfrac{1}{2}$ (diagonal) (sum of perpendiculars fromthe other vertices on the diagonal)

Ex. 1. One side of a rectangular field of 16 m and one of its diagonals 20 m. Find the area of the field.

Sol. Other side $= \sqrt{(20)^2 - (16)^2} = \sqrt{400 - 256} = \sqrt{144} = 12$ m.

∴ Area = (16 × 12) sq. m. = 192 sq. m.

Ex. 2. Find the area of a square, one of whose diagonals is 2.4 m long.

Sol. Area of the square $= \dfrac{1}{2} \times (\text{diagonal})^2 = \left(\dfrac{1}{2} \times 2.4 \times 2.4\right)$ m^2 = 2.88 m^2

Ex. 3. Find the area of a triangle whose sides measure 50 cm., 40 cm and 30 cm.

Sol. Let $a = 50$, $b = 40$ and $c = 30$.

Then, $s = \dfrac{1}{2}(a + b + c) = \dfrac{50 + 40 + 30}{2} = \dfrac{120}{2} = 60$

$\therefore \quad (s - a) = 10(s - b) = 20$ and $(s - c) = 30$

$\therefore \quad$ Area $= \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{60 \times 10 \times 20 \times 30} = 600 \text{ cm}^2$

Ex. 4. Find the area of an equilateral tiangle each of whose sides is 10 cm long.

Sol. Area of the triangle $= \left(\dfrac{\sqrt{3}}{4} \times 10 \times 10\right) \text{ cm}^2 = 25\sqrt{3} \text{ cm}^2$

Ex. 5. Find the area of a right angled triangle whose base is 12 cm and hypotenuse 13 cm.

Sol. Height of the triangle $= \sqrt{(13)^2 - (12)^2} = \sqrt{25} = 5 \text{ cm}$.

$\therefore$ Its area $= \dfrac{1}{2} \times$ Base $\times$ Height $= \left(\dfrac{1}{2} \times 12 \times 5\right) \text{ cm}^2 = 30 \text{ cm}^2$

Ex. 6. The base of a trianular field is three times its altitude. If the cost of cultivating the field at Rs. 24 per hectare be Rs. 1224, find it base and height.

Sol. Area of the field $= \dfrac{\text{Total cost}}{\text{Rate}} = \left(\dfrac{1224}{24}\right)$ hectares $= 51$ hectares

$= (51 \times 10000) \text{ m}^2 = 510000 \text{ m}^2$

Let, altitude $= x$ metre and base $= 3x$ metre.

Then, $\dfrac{1}{2} \times 3x \times x = 510000$ or $x^2 = 340000$ or $x = 583$

Base $= 1749$ m and altitude $= 583$ m.

Ex. 7. Find the cost of carpeting a square room of side 8 metre with carpet 60 cm wide at the rate of Rs. 2.40 per metre.

Sol. Side of the square room $= 8$ metre

Area $= 8 \times 8 = 64$ sq. m

Width of the carpet $= 60$ cm $= 0.60$ metre

Length of the carpet $= \dfrac{64}{.60}$ metre $= \dfrac{64 \times 100}{60}$ metre $= \dfrac{320}{3}$ metre

Cost of 1 metre carpet $=$ Rs. 2.40

$\therefore$ Total cost $=$ Rs. $\dfrac{320}{3} \times 2.40 =$ Rs. $3.20 \times 80 =$ Rs. 256

Ex. 8. The diagonal of a rhombus are 80 metre and 60 metre. Find its area and side. And also find the length of the altitude of the point of intersection on the side.
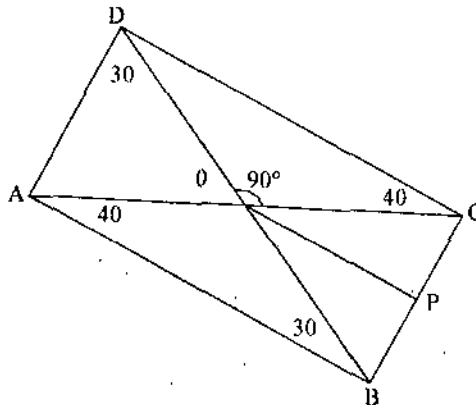
Sol. Area of the rhombus $ABCD = \dfrac{1}{2} \times 80 \times 60$ sq. m $= 2400$ sq. metre

$AB = \sqrt{(40)^2 + (30)^2}$ or 50 metre.

The diagonals divide the rhombus in four equal triangles.

∴ Area of one such triangle $BOC = \dfrac{2400}{4}$ or 600 sq. m.

Area according to other formula $= \dfrac{1}{2}$ side × altitude $= \dfrac{1}{2} \times 50 \times OP$

∴ $\dfrac{1}{2} \times 50 \times OP = 600$

Hence altitude $(OP) = \dfrac{600}{50} \times \dfrac{20}{1}$ m = 24 metre.

Ex. 9. A lawn is in the form of a rectangle having its sides in the radio 2 : 3. The area of the lawn is $\dfrac{1}{6}$ hectares. Find the length and breadth of the lawn.

Sol. Let, Length $= 2x$ metre and breadth $= 3x$ metre.

Now, area $= \left(\dfrac{1}{6} \times 10000 \right) \text{m}^2 = \left(\dfrac{5000}{3} \right) \text{m}^2$

∴ $2x \times 3x = \dfrac{5000}{3}$ or $x^2 = \dfrac{2500}{9}$ or $x = \left(\dfrac{50}{3} \right)$ m.

∴ Length $= 2x = \dfrac{100}{3}$ m $= 33\dfrac{1}{3}$ m and breadth $= 3x = \left(3 \times \dfrac{50}{3} \right)$ m = 50 m.

Ex. 10. A field is 125 m long and 1.5 m wide. A tank 1 × 7.5 m × 6 m was dug in it and the earth thus dug out was spr on the remaining field. Find the level of the field thus raised.

Sol. Area of the field = 125 × 15 or 1875 sq. m.

Area of the place where thank was dug out = 10 × 7.5 or 75 sq. m.

Area of the remaining field where dug out earth we spread

$= (1875 - 75)$ or 1800 sq. m.

Volume of the earth dug out = 10 × 7.5 × 6 or 450 cu. m.

∴ Level of the field raised $= \dfrac{450}{1800}$ or $\dfrac{1}{4}$ m = 25 cm.

Ex. 11. Find the longest possible pole that can be kep in a room 7 metre long, 5 metre broad and 4 metres high.

Sol. The room is a sort of cuboid.

∴ Required length $= \sqrt{7^2 + 5^2 + 4^2}$ m $= \sqrt{90} = 3\sqrt{10}$ metre.

Ex. 12. Find the cost of carpeting a room 13 m long and 9 m broad with a carpet 75 cm wide at the rate of Rs. 12.40 per square metre.

Sol. Area of the carpet = Area of the room $= (13 \times 9) \text{ m}^2 = 117 \text{ m}^2$

Length of the carpet $= \left(\dfrac{\text{Its area}}{\text{Its breadth}} \right) = \left(117 \times \dfrac{4}{3} \right)$ m = 156 m.

∴ Cost = Rs. (156 × 12.40) = Rs. 1934.40.

Ex. 13. The circumference fo a circle is 132 m. Find its area.

Sol. $2\pi R = 132 \Rightarrow 2 \times \dfrac{22}{7} \times R = 132$

∴ $R = \left(132 \times \dfrac{7}{44} \right) = 21$ m

∴ Area $= \pi R^2 = \left(\dfrac{22}{7} \times 21 \times 21 \right) \text{ m}^2 = 1386 \text{ m}^2$.

Ex. 13. The area of a circle is 154 cm^2. Find its circumference.

Sol. $\pi R^2 = 154 \Rightarrow \dfrac{22}{7} \times R^2 = 154$ or $R^2 = \left(154 \times \dfrac{7}{22} \right) = 7^2$.

So, $R = 7$ cm.

∴ Circumference $= 2\pi R = \left(2 \times \dfrac{22}{7} \times 7 \right)$ cm = 44 cm.

Ex. 14. Two concentric circles form a wheel. The inner and outer circumferences of the wheel are $56\frac{4}{7}$ m and $62\frac{6}{7}$ m respectively. Find the width of the wheel.

Sol. Let the inner and outer radii be r and R metre.

Then, $2\pi r = \dfrac{396}{7} \Rightarrow r = \left(\dfrac{396}{7} \times \dfrac{7}{44}\right) = 9$ m

$2\pi R = \dfrac{440}{7} \Rightarrow R = \left(\dfrac{440}{7} \times \dfrac{7}{44}\right) = 10$ m

$\therefore$ Width of the ring $= (R - r) = (10 - 9)$ m $= 1$ m   **Ans.**

Ex. 15. The diameter of the driving wheel of a bus is 140 cm. How many revolutions per minute must the wheel make in order to keep a speed of 66 kmph ?

Sol. Distance to be covered in 1 min. $= \left(\dfrac{66 \times 1000}{60}\right)$ m $= 1100$ m

Circumference of the wheel $= \left(2 \times \dfrac{22}{7} \times 0.70\right)$ m $= 4.4$ m.

$\therefore$ Number of revolutions per min. $= \left(\dfrac{1100}{4.4}\right) = 250$. **Ans.**

Ex. 16 The suface area of a cube is 486 sq. cm. Find its volume.

Sol. $6a^2 = 486 \Rightarrow a^2 = 81 \Rightarrow a = 9$ cm

$\therefore$ Volume $= (9 \times 9 \times 9)$ cm^3 $= 729$ cm^3 **Ans.**

Ex. 17. Find the number of bricks each measuring 25 cm by 12.5 cm by 7.5 cm, required to build a wall 4 m long, 6 m high and 50 cm thick, while the mortar occupies 10% of the volume of the wall.

Sol. Volume of the wall $= (400 \times 600 \times 50)$ cm^3.

Volume of bricks = 90% of the volume of the wall

$= \left(\dfrac{90}{100} \times 400 \times 600 \times 50\right)$ cm^3

Volume of 1 brick $= \left(25 \times \dfrac{25}{2} \times \dfrac{75}{10}\right)$ cu. cm.

$\therefore$ Number of bricks $= \left(\dfrac{90}{100} \times \dfrac{400 \times 600 \times 50 \times 2 \times 10}{25 \times 25 \times 75}\right) = 4608$ **Ans.**

Ex. 18. Three solid cubes of sides 1 cm, 6 cm and 8 cm are melted to form a new cube. Find the surface area of the cube so formed.

Sol. Volume of new cube $= (1^3 + 6^3 + 8^3)$ cu. cm $= 729$ cm^3.

Edge of new cube $= (9 \times 9 \times 9)^{1/3}$ cm $= 9$ cm.

$\therefore$ Surface area of the new cube $= (6 \times 9 \times 9)$ cm$^2 = 486$ cm^2. **Ans.**

Ex. 19. Find the volume, curved surface area and the total surface area of a cylinder with diameter of base 7 cm and height 40 cm.

Sol. Volume $= \pi r^2 h = \left(\dfrac{22}{7} \times \dfrac{7}{2} \times \dfrac{7}{2} \times 40\right)$ cu. cm $= 1540$ cu. cm.

Curved surface Area $= 2\pi rh = \left(2 \times \dfrac{22}{7} \times \dfrac{7}{2} \times 40\right)$ sq. cm. $= 880$ sq. cm.

Total Surface Area $= 2\pi rh + 2\pi r^2$ $(h + r)$

$= \left[2 \times \dfrac{22}{7} \times \dfrac{7}{2} \times (40 + 3.5)\right]$ cm$^2 = 957$ cm^2.

Ex. 20. Find the surface and volume of a sphere who diameter is 21 cm.

Sol. Diameter of the sphere $= 21$ cm.

$\therefore$ Radius $= \dfrac{21}{2}$ cm

$\therefore$ Surface Area of the sphere $= 4\pi r^2 = 4 \times \dfrac{22}{7} \times \dfrac{21}{2} \times \dfrac{21}{2}$ sq. cm $= 1386$ cm^2.

Volume of the sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$ cc $= 4851$ cu. cm. **Ans.**

Ex. 21. How many bullets can be made out of a lead cylinder 12 cm high and with base radius 3 cm, each bullet being 1.5 cm in diameter ?

Sol. Volume of cylinder $= (\pi \times 3 \times 3 \times 12)$ cm$^3 = (108\pi)$ cm^3.

Volume of each bullet $= \left(\frac{4}{3}\pi \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \right)$ cm$^3 = \frac{9\pi}{16}\pi$ cm^3.

Number of bullet $= \dfrac{\text{Volume of cylinder}}{\text{Volume of each bullet}} = \left(108\pi \times \frac{16}{9\pi} \right) = 192$ **Ans.**

Ex. 22. A copper sphere of diameter 12 cm is drawn into a wire of diameter 2 mm. Find the length of the wire.

Sol. Volume of sphere $= \left(\frac{4}{3}\pi \times 6 \times 6 \times 6 \right)$ cm$^3 = 288\,\pi$ cm^3.

Volume of wire $= (\pi \times 0.1 \times 0.1 \times h)$ cm^3.

$\therefore 288\pi = \pi \times \frac{1}{10} \times \frac{1}{10} \times h$

$\therefore h = 288 \times 10 \times 10 = 28800$ cm $= \frac{28800}{100}$ m $= 288$ m **Ans.**

Ex. 23. How many iron rods, each of length 7 m and diameter 2 cm can be made out of 0.88 cubic metre of iron ?

Sol. Volume of 1 rod $= \left(\frac{22}{7} \times \frac{1}{100} \times \frac{1}{100} \times 7 \right)$ cu. m $= \frac{11}{5000}$ cu. m.

Volume of iron $= 0.88$ cu. m.

Number of rods $= \left(0.88 \times \frac{5000}{11} \right) = 400$. **Ans.**

Ex. 24. A solid metallic cone of base radius 2.1 cm, and height 8.4 cm is melted and recast into a sphere. Find the radius of the sphere.

Sol. Let the radius of the sphere be R cm. Then,

Volume of cone $=$ Volume of sphere

$\therefore \quad \frac{1}{3}\pi \times 2.1 \times 2.1 \times 8.4 = \frac{4}{3}\pi R^3 \Rightarrow R^3 = (2.1)^3$ or $R = 2.1$ cm.

Hnce, the radius of the sphere $= 2.1$ cm. **Ans.**

Ex. 25. Find the quantity of canvas cloth required for making a conical tent 7 metre high and 48 metre in diameter. What will be its cost at Rs. 2.80 paise per sq. metre ?

Sol. Height of the conical tent $= 7$ metre

Diameter of the base $= 48$ metres

$\therefore$ Radius $= \frac{48}{2}$ metres $= 24$ metre

Slant height $= \sqrt{h^2 + r^2} = \sqrt{7^2 + 24^2}$ m $= \sqrt{625}$ metre $= 25$ metre.

Area of curved surface $= \pi r L = \frac{22}{7} \times 24 \times 25$ sq. metre $= 1885.7$ sq. m (approx.)

Quantity of canvas cloth required $= 1885.7$ sq. m. (approx)

Cost of one sq. metre cloth $=$ Rs. 2.80

$\therefore$ Total cost of canvas $=$ s. $\frac{280}{100} \times \frac{22}{7} \times 24 \times 25 = $ Rs. 5280. **Ans.**

Ex. 26. If each edge of a cube is increased by 50%, find the percentage increase in its face area.

iginal length of each edge $= a$.

surface area $= 6a^2$.

$f\,a) = \left(\frac{150}{100}a \right) = \frac{3a}{2}$

New surface area $= 6 \times \left(\dfrac{3a}{2}\right)^2 = \dfrac{27}{2}a^2.$

Increase percent in surface area $= \left(\dfrac{15}{2}a^2 \times \dfrac{1}{6a^2} \times 100\right)\% = 125\%.$ **Ans.**

Ex. 27. Two cubes have their volumes in the ratio 1 : 125. Find the ratio of their surface areas.

Sol. Let their edge be a and b. Then,

$$\dfrac{a^2}{b^3} = \dfrac{1}{125} \quad \text{or} \quad \left(\dfrac{a}{b}\right)^3 = \left(\dfrac{1}{5}\right)^3 \quad \text{or} \quad \dfrac{a}{b} = \dfrac{1}{5}$$

∴ Ratio of their surface areas $= \dfrac{6a^2}{6b^2} = \dfrac{a^2}{b^2} = \left(\dfrac{a}{b}\right)^2 = \dfrac{1}{25}$ *i.e.,* 1 : 25. **Ans.**

Ex. 28. If the heights of two cones are in the ratio of 1 : 6 and their diameters are in the ratio of 2 : 3, find the ratio of their volumes.

Sol. Let the heights of the cones be $h : 6h$ and their radii $2r$ and $3r$ respectively. Then

$$\text{Ratio of their volume} = \dfrac{\dfrac{1}{3}\pi(2r)^2 \times h}{\dfrac{1}{3}\pi(3r)^2 \times 6h} = \dfrac{2}{27} = 2 : 27 \quad \textbf{Ans.}$$

• TEST YOURSELF

1. Find the volume and surface area of a cuboid 16 m long, 14 m broad and 7 m high.
2. Find the length of longest pole that can be placed in a room 12 m long, 8 m broad and 9 m high.
3. The diagonal of a cube is $6\sqrt{3}$ cm. Find its volume and surface area.
4. The perimeter of a rectangular field is 480 metres and the ratio between the length and breadth is 5 : 3. What is the area of the field.
5. If each side of a square is increased by 50%, the ratio of the area of the resulting square to the area of the given square is ....
6. The area of a square is 0.5 hectare. What is its diagonal ?
7. The three sides of a triangle are 3 cm, 4 cm and 5 cm respectively. Find its area.
8. What is the altitude of an equilateral triangle of side $3\sqrt{3}$ cm ?
9. The circumference of a circle is 352 metre then what is its area ?
10. The radius of a wheel is 7 cm. How many revolutions will it make in moving 44 km?
11. If the dimensions of a tank are 8 m × 6 m × 2.5 m then calculate the capacity of tank.
12. A rectangular box is 2 m long and 3. m wide. How many cubic metres of sand are needed to fill the box upto a depth of 12 cm ?
13. The surface a cube is 150 sq. m. Find its volume.
14. Three cubes of metal whose edges are 3, 4 and 5 cm are melted to form a single cube. What will be the edge of the new cube ?
15. An iron block 11 cm long, 8 cm broad and 6 cm thick is melted and a cone with base of 4 cm radius is formed. Find the height of the cone ?
16. A cubic metre of silver is drawn into a wire whose radius is 2 millimetres. Find the length of the wire in millimetre.
17. What will it cost to construct a conical tent the radius of whose base is 42 metre and slant height 35 metre from canvas whose width is 1.5 metre and rate Rs. 2.40 per metre ?
18. How many bricks each measuring 15 cm × 10 cm × 7.5 cm are required to ⟨...⟩ wall 20 metre long 6 metre high and 0.5 metre thick when 1/10 ⟨...⟩ occupied by mortar.
19. A room is 10 metre long and 6 metre broad. Find the cost fo ca⟨...⟩ carpet of width 60 cm and rate Rs. 2.37 per metre.
20. If the radius of a sphere is increased by 50%, find the in⟨...⟩ the increase percent in the surface area.

Ex. 3. There are two towns X and Y. Shavi goes from X to B at 30 kmph and comes back to the starting point at 70 kmph. What is her average speed during the whole journey ?

Sol. Average Speed $= \left(\dfrac{2xy}{x+y}\right)$ kmph $= \dfrac{(2 \times 30 \times 70)}{(30+70)}$ kmph $= 42$ kmph. **Ans.**

Ex. 4. If Vishal walks at the rate of 8 kmph, he misses a train by only 12 minutes. However, if he walks at the rate of 9 kmph, he reaches the station 8 minutes before the arrival of the train. Find the distance covered by him to reach the station.

Sol. Let the required distance be x km.

Difference in the times takn at two speeds = 20 min. $= \dfrac{1}{3}$ hr.

∴ $\quad \dfrac{x}{8} - \dfrac{x}{9} = \dfrac{1}{8}$ or $9x - 8x = 9$ so $x = 9$.

Hence, the required distance is 9 km. **Ans.**

Ex. 5. Akshi travels for 5 hrs 15 min. If she covers the first half of the journey at 60 kmph and the rest at 45 kmph. find the total distance travelled by her.

Sol. Let the total distance be x km. Then,

$$\dfrac{(x/2)}{60} + \dfrac{(x/2)}{45} = \dfrac{21}{4} \quad \text{or} \quad \dfrac{x}{120} + \dfrac{x}{90} = \dfrac{21}{4}$$

or $\quad 3x + 4x = 21 \times 90 \quad$ or $\quad x = 270.$

∴ $\quad$ Required distance = 270 km. **Ans.**

Ex. 6. A and B are two stations 340 km apart. A train starts from A at 9 p.m. and travels towards B at 40 kmph. Another train starts from B at 10 a.m. and travels towards A at 60 kmph. At what time do they meet ?

Sol. Suppose they meet x hrs after 9 p.m. Then,

(Distance moved by first x hrs.) + [Distance moved by second in $(x-1)$ hrs] = 340

∴ $\quad 40x + 60(x-1) = 340 \quad$ or $\quad x = 4$

So, they meet at 13 (1) a.m.

Ex. 7. A goods train leaves a station at a certain time and at a fixed speed After 6 hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.

Sol. Let the speed of the goods train be x kmph.

Distance covered by goods train in 10 hours

$\qquad\qquad$ = Distance covered by the express trainin 4 hours

∴ $\quad 10x = 4 \times 90 \quad$ or $\quad x = 36.$

∴ $\quad$ Speed of goods train = 36 kmph. **Ans.**

Ex. 8. Walking $\dfrac{3}{5}$ of its usual speed, a train is 15 minutes too late. Find its usual time to cover the journey.

Sol. New speed $= \dfrac{3}{5}$ of the usual speed.

∴ New time taken $= \dfrac{5}{3}$ of the usual time.

∴ $\left(\dfrac{5}{3} \text{ of the usual time}\right) - (\text{usual time}) = 15$ min.

∴ $\dfrac{2}{3}$ of the usual time = 15 min. or usual time $= \dfrac{45}{2}$ min.

Ex. 9. Two bicyclists cover the sam distance at 10 kmph and 12 kmph respectively. Find the distance travelled by each, if one takes 20 minutes longer than the other.

Sol. Let the required distance be x km. Then,

$$\dfrac{x}{10} - \dfrac{x}{12} = \dfrac{20}{60} \quad \text{or} \quad 6x - 5x = 20 \quad \text{or} \quad x = 20$$

Hence, the required distance = 20 km. **Ans.**

• TEST YOURSELF

1. A train covers a distance of 80 km. at a speed of 40 km. p.h. for the first 60 km and the remaining distance at the speed of 20 km. p.h. What is the average speed of the train on the journey ?

2. Two trains are moving in opposite directions at the speed of 50 and 70 km. per hour. Their lengths are 150 m and 100 m. What is time required for their crossing each other ?

3. A train runs at 45 km per hour. How far does it go in 6 seconds ?

4. A train 150 metres long running at a speed of 60 km per hour takes 30 seconds to cross a bridge. What is the length of the bridge ?

5. A railway train 140 metres long travelling at 90 km/hr will overtake another train of length 160 metres moving in the same direction at 72 km/hour in what time ?

6. A train moving with a speed of 40 km per hour takes 2 hours 6 minutes more to cover a certain distance than a train moving at 96 km per hour. What is the distance ?

7. If a train running at 72 km per hour crosses a tree standing by the side of the track in 7 seconds the length of the train is ?

8. If the speed of train is 92.4 km/hr then how many metres are covered by it in 20 minutes ?

9. A man is going on his car at a rate of 40 km/hr. After 80 km he rests for 10 minutes. How long will it take for him to cover 160 km ?

10. A car takes 6 hours to cover a journey at a speed of 45 kmph. At what speed must it travel in order to complete the journey in 5 hours ?

11. Two cyclists start from the same place in opposite directions. One goes towards north at 18 kmph and the other goes towards south at 20 kmph. What time will they take to be 47.5 km apart ?

12. A car covers four successive 3 km stretches at speeds of 10 kmph, 20 kmph, 30 kmph and 60 kmph respectively. What is average speed over this distance ?

13. If a man running at 15 kmph crosses a bridge in 5 minutes, then the length of the bridge is :
    (a) 1333.33 m   (b) 1000 m   (c) 7500 m   (d) 1250 m

14. Ravi runs at 1.6 kmph. How many metres does he run in 2 minutes ?
    (a) 260 m   (b) 312 m   (c) 520 m   (d) 1040 m

15. A person walks at 5 kmph for 6 hours and at 4 kmph for 12 hours. The average speed of the man is :
    (a) 4 km/hr   (b) $4\frac{1}{3}$ km/hr   (c) $4\frac{1}{2}$ km/hr   (d) $4\frac{2}{3}$ km/hr

16. In covering a certain distance, the speeds of *A* and *B* are in the ratio of 3 : 4. If *A* takes 20 minutes more than *B* to reach the destination, the time taken by *A* to reach the destination is :
    (a) $1\frac{1}{4}$ hrs.   (b) $1\frac{1}{3}$ hrs   (c) 2 hrs   (d) $2\frac{1}{2}$ hrs.

17. The ratio between the speeds of *A* and *B* is 2 : 3 and therefore *A* takes 10 minutes more than the time taken by *B* to reach a destination. If *A* had walked at double the speed, he would have covered the distance in :
    (a) 30 min   (b) 25 min   (c) 20 min.   (d) 15 min.

18. A man perform $\frac{3}{5}$ of the total journey by rail $\frac{7}{20}$ by bus and the remaining 6.5 km on foot. His total journey is :
    (a) 100 km   (b) 120 km   (c) 130 km   (d) 65 km

19. A car can finish a certain journey in 10 hours at a speed of 48 kmph. In order to cover the same distance in 8 hours, he speed of the car must be increased by :
    (a) 6 km/hr   (b) 7.5 km/hr   (c) 12 km/hr   (d) 15 km/hr

20. Walking at $\frac{3}{4}$ of his usual speed, a man is late by $2\frac{1}{2}$ hours. The usual time would have been :

    (a) $7\frac{1}{2}$ hrs   (b) $3\frac{1}{2}$ hrs   (c) $3\frac{1}{4}$ hrs   (d) $\frac{7}{8}$ hrs

21. Walking at $\frac{6}{7}$ of his usual speed, a man is 25 min. too late. His usual time is :

    (a) $1\frac{1}{2}$ hrs   (b) $2\frac{1}{2}$ hrs   (c) $1\frac{6}{7}$ hrs   (d) $2\frac{4}{5}$ hrs

22. Two trains starting at the same time from two stations 200 km apart and going in opposite directions cross each other at a distance of 110 km from one of the stations. What is the ratio of their speeds ?

    (a) 11 : 20   (b) 9 : 20   (c) 11 : 9   (d) None of these

23. *A* walks at 4 kmph and 4 hours after his start, *B* cycles after him at 10 kmph. How far from the start does *B* catch up with *A* ?

    (a) 16.7 km   (b) 18.6 km   (c) 21.5 km   (d) 26.7

24. A man goes uphill with an average speed of 24 kmph and comes down with an average speed of 36 kmph. The distance travelled in both the cases being the same, the average speed for the entire journey is :

    (a) 30 km/hr   (b) 28.8 km/hr   (c) 32.6 km/hr   (d) None of these

25. *A* and *B* are two towns. Mr. Faruqui covers the distance from *A* to *B* on cycle at 17 kmph and returns to *A* by a tong a running at a uniform speed of 8 kmph. His average speed during the whole journey is :

    (a) 12.5 km/hr   (b) 5.44 km/hr   (c) 10.88 km/hr   (d) None

ANSWERS

1. 32 km/h   2. 7.5 second   3. 75 m   4. 350 m   5. 1 minute   6. 144 km   7. 140 m

8. 30800 m   9. 4 hr 10 minutes   10. 54 km/h   11. $1\frac{1}{4}$ h   12. 20 km/h   13. (d)

14. (c)   15. (b)   16. (b)   17. (d)   18. (c)   19. (c)   20. (a)   21. (b)   22. (c)   23. (d)
24. (b)   25. (c).

U N I T

15

ARITHMETICAL REASONING

STRUCTURE

- Simplification
- Laws of Indices
- Laws of Surds
  - Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on indices and surds for practice.

• 15.1. SIMPLIFICATION

In simplifying an expression, we shold remove the all bar fixs of all : After that, we should remove the brackets in order (), {} and []. After removing the brackets the order simplifying should be :

(1) B — Brackets

(2) O — Of (multiplication)

(3) D — Division

(4) M — Multiplication

(5) A — Addition

(6) S — Substraction

• 15.2. LAWS OF INDICES

(i) $a^x \times a^y = a^{x+y}$ (ii) $\dfrac{a^x}{a^y} = a^{x-y}$ (iii) $(a^x)^y = a^{xy}$

(iv) $(ab)^x = a^x b^x$ (v) $\left(\dfrac{a}{b}\right)^x = \dfrac{a^x}{b^x}$ (vi) $a^0 = 1$

• 15.3. LAWS OF SURDS

We write $\sqrt[n]{a} = a^{1/n}$ and it is called a surd of order n.

(i) $(\sqrt[n]{a})^n = (a^{1/n})^n = a$ (ii) $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ (iii) $\sqrt[n]{\dfrac{a}{b}} = \dfrac{\sqrt[n]{a}}{\sqrt[n]{b}}$

(iv) $(\sqrt[n]{a})^m = \sqrt[n]{a^m}$ (v) $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$

Ex. 1. Simplify : $90 \div 40$ of $\dfrac{1}{4} + \dfrac{2}{5} \times 3\dfrac{1}{4}$.

Sol. Given expression $= 90 \div 10 + \dfrac{2}{5} \times \dfrac{13}{4} = \dfrac{90}{10} + \dfrac{13}{10} = \left(\dfrac{90+13}{10}\right) = \dfrac{103}{10} = 10\dfrac{3}{10}$.

Ex. 2. Simplify : $\dfrac{2}{3} \div \dfrac{5}{3} + \dfrac{1}{2} \times \dfrac{3}{5} - \dfrac{2}{5}$ of $\dfrac{5}{7}$.

Sol. Given expression $= \dfrac{2}{3} \div \dfrac{5}{3} + \dfrac{1}{2} \times \dfrac{3}{5} - \dfrac{2}{5}$ of $\dfrac{5}{7}$

21. A ball 20 m long and 15 m broad is surrounded by a verandah of uni width of 2.5 m. The cost of flooring the verandah at Rs. 3.50 per sq. metre is :

    (a) Rs. 500 (b) Rs. 600 (c) Rs. 700 (d) Rs. 800

22. The number of marble slabs of size 20 cm × 30 cm required to pave floor of a square room of side 3 metre, is :

    (a) 100 (b) 150 (c) 225 (d) 25

23. If each side of a square is increased by 25%, its area is increased :

    (a) 25% (b) 50% (c) 40.5% (d) 56.25%

24. A man walking at the speed of 4 kmph crosses a square field diagon in 3 minutes. the area of the field is :

    (a) 18000 m^2 (b) 20000 m^2 (c) 19000 m^2 (d) 25000 m^2

25. A beam 9 m long, 40 cm wide and 20 cm high is made up of iron which weighs 50 kg per cubic metre. The weight of the beam is :

    (a) 56 kg (b) 48 kg (c) 36 kg (d) 27 kg

26. The length of the longest rod that can be placed in a room 30 m long, 24 m broad and 18 m high, is :

    (a) $30\sqrt{2}$ m (b) $5\sqrt{2}$ m (c) $15\sqrt{2}$ m (d) 60 m

27. A wall 8 m long, 6 m high and 22.5 cm thick is made up of bricks, each measuring (25 cm × 11.25 cm × 6 cm). The number of bricks required is :

    (a) 5000 (b) 6400 (c) 5600 (d) 7200

28. The surface ara of a cube is 1734 sq. cms. Its volume is :

    (a) 2197 cu. cm. (b) 4913 cu. cm (c) 2744 cu. cm (d) 4096 cu. cm

29. The surface area of a cube is 600 cm^2. The length of its diagonal is :

    (a) $\dfrac{10}{\sqrt{3}}$ cm (b) $\dfrac{10}{\sqrt{2}}$ cm (c) $10\sqrt{3}$ cm (d) $10\sqrt{2}$ cm

30. The volume of a cube is 2744 cu. cm. Its surface area is :

    (a) 196 cm^2 (b) 1176 cm^2 (c) 784 cm^2 (d) 588 cm^2

31. The breadth of a room is twice its height and half its length. The volume of the room is 512 cu. m. The length of the room is :

    (a) 12 m (b) 16 m (c) 32 m (d) 20 m

32. The ratio between the radius of the base and the height of a cylinder is 2 : 3. If its volume is 12936 cm^3, the total surface area of the cylinder is :

    (a) 2587.2 cm^2 (b) 25872 cm^2 (c) 38808 cm^2 (d) 3080 cm^2

33. How many bullets can be made out of a cube of lead whose edge measures 22 cm, each bullet being 2 cm in diameter ?

    (a) 2662 (b) 1347 (c) 5324 (d) 2541

ANSWERS

1. 1568 m^3, 868 cm^2 2. 17 m 3. 216 cm^3; 216 cm^2 4. 13500 m^2 5. 9 : 4

6. 100 m 7. 6 cm^2 8. 4.5 cm 9. 9856 cm^2 10. 100000 11. 120000 litre

12. 0.84 m^3 13. 125 m^3 14. 6 cm 15. 31.5 cm 16. $79\dfrac{6}{11}$ km 17. Rs. 7392

18. 24000 19. Rs. 237 20. 237.5%, 125% 21. (c) 22. (b) 23. (d) 24. (b)

25. (c) 26. (a) 27. (b) 28. (b) 29. (c) 30. (b) 31. (b) 32. (d) 33. (d)

U N I T

14

TIME AND DISTANCE

STRUCTURE

- Formulae
  □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Formulae of average speed, time and relative speed.
- Questions based on these formulae for practice.

• 14.1. FORMULAE

(i) Average speed $= \dfrac{\text{Distance travelled}}{\text{Time taken}}$

(ii) Distance travelled = Average Speed × Time taken

(iii) Time taken $= \dfrac{\text{Distance travelled}}{\text{Average speed}}$

(iv) 1 km/hour $= \dfrac{5}{18}$ m/sec

(v) 1 m/sec $= \dfrac{18}{5}$ km/hour

(vi) If the ratio of the speed of A and B is $a : b$, then the ratio of the times taken by them to cover the same distance is $\dfrac{1}{a} : \dfrac{1}{b}$ or $b : a$.

(vii) Avrage speed $= \dfrac{2xy}{x+y}$

'x' stands for speed of a body for a certain distance

'y' stands for the speed of a body for an equal distance.

Relative Speed

(vii) $u + v \rightarrow$ if two bodies are moving in opposite direction with their speed as u and v km/hr respectively.

(ix) $u - v \rightarrow$ if two bodies are moving in the same direction with their speed as u and v respectively.

Ex. 1. A man covers a certain distance at 54 kmph by a car. How many metre does he cover in 3 minutes ?

Sol. Speed = 54 kmph $= \left(54 \times \dfrac{5}{18}\right)$ m/sec = 15 m/sec.

∴ Distance covered in 3 min. = (15 × 3 × 60) m = 2700 m. **Ans.**

Ex. 2. If a man runs at 5 metre per second, how many kilometre does he run in 1 hour 20 minutes.

Sol. Speed of the man $= \left(5 \times \dfrac{18}{5}\right)$ km/hr = 18 km/hr.

Distance covered in $\dfrac{4}{3}$ hours $= \left(18 \times \dfrac{4}{3}\right)$ km = 24 km.

$$= \frac{2}{3} \div \frac{5}{3} + \frac{1}{2} \times \frac{3}{5} - \frac{2}{7} = \frac{2}{3} \times \frac{3}{5} + \frac{3}{10} - \frac{2}{7}$$

$$= \frac{2}{5} + \frac{3}{10} - \frac{2}{7} = \frac{4+3}{10} - \frac{2}{7} = \frac{7}{10} - \frac{2}{7}$$

$$= \frac{49-20}{70} = \frac{29}{70} \text{ Ans.}$$

Ex. 3. Simplify : $3.5 \div 0.7$ of $7 + 0.5 \times 0.3 - 0.1$.

Sol. Given expression $= 3.5 \div 4.9 + 0.5 \times 0.3 - 01$

$$= \frac{3.5}{4.9} + 0.15 - 0.1 = \frac{5}{7} + \frac{15}{100} - \frac{1}{10}$$

$$= \frac{5}{7} + \frac{15-10}{100} = \frac{5}{7} + \frac{5}{100} = \frac{5}{7} + \frac{1}{20}$$

$$= \left(\frac{100+7}{140}\right) = \frac{107}{140} = 0.764. \text{ Ans.}$$

Ex. 4. Simplify : $2 - [3 - \{6 - (5 - \overline{4 - 3})\}]$

Sol. Given expression $= 2 - [3 - \{6 - (5 - 1)\}]$

$$= 2 - [3 - \{6 - 4\}] = 2 - [3 - 2] = (2 - 1) = 1 \text{ Ans.}$$

Ex. 5. If $620 \div 12.24 + x = 100$ find the value of x.

Sol. Let $620 \div 12.24 + x = 100$. Then,

$$\frac{620}{12.24} + x = 100 \text{ or } 50.65 + x = 100 \text{ or } x = (100 - 50.65) = 49.35$$

Ex. 6. Simplify : $1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{2}}}$.

Sol. Given expression $= 1 \div \cfrac{1}{1 + \cfrac{1}{(3/2)}} = 1 + \cfrac{1}{1 + \frac{2}{3}} = 1 + \frac{1}{(5/3)} = \left(1 + \frac{3}{5}\right) = 1\frac{3}{5}$.

Ex. 7. Simplify : $1 - \cfrac{5}{7 + \cfrac{1}{3 + \cfrac{1}{2 + \frac{2}{5}}}}$.

Sol. Given expression $= 1 - \cfrac{5}{7 + \cfrac{1}{3 + \frac{1}{12}}} = 1 - \cfrac{5}{7 + \cfrac{1}{\left(3 + \frac{5}{12}\right)}}$.

$$= 1 - \cfrac{5}{7 + \cfrac{1}{(41/12)}} = 1 - \cfrac{5}{7 + \frac{12}{41}} = 1 - \frac{5}{\frac{299}{41}}$$

$$= 1 - \frac{5 \times 41}{299} = \frac{299 - 205}{299} = \frac{94}{299} \text{ Ans.}$$

Ex. 8. A girl was asked to multiply a certain number by 65. She multiplied it by 56 and got his answer less than the correct one by 1125. Find the number to be multiplied.

Sol. Let the required number be x. Then,

$$65x - 55x = 1206 \text{ or } 9x = 1125 \text{ or } x = 125$$

$\therefore$ Required number = 125.

Ex. 9. Simplify : (i) $(81)^{3/4}$ (ii) $\left(\frac{1}{64}\right)^{-5/6}$ (iii) $(256)^{-1/4}$

Sol. (i) $(81)^{3/4} = (3^4)^{3/4} = 3^{\left(4 \times \frac{3}{4}\right)} = 3^3 = 27$.

(ii) $\left(\dfrac{1}{64}\right)^{-5/6} = (64)^{5/6} = (2^6)^{5/6} = 2^{\left(6 \times \frac{5}{6}\right)} = 2^5 = 32.$

(iii) $(256)^{-1/4} = \left(\dfrac{1}{256}\right)^{1/4} = \left[\left(\dfrac{1}{4}\right)^4\right]^{1/4} = \left(\dfrac{1}{4}\right)^{\left(4 \times \frac{1}{4}\right)} = \dfrac{1}{4}.$

Ex. 10. Which is larger : $\sqrt[3]{4}$ or $\sqrt[4]{5}$?

Sol. Given surds are of order 3 and 4, whose l.c.m. is 12. We change each one of the given surds into a surd of order 12.

$\therefore \ \sqrt[3]{4} = 4^{1/3} = 4^{\left(\frac{1}{3} \times \frac{4}{4}\right)} = (4^{4/12}) = (4^4)^{1/12} = (256)^{1/12}$

$\sqrt[4]{5} = 5^{1/4} = 5^{\left(\frac{1}{4} \times \frac{3}{3}\right)} = (5^{3/12}) = (5^3)^{1/12} = (125)^{1/12}.$

Clearly, $(256)^{1/12} > (125)^{1/12}$ or $\sqrt[3]{4} > \sqrt[4]{5}.$

• TEST YOURSELF

1. How many pieces of 0.85 metre can be cut from a rod 42.5 metre long ?

2. The value of 25 coins of 50 paise and 25 paise is Rs. 5.50. Then what is the number of 25 paise coins.

3. $\dfrac{1}{4}$ of Mukul's money is equal to $\dfrac{1}{6}$ of Manoj Pandey's money. If both together have Rs. 600, then what is the difference between their amounts ?

4. A third of Priyansh's marks in Mathematics exceeds a half of his marks in social studies by 30. If he got 240 marks in the two subjects together, how many marks did he get in Social Studies ?

5. If $617 \div 24.68 + x = 90$, find the value of x.

6. A boy was asked to multiply a certain number by 53. He multiplied it by 35 and get his answer less then the correct one by 1206. Find the number to be multiplied.

7. Which is greater $5\sqrt{3}$ or $4\sqrt{2}$?

8. In a school, $\dfrac{1}{5}$th of the boys and $\dfrac{1}{8}$th of the girls took part in a party. What of the total number of students in the school took part in the party ?

9. If $\dfrac{5}{6} + \dfrac{6}{7} \times x - \dfrac{8}{9} \div 1\dfrac{3}{5} + \dfrac{3}{4} \times 3\dfrac{1}{3} = 2\dfrac{7}{9}$ then what is the value of x ?

10. The value of $(\sqrt{8})^{1/3}$ is :

    (a) 3   (b) 5   (c) $\sqrt{2}$ (d) 7

11. The value of $\left(\dfrac{32}{243}\right)^{-4/5}$ is :

    (a) $\dfrac{81}{16}$ (b) $\dfrac{7}{4}$ (d) $\dfrac{16}{81}$ (d) $\dfrac{70}{16}$

12. $\left(\dfrac{1}{216}\right)^{-2/3} \div \left(\dfrac{1}{27}\right)^{-4/3} =$

    (a) $\dfrac{2}{3}$ (b) $\dfrac{1}{8}$ (c) $\dfrac{3}{4}$ (d) $\dfrac{4}{9}$

13. $3\dfrac{1}{4} + 4\dfrac{1}{6} + x + \dfrac{1}{4} = 10$, the value of x is equal to :

    (a) $2\dfrac{1}{6}$ (b) $4\dfrac{1}{3}$ (c) $1\dfrac{1}{3}$ (d) $2\dfrac{1}{3}$

14. If $4\dfrac{1}{2} + 3\dfrac{1}{6} + x + 2\dfrac{1}{3} = 13\dfrac{2}{5}$ then the value of $x =$

    (a) $3\dfrac{2}{5}$ (b) $1\dfrac{2}{5}$ (c) $4\dfrac{1}{5}$ (d) $4\dfrac{1}{6}$

15. $5\dfrac{2}{5}$ of $140 + x = 800$, then $x =$

    (a) 28   (b) 36   (c) 44   (d) 52

16. $1 + \dfrac{1}{1 + \dfrac{1}{1 - \dfrac{1}{6}}} = ?$

    (a) $\dfrac{6}{11}$ (b) $\dfrac{16}{11}$ (c) $\dfrac{7}{6}$ (d) $\dfrac{1}{6}$

17. The value of $1 + \dfrac{1}{2 + \dfrac{1}{1 - \dfrac{1}{3}}}$ is :

    (a) $\dfrac{2}{7}$ (b) $\dfrac{7}{9}$ (c) $\dfrac{9}{7}$ (d) $\dfrac{13}{9}$

18. $\left(4.59 \times 1.8 + 3.6 + 5.4 \text{ of } \dfrac{1}{9} - \dfrac{1}{5}\right) = ?$

    (a) 2.45   (b) 3.705   (c) 1.285   (d) None of these

19. $\dfrac{\dfrac{1}{2} + 4 + 20}{\dfrac{1}{2} \times 4 + 20} = ?$

    (a) $\dfrac{165}{178}$ (b) $\dfrac{161}{176}$ (c) $\dfrac{162}{175}$ (d) $\dfrac{164}{176}$

20. $\dfrac{(12)^2 - (8)^2 \times 2}{4 \times 6} = ?$

    (a) 11   (b) $1\dfrac{1}{4}$ (c) $6\dfrac{2}{3}$ (d) None of these

21. $0.5 \times 0.5 + 0.5 + 5 = ?$

    (a) 0.15   (b) 0.45   (c) 0.37   (d) 1.35

22. $108 \div 48 \text{ of } \dfrac{1}{4} + \dfrac{2}{5} \times 3\dfrac{3}{4} = ?$

    (a) $8\dfrac{3}{4}$ (b) $10\dfrac{1}{2}$ (c) $6\dfrac{1}{4}$ (d) $2\dfrac{1}{2}$

23. If $9^{x+3} = 27^{x-1}$ then the value of x is :

    (a) 8   (b) 7   (c) 9   (d) 6

24. $12\sqrt[3]{4} \div 3\sqrt{2} = ?$

    (a) $3\sqrt[6]{3}$ (b) $4\sqrt[6]{2}$ (c) $\sqrt[6]{5}$ (d) None of these

ANSWERS

1. 50   2. 2.8   3. Rs. 120   4. 132   5. 65   6. 67   7. $5\sqrt{3} > 4\sqrt{2}$ 8. $\dfrac{2}{13}$ th of total strength

9. $\dfrac{6}{7}$ 10. (c)   11. (a)   12. (d)   13. (d)   14. (a)   15. (c)   16. (b)   17. (c)   18. (a)

19. (b)   20. (c)   21. (d)   22. (b)   23. (c)   24. (b).

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C H A P T E R

II

DATA INTERPRETATION

</div>

▶ The term data is used to represent numerical information of a particular condition.

▶ **Primary Data :** If the numerical facts are collected by a statistician himself, it is called primary data.

▶ **Secondary Data :** If the data is collected from other sources such as published reports, official records, etc. It is called secondary data.

▶ Occassionally, the data are presented in a chart or table, but much more often, they are presented graphically.

▶ A graph is used to present the organised data in pictorial form giving the major details. There are many type of graphs like circle graphs line graphs, picto-graphs, bar graphs.

▶ The act of organising and interpreting data to get meaningful information is called data interpretation.

U N I T

16

DATA TABLE AND GRAPH

STRUCTURE

- Data Table
  - ○ Test Yourself
- Graph
  - ○ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Different parts for reading a table like title of the table, column heading and head note.
- Line graph and bar graph.
- Circle graph or pie charts.
- Problems based on table and graph for practice.

• 16.1. DATA TABLE

In studying problems based on statistics, the numerical data relating to any type of situation can be generally represented in the form of a table. In a table, horizontal lines are called raws and vertical lines are called columns. Tabular form is one of the easiest and the most accurate way of presenting data in a non-graphical manner. While reading a table, the following parts need are full observation :

(a) Title of the table : This gives a description of the contents of the table and precisely defines the kind of data and the period for which it occurred.

(b) Column heading : This defines the information contained in various columns and also specifies the unit of measurement in some cases.

(c) Head note : Invariably, the unit of measurement is specified in the head note. Foot notes are used to point out any exceptions in arriving at the data.

Ex. 1. The table given below shows the population, literates and illiterates (in thousands) and the percentage of literacy in three states, in a year :

State	Population	Literates	Illustrates	Percentage of Literacy
Madras	49342	6421	....	....
Mumbai	....	4068	16790	....
Bengal	60314	....	....	16.1

After reading the table, answer the following questions :
1. Percentage of literacy in Madras.
2. Percentage of literacy in Mumbai.
3. Number of literates in Bengal (in thousands) ?

Sol. 1. Percentage of literacy in Madras
$$= \left(\frac{6421}{49342} \times 100\right)\% = 13.01\%$$

2. Population of Mumbai = (4068 + 16790) thousands = 20858 thousands.

∴ Percentage of literacy in Mumbai = $\left(\frac{4068}{20858} \times 100\right)\% = 19.5\%$.

3. Number of literates in Bengal $= \left(\dfrac{161}{100} \times 60314 \right) = 9715$ thousands.

Ex. 2. The following table shows the production of food grains (in million tonnes) in a state for the period from 2004–05 to 2008–09.

Year	Production in Million Tonnes				Total
	Wheat	*Rice*	*Maize*	*Other cereals*	
2004-05	580	170	150	350	1350
2005-06	600	220	234	400	1474
2006-07	560	240	228	420	1538
2007-08	680	300	380	460	1660
2008-09	860	260	340	500	1910
Total	3280	1190	1332	2130	7932

Read the above table and mark (√) against the correct answer in each of the following questions :

1. During the period from 2004–05 to 2008–09, what percent of the total production is the wheat ?
2. During the year 2008-09. What was the percentage increase in production of wheat over the previous year ?
3. For which cereal the increase in production was maximum in year 2007-08 ?
4. During 2006-07, what was the percentage of decrease in the production of maize ?
5. The increase in the production of other cereals was minimum during which year ?

Sol. 1. Total production = 7932 million tonnes.

Wheat production = 3280 million tonnes.

Required percentage $= \left(\dfrac{3280}{7932} \times 100 \right) \% = 41.3\%$.

2. Production of wheat in 2008-09 = 860 million tonnes.
    Production of wheat in 2007-08 = 680 million tonnes

    $\therefore$ Increase % $= \left[\dfrac{860 - 680}{680} \times 100 \right] \% = \left(\dfrac{180}{680} \times 100 \right) \% = 26.4\%$.

3. It is clear from the table that during the year 2007-08, the increase in the production of wheat, rice, maize and other cereals is

    $(680 - 560) = 120$, $(300 - 240) = 60$, $(380 - 228) = 152$.

    and $(460 - 420) = 40$ million tonnes respectively. Clearly, increase in maize production is maximum.

4. Production of maize in 2006-07 = 228 million tonnes
    Production of maize in 2005-06 = 234 million tonnes

    Decrease in production $= \left(\dfrac{6}{234} \times 100 \right) \% = 2.56\%$.

5. Increase in production of other cereals over previous year was 50, 20, 40 and 40 million tonnes during 2005-06, 2006-07, 2007-08 and 2008-09 respectively.
    So, it is minimum in 2006-07.

Ex. 3. Study the table given below and answer the questions given below it :

Number of Employees Working in Various Departments of a Factory

Year	Departments (Number of employees)				
	Production	*Sales*	*Purchase*	*Accounts*	*Research*
1989	150	25	50	45	75
1990	225	40	45	62	70
1991	450	65	30	90	73
1992	470	73	32	105	70
1993	500	80	35	132	74
1994	505	75	36	130	75

1. In which year, the total number of employees reached approximately twice the total number of employees the factory had in the year 1989 ?
   (a) 1994   (b) 1993   (c) 1992   (d) 1991

2. In which department the number of employees approximately remained the same during the years 1989 to 1994 ?
   (a) Production   (b) Sales   (c) Research   (d) Accounts

3. In which year the number of employees working in production department was less than 50% of the total employees ?
   (a) 1989   (b) 1991   (c) 1992   (d) 1993

4. In which of the following years each department had more number of employees than it had in the immediately preceding year ?
   (a) 1993   (b) 1992   (c) 1991   (d) 1990

5. Which department had less than 10% of the total employees all through the year 1989 to 1994 ?
   (a) Purchase   (b) Sales   (c) Accounts   (d) Research

Sol. 1. Total number of employees in various years are :
   1989 → 345, 1990 → 442, 1991 → 708, 1992 → 750, 1993 → 821, 1994 → 821.
   Employees in 1989 = 345.
   ∴ Number in 1991 is twice the number in 1989. Hence option (d) is correct.

2. Clearly, the number of employees approximately remained the same in research department. Hence option (c) is correct.

3. In 1989, the number of employees in production was 150 while the total number of employees was 345.
   Clearly, 150 < 50% of 345. Hence option (a) is correct.

4. Clearly, in 1993 the factory had more number of employees in each department than it had in 1992. Hence option (a) is correct.

5. Clearly, sales department had less than 10% of the total employees all through the years 1989 to 1994. Hence option (b) is correct.

Ex. 4. According to the following table, give the answers of questions given below :
Production of straight and complex Fertilisers in Tamil Nadu
(in thousand tonnes)

Unit	End Product	1988-89	1989-90	1990-91
Madras Fertiliser Ltd.	Urea	243.8	413.2	238.6
Coimbatore Pioneer	SSP	35.9	31.6	42.3
SPIC	Urea	582.9	535.0	570.0
Kothari Industrial Corp.	SSP	59.6	57.6	75.0
Shaw Wallace	SSP	—	74.6	71.0
Indag product	SSP	16.6	22.3	23.8
EID Party	Urea	51.7	53.0	48.5
Neyveli Lignite Corp.	Urea	141.1	143.10	101.5

1. What was the approximate growth rate in Urea Production in Tamil Nadu between 1988-89 and 1990-91 ?
   (a) 6%   (b) 3.5%   (c) – 6%   (d) 4.9%

2. Which unit saw the maximum percentage increase in SSP production between 1989-90 and 1990-91 ?
   (a) Coimbatore Poineer   (b) Kothari Industrial Corporation
   (c) Shaw Wallace   (d) Indag Production

3. Of the total fertiliser production in 1990-91, what was the approximate Contribution of Madras Fertiliser Limited ?
   (a) 20.4%   (b) 24.7%   (c) 25.8%   (d) 2.0%

4. The growth rate in fertiliser production from 1988-89 to 1989-90 was about ?

    (a) 16.5%   (b) 17.6%   (c) 18.4%   (d) 19.1%

5. The percentage increase required in SSP production in 1990-91, for it to equal urea production of that year is about :

    (a) 350%   (b) 450%   (c) 45%   (d) 300%

Sol. 1. From the table, it is clear that the urea production has decreased for all the units from 1988-89 to 1990-91. Therefore, the answer should be negative. Hence option (c) is correct choice.

2. Percentage change for Coimbatore Pioneer $= \dfrac{42.3 - 31.6}{31.6} = \dfrac{10.7}{31.6} \approx \dfrac{1}{3}$

    Kothari Industrial Corporation $= \dfrac{75 - 57.6}{57.6} = \dfrac{17.4}{57.6} \approx \dfrac{1}{3.3}$

    Shaw Wallace $= \dfrac{71 - 74.6}{74.6} < 0$

    Indag production $= \dfrac{23.8 - 22.3}{22.3} = \dfrac{1.5}{22.3} \approx \dfrac{1}{15}$

Hence, Coimbatore Pioneer has the max. percentage increase in SSP production.

3. Total fertiliser production in 1990-91.

    $= 238.6 + 42.3 + 570 + 75 + 71 + 23.8 + 48.5 + 101.5 = 1170.70$

% Contribution of Madras Fertiliser Limited $= \dfrac{238.6}{1170.7} \times 100 = 20.4\%$

Hence, option (a) is the correct choice.

4. Fertiliser production is 1988-1989 = 1131.6

    Fertiliser production in 1989-90 = 1330.4

% growth $= \dfrac{1330.4 - 1131.6}{1131.6} \times 100 = \dfrac{198.8}{1131.6} \times 100 = 17.6\%$

Hence, option (b) is our answer.

5. SSP production in 1990-91 = 212.1

    Urea production in 1990-91 = 958.6

Hence, % increase required $= \dfrac{958.6 - 212.1}{212.1} \times 100 = \dfrac{746.5}{212.1} \times 100 = 350\%$

Ex. 5. Answer the question based on the following data given are the transportation schedules for a company :

P	
Godown	Quantity available
1	150
2	220
3	190

Q	
Outlet	Quantity required
A	220
B	140
C	180

Transportation cost per unit (Rs. per unit)

Godown	Outlet		
	A	B	C
1	8	6	10
2	5	3	7
3	4	9	12

1. If only godown 2 was available, at what minimum cost can it supply at quantity available :

    (a) Rs. 1120 (b) Rs. 820   (c) Rs. 370   (d) Rs. 560

2. If only outlet *A* is present, what will be the minimum cost of supply ?

    (a) Rs. 910 (b) Rs. 730   (c) Rs. 640   (d) Rs. 1010

3. If only godown 3 was available, at what minimum cost can it supply all the quantity available ?
   (a) Rs. 910   (b) Rs. 820   (c) Rs. 760   (d) Rs. 1120

4. If godown 2 is shut down and its availability is divided equally between 1 and 3, which of the two godowns can exhaust its availability more economically and at what cost ?
   (a) 1, Rs. 1600   (b) 1, Rs. 1800   (c) 3, Rs. 1600   (d) 3, Rs. 1800

5. If the goods shipping matrix is as shown :

Godown	A	B	C
1.	30	40	--
2.	25	--	70
3.	60	--	30

Then what is the total cost in curred ?
   (a) Rs. 1210   (b) Rs. 1695   (c) Rs. 1815   (d) Rs. 965

Solution :

1. Cost will be minimum when the efficiency utilization is maximum.
   To outlet $B = 140 \times 3 = $ Rs. 420
   To outlet $A = 80 \times 5 = $ Rs. 400
   So, the total cost of transportation = Rs. 820

2. Cost of transportation from godown 3 = $190 \times 4 = 760$
   Cost of transportation from godown 2 = $30 \times 5 = $ Rs. 150.
   So, the total cost of transportation = Rs. 910.

3. Cost of transportation to outlet $A = 190 \times 4 = $ Rs. 760.

4. Cost of transportation from godown 3 to outlet $A = 220 \times 4 = $ Rs. 880
   Cost of transportation from godown 3 to outlet $B = 80 \times 9 = $ Rs. 720.
   Total = Rs. 1600 for godown 3.

5. Cost of transportation from godown 1 to $A = 30 \times 8 = $ Rs. 240
   Cost of transportation from godown 1 to $B = 40 \times 6 = $ Rs. 240.
   Cost of transportation from godown 2 to $A = 25 \times 5 = $ Rs. 125.
   Cost of transportation from godown 2 to $C = 70 \times 7 = $ Rs. 490
   Cost of transportation from godown 3 to $A = 60 \times 4 = $ Rs. 240
   Cost of transportation from godown 3 to $C = 30 \times 12 = $ Rs. 360
   Total cost = Rs. 1695.

• 16.2. GRAPH

A graph is used to present the organised data in pictorial form giving the major details. These are useful for their easier readability.

There are many types of graph such as circle graphs, line graphs, bar graphs. The circle graphs are commonly used to show some type of distribution : line graphs are used to represent change in a particular variable or variables; bar graphs are used mainly for the purpose of comparisons.

Line Graph

Line graph is also known as cartesian graph. It indicates the variation of a parameter with respect to another. The line graphs are read on x and y-axis. One parameter is taken on x-axis and another on y-axis. The type of graph simplifies the data interpretation, as it is a pictorial presentation of data and is therefore very useful for determining tends and rate of change. The slope of graph shows the absolute growth and not the percentage growth.

Bar Graph

A bar is thick line whose width is shown merely for attention. In this method of data representation, the data is plotted on the X and Y axes as bars. This method of data

interpretation is more or less similar to the one in Cartesian graphs except that the data plotted on Cartesian graphs is continuous whereas in Bar chart the data is discrete. Also, a single point denoted in the line graph is represented by an entire bar in the bar graph.

One axis (normally the x-axis) of the bar diagram represents a discrete variable while the other axis represents the scale for one or more continuous variable. Each bar diagram has a title indicating the subject matter represented in the diagram.

Circle Graph or Pie Charts

In circle graph, the data can be plotted with respect to only one parameter while in bar charts, the variable can be plotted on coordinates x and y. In questions of Circle Graph, the total quantity is distributed over a total angle of 360°. The use of circle graph are restricted to represent limited type of information. This method is also useful for representing proportions or percentages of various elements with respect to the total quantity.

The following circle graph gives the distribution of the population in different geographical zones.

Distribution of Population in Geographical Zones
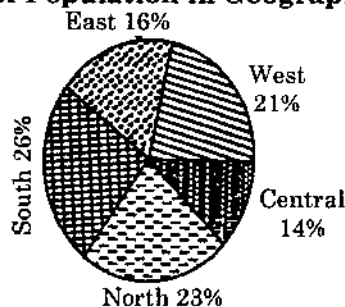
From the above circle graph, we can calculate the following :

▶ Population in any zone given the total population.

▶ Population of any zone as a percentage of that of another zone.

▶ Percentage increase in the total population given the percentage increase in the population of one or more zones.

Ex. 6. According to following given line graph, answer the questions given below :

—◆— Income —●— Expenditure
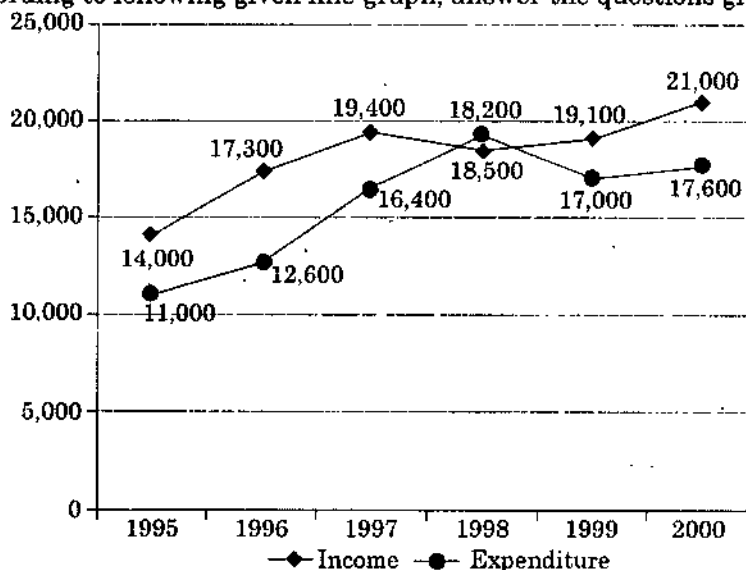
1. In the year 1998, by how much did the person's saving get depleted ?

2. What is average increase in expenditure of the person between 1995 and 2000 ?

3. What was the perentage increase in income between 1996 and 1998 ?

4. What was the commulative savings of the person over the period 1995-2000 ?

5. Which year is the best year for the person in terms of savings as a percentage of income ?

Sol. 1. Average monthly saving for the year 1998 = (19200 − 18500) = Rs. 700

Hence, annual saving = 700 × 12 Rs. 8400.

2. Monthly expenses in 1995 = 11,000 and monthly expenses in 2000 = 17,6000. Let the commulative increase be $r\%$. Then

$$17,600 = 11,000\,(1-r)^5$$

$$\Rightarrow \qquad 1.6 = (1+r)^5$$

Now using options, we find that value of r can be 10%.

3. Required percentage increase $= \left(\dfrac{18500 - 17300}{17300}\right) \times 100 - 6.93\% = 7\%$

4. Average monthly saving in 1995 = Rs. 3000

In 1996 = Rs. 4700, In 1997 = Rs. 3000, In 1998 = Rs. 700,

In 1999 = Rs. 2100, In 2000 = Rs. 3400.

Hence, commulative annual saving

$$= 12 \times (3000 + 4700 + 3000 - 700 + 2100 + 3400)$$

$$= 12\,(15500) = \text{Rs. } 1,86,000$$

5. Saving as $a\%$ of income in 1995 $= \dfrac{3000}{14000} \times 100 = 21.42\%$

Saving as $a\%$ of income in 1996 $= \dfrac{4700}{17300} \times 100 = 27.16\%$

Saving as $a\%$ of income in 1997 $= \dfrac{3000}{19400} \times 100 = 15.46\%$

Saving as $a\%$ of income in 1998 = negative growth

Therefore, 1996 was the best year in terms of saving as a percentage of income.

Ex. 2. According to given line graph, answer the following questions :

Trade in India
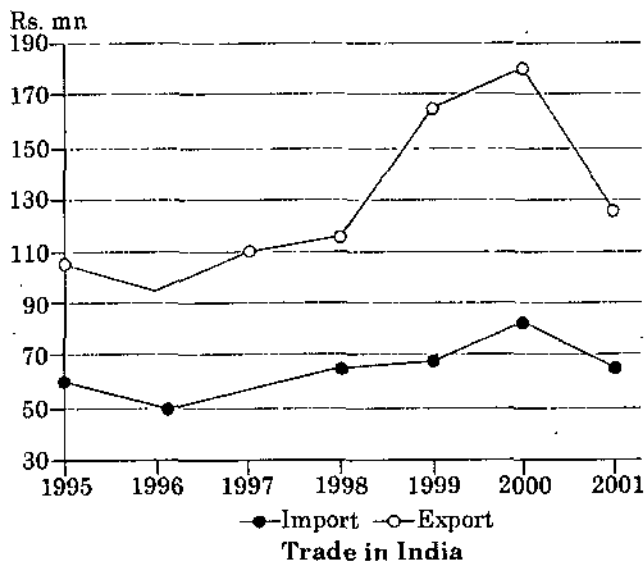
1. What was the percentage increase in imports in the year which has the maximum increase in exports over its preceding year ?
   (a) 21% (b) 13% (c) 9% (d) none of these

2. Which of the following years witnessed maximum fall in exports in the period under review ?
   (a) 1998 (b) 1999 (c) 2000 (d) 2001

3. During which year there was maximum increase in imports over its preceding year?
   (a) 1997 (b) 1998 (c) 1999 (d) 2000

4. If trade balance = exports – imports, what was the net trade balance of India for the period under review ?
    (a) Rs. 483 million deficit   (b) Rs. 243 million surplus
    (c) Rs. 374 million deficit   (d) Rs. 455 million surplus

5. What is the maximum percentage fall in imports over the given period ?
    (a) 30%   (b) 24%   (c) 14%   (d) 20%

6. If total trade is defined as the addition of imports and exports, what was the ratio of exports to imports in the year when total trade was maximum ?
    (a) 9 : 10   (b) 10 : 9   (c) 9 : 4   (d) 4 : 9

Sol. 1. Maximum export increase in witnessed in 1999

∴ % increase in imports in the year 1999 $= \dfrac{68 - 60}{60} \times 100 \approx 13\%.$

2. It is very clear from the graph the maximum fall in exports was witnessed in the year 2001.

3. Imports rose by Rs. 4 million in 1997, Rs. 6 million in 1999 and Rs. 8 million in 2000.

4. Trade balance of India for the period (1995-2001) can be calculated as below :

Year	Exports-Imports
1995	40
1996	45
1997	60
1998	55
1999	90
2000	100
2001	35
Total	**455**

5. Clearly maximum fall in imports is seen in the year 2001

% decrease $= \dfrac{78 - 60}{78} \times 100 \approx 24\%$

6. Required Ratio $= \dfrac{\text{Exports}}{\text{Imports}} \approx \dfrac{180}{80} = 9 : 4$

Ex. 8. According the following bar charts, answer the questions that follow :
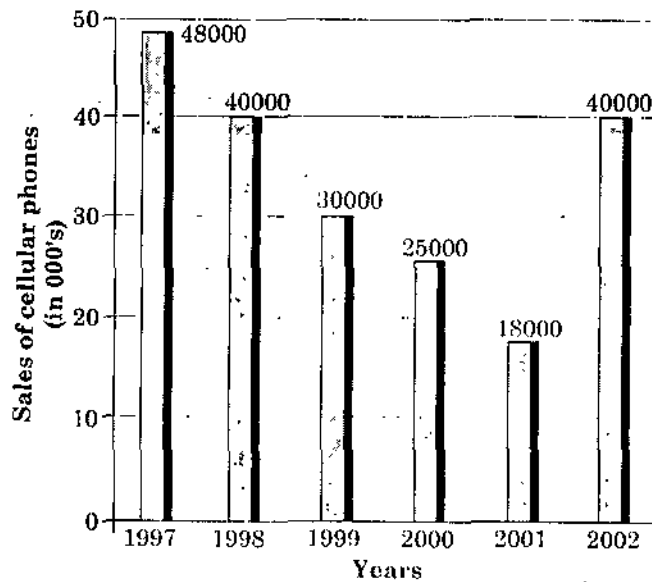
1. What is the percentage increase in sales from 2001 to 2002 ?
2. In between which two years, the rate of change of cellular phones is minimum ?

Sol. 1. % increase in sales $= \dfrac{40-18}{18} \times 100 \approx \dfrac{22}{18} \times 100 = 122\%$

2. Rate of change $\quad 1997\text{–}1998 = \dfrac{8}{48} \times 100 = 16.6\%,$

$$1999\text{–}2000 = \dfrac{5}{30} \times 100 = 16.6\%,$$

$$2001\text{–}2002 = \dfrac{22}{18} \times 100 = 122\%.$$

Hence, it is minimum for 1997–98 and 1999–2000.

Ex. 9. According to following bar graph answer the given questions :

☐ Production capacity ■ Production in 1989
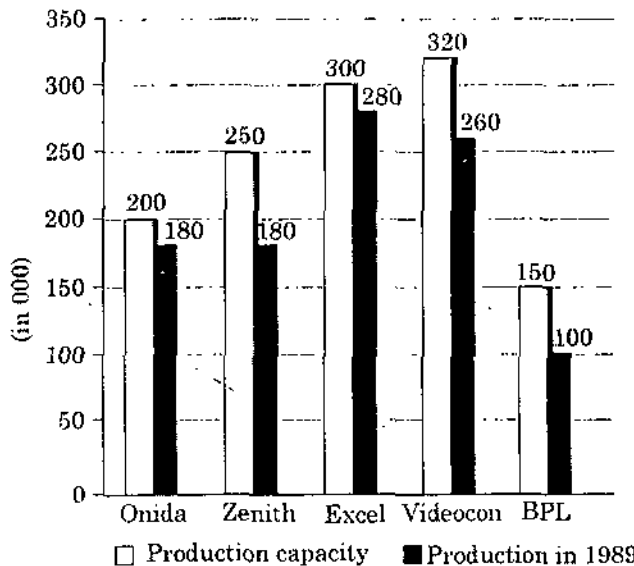
1. In 2005, which company had the maximum percentage utilised capacity ?
   (a) Onida   (b) Zenith   (c) BPL   (d) Videocon
2. The TVs produced by Excell form what percentage of the total production ?
   (a) 32%   (b) 25%   (c) 26%   (d) 28%
3. A new company CASINO was set up in 2006 and sold 1,22,000 pieces in that year. Due to this the other five given companies together reduced their production by the same number of sets sold by CASINO in the ratio of their production capacities. What is the production of Excel in 2006 ?
   (a) 275   (b) 250   (c) 264   (d) 270

Sol. 1. % of unutilised capacity $= \dfrac{\text{Production capacity} - \text{Productions}}{\text{Production capacity}} \times 100$

Onida $\dfrac{20}{200} \times 100 = 10\%$

Zenith $\dfrac{70}{250} \times 100 = 28\%$

BPL $\dfrac{50}{150} \times 100 = 33.3\%$

Videocon $\dfrac{60}{320} \times 100 = 18.75\%$

Hence, option (c) is the correct answer.

2. Total production $= 180 + 180 + 280 + 260 + 100 = 1000$

$\therefore \quad$ Required % $= \dfrac{280}{1000} \times 100 = 28\%$

3. Total number of TVs sold by CASINO = 1,22,000
   Total production capacity of all the companies put together
   $$= 200 + 250 + 300 + 320 + 150 = 1220$$

   Decrease in production of Excel $= \dfrac{300}{1220} \times 122000 = 30000$

   $\therefore$ Actual production of Excel in 1990 = 280,000 – 30,000 = 250,000.

Ex. 10. Answer these questions based on the following given circle graph :

Expenditure incurred by Mr Gupta on various Heads in 2008 and 2009

2008   2009

Total salary = Rs. 1,20,000 p.a.   Total salary = Rs. 40,000 p.a.
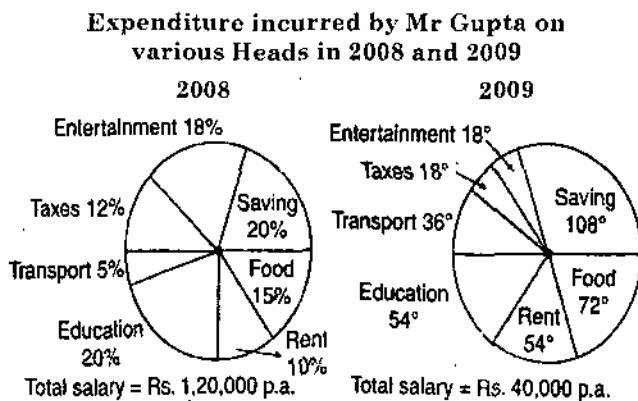
1. How much more money does Mr. Gupta spend on taxes than on transport in the year 2008 ?
2. How much more money was spent on education than the entertainment in th year 2009 ?
3. The percentage increase in the savings from 2008 to 2009 is how many percentage points more than that of transport ?

Sol. 1. Money spent on taxes = 12%

Money spent on Transport = 5%

Difference of Taxes and Transport $= \dfrac{(12-5)}{100} \times 120000 = $ Rs. 8400

2. Difference in the angle subtended by education and entertainment = 36°

∴ Difference (in terms of amount) $= \dfrac{2,40,000 \times 36}{360} = $ Rs. 24000

3. Savings in 2008 $= \dfrac{120000 \times 20}{100} = 24000$

Savings in 2009 $= \dfrac{240000 \times 108}{360} = 72000$

∴ % increase in saving $= \dfrac{48000}{24000} \times 100 = 200\%$

Amount spent on transport in 2008 $= \dfrac{120000 \times 5}{100} = 6000$

Amount spent on transport in 2009 $= \dfrac{240000 \times 36}{360} = 24000$

∴ % increase in the amount spend on transport $= \dfrac{18000}{6000} \times 100 = 300\%$

The percentage point difference = 200 − 300 = − 100

∴ less by 100% points.

Alternately : Total salary in 2009 was increased by 100&. Share of saving in 2009 is 30%, when the total salary increased by 100%, share of saving will also be doubled, *i.e.,* 60%. Similarly, the share of transport in 2009 is 20%. Percentage increase in saving is 20% to 60%, *i.e.,* 200%. Percentage increase in transport is 10% to 20%, *i.e.,* 100%.

∴ Difference in percentage is 100% points.

Ex. 10. *Refer to the following pie charts and answer the questions that follow :*
Countrywise split up of Global Exports
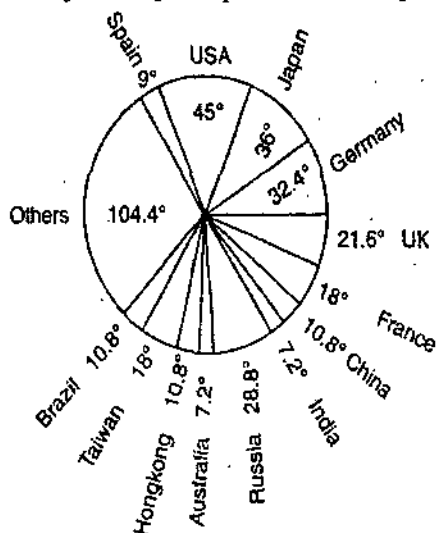
1. By how much does the value of the exports of USA exceed that of Germany ?
   (a) $2300 billion   (b) $2520 billion
   (c) $3510 billion   (d) $2860 billion

2. The difference in the value of the exports of Japan and France is how many times that of UK and Taiwan ?
   (a) 2 times   (b) 3 times   (c) 5 times   (d) 12 times

3. The value of the exports of the OPEC countries is how much more than the value of the exports of India and Australia put together, given that OPEC has a 20% share in the value of the exports of others ?
   (a) $1296 billion   (b) $1298 billion
   (c) $1305 billion   (c) None of these

4. If exports of developing countries accounted for 36% of the total worldwise exports, then what is the value of the exports of Japan as a percentage of the exports of the developing countries :
   (a) 25.01%   (b) 26.23%   (c) 27.77%   (d) 29.87%

5. Considering 'others' as a single country, what is the number of countries, whose exports are more than the average exports per country ?
   (a) 3   (b) 4   (c) 5   (d) None of these

Sol. 1. The difference in the angles subtended by USA and Germany
$$= 45° - 32.4° = 12.6°$$
∴ Difference in the exports of USA and Germany (in $ billion)
$$= 72000 \times \frac{12.6°}{360°} = \$2520 \text{ billion}$$
Hence, correct option is (b).

2. The difference in the angles subtended by Japan and France
$$= 36° - 18° = 18° \qquad \text{... (A)}$$
The difference in the angles subtended by UK and Taiwan
$$= 21.6° - 18° = 3.6° \qquad \text{... (B)}$$
A is 5 times B.
Hence, correct option is (c).

3. Value of the exports of India and Australia $= 7.2° + 72° = 14.4°$ ... (A)
Value of exports OPEC countries $= 104.4° \times \dfrac{20}{100} = 20.88°$ ... (B)
$$20.88° - 14.4° = 6.48° \text{ is the difference.}$$
In terms of value, difference is

$$72000 \times \frac{6.48°}{360°} = \$1296 \text{ billion.}$$

Hence, correct option is (a).

4. Exports of developing countries $\approx 36\%$ of total imports

Exports of Japan = 10% of total exports

$$\text{Ratio} = \frac{10}{36} = 0.2777 = 27.77\%$$

Hence, option (c) is correct.

5. The total number of countries = 14

$\Rightarrow$ Average angle subtended by each country $= \dfrac{360°}{14} = 25.7\%$.

Only USA, Japan, Germany, Russia and others are greater than 25.7. Hence, our answer is 5.

• TEST YOURSELF

Long Answr Type Questions

I. In the following table, the production of fruits (in million tonnes) in a state are given in the period from 1998–99 to 2002–03.

Year	Production in million tonnes				
	Apple	Bananas	Grapes	Oranges	Total
1998-99	420	600	310	250	1580
1999-2000	500	720	380	300	1900
2000-2001	640	760	420	320	2140
2001-2002	730	800	460	380	2370
2002-2003	800	690	500	460	2450
Total	3090	3570	2070	1710	10440

After reading the table, answer the following questions :

1. What percentage of the total production is the apple during the period 1998-99 to 2002-93 ?
2. During the year 2002-03 what was the percentage increase in production of graphs over the previous year.
3. For which fruit, the increase in production was maximum in year 2000-2001 ?
4. During the year 2001-02 what was the percentage of decrease in the production of banana ?
5. The increase in the production of oranges was maximum during which year ?
    II. Study the following graph carefully and answer the questions given below it.
    Production of three types of vehicles by a company over the years (in thousands)
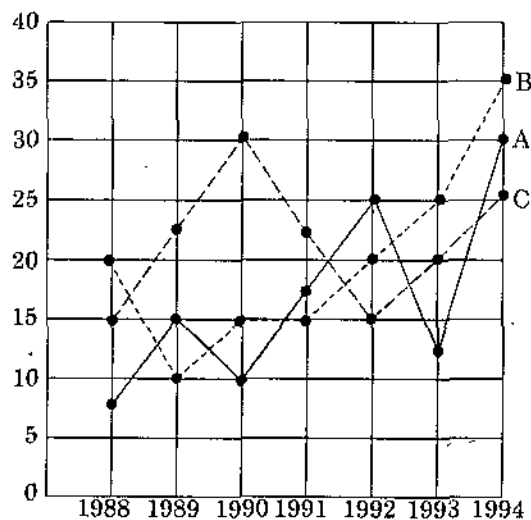
6. The number of *A* type vehicles produced in 1990 was what percent of the number of *C* type vehicles produced in 1992 ?

7. In how many years was the production of *A* type vehicles less than its average production ?

8. What was the average number of *B* type vehicles produced by the company over the years ?

9. In which year was the total production of all the three types of vehicles 60,000 ?

10. What was the percentage increase in the production of *C* type vehicles from 1989 to 1990 ?

III. A company produces five types of shirts — *A, B, C, D* and *E*, using the cloth of three qualities — high, medium and low and dyes of the three qualities – high medium and low. One shirt requires 1.5 m cloth. The following table gives respectively :

    1. The number of shirts (of each category) produced in thousand.

    2. The percentage distribution of cloth quality in each type of shirt, and

    3. The percentage distribution of dye quality in each type of shirt.

Distribution of cloth %						Distribution of dye %			
Shirt type	Number (000)	Shirt type	High	Medium	Low	Shirt type	High	Medium	Low
A	20	A	80	20	--	A	70	15	15
B	30	B	30	40	30	B	20	50	30
C	30	C	–	70	30	C	–	60	40
D	10	D	–	60	40	D	–	40	60
E	10	E	–	10	90	E	–	20	80

11. What is the total requirement of cloth ?

12. How many metres of low-quality cloth is consumed ?

13. How many metres of high-quality cloth is consumed by *A*-shirts ?

14. What is the ratio of the three qualities of dyes in high-quality cloth ?

IV. Answer the questions based on the following graph :

Solubility-temperature relationships for various salts.
(The Y-axis denotes solubility (kg/L of water)

— Potassium chlorate
—■— Potassium chloride
—▲— Potassium nitrate
– – Sodium chloride
— Sodium chloate
—●— Sodiumnitrate

Temperature in degree celsius
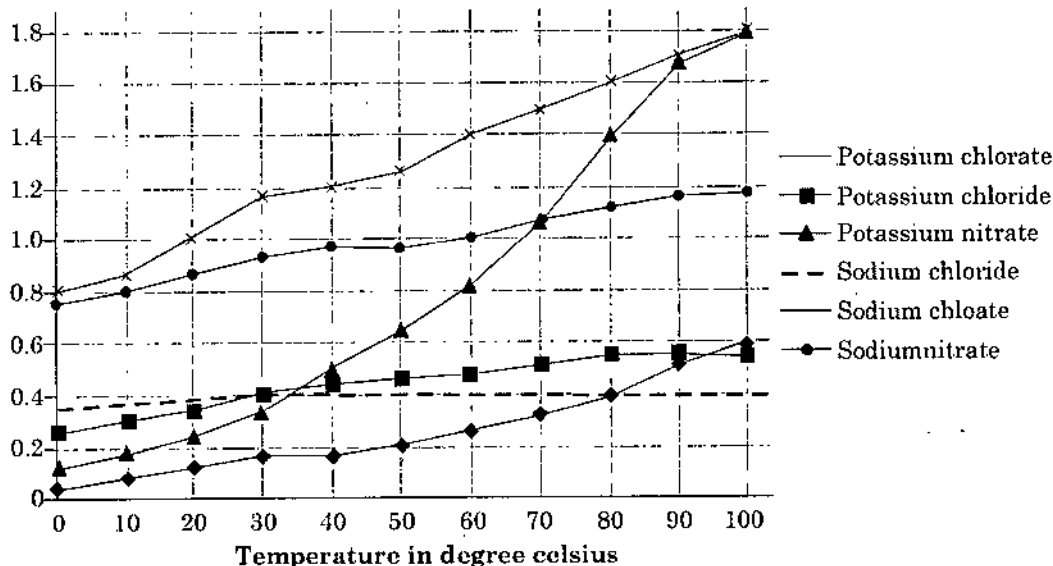
15. Which salt has the greatest solubility ?

16. Approximately, how many kilogram of potassium nitrate can be dissolved in 10 L water of 30°C ?

17. By what percentage is the solubility of potassium chlorate in water increased as the water is heated from 30°C to 80°C ?

18. If one mole of potassium chloride weighs 0.07456 kg. approximately, how many moles of potassium chloride can be dissolved in 100 L water at 36°C ?

19. Which salt has greater change in solubility in kg/L of water between 15°C and 25°C ?

V. Refer to the following bar chart and answer the questions that follow :

Indian's foreign trade in Rs. Cr.
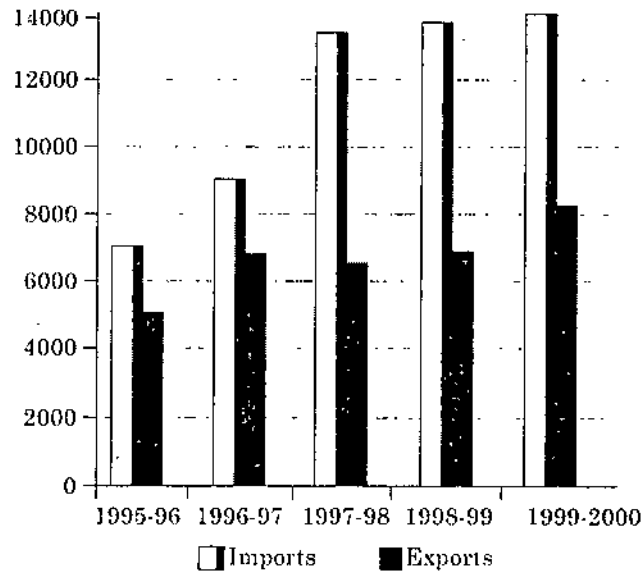
☐ Imports   ■ Exports

20. What is the percentage increase in imports between 1995-96 and 1999-2000 ?

21. If oil imports constituted 20% of the total imports in 1997-98, then what prcentage of the trade gap was due to oil (assuming that no oil is exported) ?
(a) 30%   (b) 40%   (c) 85%   (d) 25%

22. The statement "The trade gap first increases and then exhibits a decreasing trend" is true or false ?

VI. According to following circle graph, answer the following questions :

The following two pie charts give the sales of the company Tenner India Ltd. for the year 1998-99. Chart A gives the region-wise sales and chart B gives the product wise sales of the company.
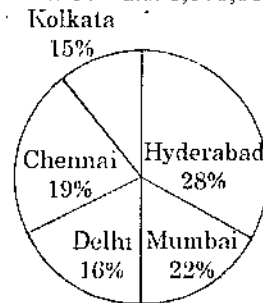
Total sales = Rs. 6,870,000,000   Total sales = Rs. 6,870,000,000
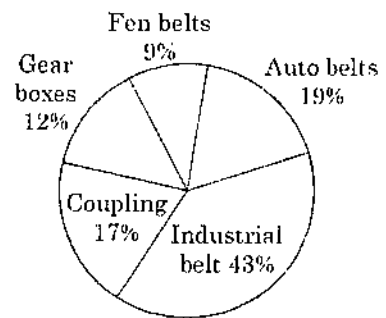
23. If Hyderabad and Mumbai regions post a growth of 12% each and Kolkata posts a negative growth of 6% next year. What is the total sales of Tenner India Ltd, assuming the sales in Delhi and Chennai to be the same in the given year ?

24. What are the angles subtended by Auto Belts, industrial belts and Fan belts respectively ?

25. What is the sales of Gear Boxes in the Delhi region in Rs. crore ?

26. What is the difference between the sales (in Rs. crore) of Kolkata and Hyderabad regions of Tenner India Ltd. ?

27. If all the couplings are sold in the Hyderabad region what is the sales (in Rs. crore) of all the other products in the same region ?

Short Type Questions :

I. Define the graph.

II. What do you understand by line graph ?

III. Explain the Bar graph.

IV Define the circle graph.

Objective : Study the given group and answer the questions given below it.
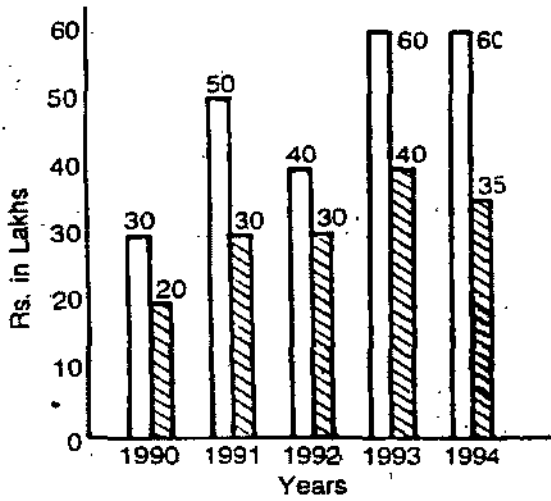
28. What was the difference in profit between 1991 and 1992 ?

    (a) Rs. 10 lakh   (b) Rs. 5 lakh   (c) Rs. 15 lakh   (d) No profit

29. In the case of how many years was the income more than the average income of the given years ?

    (a) One   (b) Two   (c) Three   (d) Four

30. What was the percentage increase in expenditure from 1992 to 1993 ?

    (a) 10%   (b) $33\frac{1}{3}$%   (c) $66\frac{2}{3}$%   (d) 20%

31. The income in 1992 was equal to the expenditure of which of the following years ?

    (a) 1990   (b) 1991   (c) 1993   (d) 1994

32. In which of the following years was the profit maximum ?

    (a) 1990   (b) 1994   (c) 1992   (d) 1993

VI. Study the following graphs carefully and answer the questions that follow :
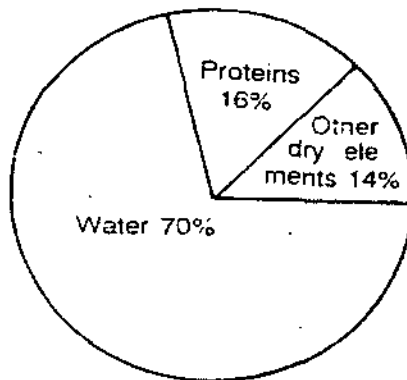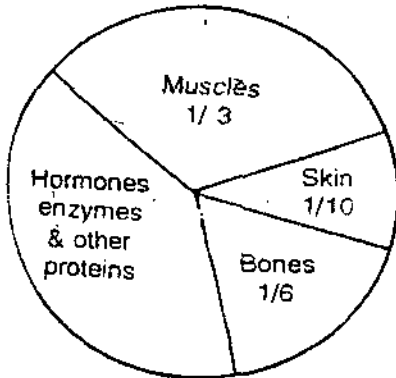
33. In the human body, what part is made of neither bones nor skin ?

    (a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{1}{40}$ (d) $\frac{3}{80}$

34. What is the ratio of the distribution of proteins in the muscles to that of the distribution of proteins in the bones ?

    (a) 1 : 18   (b) 18 :1   (c) 2 : 1   (d) 1 : 2

35. What will the quantity of water in the body of a person weighing 50 kg ?
    (a) 20 kg   (b) 35 kg   (c) 71.42 kg   (d) 120 kg

36. What percent of the total weight of human body is equivalent to the weight of the skin in human body ?
    (a) 0.016   (b) 1.6   (c) 0.16   (d) Data inadequate

37. To show the distribution of proteins and other dry elements in the human body, the arc of the circle should subtend at the centre an angle of :
    (a) 54°   (b) 126°   (c) 108°   (d) 252°

    VII. Answer the questions based on the following information. In the following chart the price of logs shown in per cubic metre that of plywood and saw timber is per tonne.
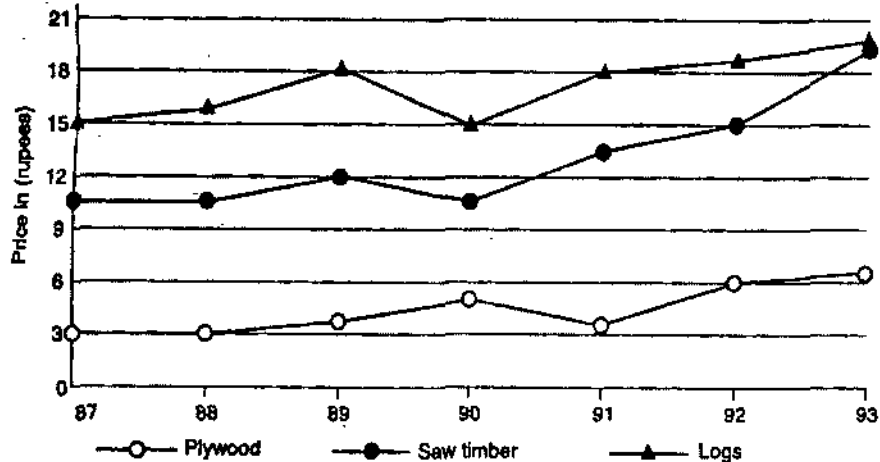
38. What is the maximum percentage increase in price per cubic metre or per tonn over the previous year ?
    (a) 33.33% (b) 85%   (c) 50%   (d) Cannot be determined

39. Which product shows maximum percentage increase in price over the period ?
    (a) Saw timber   (b) Plywood   (c) Logs   (d) Cannot be determined

40. If one cubic metre = 700 kg for plywood and 800 kg for saw tiber, find in which year was the difference in the prices of plywood and saw timber (per cubic metre) the maximum ?
    (a) 1989   (b) 1900 ·   (c) 1991   (d) 1992

41. If the volumes of sales of plywood, saw timber and logs were 40%, 30% and 30% respectively, then what was the average realisation in 1993 per cubic metre of sales? (One cubic metre of saw dust and plywood both = 800 kg).
    (a) 18   (b) 15   (c) 16   (d) 13

42. In the previous question, if in 1994 prices increased by 5%, 1% and 10% while the volume of sales break-up was 40%, 30% and 30% for plywood, saw timber and logs respectively, then what was the average realisation ?
    (a) 18.95   (b) 16.45   (c) 13.15   (d) 10.25

VIII. Study the following table carefully and answer the questions given below it.

    Total number (in thousands) of different types of toys produced and percentage defect under each type in a factory over the years.

year	A		B		C		D		E	
	Number Produced	Percentage Defect	Number Produced	Percentage Defect	Number Produced	Percentage Defect	Number Produced	Percentage Defect	Number produced	Percentage defect
1986	64	12	75	20	45	08	85	14	48	18
1987	80	08	90	12	30	09	95	16	94	14
1988	40	06	65	16	55	06	75	12	84	05
1989	95	09	80	18	25	05	70	10	78	09
1990	75	14	60	19	40	07	65	13	62	11
1991	112	16	55	15	60	04	80	15	37	10

43. What was the approximate number of E type toys without defect in the year 1988 ?
   (a) 60,000   (b) 80,000   (c) 82,000   (d) 76,000
44. What was the difference in the production of D type toys without defect between 1989 and 1991 ?
   (a) 10,000   (b) 5000   (c) 6000   (d) 8000
45. What was the percentage increase in production of C type toys from 1989 to 1990 ?
   (a) 40   (b) 160   (c) 20   (d) 60   (e) None of these
46. What was the approximate number of defective A type toys inthe year 1991 ?
   (a) 18000   (b) 12000   (c) 15000   (d) 24000   (e) 16000
47. In the case of which of the following types of toys was the average percentage defect over the given years the minimum among all the types ?
   (a) A   (b) B   (c) C   (d) D   (e) E

ANSWERS

1. 29.6%   2. 8.7 %   3. Apple   4. 5%   5. 2002-03   6. $66\frac{2}{3}$%   7. 4 years

8. 20 Thousands   9. 1992   10. $33\frac{2}{3}$%   11. 150000 m   12. 46500 m   13. 24000 m

14. Can't be determined   15. Potassium nitrate   16. 3.8 kg   17. 166.66%
18. 533 moles   19. Sodium chlorate   20. 100%   21. 40%   22. True   23. 722 crore
24. 68°, 155°, 32°   25. Can't be determined   26. Rs. 89 crore   27. 68.7 crore
28. (a)   29. (c)   30. (b)   31. (c)   32. (b)   33. (a)   34. (c)   35. (b)   36. (b)   37. (c)
38. (c)   39. (b)   40. (d)   41. (d)   42. (c)   43. (b)   44. (b)   45. (d)   46. (a)   47. (a)

U N I T

17

ANALYTICAL ABILITY

STRUCTURE

- Methods of Reasoning
- Methods of Analysis
- Questions Relating to the Conclusions
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Inductive method and deductive method of reasoning.
- Questions relating to the assumption.
- Questions relating to the force of argument.
- Questions relating to the inconsistency of arguments or interference.
- Laws of logical reasoning : law of identity, law of non-contradiction and law of prevailing truth.

Day-by-day analytical reasoning is gaining importance in logical reasoning tests. Classical logic like *Logical deduction*, or Syllogism, fallacies or *excluded middle* have their own reorientation. Analytical reasoning is a recent form in which almost all classical terms are covered.

• 17.1. METHODS OF REASONING

Generally, in such type of questions a passage covering concepts, facts, theories, figures, etc. is given and questions are asked with regard to (a) arguments and (b) conclusion. Before attempting such questions one should know the various methods of reasoning used by an author in a passage. The Methods of Reasoning in a passage are :

(a) Inductive method of reasoning : It means general inference from particular instances. According to L.S. Stebbing, "When the premises do not suffice to imply the conclusion but nevertheless have some weight as evidence in favour of it the argument is said to be inductive".

For example : "A baby monkey was reared with a group of human children. At first the monkey's intelligence developped as fast as the children's. Only as they began to talk did the children leap ahead. Talk, therefore is what makes us human".

(b) Deductive method of reasoning : It implies proceeding from general to the particular. Mrs. L.S. Stebbing says. "When the conclusion is implied by the premises the argument is deductive".

For example : "All men are mortal; but Peter is man; therefore he is mortal".

(c) Giving illustrations from the different sources to come to a definite conclusion. *For example :* He has been hard working his superiors, telling lies to his friends and deserting his relatives. How can one depend on him.

(d) Quoting authorities in support of statements. *For example :* Democracy will not suit Asians. Churchill once said, "Democracy is not a harlot to be picked up by anybody in the street".

Whatever method the writer may adopt he gives three things (i) premises of the argument. (ii) arguments. (iii) conclusion, though in some cases he confines his attention to the last two.

After reading the whole of the paragraph one should ask oneself (i) What the writer *is discussing about.* (ii) Which aspect of the topic is he discussing. (iii) Which arguments does he give to come to a conclusion.

Clearly in the *inductive method of reasoning* conclusion is generally given in the beginning of the paragraph. In the second type (deductive) paragraph's conclusion is towards the close of the passage *In the third and fourth types of paragraphs if we* eliminate examples or quotations, conclusion will be left.

But the paragraphs are not so chaste as we made them in the foregoing *discussion.* Paragraphs contain illustrations, quotations and arguments all together. These lead to a definite conclusion which is the topic point of the paragraph.

• 17.2. METHODS OF ANALYSIS

1. Mark the important assumptions in the passage.

2. Note the interference (inductive as well as deductive).

3. Mark the supporting *arguments.*

4. Note the premises of supporting arguments.

5. See the nature of Questions.

Nature of Questions : The following types of questions are generally based on a passage or model paragraph.

Questions Relating to the Assumption : An assumption is the fact on which an argument is based. *For example :* when we say "social nature of man will force him to cooperate with others" we assume that "Man is social by nature".

Questions Relating to the Force of Argument : Some statements are given followed by questions, such as :

Which of the following will strengthen the argument ?

Which of the following will weaken the argument ?

For example : "Educated people are enlightened persons. The statements like "Graduates cannot analyse the political situation" or "In colleges our thinking does not become analytical" are contradictory of the first statement so they weaken the argument. If the statement give the same idea as is given by the argument it strengthens it.

Questions Relating to the Inconsistency of Arguments or Inference : Statement is given followed by questions, such as :

Which statement is consistent with the arguments or inference ?

Inconsistency means that the statement does not fall in line with the trend of the argument or inference. *For example* if we say "He has just come from the morning walk" it will be inconsistent to assert that "He does not go any where on foot".

• 17.3. QUESTION RELATING TO THE CONCLUSIONS

In this type some statements are given in the form of conclusion and a question is asked about the validity of the conclusion drawn from the given answer choices as —(a) True (b) Probably True (c) Irrelevant, Uncertain, or 'I do not know' (d) False (e) Probably False. In such a type of question Law of Logical Reasoning should be applied. Important laws are given here :

1. Law of Identity. It means that a word or phrase should not be used in two different senses, for example, in the above passage in the premises 'knowledge is power' and 'power tends to corrupt', 'power' is used in two different senses.

2. Law of Non-contradiction. The inferential statements should not be self-contradictory, otherwise correct inference cannot be drawn. *e.g.,*

USA and USSR are *exploiting developing nations.*

USA and USSR are helping developing nations.

Both statements are self-contradictory.

3. Law of Prevailing Truth. The premises on which the arguments are based and conclusions are drawn must be factually correct. Take the example :

Knowledge is power.

Power tends to corrupt.

∴ Knowledge tends to corrupt.

The argument if formally correct but the conclusion is factually incorrect.

4 Law Fallacies. Laws of material fallacies, like fallacy of composition, division, accident, uncertainty should also be applied in analytical reasoning.

• TEST YOURSELF

Instruction : Read the passage (fact situation) and the result. Point out about each statement which follows . Whether :

(a) It contradicts fact situation or result or both.

(b) It is possible and adequate explanation of the result.

(c) It can be deduced from fact situation or result.

(d) The statement weakens a possible explanation.

(e) The statement is irrelevant.

Passage. Properly fed and starved monkeys were made to run through the maze. It was seen that starved monkeys could not run fast. This proved that the lower intelligence of people in poor countries is the result of malnutrition.

1   The assumption(s) made in the arguments is (are) :

(M) The effect of nutrition on the intelligence of the monkeys is parallel to those on human beings.

(N) The poorer food has a direct co-relation to the intelligence level in monkeys and people

(O) Captive monkeys are more intelligent than wild monkeys

(a) M only   (b) N only   (c) O only   (d) M and N only   (e) N and O only

2.   Which of the following statements would weaken the argument ?

(a) Wild monkeys do not get proper diet.

(b) Monkeys have short memories.

(c) The intelligence of human being varies from one another.

(d) In poor countries health cannot be maintained.

(e) Educational facilities in poor countries are limited.

3.   Which one of the following would strengthen the arguments ?

(a) Monkeys are used to going without food

(b) Even in wealthy countries there are under nourished people.

(c) Countries which have increased food production have increased the level of intelligence.

(d) Tests of intelligence are becoming accurate.

(e) Many people in poor countries do not get food.

Passage. *Situation.* Antelopes had roamed the steppe land in S. Africa since the earliest memories. A tribe was forced into that desert as the pressure of population increased. They became more and more dependent on hunting the antelopes until they were hunting as many antelopes as the lion. Because the central government was alarmed they demarcated an area in the steppe country where antelope could be hunted. The members of the tribe were angry but could not oppose this policy of the new government. Enforcement was maintained by armed guards who patrolled the Southern boarder. This policy prevented the tribe to hunt that animal.

Result. The antelope continued to diminish in number.

4.   The state government was more powerful than the tribe.

5   The tribe was very skilled in hunting animals.

6.   Park guards provided food and water for the antelopes.

7. There was drought which killed that wild life in steppe.

8. The tribe realised that hunting of animals was not good.

Instructions. At the end of each paragraph some inferences drawn or supposed to be drawn from the paragraph are given. On the basis of the study of the paragraph point out whether the inference is :

(a) Definitely true

(b) Definitely false

(c) Probably true

(d) Probably false

(e) Can't say

Passage. Political freedom is incomplete and has little meaning without economic independence. Until the battle for economic independence is won the emerging nation will be subjected to external pressure, which must be resisted. India though herself in the throes of development has assisted the developing nations.

9. Politically free countries must be economically free.

(a)　　(b)　　(c)　　(d)　　(e)

10. Developing nations must be helped by the other developing nations.

(a)　　(b)　　(c)　　(d)　　·(e)

11. Economically poor countries are exploited by other nations.

(a)　　(b)　　(c)　　(d)　　(e)

12. India is one of developing countries.

(a)　　(b)　　(c)·　　(d)　　(e)

13. Nations should not succumb to external pressure.

(a)　　(b)　　(c)　　(d)　　(e)

Directions. Read the following passage and answer the questions which follow:

Passage. Science is a sort of news agency comparable in principle to other news agencies. But this news agency gives us information which is reliable to an extraordinary high degree due to elaborate technique of verification and its capacity to survive centuries. So science should be read with as much interest as we read news.

14. The assumption of the passage is :

(a) Science encourages investigative spirit

(b) Science is objective in approach

(c) Science gives us news and not any other information regarding national phenomenon

(d) Verification of news is necessary

(e) None of these

15. Which of the statements will weaken the argument ?

(a) Science gives information

(b) News agencies cannot verify news

(c) Scientific information is revised from time to time.

(d) Man is intelligent creature

(e) None of these

16. Which statement strengthen the argument ?

(a) Science gives abstract theories

(b) Science is a compulsory subject

(c) Agricultural research is scientific

(d) Verified information is dependable

(e) None of these

Directions. Read the following statements and answer the questions which follow.

Passage. Six persons A, B, C, D, E, F were playing a game of cards. A's father, mother and uncle were in the group. There were two women. B the mother of A got more

points than her husband. D got more points than E but less than F. Niece of E got lowest points. Father of A got more points than F but could not win the game.

17. Who won the game ?
    (a) A   (b) B   (c) F   (d) D

18. Who got the lowest points ?
    (a) A   (b) C   (c) E   (d) B

19 Who is the husband of B ?
    (a) F   (b) E   (c) D   (d) C

20. B was one of the ladies. Who was the other lady ?
    (a) C   (b) D   (c) E   (d) A

21. Who stood second in to the game ?
    (a) A   (b) B   (c) C   (d) D

22. Five boys were climbing up a hill. Mr. J was following H and R was ahead of G and K was between G and M. They were climbing in a column. Who was second in climbing ?
    (a) M   (b) R   (c) J   (d) G   (e) K

23. Seven persons are sitting at a dining table. S is facing R who is to the left of A and right of P. A is to the left of D. Q is to the left of P. If D exchanges seat with Y and P with R. Who is sitting to the left of D ?
    (a) Y   (b) R   (c) A   (d) S   (e) P

24. There are five rivers A, B, C, D, E. River A is shorter than B but longer than E. River C is the longest. D is a bit shorter than B and a bit longer than A. Which of the following is the shortest river ?
    (a) A   (b) B   (c) C   (d) D   (e) E

Directions. To answer these questions use the information given below

In a group of five persons — A, B, C, D and E, there is a professor, a business man and an artist. A and D are ladies who are unmarried and do not work. Of the married couple in the group E is the husband. B is the brother of A and is neither a businessman nor an artist. E's wife is an artist.

25 Who is the professor ?
    (a) A   (b) B   (c) C   (d) D

26. Who is the artist ?
    (a) A   (b) B   (c) C   (d) D

27. Who is the wife of E ?
    (a) A   (b) B   (c) C   (d) D

28. Which of the following groups include all the men ?
    (a) BE   (b) AB   (c) BC   (d) None of these

Directions. Use the following information and answer the questions that follow.

In a group of five persons (A, B, C, D and E) one of them is an advocate, one is a doctor, one is a businessman, one is a shopkeeer and one is a professor. Three of them A, C and the professor prefer playing cricket to football and two of them B and the businessman prefer playing football to cricket. The shopkeeper and 'B' and 'A' are friends but two of these prefer playing football to cricket. The advocate is C's brother and both play same game. The doctor and E play cricket.

29. Who is an advocate ?
    (a) A   (b) B   (c) C   (d) D

30. Who is the shopkeeper ?
    (a) A   (b) B   (c) C   (d) D

31. Which of the following group include persons who like playing cricket but does not include the professor ?
    (a) AB   (b) BC   (c) CD   (d) None of these

32. Who is the doctor ?
    (a) A   (b) B   (c) C   (d) D

Answer the following questions :

33. Arun is the father of Rohit. Rohit is the brother of Mala. Mala is the wife of Dalip. How is Dalip related to Rohit ?

    (a) brother-in-law   (b) father-in-law   (c) son   (d) uncle

34. Rajiv is the brother of Atul. Sonia is the sister of Sunil. Atul is the son of Sonia. How is Rajiv related to Sunil ?

    (a) nephew   (b) son   (c) brother   (d) father

35. Dinesh is the brother of Sudhir, Surender is the son of Renu. Who is Ruby's sister? Surinder is the son of Ruby. How is Sudhir related to Dinesh ?

    (a) uncle   (b) father   (c) father-in-law (d) brother

36. Atul is the son of Pramod. Alka is the daughter of Aman. Sheela is the wife of Aman. Mohan is the son of Sheela. How is Alka related to Mohan ?

    (a) sister   (b) uncle   (c) son   (d) father

37. A is the mother of 'D' and sister of B. B has a daughter 'C' who is married to 'F'. G is the husband of A. How is G related to D ?

    (a) husband   (b) son   (c) father   (d) uncle

38. A man goes 5 km. east, then he turns right and goes 4 km. then he turns left and goes 5 km. Which direction is he from the starting point ?

    (a) north-west   (b) north-east   (c) east   (d) west

39. A man starts from his house and walks 10 km in south direction then he turns right and goes 6 km then again he turns right and goes 10 km and then again turns right and goes 6 km. At what distance is he from the starting point ?

    (a) 2 km.   (b) 0 km.   (c) 3 km.   (d) 4 km.

40. Arun walks north east and after some distance turns left and walks straight then again he turns left. In which direction is he going now ?

    (a) south-west   (b) west   (c) west   (d) north

41. A starts and walks towards southwards. He then turns to his right and walks 5 km. then again left and walks 3 km. and then again left and walks 5 km. In which direction is he from the starting point ?

    (a) west   (b) south   (c) north   (d) east

42. A man drives his car 5 km in east ward direction he turned right and went for 3 km then he turned west and drove for 1 km. How far is he from the starting point ?

    (a) 5 km.   (b) 6 km.   (c) 10 km.   (d) 20 km.

ANSWERS

1. (d)   2. (b)   3. (c) 4. (c)   5. (e)   6. (d)   7. (b)   8. (a)

9. A–First sentence implies   10. E – The word 'must' makes it uncertain

11. A – "External pressure" implies it   12. A – Last sentence states it

13. A – "Must be resisted" implies it

14. (c) 15. (c) 16. (d) 17. (b) 18. (a) 19. (d) 20. (d) 21. (c) 22. (d) 23. (d)

24. (e) 25. (b) 26. (d) 27. (c) 28. (a) 29. (a) 30. (d) 31. (d) 32. (c) 33. (a)

34. (a) 35. (d) 36. (a) 37. (c) 38. (b) 39. (b) 40. (c) 41. (b) 42. (a)

U N I T

18
CODING/DECODING

STRUCTURE

- Letter Coding Test
- Number Coding Test
- Coding /Decoding from Letter Matrices
- Derivation and Application of Coding Rules
  - □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Methods of number ending.
- Questions based on codes/decodes and telegraphic letter for practice.

Coding/decoding tests are of following four types :

• 18.1. LETTER CODING TEST

In the letter coding tests certain letters or alphabets stand for certain other letters or alphabets. For example, if COLD is coded as DPME what will be the code for HOT ? In this example each letter is replaced by its following letters C by D, O by P and so on. Thus observing the pattern HOT will be coded by IPU.

• 18.2. NUMBER CODING TEST

In number coding test, letters are changed by the number of alphabets in their corresponding alphabetic position. Some methods of number ending are :

(i) Sometimes position numbers of letters remain the same. For example, if BATH is coded as 21208, what will BANG be coded as ? In this case, position numbers of corresponding letters remain the same. Naturally BANG would be coded as 21147.

(ii) Position numbers of letters are added. For example if BATH is coded as 31, what is the code number for BANG ? In this case, position number is added BATH = 2 + 1 + 20 + 8 = 31. Therefore BANG will be (2 + 1 + 14 + 7 = 24) coded as 30.

(iii) Position numbers of letters are added but at the same time a certain number is subtracted. For example, if BATH is coded as 27 how will BANG be coded ? In BATH, there are four letters, thus 4 is subtracted from the total sum to get 27. In BANG, there are 4 letters; subtracting 4 from 24 we get 20 which is the code by this rule..

(iv) Sometimes the sum of the position numbers of letters in a word is divided by a certain number or by the sum of the letters. For example if BATH is coded as 6.5, what will be the code for BANG ? Dividing sum of the position numbers in BATH by 5 we get (31/5) = 6.5. Now if we divide the sum of the position numbers in BANG by 5 (24/5) we get 4.8.

• 18.3. CODING/DECODING FROM LETTER MATRICES

In this type of coding/decoding, there are usually two sets of letters provided in two columns. Column A has a set of letters in capitalized form (equivalent to problem figures in Abstract Reasoning Tests while column B constitutes multiple choice in small letters (equivalent to answwer figures). If there are five sets of questions under column A, there will be 25 choices under column B, so that they form a complete matrix of 25

letters in each column. But the choice for a particular question will always be from that particular row in which item is underlined. The selection for a particular word code is always indicated by underlining the letter.

Method : Observe the frequency of letters in both the left and right columns. Tally the frequency rate, discard those which are common or most frequent and select for decoding those which are least frequent.

• 18.4. DERIVATION AND APPLICATION OF CODING RULES

Sometimes candidates are asked to find out the rules from a set of letters and apply those rules in another set of words/letters for coding/decoding. See the worked example given below :

Example :

Instructions : The word METAL is coded in five different ways using five different rules as :

(a)	N	F	U	B	M
(b)	I	D	S	Z	K
(c)	Q	I	X	E	P
(d)	K	C	R	Y	J
(e)	O	G	V	C	N

Observe the pattern and make out the rules and find out which one of the rules *viz.*, a, b, c, d, e has been applied in each of the following codes :

	Word	Code
1.	IRON	(a) MVSR
2.	SILVER	(b) TJMWFS
3	LEAD	(c) JCYB
4..	ZINC	(d) YHMB
5.	COPPER	(e) EQRRGT

Observe the Pattern and derive the Rule :

(a) Ist Step : *Observation.* METAL is coded as NFUBM; in alphabetic order N comes after M, F comes after E, and so on.

2nd Step : *Formulation.* Rule (a) states that next letter of the alphabet becomes the code letter.

(b) 1st Step : *Observation.* METAL is coded as LDSZK. In alphabetical order L comes before M, D comes before E. Similarly is a cyclic order of alphabet Z comes before A.

2nd step : *Formulation.* Rule (b) states that each preceding letter of alphabet becomes code letter.

(c) Ist Step : *Observation.* METAL is coded as QUXEP. Q is the fourth letter from M *i.e.,* M (NOP) Q. I is the fourth letter from E, and so on.

2nd Step : *Formulation.* Rule (c) states that each letter in fourth place from given one of alpphabet becomes the code letter.

(d) 1st Step : *Observation.* METAL is coded as KCRYJ; it means K is one letter (L) ahead of M; C is one letter ahead of E. Similarly Y is one letter (Z) ahead from A.

2nd Step : *Formulation.* Rule (d) states that the second preceding letter to the one given on the alphabet becomes the code letter.

(e) Ist Step : *Observation.* METAL is coded as OGVCN which means O is one letter (N) after M. Similarly between E and G intervening letter is F; C comes one letter (B) after A and so on.

2nd Step : *Formulation.* Rule (e) states that each of the following second letter to the one given on the alphabet becomes the code letter.

After completing both steps of observation as well as formulation in each case, come to the main question and observe the pattern, and apply the rule. Now answer of each question is easy, as given below :

1. Rule (c) is applied.
2. Rule (a) is applied.
3. Rule (d) is applied.
4. Rule (b) is applied.
5. Rule (e) is applied.

• TEST YOURSELF

Instructions : Questions 1 to 6 are based on the following : If ABCDLMN is decoded from ZYXWMNO, choose the codes/decodes of following codes/decodes :

1. RIGHT :
   (a) TRISG   (b) IRTSG   (c) GRIST   (d) TIGRS
2. WRONG :
   (a) MILTD   (b) DTLIM   (c) DILMT   (d) MTLDI
3. TLLW :
   (a) OOD   (b) DOGO   (c) BADO   (d) BOOD
4. YZW :
   (a) DAC   (b) CAD   (c) DAB   (d) BAD
5. How can INDIA be coded ?
   (a) DINIA   (b) RMWRZ   (c) DRWIZ   (d) INDWR
6. LOVE will be coded as :
   (a) EVOL   (b) VOEL   (c) OLEV   (d) LEVO

Instructions : Questions are based on telegraphic letter 'COME SOON FATHER SERIOUS' which was coded as AMKC QMML DYRFCP QCPGMSQ. Select the codes/decodes among the choices which best fit the questions.

7. MOTHER :
   (a) RFKPMK   (b) MRCFPK   (c) CFRMKP   (d) KMRFCP
8. SISTER :
   (a) PCRQQG   (b) QRGPCR   (c) QGQRCP   (d) RCPQGQ
9. BROTHER :
   (a) ZPMRFCP   (b) MRFCPZP   (c) ZPMRPCF   (d) ZPRMPCF
10. In a certain code 'FIRE' is written as EJQF. The code for 'COME' would be :
    (a) BPLF   (b) BPNF   (c) BPFL   (d) BFPL
11. If HKUJ means FISH what will be the code for STAB ?
    (a) VUCD   (b) UVCD   (c) UVDC   (d) VUDC
12. If LDM means MEN what does PTDDM mean ?
    (a) PEDPL   (b) KINGS   (c) QUEEN   (d) UNIQUE

Instructions : A businessman uses a code of URBIC DATE = Rs. 45 for secret prices of certain commodities where he takes U for Re. 1, R for Rs. 2. B for Rs. 3, I for Rs. 4 and so on. Pick the correct answer for each of the following questions.

13. What is the added price of RICE ?
    (a) Rs. 18   (b) Rs. 19   (c) Rs. 20   (d) Rs. 21
14. The added price of BUTTER is :
    (a) Rs. 31   (b) Rs. 34   (c) Rs. 35   (d) Rs. 30
15. Rs. 27 per basket will be the added price of :
    (a) DATE   (b) BREAD   (c) BARLEY   (d) RICE
16. The businessman has to pay a DEBT of
    (a) Rs. 6983   (b) Rs. 9368   (c) Rs. 9863   (d) Rs. 6938
17. The price of DATE/1000 Kg is :
    (a) 6789   (b) 6.789   (c) Rs. 67.89   (d) Rs. 678.9
18. How will you write Rs. 25.65 in letters ?
    (a) RC.DC   (b) DC.RC   (c) CR.CD   (d) CC.DD

Instructions : The following questions are based on position number of letters in alphabetic order. Find out the pattern and select the best choice out of those given below :

19. If DEAF is coded as 16, what will be the code number for LEAF ?

    (a) 24   (b) 25   (c) 26   (d) 28

20. If BAD is coded as 214 what will be the code number for SAD ?

    (a) 1924   (b) 1914   (c) 314   (d) 614

21. KALAJAM is coded as 7, how will you assign the code number for BARFI ?

    (a) 5   (b) 6   (c) 7   (d) 8

22. If RASICA is coded as 9 how will you code DRINKS in number ?

    (a) 9   (b) 12   (c) 14   (d) 76

23. If MOON is coded as –2, STAR will be coded as :

    (a) –2   (b) 2   (c) 3   (d) –3

24. MAN is coded as 28. Assign code number for RAN ?

    (a) 30   (b) 33   (c) 43   (d) 53

Directions : The word LIRA is coded in five different ways and is written as shown below using different codes :

    (a) OLUD   (b) MKUE   (c) QNWF   (d) OKUC   (e) LJRB

    Using the above codes, different words have been coded as shown below. Find out which codes out of (a), (b), (c), or (e) have been used to write the code in each of the following questions :

Word	Code
25. DOLLAR	GQONDT
26. ORIENT	RTLGQV
27. SPRINT	TRUMSZ
28. LIQUID	LJQVIE
29. MARCH	PDUFK
30. RACE	SCFI
31. PACIFIC	UFHNKNH
32. WATER	BFYJW

ANSWERS

1. (b)   **2.** (c)   **3.** (a)   **4.** (d)   **5.** (b)   **6.** (c)

Questions 7–9 have each letter of code preceding by one letter in the alphabet. Thus in COME = AKMC, A is preceding C by one letter (B), K precedes M by one letter (L). So,

    7. (d) **8.** (c) **9.** (a)

10. (a) First and third letters are written as preceding letters while second and fourth letters in the alphabetic order.

11. (b) Each letter of code comes after one letter of decode.

12. (c) LDM are three preceding letters of MEN respectively. Therefore PTDDM will stand for QUEEN.

13. (c) To solve questions 1 to 10 first assign Rs. value to each letter of URBIC DATE as businessman has assumed; *i.e.,* U = Rs. 1, R = Rs. 2, B = Rs. 3, I = Rs. 4, C = Rs. 5, D = Rs. 6, A = Rs. 7, T = Rs. 8 and E = Rs. 9. The added value comes as 1 + 2 + 3 + 4 + 5 + 16 + 7 + 8 + 9 = Rs. 45. Now, for question 1 add the value of Rice = 2 +4+5+9 = Rs. 20.

14. (a) BUTTER = 3+1+8+8+9+2 = Rs. 31.

15. (b) Calculate added price of each article as BREAD = 3 + 2 + 9 + 7 + 6 = Rs. 27.

16. (d) According to assigned code DEBT stands for 6938.

17. (b) The code price for DATE = Rs. 6789/1000 Kg. = Rs. 6.789.

18. (a) Seek the letter for each code number. Rs. 25.65. = RC.DC

19. (c) For questions 11 to 20 see the position number of each letter in alphabetic order and then move to simple arithmetic calculation according to need. Here DE AF = 16;

i.e., in alphabetic order D = 4, E = 5, A = 1, F = 6 and (4+5+1+6) = 16. Therefore LEAF (12 + 5 + 1 + 6) = 24 So 24 is the code number for LEAF.

21. (b) Position number of each letter remains the same.

 Add position numbers, and take under-root *e.g.,* KALAJAM (11+1+12+1+10+1+13) = 49; $\sqrt{49}$ = 7 so BARFI (2+1+18+6+9) = 36 and $\sqrt{36}$ = 6.

22. (c) Add the position numbers, subtract 6 from the total divided by 5. (Both RASICA and DRINKS have six letters. RASICA = 51 – 6 = 45; 45/5 = 9. DRINKS = 76 – 6 = 70; 70/5 = 14).

23. (d) Add the position numbers and subtract the integers; *e.g.,* MOON (13+15+15+14) = 57, 5 – 7 = 2; Similarly STAR = 58, 5 – 8 = – 3.

24 (b) Simple addition of position numbers. MAN = (13+1+14) = 28; RAN = 33.

25. (d) Alternately 2, 1, 2, 1, – letters are skipped to write the code.

26. (d)

27. (b) Successively 0, 1, 2, 3 – letters of the alphabet are skipped to write the coded version.

28. (e) Alternate letters are replaced by succeeding letters of the alphabet

29. (a) Two letters are skipped to write the coded letter.

30. (b)

31. (c) Each letter is replaced by a new one after skiping four letters of the alphabet.

32. (c)

· 19

RELATIONAL ARGUMENTS AND THEIR VALIDITY

STRUCTURE

- Symmetry
- Transitivity
- Reflexiveness
- Connexity
  - ◻ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Transitive relation, intransitive relation and non-transitive relation.
- Reflexive relation, irreflexive relation and non-reflexive relation.
- Rules in terms of validity.

Deductive reasoning depends upon the properties of relation involved in a particular piece of argument. There are two characteristics of relation, (i) relation to itself and (ii) relation to others. For example,

Apple is sweet   (relation to itself)

Ram is brother of Shyam   (relation to other).

The logical properties of relational arguments are discussed below :

• 19.1. SYMMETRY

It is the property of pairs of terms to a relation. Observe the nature of arguments in the following :

    (i) A is equal to B.

        ∴ B is equal to A   **Valid**

    (ii) A is greater of B.

        ∴ B is greater than A   **Invalid**

    (iii) A is brother of B.

        ∴ B is brother of A   **... May or may not be valid;**

                                 (B may be sister of A).

• 19.2. TRANSITIVITY

It is a property of pairs of terms to a relation.

    (i)   Transitive relation implies that a relation travels from A to C via B, or X to Z via Y. For example.

    A is equal to B   B is equal to C   ∴ A is equal to C.

The above argument is valid, it possesses the logical property of transivity. Where the premises are true, the conclusion is also valid. Such relations as 'equal to', 'younger to', 'other than', 'ancestor of', 'precedes', 'succeeds', 'north of' etc. are transitive relations. This form of argument is also known as non-syllogistic mediate a fortior inference.

(ii) Intransitive relations are those where relation does not travel from X to Z via Y. For example,

   A is father of B.   B is father of C.   ∴ A is father of C.

This argument is invalid. It possesses the property of intransitivity where if the premise is true, conclusion is false. Such words as 'father of', 'son of' denotes intransitive relations..

(iii) Non-transitive relations are those where a relation may or may not travel through a media for example,

   A is friend of B.   B is friend of C.   ∴ A is friend of C

           ... Invalid

It may or may not be that A is friend of C. Therefore conclusion is false. Such relations as 'friend of', 'enemy of', 'neighbour of', are non-transitive relations.

• 19.3. REFLEXIVENESS

(i) **Reflexive relations.** A relation is reflexive when it holds between a term and itself *e.g.*, 'A is equal to itself and identical to itself'. Other such words are, as old as, of the same age, as young as, etc. Sometimes reflexiveness is partial when it establishes relation with some other things. For example,

   A is as tall as B.   B is as tall as C.   ∴ A is as tall as C.

This conclusion is valid because relations having the property of reflexiveness also possesses the property of symmetry and transitiveness.

(ii) **Irreflexive relations.** A relation is irreflexive or aliorelative when it cannot hold between a term and itself, *e.g.*, 'A is greater than itself'; A is older than itself', 'A is north of itself', etc.

(iii) **Non-reflexive relations.** These may or may not hold between a term and itself. For example, 'A hates itself' may or may not be that A hates itself.

• 19.4. CONNEXITY

Connexity is the relation which holds both ways between any two terms or numbers in a given field of relation. For example, 2 is greater than 1 but less than 3.

In any natural series 1, 2, 3, 4, any two numbers from the series can be related to one another as 'greater than' and 'less than'. Both these relations are asymmetrical and transitive.

Rules. From the foregoing discussion we can derive the following rules in terms of validity.

(i) A relational argument having one premise is valid only when based on the logical property of symmetrical relation; if based on asymmetrical or on-symmetrical properties of relation it is invalid.

Symbolically, if 'r' denotes relationship between X and Y then X r Y and Yr X is only true in case of symmetrical relationship.

(ii) A relational argument on the property of transitivity is valid but invalid in case of intrasitivity or non-transitivity.

Symbolically, if X r Y and Yr Z then X r Z is only valid in case of transitivity.

(iii) Relational arguments based on reflexiveness, if they show the property of transitivity and symmetry, are valid

Some Peculiar Examples

   I am taller than you You are taller than him. ∴ I am taller than him.

If we treat it as a syllogistic argument, it is invalid due to the fallacy of four terms. However, argument is evidently correct from common sense.

Note. Do not treat the relational argument on basis of syllogistic forms; rather apply your common sense. Some are 'fortiori' arguments where if premises are true, conclusion is also true.

Now consider the following example :

   A is neighbour of B.   B is neighbour of C.   C is neighbour of D.

                ∴ A is neighbour of D.

Neighbour of or 'next to' are symmetrical but non-transitive. Though premises are true, the conclusion is false, unless houses are situated in a circle.

• TEST YOURSELF

Instructions. A situation is explained in a few sentences in the form of statements followed by a conclusion You have to determine whether.

(a) Conclusion is valid;   (b) Conclusion is a long-drawn one;

(c) Conclusion is invalid;   (d) Conclusion is doubtful.

Your answer should be only in the light of the statements given.

1. Statements :
   1. Ram is taller than Shyam.   2. Shyam is shorter than Krishan.
   3. Krishan is taller than Ram.
   Conclusion. Therefore Krishan is the tallest of all.

2. Statements :
   1. X is east of Y.   2. Y is north of Z.
   Conclusion. Therefore X is exactly east of Z.

3. Statements :
   1. B is standing behind A   2. D is standing behind B
   3.. C is standing behind D.
   Conclusion. A is standing in front and C is standing behind all.

4. Statements :
   1. The higher we go, the cooler we feel.
   2. Pressure of the air goes on decreasing as we ascend higher and higher..
   Conclusion. Lower the pressure of the air, the cooler we feel.

5. Statements :
   1. The predecessors of human beings resembled chimpanzees.
   2. Chimpanzees resemble apes in many ways.
   Conclusion. Therefore human beings have evolved from apes.

6. Statements :
   1. Wood floats on water.   2. Rubber also floats on water.
   Conclusion. Both wood and rubber are lighter than water.

7. Statements :
   1. Children of criminals are generally criminal.
   2. Gopal is the son of a thief.
   Conclusion. Therefore Gopal is a criminal.

8. Statements :
   1. Ram generally goes for a walk with Sita. 2. Sita is a pretty young girl.
   Conclusion : Sita must be Ram's wife.

9. Statements :
   1. Baldev is Zakir's friend.   2. Zakir is Amar's friend.
   Conclusion. So Amar must be Baldev's friend.

10. Statements :
    1. Early rising is good for health..   2. Hanif generally rises early in the morning.
    Conclusion. Therefore Hanif has good health.

11. Statements :
    1. In summer the nights are generally cold and the days are hot.
    2. June is a hot month.
    Conclusion. On the 22nd June the night will be cool.

12 Statements :
    1. People living in cold countries generally have fair complexion.
    2. Canada is a cold country.
    Conclusion. All Canadians have fair complexion.

13. Statements :
    1 All my friends are studying in the University.
    2. Mohan is studying in the University.

For example :

(i) If the price of this article rises, demand will fall.

(ii) The price of this article rises.

(iii) Demand of this article will fall.

Disjunctive Categorical : The major premise is disjunctive, both the minor premise and conclusion are categorical.

For example :

(i) Either A is B or C is D

(ii) A is not B

(iii) C is D.

Dilemma : Major premise is a compound hypothetical, the minor premise is disjunctive and the conclusion is either categorical or disjunctive.

For example : —

(i) If A is B, C is D; and If E is F, C is D

(ii) Either A is B or E is F.

Relational argument : All the three types of proposition are relational and conclusion is also relational.

For example :

(i) Ram is richer than Shyam.

(ii) Shyam is richer than Mohan.

(iii) Ram is richer than Mohan.

Rules for Categorical Syllogism

1. Every syllogism must contain three and only three terms.

2. A syllogism must consist of only three propositions.

3. Th middle term must be distributed at least once in the premises.

4. If one premise is negative, the conclusion must be negative.

5. If both premises are negative, no conclusion will be drawn.

6. If both premises are particular, no conclusion will be drawn.

7. From a particular major premise and a negative minor premise no conclusion can be drawn.

8. If one premise is particular, the conclusion is particular.

9. No term can be distributed in the conclusion if it is not distributed in the premises.

Violation of these rules leads to fallacious conclusions as follows :

1. Fallacy of four terms like ambiguous major, ambiguous middle or ambiguous minor will result in the violation of Rule : *e.g.,*

All master of arts are educated persons.

A robber is a master of his art.

A robber is an educated person.

Here middle term 'master of art' is used in a different sense from that used in the major premise.

2. Fallacy of four propositions occur on the violation of Rule 2; *e.g.,*

A is B, B is C, C is D

∴ A is D.

The above argument is not in a proper syllogistic form.

3. Fallacy of undistributed middle occurs on violation of Rule 3; *e.g.,*

All men are mortal

All birds are mortal

All birds are men.

Here the middle term is 'mortal' which is undistributed and therefore fails to establish a legitimate relation between the major and minor terms.e

4. Fallacy of two negative premises results on violating Rule 5; *e.g.,*

No quadrupeds are rational.

No men are quadrupeds.

No men are rational. (Fallacious conclusion)

5. Fallacy of two particular premises results on violation of Rule 6; *e.g.,*

Some men are happy.

Some men are honest.

∴ Some honest beings are happy. (Fallacy of illicit minors)

6. Fallacy of two particular premises results on violation of Rule 8; *e.g.,*

Some men are rich

All men are happy.

∴ All happy being are rich (fallacy of illicit minor)

On the other hand it is valid to conclude :

Some happy beings are rich.

Therefore, if the conclusion is universal both the premises must be universal.

7. Fallacies of illicit major and illicit minor result on violation of Rule 9, *e.g.,*

All Hindus are Indian	... A
No Muslims are Hindus	... E
∴ No Muslims are Indian.	... E

Here major term Indian is distributed in conclusion but being predicate in 'A' proposition, major premise remains undistributed. The conclusion is fallacious because of illicit major.

How to detect Fallacy

(i) Analyse the propositional character of all premises constituting a syllogism as A, E, I and O.

(ii) Identify the middle term and determine its place as subject or predicate in the given premises.

(ii) Then apply the following rules :

1. In A proposition only subject is distributed.

2. In E proposition both subject and predicate are distributed.

3. In I proposition neither subject nor predicate is distributed.

4. In O proposition only predicate is distributed.

Rules for hypothetical-categorical syllogism

1. To affirm the antecedent is to affirm the consequent in conclusion and not conversely, *e.g.,*

If he works, I will pay. (If A is B, C is D)

He works. (A is B)   – *Antecedent is affirmed.*

∴ I will pay. (C is D)   – *Consequent is also affirmed in conclusion.*

2. To deny the consequent is to deny the antecedent, but not conversely, *e.g.,*

If he works, I shall pay. (If A is B, C is D)

I shall not pay. (C is not D)   – *Consequent is denied.*

∴ He does not work. (A is not B)   – *Antecedent also denied.*

3. If both the premises are hypothetical, no conclusion can be drawn.

Violation of these rules will lead to fallacious conclusions of either affirming the consequent without affirming the antecedent or denying the antecedent without denying the consequent.

If he works, I shall pay	(If A is B, C is D)
He does not work.	(A is not B)
I shall not pay.	(C is not D)

Here we have denied the antecedent in the minor premise and on the strength of that the consequent is denied in conclusion. This is contrary to rule. This fallacy will

clearly be illustrated if you change the proposition into a pure categorical one. There you will observe a fallacy of illicit major. Similarly, in the example :

If he works, I shall pay.	(If A is B, C is D)
I shall pay,	(C is D)
∴ He works.	(A is D)

There is a fallacy of affirming the consequent and on the strength of that affirming the antecedent in the conclusion. This is contrary to rule 2. The example of fallacy will be made clear if you change the proposition to a pure categorical one. You will find a fallacy of undistributed middle.

Rule for Disjunctive Categorical-Syllogism

Denying any of the alternatives of the disjunctive major premise in the minor premise is the case of affirming the other alternative of the major premise in the conclusion. For example :

1. Either A is B or C is D

   A is not B

   ∴ C is D.

2. Either A is B or C is D.

   C is not D

   ∴ A is B.

Rules for Dilemma : The rules of hypothetical-categorical syllogism are applicable:

1. To affirm the antecedents in the minor premise is to affirm the consequent in the conclusion. The violation of this rule leads to the fallacy of affirming the consequent.

2. To deny the consequents in the minor premise is to deny the antecedents in the conclusion. The violation of this rule leads to the fallacy of denying the antecedent.

Material Validity

(1) The major premise consisting of double hypothetical propositions must have 'real' antecedents and 'real' consequents The violation of this rule leads to the fallacy of 'taking the dilemma by the horns'.

(2) The minor premise must have exclusive alternatives. The violation of this rule leads to the fallacy of 'escaping between the horns of a dilemma'.

• TEST YOURSELF

Instructions : In the following type of questions, you have to examine the conclusions separately in the context of the facts given and decide upon its degree of truth and falsity. Mark the conclusions as follows :

(a) Definitely true

(b) Probably true

(c) Data is inadequate

(d) Probably false

(e) Definitely false

1. **Statements :**

   1. All pine trees are found at great heights.

   2. This is a very high peak.

   Conclusion. Therefore pine trees are found on this peak.

2. **Statements :**

   1. Girls on the whole are brighter than the boys in this class.

   2. Vimla is a girl student of class.

   Conclusion. Therefore Vimla is brighter than all the boys in the class.

3. **Statements :**

   1. Sometimes homoeopathic medicines act very quickly.

   2. Allopathic drugs are generally very strong.

   Conclusion. So we should prefer homoeopathic medicines to allopathic drugs.

4. **Statements :**
   1.   Liquids keep their level.
   2.   Turpentine is a liquid.
   Conclusion. So turpentine keeps its level.

5. **Statements :**
   1. Like electric charges repel and unlike electric charges attract each other.
   2. A glass rod is positively charged.
   3. An ebonite rod is negatively charged.
   Conclusion. Therefore two charged glass rods will attract each other.

6. **Statements :**
   1. As we go higher the air pressure goes on decreasing.
   2. Lower the air pressure, lower is the boiling point and higher the air pressure, higher is the boiling point.
   Conclusion. So in Shimla, it will be more difficult to cook meat or pulses.

7. **Statements :**
   1. Evaporation causes cooling.
   2. When moisture comes in contact with a cold place, it forms droplets.
   Conclusion. That is why dew is formed on grass.

8. **Statements :**
   1. Black colour is a good absorber of heat.
   2. Heat waves are reflected by bright surfaces.
   Conclusion. Therefore we should always wear bright coloured clothes when the sun is hot.

9. **Statements :**
   1. Green plants change carbon dioxide into oxygen gas.
   2. Oxygen gas is good for health.
   Conclusion. Therefore we must have green plants near our houses.

10. **Statements :**
    1. In the presence of moisture iron combines with the oxygen of the air to form rust
    2. Rust eats away an article made of iron.
    Conclusion. Therefore we should keep things made of iron in the open.

11. **Statements :**
    1. Lightning and thunder are produced at the same time.
    2. We see lightning first and hear thunder afterwards.
    Conclusion. Light travels faster than sound.

12. **Statements :**
    1. For night vision, cones in the retina play a very important role.
    2. For day vision rods in the retina play a very important role.
    3. Cats can see very well at night.
    Conclusion. So cats have many cones in the retina.

13. **Statements :**
    1. In the heart disease there is pain in the chest.
    2. There can also be other reasons for pain in the chest.
    3. X often feels pain on the right side of his chest.
    Conclusion. He is suffering from a heart disease.

Instructions : In the following statements, a situation is explained in a few sentences, followed by a conclusion. You have to mark it :
   (a) If conclusion necessarily follows from the statements;
   (b) If conclusion is only a long drawn one;
   (c) If conclusion definitely does not follow from the statements;
   (d) If conclusion drawn is doubtful.
Note : Your answer should be only in the light of the statements given.

14. Statements :

1. Oxygen is found in the air.
2. Things burn in the air.

Conclusion. Therefore oxygen helps in burning of things.

15. Statements :

1. Generally the birds fly in the air in the morning.
2. Generally monkeys jumps about in the trees in the morning.

Conclusion. Therefore elephants roam in the jungle in the morning.

16. Statements :

1. Solids expand on heating.
2. Gases expand more than solids.

Conclusion. That is why a balloon filled with air burst on heating.

17. Statements :

1. Laziness is a bad habit.
2. Very rich people are generally lazy.

Conclusion. Richness is not desirable.

18. Statements :

1. One should not have more than two or three children.
2. He has three chiildren.

Conclusion. He is therefore very rich.

19. Statements :

1. Four and four make nine.
2. Five and five make eleven.

Conclusion. Therefore four and five make twelve.

20. Statements :

1. The sum of the angles of triangle is 200 degrees.
2. The sum of the angles of a rectangle is 380 degrees.

Conclusion. Therefore the sun of the angles of a pentagon is 470 degrees.

21. Statements :

1. Earth pulls things down.
2. The force of the pull of the earth is maximum in the world.

Conclusion. Therefore when things are thrown up in the air, they fall down towards the earth.

22. Statements :

1. Those who work hard may succeed.
2. Krishen is working hard for his examination.

Conclusion. Krishen must succeed in the next examination.

23. Statements :

1. Carbohydrates are converted into sugars in the digestive tract.
2. Excess of sugar is not good for health..

Conclusion. Too much intake of carbohydrates is not desirable.

24. Statements :

1. India is a country inhabited by communities of different religions.
2. Different religions show the way to a higher way of life.

Conclusion. That explain the incidence of communal riots in India.

25. Statements :

1. Green colouring matter in the leaves is called chlorophyll.
2. Chlorophyll changes carbon dioxide into oxygen in the presence of sunlight.

Conclusion. During sunlight green plants enrich the air with oxygen.

26. Statements :
   1. Plants are also living things.
   2. Animals mostly live on plants.
   Conclusion. Therefore plants beautify the campuses.

27. Statements :
   1. Most of the politicians are well-versed in the interpretation of the Constitution.
   2. Dinesh is a politician.
   Conclusion. So Dinesh knows all about the Constitution.

28. Statements :
   1. Animals generally cannot see in the dark.
   2. Cats are animals.
   Conclusion. Therefore some cats cannot see in the dark.

ANSWERS

1. (b) Pine trees may or may not be found.
2. (c) We can't draw this conclusion unless we are told that Vimla is the brightest student.
3. (e) The conclusion is not based on the statements given.
4. (a) The conclusion clearly follows from the statements.
5. (e) They will repel and not attract – a common fact.
6. (a) Because of the low pressure and so low boiling point of water – a common fact.
7. (c) Nothing has been said as to how grass gets a cold surface.
8. (b) White clothes are better than coloured ones.
9. (a) The conclusion follows from the statements.
10. (d) The conclusion is not in keeping with the statements made. Therefore probably false.
11. (a) The conclusion is definitely true.
12. (a) The conclusion follows from the statements.
13 (c) The data provided is not enough to declare it as a heart disease.
14. (c) Nowhere in the statements is there any indication of oxygen helping in burning.
15. (c) Nothing has been said about elephants in the statements.
16. (a) Since gases expand more than solids, so the balloon bursts.
17. (d) From a general statement to draw such a conclusion about richness is doubtful.
18. (c) Conclusion has no relevance to the statements given.
19. (c) Conclusion does not follow.
20. (c) The conclusion cannot be explained in terms of the given statements.
21. (a) The conclusion definitely follows from the statements given.
22. (d) It is not absolutely certain that he will succeed in the next examination. Chance factor can never be totally eliminated.
23. (a) The conclusion definitely follows from the statements.
24. (d) The conclusion drawn is not the direct outcome of the statements given.
25. (a) The conclusion does follows from the statements.
26. (c) The conclusion definitely does not follow from the statement.
27. (b) It is not quite certain because in statement 1, the word 'most' has been used.
28. (d) The word 'generally' in statement 1, makes the conclusion doubtful.

U N I T

21

VERBAL CLASSIFICATIION

STRUCTURE

- Types of Claissification
- □ Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Words Classification with rules.
- Alphabets classification with rules.
- Questions based on classification for practice.

Classification type questions are based on similarity or similar relationship that exists between the things, objects, words or alphabets. Items are grouped together on the basis of similarity and the one to be picked out is that which does not belong to the same group. For example, among shirt, coat, trousers, socks, shoe, all are materials of wear. But the first four form a group in being clothing garments while shoes are different.

• 21.1. TYPES OF CLASSIFICATION

(i) Words classification (ii) Alphabets classification.

(i) In classification of words similar groups are found among the names, places, things, *nouns, verbs, different sexes, race*, or any other matter pertaining to verbal classification as seen in the foregoing example.

(ii) In alphabetic classification, a jumble of alphabets form a set or group and we have to find out that which does not belong to the same group. For example :

(a) EVIL (b) LIAR (c) PERT (d) TRAP (e) PINS

These jumbled alphabets when spelt backwards give meaningful words — like live, rail, part and snip. The exception is (c) PERT which when spelt backwards does not give a meaningful word.

Rules :
1. Seek the possible relationship between the words to group them together.
2. Find out the similarity in the alphabetic grouping between the vowels and consonents.
3. Observe the frequency of vowels or consonents occurring in jumbled alphabets.
4. Observe the capital and small letters in a group of alphabets.
5. Note the repetition of letters and their frequency.
6. Consider other possible means of equation among the given words/alphabets.

• TEST YOURSELF

Instructions : In each of the following questions, there are five choices (a), (b), (c), (d), and (e). Four of them are alike and form a group. One is different and does not belong to the group. Find the odd man out.

1.	(a) Black	(b) Blacksmith	(c) Red	(d) Green	(e) White
2.	(a) Man	(b) Animal	(c) Plant	(d) Soil	(e) Insect
3.	(a) Earth	(b) Moon	(c) Mercury	(d) Venus	(e) Saturn
4.	(a) Circle	(b) Rectangle	(c) Triangle	(d) Square	(e) Polygon
5.	(a) Rice	(b) Wheat	(c) Peanut	(d) Gram	(e) Mustard
6.	(a) Clouds	(b) Thunder	(c) Lightning	(d) Rain	(e) Water

7. (a) Cyclone   (b) Doldrums   (c) Anticyclone
   (d) Storms   (e) Hurricane

8. (a) Kerry   (b) Kentucky   (c) Utah
   (d) Alabama   (e) Mississippi

9. (a) Andhra Pradesh   (b) Chandigarh   (c) Madhya Pradesh
   (d) Uttar Pradesh   (e) Himachal Pradesh

10. (a) Chess   (b) Cricket   (c) Hockey
   (d) Football   (e) Volleyball

11. (a) Clove hitch   (b) Cat's cradle   (c) Granny
   (d) Reef   (e) Sheepshank

12. (a) Vixen   (b) Hen   (c) Peacock
   (d) Filly   (e) Mare

13. (a) Sofa   (b) Chair   (c) Table
   (d) Settee   (e) Kemptee

14. (a) Oil   (b) Coal   (c) Peat
   (d) Coke   (e) Lignite

15. (a) Roof   (b) Wall   (c) Window
   (d) House   (e) Door

16. (a) Good   (b) Bad   (c) Nice
   (d) Better   (e) Best

Instructions : In each of the five group of letters one is different, others are alike. Find the odd word out.

17. (a) BAT   (b) CAT   (c) DOT
   (d) EAT   (e) FAT

18. (a) SIR   (b) MAN   (c) TON
   (d) HOG   (e) FIG

19. (a) INDIA   (b) ICELAND   (c) EIRE
   (d) FRANCE   (e) PORTUGAL

20. (a) CHEESE   (b) LARD   (c) BUTTER
   (d) SAFFRON   (e) PEPPER

21. (a) IRAN   (b) IRAQ   (c) INDIA
   (d) ITAWA   (e) ITALY

22. (a) ABC   (b) EfD   (c) eHK
   (d) LMn   (e) XyZ

23. (a) BCd   (b) CDe   (c) DeF
   (d) EFg   (e) FGh

24. (a) AbbC   (b) BcCD   (c) CddE
   (d) KuM   (e) JkkL

25. (a) ToWeR   (b) PoWeR   (c) MoWer
   (d) LOWeR   (e) SoWeR

26. (a) SNPqR   (b) STUw   (c) IjKM
   (d) CdEG   (e) VWxz

27. (a) CRDT   (b) APBQ   (c) EUFV
   (d) GWHX   (e) LNMo

28. (a) MMPQ   (b) NNRS   (c) QQXY
   (d) OOTU   (e) PQVW

29. (a) EVFU   (b) CXDW   (c) AZBZ
   (d) GTHS   (e) IRJQ

30. (a) ECLAP   (b) YSORT   (c) PHYPA
   (d) QREAT   (e) REBAD

31. (a) EKMA   (b) DINIA   (c) RUMBA
    (d) NAJPA   (e) HICNA
32. (a) TAB   (b) POT   (c) DEAR
    (d) LIFER   (e) LEVEL

ANSWERS

1. (b) Others form a group of colours.
2. (d) Others represent living beings while soil is non-living.
3. (b) Others are planets while the moon is a satellite.
4. (a) Others represent formation of straight line figures.
5. (a) Rice is a kharif crop while others belong to rabi crop.
6. (e) Others are associated with a single phenomenon of rain.
7. (b) Others represent the types of moving winds; Doldrums is a place.
8. (a) Kerry is in Ireland, others are in USA.
9. (b) Others are States.
10. (a) Chees is an indoor game while others form a group of outdoor games.
11. (b) Cat's cradle is a game, others are knots.
12. (c) All except peacock are female.
13. (e) Others belong to the group of furniture.
14. (a) Oil is the liquid form of fuel while others are solid forms of fuel.
15. (d) Others are parts of a house.
16. (b) Others belong to group of greatness, while bad does not.
17. (c) Others end with AT.
18. (c) In the other groups two consonants are consecutive letters in the alphabet.
19. (d) Others contain three vowels while FRANCE contain only two vowels.
20. (b) Other groups contain double letters.
21. (c) Others form a group by having one consonant between two vowels I and A.
22. (a) In the others one letter is small, others are capital.
23. (c) Middle letter is small while others are capital.
24. (a) Others are having two small letters.
25. (d) Other words contain vowels in small letters while in LOWER one vowel is in capital letter.
26. (e) In this group there are two small letters whereas in the others there is only one small letter.
27. (a) In all other groups third letter is the next one to the first in the alphabet and the fourth is next to the second in the alphabet. For example in (b) 'A' is the first letter and 'B' is the third letter, 'P' is the second 'Q' is the fourth.
28. (e) In the others first two letters are the same.
29. (c) In the other alternatives, first and the third letters are consecutive in the alphabet and second and fourth are also consecutive though the fourth comes earlier than the third in the alphabet.
30. (d) Others are anagrams of words : ECLAP = PLACE, YSORT = STORY; PHYPA = HAPPY; REBAD = BREAD.
31. (a) Others are anagrams of country names *e.g.,* (b) INDIA (c) BURMA (d) JAPAN (e) CHINA
32. (c) Other words when read backward given meaningful words.

C H A P T E R

22

ABSTRACT REASONING

STRUCTURE

- Principle of Series
- Principle of Classification
- Principle of Analogies
    - Test Yourself

LEARNING OBJECTIVES

After going through this unit you will learn :
- Series based on addition and subtraction method.
- Series based on addition with subtraction, addition with rotation and subtraction with rotation.
- Series based on principle of rations.
- Series based on principal of parallels and unparallel lines.
- Series based on definite and indefinite structures, and angles.
- Completion of series from the six numbered figures.
- Analogies based on principle of lapses.
- Analogies based on combination principle.

One of the most important psychological tests comes under the head of ABSTRACT REASONING (AR). Here, verbal language is no more used. The purpose of AR is to find out how well you understand ideas which are not presented in words or numbers; how well you think out problems even when there are no words to guide you. The tools of abstract reasoning are figures, diagrams, pictograms which will indicate how easily and clearly you can reason when problems are presented in terms of size or shape or position or quantity or other non-verbal, non-numerical forms.

Abstract reasoning greatly help in solving the problems that involve invisible processes such as the chemists, physicist or biologist seeking to understand an invisible process; the computer programmer and the systems engineer sorting out their data processing; the bank managrs trying to understand any economic process.

• 22.1. PRINCIPLE OF SERIES

Generally, most of the questions in Abstract Reasoning are based on the Principle of Series. Here two sets of figures are given, the Problem Figures and the Answer Figures. The candidates are required to choose the figure from the Answer Figures which will continue the series in the Problem Figures. The Problem Figures generally continue to change from left to right in a specific order (set order). This specific order provides the logical base or methodology to operate in solving the question. he candidates are required to operate the following methods on a given problem as quickly as possible :

(a) Series based on Addition Method : In this type of series, there is a continuous change from left to right in the problem figure due to some addition in specific order. *e.g.,*

Problem Figure **Ans.**
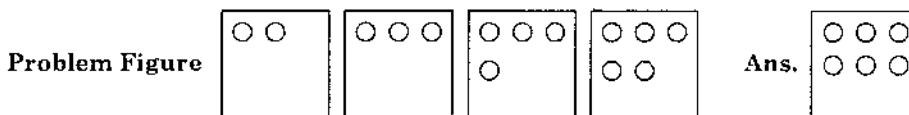
(b) Series based on Subtraction Method : The series based on subtraction method continue to change in the same rate of subtraction as in the case of addition. *e.g.,*

Problem Figure **Ans.**
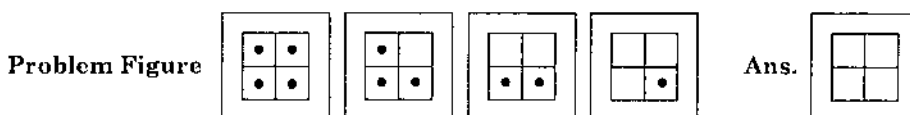
(c) Series based on Rotation Methods : Rotation may be clockwise or anticlockwise. The candidates are required to observe the direction keenly to locate the position next in the problem series. *e.g.,*
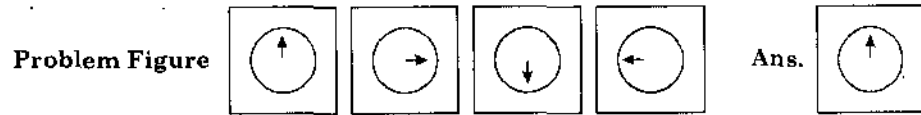
Problem Figure Ans.

Note : It may be anti-clockwise.

(d) Series based on Addition with Subtraction : In this case, the problem figures contain two aspects : one is added while the other is subtracted, both simultaneously in a given set order. If the figures in such an order continue to change, what will be the next figure ? *e.g.,*
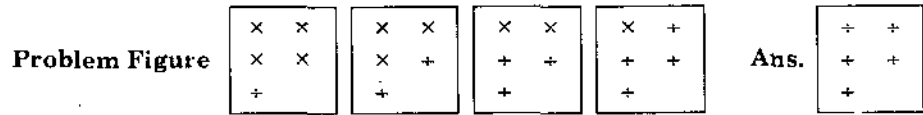
Problem Figure Ans.

(e) Series Based on Addition with Rotation (Clockwise/Anticlockwise) : In this operation, two or three combinations are found in the problem figure (either addition + rotation clock-wise or anti-clockwise or both). If the same condition persists what will be the next figure. *e.g.,*

Problem Figure Ans.
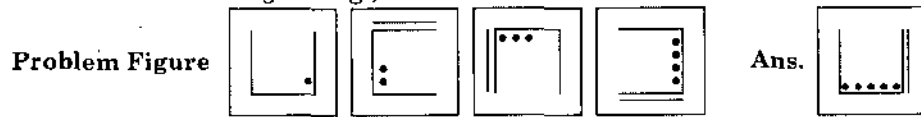
(f) Series Based on Subtraction with Rotation (Clockwise/Anti-clockwise) : Sometimes series are based on the principle of subtraction plus clockwise or anti-clockwise rotation or both. *e.g.,*
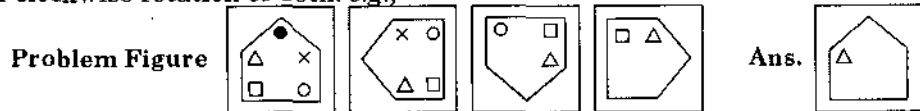
Problem Figure Ans.

(g) Series Based on the Principle of Ratios :

(i) Ratio of 1 : 2, 1 : 2. In this type of series there exists a ratio of 1 : 2, 1 : 2 among the problem figures. the second figure is different or opposite to the first figure but the third figure will be the same as the first one and the fourth figure will exhibit similarity to the second one. *e.g.,*

Problem Figure Ans.
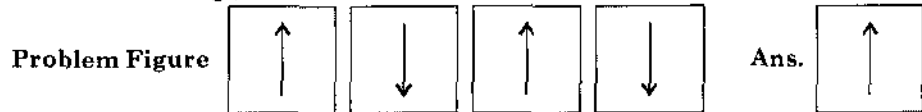
(ii) Ratio of 1 : 1, 2 : 2, 1 : 1. In this type of series, the first and second figures are same. Similarly, the third and fourth are identical thus exhibiting a ratio of 1 : 1, 2 : 2. Thus the fifth and sixth figures should be identical to the first or second one to exhibit the ratio of 1 : 1.

Problem Figure Ans.
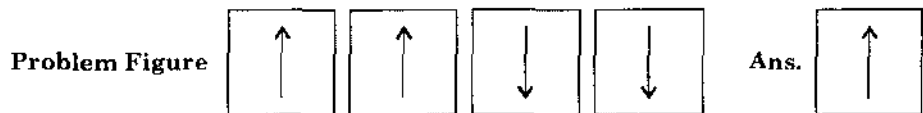
(iii) Ratio of 1 : 2 : 3, 1 : 2 : 3. In these series, the first, second and third figures are different to one another but the fourth figure is identical to the first one. The fifth figure will be identical to the second one and the sixth will be identical to the third one, completing the ratio of 1 : 2 : 3, 1 : 2 : 3. *e.g.,*

Problem Figure Ans.
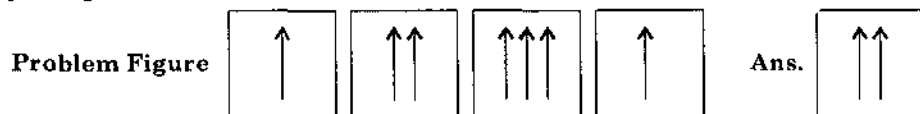
(iv) Ratio of 1 : 2 : 1, 3 : 1 : 4. In this type of series, the third figure will repeat similarity to first one and after fourth, resembling a ratio of 1 : 2 : 1 : 3 : 1 : 4. So the second, fourth and sixth figures will be different. *e.g.,*

Problem Figure | ↑ | ↑↑ | ↑ | ↑↑↑ | **Ans.** | ↑
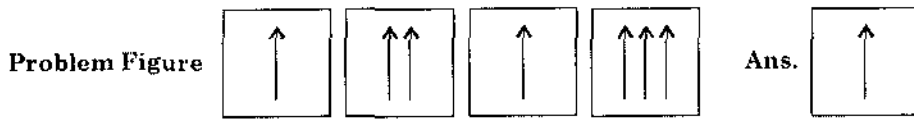
(h) Series based on Principle of Parallels : Sometimes, the set order in a series is based on the principle of parallelism. No matter what the direction or shape of the parallelogram, in these case the fifth figure will certainly be composed or parallel lines to continue the series. *e.g.,*
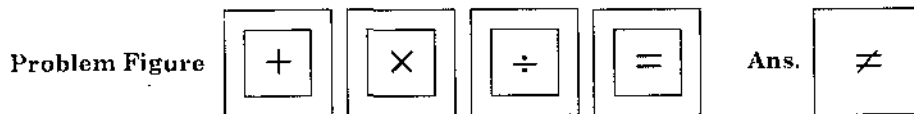
Problem Figure | ‖ | ╲ | = | ⫽ | **Ans.** | ‖
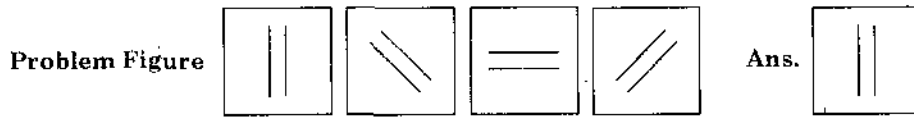
(i) Series Based on the Principle of Unparallel Lines : Sometimes, series are based on figures containing unparallel lines. *Obviously, in the answer figure only that figure will continue the series which is composed of unparallel lines. e.g.,*

Problem Figure | ◺ | ⊥ | ⊢ | ⟋ | **Ans.** | ⟍⟋

(j) Series Based on the Principle of Definite Structure : The problem figures sometimes exhibit a definite structure as one moves from left to right. The fifth figure should also have a definite structure as exhibited in the problem figures. For example the structures may have an open or closed end or one side, two sides, three sides or four sides open, or the structure will exhibit similar trigonometrical forms. In any case figures of the problem figures will exhibit a definite structure. *e.g.,*

Problem Figure | Y | T | K | F | **Ans.** | 人

(k) Series Based on Indefinite Structures : The problem figures do not contain any definite structures though sometimes they appear to have a definite structure. Minute observation is necessary to distinguish between definite and indefinite structures. *e.g.,*

Problem Figure | + | × | ÷ | = | **Ans.** | ≠

(l) Series Based on the Principle of Angles : The problem figures involve a continuous adjustment of angles or moving in coordinates. Candidates are required to observe the pattern of angles and coordinates in the respective figures moving from left to right in a set order, *e.g.,*

Problem Figure | L | L | | | ⌐ | **Ans.** | ⌐

(m) Completion of series from the six-numbered figures : The candidate should appreciate the problem from the four or five numbered series to six numbered one. It is possible that in this type of series there is change of position, rotation, addition, subtraction, ratio, angles, definite or indefinite shape, size; directions, etc. The candidates are invariably required to apply their mind to the problem. In no case candidates are advised to guess. the questions are in no way trick questions. All of them are based on reasoning; what is required is to consider a variety of methods approaching the problem, *e.g.,*

● ◬ □
■ ⊜ ?   **Ans.** △

• 22.2. PRINCIPLE OF CLASSIFICATION

The principle of classification in the non-verbal tests is based on the principle of similarities in a group of figures. Often a group of four or five figures are presented to the students and they are asked to point the odd man out.

Types of Questions Based on Principle of Classification : In non-verbal test, the following tests of similarities may classify figures in a group :

1. Classification Based on Rotation/Direction;
2. Classification Based on Division/Lapses;
3. Classification Based on Parallelism/Unparallelism;
4. Classification Based on Structure (Definite/Indefinite).

Solved Example :

Instructions : The following five figures constitute both the problem figures as well as the answers. All but one of the figures resemble or similar to each other in certain attributes. Single the odd man out.
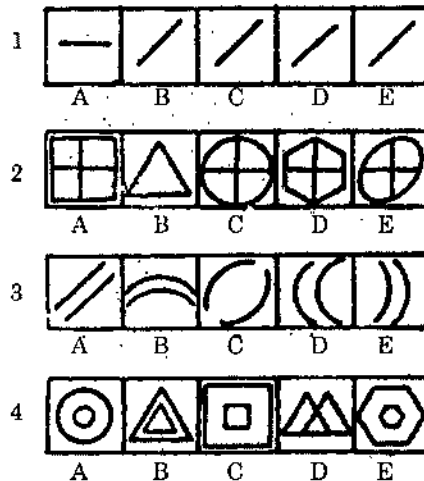
Explanation :

1. A All others are inclined at 45°
2. B All others are divided into 4 parts.
3. B All others are parallel lines.
4. D All others show a definite structure so that the bigger figure includes the smaller one.

• 22.3. PRINCIPAL OF ANALOGIES

In non-verbal tests, the principle of analogies is often applied to measure how far a candidate has the capacity to relate the objects in the universe.

Rules : To attempt non-verbal questions of analogies always remember the type of relationship between the objects.

1. Analogies Based on Principle of Lapses : Sometimes figure 1 is broken into parts in figure 2. This process of breaking up is termed as lapses or division. In such cases figure 3 should also be broken in the same ratio as is figure 1 to fig 2 so as to occupy the place of fourth figure. Sometimes the opposite is the case : the broken figure in 1 gets solidified in figure 2.

Problem Figures

2. Analogies Based on Combination Principle : There are several combinations of operations in non-verbal analogies tests. The candidates should try to work them out by across matrices for their own benefit. Some of the major combinations are given below and others are dealt with in the exercises.

• Analogies based on addition + subtraction;

• Analogies based on addition + rotation;

• Analogies based on subtraction + rotation.

• Analogies based on different types of ratios;

• Analogies based on mirror images;

• Analogies based on addition + subtraction + rotation, etc.

The following example will suffice for most of the above mentioned combinations.

Problem Figures
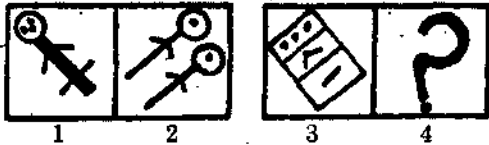
Ans. Figures
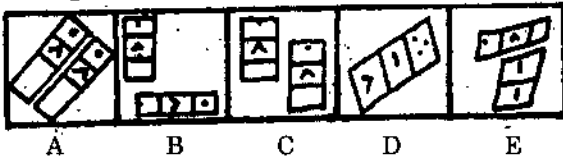
Solved Example

Instructions : Which of the answer figures will fit the question mark in the problem figure so that the relationship between 1 and 2 be maintained in between 3 and 4.

Explanation : Figure 1 consists of one circle with three dots standing on a bar with two hands and a flat limb. Figure 2 is the double of figure one in a ratio of 1 : 2, dots in circle have been decreased by two, flat limb is missing. Figure 2 is also a case of rotation of figure 1 at 90°. If we seek all these attributes in figure 4, in comparison to figure 3, it is only figure (A) which will suit.

• **TEST YOURSELF**

Instructions : There two sets of figures viz. Problem Figures and Answer Figures. Problem Figures form a kind of series. You have to select one figure from the Answer Figures marked, (a), (b), (c), (d) and (e) which will continue the series given in the Problem Figures.

Problem Figures   Answer Figures

1.

2.

3.

4.

(a) (b) (c) (d) (e)

5.

(a) (b) (c) (d) (e)

6.

(a) (b) (c) (d) (e)

7.

(a) (b) (c) (d) (e)

8.

(a) (b) (c) (d) (e)

9.

(a) (b) (c) (d) (e)

10.

(a) (b) (c) (d) (e)

11.

(a) (b) (c) (d) (e)

12.

(a) (b) (c) (d) (e)

13.

(a) (b) (c) (d) (e)

14.

(a) (b) (c) (d) (e)

15.

(a) (b) (c) (d) (e)

16.

(a) (b) (c) (d) (e)

17.

18.

19.

20.

21.

22.

23.

24.

25.
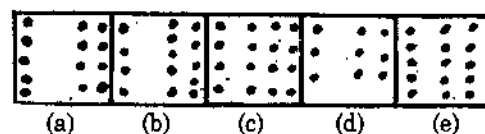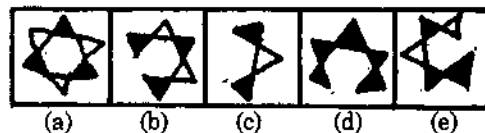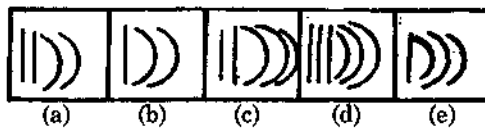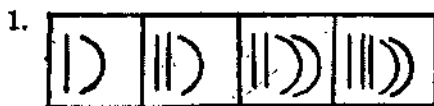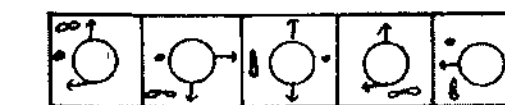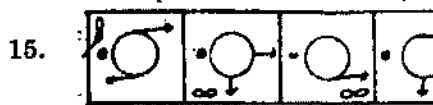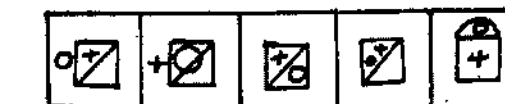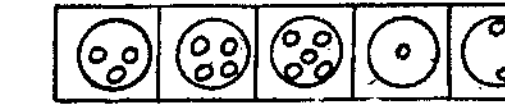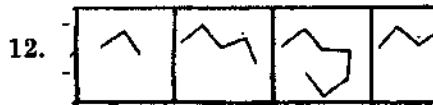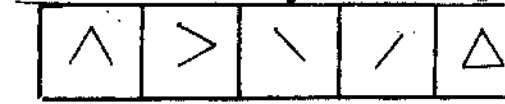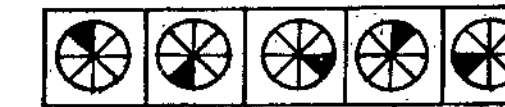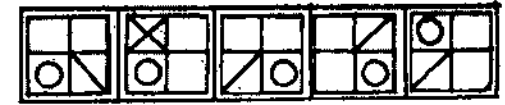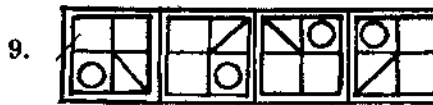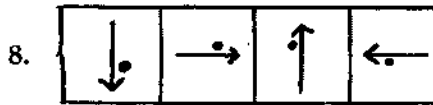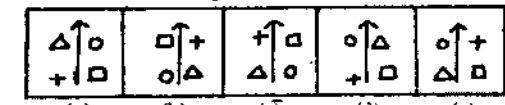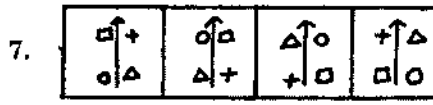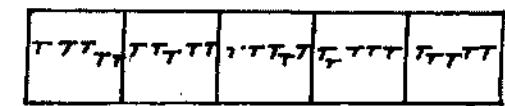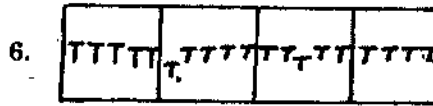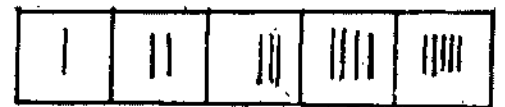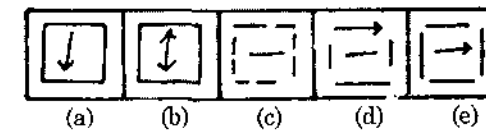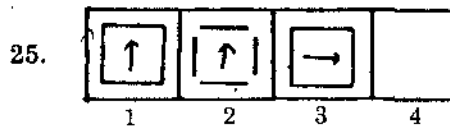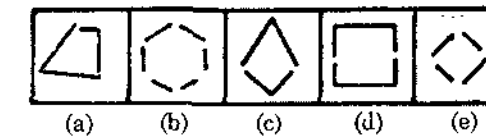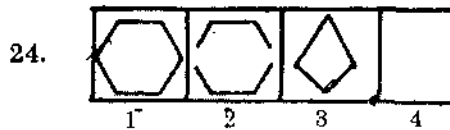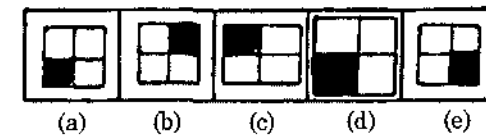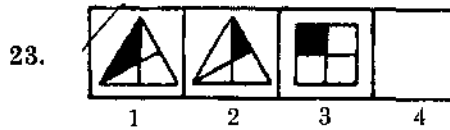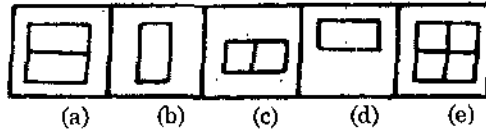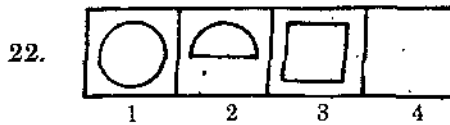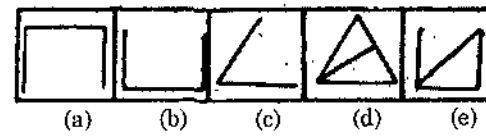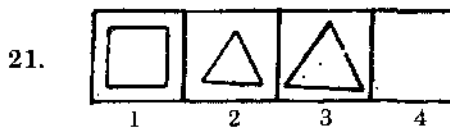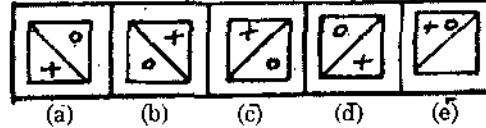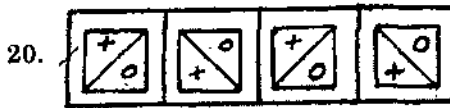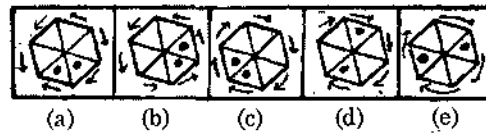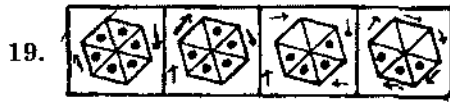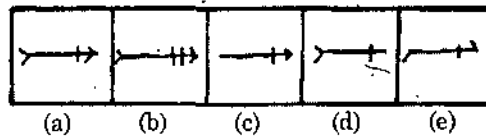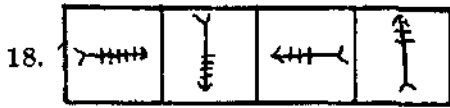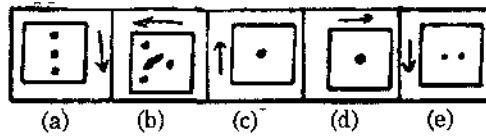
Instructions : Given below is a set of five figures marked (a), (b), (c), (d), and (e). The Problem Figures are themselves Answer Figure. Four of them resemble one another in a certain way and form a class. You have to identify the one which does not belong to the same class.

26.

27.

28.

29.
    (a) (b) (c) (d) (e)

30.
    (a) (b) (c) (d) (e)

31.
    (a) (b) - (c) (d) (e)

32.
    (a) (b) (c) (d) (e)

33.
    (a) (b) (c) (d) (e)

34.
    (a) (b) (c) (d) (e)

35.
    (a) (b) (c) (d) (e)
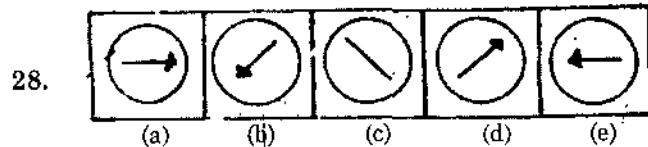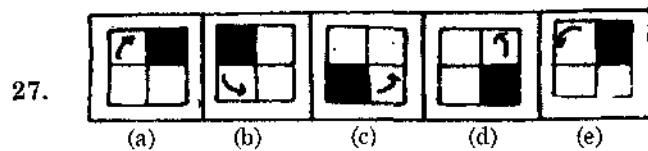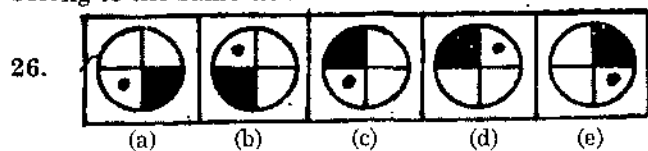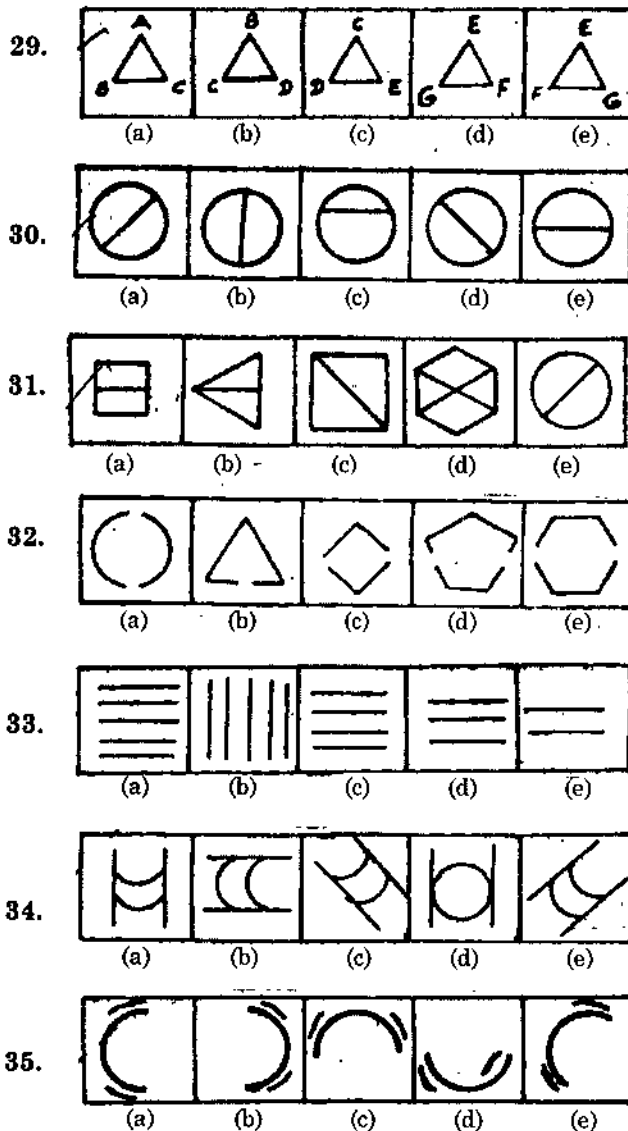
ANSWERS

1. (d) Vertical line and arc are increasing alternately in a set order.
2. (b) Blank and solid triangles are increasing alternately.
3. (e) There is an addition of a row of three dots while a gap is maintained between first and second columns.
4. (a) There is a reduction of one line at each step in a set order.
5. (b) At each step the innermost figure is missing.
6. (c) In each step the button is pushed alternately.
7. (b) All the four signs rotate along the line 90°, one step further clockwise.
8. (b) Figure moves anti-clockwise 90° each time while the dot sticks to its place.
9. (a) Both the circle and line move in an anti-clockwise direction in each quadrangle of the square at a time.
10. (d) The shaded area moves 90° alternately.
11. (e) Simultaneous subtraction and addition of a side of the triangle in two steps.
12. (a) Simultaneous addition and subtraction of two sides of the figures in two steps.
13. (b) 5 – 3 = 2; 2 + 2 = 4. The number of circles in second figure are subtractd from the first to get third figure. Third and fourth are added to get fifth figure.
14. (b) 'O' continues to be closer to the new line added. '+' rotates anti-clockwise outside the rectangle. Vertical line goes on adding.

15. (a) -> rotates, clockwise; <- rotates anti-clockwise; black dot moves weshwards; figure '8' rotates around ellipse anti-clockwise.

16. (d) The number of '>' goes on increasing alongwith '.' the arrow-head rotates clockwise.

17. (d) Clockwise rotation and subtraction of dots by 2.

18. (a) Clockwise rotation of arrow and decreasing of '–' by 1.

19. (c) Hexagon rotates clockwise, the dots decrease by one in each step in clockwise while the arrows increase by one.

20. (c) Alternate figures are identical *i.e.,* fifth figure will be identical to third one.

21. (c) The square in figure 1 is reduced to a triangle in figure 2. Similar analogy is found *in a triangle in figure 3 and an angle in figure (c).*

22. (d) Figure 2 is just half of figure 1 in a horizontal direction. Likewise answer figure (d) is half of figure 3 in the same direction.

23. (b) The shaded area is rotating clockwise from one quadrangle of a figure to another quadrangle of second figure.

24. (c) Second figure is the first figure divided into two parts and a little vertically apart from each other. Similar change in figure 3 will result in figure (c).

25. (e) The lines of square in figure 1 are broken in figure 2. Position of arrow-head remains the same. Similar relationship is found between figure 3 and figure (e).

26. (c) In all other figures, the blackened segment follows the dot in a clockwise direction.

27. (a) In all other figures arrow-mark is followed by shaded area except A where arrow-mark is faced by shaded area.

28. (c) In all circles arrows show a certain direction. Figure (c) is directionless.

29. (d) All others have a connotation in a sequential order ABC, BCD, CDE, etc. Figure (d) should have a connotation of DEF instead of EFG to belong to the same class.

30. (c) All others are divided into two equal parts.

31. (d) All others are divided into two equal parts.

32. (b) All others are broken at two places.

33. (b) All others are horizontal parallel lines.

34. (d) All other figures bounded with the two bars are parallel.

35. (d) In all other figures, smaller curves are parallel to the main curve except (d) where they are on opposite sides.

U N I T

23

SENSE OF ORDER

STRUCTURE

- Sense of Order

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on arrangement of given options in ascending or descending order for practice.

In these type of questions, according to the basis of dictionary, size, rank, weight, natural sequence we have to do the arrangement of given options in descending or ascending order. Let us see some examples :

Ex. 1. Which of the following words would appear in the middle if they are arranged as in the dictionary order ?

(a) Delude   (b) Delirium   (c) Defer   (d) Demean   (e) Delete

Solution. (b) The dictionary order of word is — Defer, Delete, Delirium, Delude, Demean.

Ex. 2. Which one would be a meaningful order of the following ?

1. Key   2. Door   3. Lock   4. Room   5. Switch on

(a) 5 1 2 4 3   (b) 4 2 1 5 3   (c) 1 3 2 4 5   (d) 1 2 3 4 5

Solution. (c) With the Key you open a Lock, then open the Door to enter the Room and Switch on the light.

Ex. 3. What would be the proper order of the following :

1. Decametre   2. Metre   3. Kilometre   4. Centimetre   5. Milimetre

(a) 1 4 3 2 5   (b) 5 4 1 2 3   (c) 5 4 3 2 1   (d) 5 4 2 1 3

Solution. (d) The proper order of measurement in increasing order is — Milimetre, Centimetre, Metre, Decametre, Kilometre.

Ex. 4. What will be the middle word in natural order of the words given ?

1. Medication   2. Patient   3. Diagnosis   4. Recuperation 5. Doctor

(a) Doctor   (b) Patient   (c) Medication   (d) Recuperation   (e) Diagnosis.

Solution. (e) The words in natural order are — Patient, Doctor, **Diagnosis,** Medication, Recuperation. A Patient goes to the Doctor who gives the Diagnosis and Prescribes the Medication for Recuperation.

• TEST YOURSELF

1. Which word will come in the second place if the following words are arranged according to dictionary ?
   1. Respire   2. Rich   3. Regard   4. Rain   5. Ribald
   (a) Respire (b) Ribald   (c) Regard   (d) Rain   (e) Rich

2. Which one would be a meaningful order of the following ?
   1. Consultation   2. Illness   3. Doctor   4. Treatment   5. Recovery
   (a) 4 3 1 2 5   (b) 2 3 4 1 5   (c) 5 1 4 3 2   (d) 2 3 1 4 5   (e) 4 1 5 3 2

3. In a telephone directory, which of the following names will appear in the middle ?
   (a) Randhir (b) Randesh   (c) Rama   (d) Ramesh   (e) Renmurthi

4. What will be the natural sequence of the given words in descending manner ?

1.Words   2. Paragraph   3. Book   4. Lesson   5. Sentence

4. What will be the natural sequence of the given words in descending manner ?
   1. Words   2. Paragraph   3. Book   4. Lesson   5. Sentence
   (a) 15243   (b) 24153   (c) 32451   (d) 34251   (e) 54213

5. What word will come in the middle if the following words are arranged in ascending order of weight ?
   1. Paperweight   2. Pencil   3. Chair   4. Knife   5. Pin
   (a) Pin   (b) Scissors   (c) Pen   (d) Paperweight (e) Table

6. What would be a meaningful order of the following ?
   1. Uttar Pradesh 2. Universe   3. Taj Mahal   4. World   5. India
   (a) 1 5 3 2 4   (b) 4 1 5 3 2 (c) 5 4 2 1 3   (d) 2 1 3 5 4 (e) 3 1 5 4 2

7. Arrange the following words in the sequence in which they occur in dictionary :
Liver	Long	Late	Load	Luminous	Letter
1	2	3	4	5	6
   (a) 3 6 1 4 2 5   (b) 3 6 1 2 4 5 (c) 3 1 6 2 4 5 (d) 3 1 6 2 5 4 (e) 3 4 1 6 2 5

8. Which number-sequence of the following represents a correct sequence from small to big ?
   1. Bungalow   2. Flat   3. Cottage   4. House   5. Palace   6. Mansion
   (a) 3 2 1 4 6 5   (b) 3 2 4 1 6 5 (c) 3 2 4 1 5 6 (d) 5 6 4 1 2 3 (e) 5 4 6 2 1 3

9. Which one would be a meaningful order of the following ?
   1. Snake   2. Grass   3. Eagle   4. Frog   5. Insect
   (a) 3 2 1 4 5   (b) 5 2 1 4 3 (c) 2 5 4 1 3   (d) 2 4 5 3 1 (e) 2 4 5 1 3

10. Which one would be a meaningful order of the following ?
    1. Windows 2. Walls   3. Floor   4. Foundation 5. Roof 6. Room
    (a) 4 2 1 5 3 6   (b) 4 3 5 6 2 1 (c) 4 5 3 2 1 6 (d) 4 1 5 6 2 3 (e) 4 1 5 3 6 2

11. Which would be a meaningful order of the following ?
    1. Index   2. Contents   3. Title   4. Chapters 5. Introduction
    (a) 2 3 4 5 1   (b) 3 2 5 4 1 (c) 5 1 4 2 3   (d) 3 2 5 1 4 (e) 5 4 2 1 3

12. If the following words are arranged in their natural sequence in descending order, which word will occur in the second place ?
    1. Book   2. Paragraph   3. Library   4. Alphabet 5. Page
    (a) Page   (b) Paragraph (c) Book   (d) Library (e) Alphabet

13. Which one would be a meaningful order of the following ?
    1. Mother   2. Child   3. Milk   4. Cry   5. Smile
    (a) 3 2 1 5 4   (b) 2 4 1 3 5 (c) 1 5 2 4 3   (d) 2 4 3 1 5 (e) 3 4 1 2 5

14. Which would be the proper order of the following ?
    1. Rainbow   2. Rain   3. Sun   4. Happy   5. Child
    (a) 4 2 3 5 1   (b) 4 5 1 2 3 (c) 2 1 4 3 5   (d) 2 3 1 5 4 (e) 4 3 1 2 5

15. Which one will be a meaningful order of the following ?
    1. Birth   2. Death   3. Funeral   4. Marriage 5. Education
    (a) 1 3 4 5 1   (b) 4 5 3 1 2 (c) 1 5 4 2 3   (d) 2 3 4 5 1 (e) 3 1 4 2 5

16. In a telephone directory which of the following names will appear in the middle ?
    (a) Sajewet   (b) Sajewat   (c) Segyan   (d) Salwar   (e) Sajevar

17. Which one would be a meaningful order of the following ?
    1.Book   2. Written matter 3. Composing 4. Printing 5. Proof 6. Binding
    (a) 5 6 4 2 3 1   (b) 5 6 3 2 4 1 (c) 2 3 5 4 6 1 (d) 6 5 4 2 3 1 (e) 6 5 2 1 3 4

18. What would be a meaningful order of the following ?
    1. Caste 2. Family 3. Newly-married couple 4. Clan   5. Species
    (a) 3 4 5 1 2   (b) 5 2 1 4 3 (c) 2 3 1 4 5   (d) 4 5 3 2 1 (e) 4 3 2 5 1

19. Which one would be a meaningful order of the following ?
    1. College   2. Child   3. Salary   4. School   5. Employment

(a) 1 2 4 3 5　　(b) 4 1 3 5 2　　(c) 2 4 1 5 3　　(d) 5 3 2 1 4　　(e) 3 4 1 2 5

20. What will be the dictionary order of the these words?

Bungling,	Burgling,	Bubble,	Bundle,	Bushy,	Bully,
1	2	3	4	5	6

(a) 2 4 5 6 1 3　　(b) 5 6 1 4 3 2　　(c) 1 4 6 5 2 3　　(d) 6 1 2 3 5 2　　(e) 3 6 4 1 2 5

21. Which word would be in the second place if the following are arranged in a natural sequence ?

1. Noon　　2. Night　　3. Evening　　4. Dusk　　5. Dawn

(a) Night　　(b) Noon　　(c) Dusk　　(d) Dawn　　(e) Evening

22. Which name will come in the middle if these names are arranged in a telephone directory ?

1. Anamika 2. Akshi　　3. Anuradha　　4. Akansha　　5. Amita

(a) Anuradha　　(b) Amita　　(c) Anamika　　(d) Akansha　　(e) Akshi

23. What will be the natural order of the following words according to size ?

1. Dog　　2. Elephant　　3. Cat　　4. Giraffe　　5. Mouse

(a) 5 3 1 4 2　(b) 3 1 5 2 4　　(c) 3 5 1 4 2　　(d) 3 5 2 1 4　(e) 3 5 2 4 1

24. What will be the natural order of the following in descending order ?

1. Hut　　2. Skyscraper　　3. Palace　　4. Room　　5. House

(a) 2 3 1 5 4　(b) 4 1 5 3 2　　(c) 2 3 5 1 4　　(d) 3 2 5 4 1　　(e) 2 3 5 4 1

25. Which would be the proper order of the following ?

1. Euphoria　　2. Happiness　　3. Ambivalence　　4. Ecstasy　　5. Pleasure

(a) 3 4 1 2 5　(b) 3 2 5 4 1　　(c) 5 4 1 3 2　　(d) 3 5 2 1 4　　(e) 1 4 3 2 5

26. What will be the natural order of the following ?

1. Independence Day　　2. Christmas　　3. Diwali　　4. Holi　　5. Republic Day

(a) 5 4 1 3 2　(b) 5 1 4 3 2　　(c) 4 1 5 3 2　　(d) 2 3 4 1 5　　(e) 4 3 1 5 2

27. What will be the natural order of the following words according to weight ?

1. Drum　　2. Pin　　3. Paper weight　　4. Pebble　　5. Coffee cup

(a) 4 2 3 5 1　(b) 2 4 5 3 1　　(c) 4 2 5 1 3　　(d) 2 4 3 5 1　　(e) 4 2 5 3 1

28 What word will come in the third place if these words are arranged in descending order ?

1. Judge　　2. Listen　　3. Act　　4. Analyse　　5. Observe

(a) Listen　　(b) Observe　　(c) Act　　(d) Judge　　(e) Analyse

29. If the following words are arranged in natural order then what will come in the second place ?

1. Producer　　2. Raw material　　3. Seller　　4. Consumer　　5. Distributor

(a) Producer　　(b) Seller　　(c) Consumer　　(d) Distributor　　(e) Raw Material

30. If the words are arranged in ascending order which word will occur in the fourth place ?

1. Youth　　2. Infant　　3. Adult　　4. Childhood　　5. Teenager

(a) Teenager　　(b) Childhood　　(c) Adult　　(d) Youth　　(e) Infant

ANSWERS

1. (c) The order of words according to dictionary is Rain, Regard, Respire, Ribald, Rich.

2. (d) An ill person goes to a Doctor for Consultation who prescribes Treatment for Recovery.

3. (b) In telephone directory the order of names is — Ramesh, Rana, Randesh, Randhir, Renmurthi.

4. (d) A book contains many lessons, a lesson contains many paragraphs, a paragraph contains many sentences and a sentence contains many words.
   (*Note*. Option (a) is in ascending manner).

5. (b) According to ascending order of weight the arrangement will be — Pin, Pen, Scissors, Paper weight, Table.

6. (e) Taj Mahal is in U.P. which is a state in India and India is a part of the World which is in Universe.

7. (a) Order is Late, Letter, Liver, Load, Long, Luminous.

8. (b) The correct sequence of letters from small to big is :
Cottage < Flat < House < Bungalow < Mansion < Palace

9. (c) In the Grass there are many Insects. Frog who eats them is a prey of Snake who in turn is the prey of an Eagle.

10. (a) The order of words depict the right-order of constructing a building/room.

11. (b) A Title comprises Contents of Introduction for Chapter Index.

12. (c) The words in descending order of natural sequence are — Library, Book , Page, Paragrah, Alphabet. Library is a collection of Books, a Book is a collection of many Pages, in a Page there are many paragraphs which contain an Alphabet.

13. (b) When a Child Cries the Mother gives him Milk and then he Smiles.

14. (d) When it rains in the Sun a Rainbow is formed and the Child is Happy to see it.

15. (c) After the Birth of a child, his Education is important. When he is grown up he is Married. When he is old he Dies and is taken for the Funeral.

16. (a) In telephone directory the order of names — Sajevar, Sajewat, Sajewet, Salwar, Segvan.

17. The meaningful order of the words is — Written matter, Composing, Proof, Printing, Binding, Book.

18. Meaningful order : Species, Family, Caste, Clan, Newly married couple.

19. (c)   20.(e)   21. (e)   22. (b)   23. (a)

24. The words in descending order are : Skyscraper, Palace, House, Hut, Room.

25. The order of expressions of feeling of joy is : Ambivalence, Happiness, Pleasure, Euphoria, Ecstasy.

26. (a)   27. (b)   28. (e)

29. (a) The natural order of words is — Raw material, **Producer**, Distributor, Seller, Consumer. Raw material is used by the Producer to make a product which its Distributor gives to the Seller from whom the consumer can purchase it.

30. (d) The words in ascending order depict the natural growth of a human being — Infant, Childhood, Teenager, Yough, Adult.

U N I T

24

REAL LIFE PROBLEMS

STRUCTURE

- Real Life Problems

LEARNING OBJECTIVES

After going through this unit you will learn :
- Questions based on real life problems for practice.

The questions related to real life problems are based on spot reaction, some event is mentioned followed by options which reveal possible instant reactions related to the event. The candidate's action depends on experience of unforeseen events. From the suggested alternatives, he has to select the most suitable action he will possibly take on the spot of the event.

Ex. 1. While going to the office, you see a child being hit by a speeding car. The most immediate thing you would do is :

(a) chase the car on your scooter

(b) ignore and pass by

(c) render first aid to the child

(d) inform at the nearest police station about the accident

Ans. (c) : The most important step is to save the child.

Ex .2. Pakistan does not want peace because that is still acquiring nuclear technology. So, you can say :

(a) Most nations which want peace do not acquire nuclear technology.

(b) Some nations which want peace acquire nuclear technology.

(c) No nation which wants peace acquires nuclear technology.

(d) Some nations which do not want peace acquire nuclear technology.

Ans. (c)

Ex. 3. Your house is locked and you are standing outside the door. At this time, you listen a voice in your house. It means that some thieves are in the house. At this time, the most immediate thing you would do is :

(a) run away from the house   (b) call the police

(c) ` make a noise   (d) open the door.

Ans. (b)

Note : There is no limit to the variations in such type of questions. The questions are given in this chapter only for an idea.

• TEST YOURSELF

1. In a exam, you find that your question paper is too tough to be answered satisfactorily by you. The best thing you can do is :

(a) try cheating from your neighbouring candidate.

(b) leave the paper and walk out.

(c) try attempting those questions first of which you know something.

(d) complain to the examiner about the toughness of the question paper.

2. Your best friend is annoyed with you for certain reasons. You will :
   (a) try your best to reason out your friend's annoyance.
   (b) go out and make new friends.
   (c) show indifference.
   (d) remind the friend of your good friendship.

3. You were invited to a party, but on the day of the party you are informed that the party has been cancelled. You will :
   (a) try to find out the reasons for its cancellation.
   (b) decide that you will never go to that place ever again.
   (c) not discuss the matter with anyone.
   (d) hold the party at your place instead.

4. You find that the cooking gas cylinder is leaking. The first thing you would do is :
   (a) switch off the light.
   (b) close the knob of the cylinder.
   (c) call the fire brigade for help.
   (d) alert all the members at home.

5. While returning home from a far away place you find that your pocket has been picked. You will :
   (a) try to hitch-hike till home.
   (b) hire a taxi and pay on reaching home.
   (c) go to the nearest police station and lodge a FIR.
   (d) call home and ask someone to pick you from the place you make the phone call.

6. Your friend has not invited you to his marriage party, will you :
   (a) ignore the whole affair ?
   (b) send him your best wishes ?
   (c) attend the ceremony ?
   (d) hold it against him ?

7. You are interviewed for a new job. Which of the following questions is most important to you ?
   (a) Remuneration you will be paid.
   (b) Opportunities for promotion.
   (c) Scope to develop your ideas and use them to improve the working of the organisation.
   (d) All the above are equally important.

8. You are walking down the street and suddenly you see two hundred-rupees notes on the pavement. What action will you take ?
   (a) Give the money to beggar.
   (b) Pocket it yourself.
   (c) Deposit it in the nearest police station.
   (d) Leave it where it is.

9. You have made some silly mistakes which have been pointed out to you. Will you :
   (a) get angry ?
   (b) feel miserable ?
   (c) feel thankful ?
   (d) laugh it away ?

10. You are in a bus. The bus reaches your stop but still you have not purchased the ticket because of heavy rush. What will you do ?
    (a) Hand the money to someone sitting nearby to give it to the conductor.
    (b) Jump out quickly to avoid embarassment.
    (c) Give the money to the driver.
    (d) Call the conductor, give him the money and get the ticket.

11. You want to write a book on the techniques of yoga. First of all :
    (a) You will contact the publisher.
    (b) You will write the book without contact any publisher.
    (c) you will learn yoga.
    (d) you will contact a doctor.

12. While returning home from the office you find that some boys are teasing a girl. Then first of all :
    (a) You will inform the police by phone.
    (b) You will fight with boys.
    (c) You will not do anything.
    (d) You will make a noise.

13. If you are on the railway station. A boy is hungry and begging some money to you. Then :
    (a) You will beat him.
    (b) You will give him money.
    (c) You will feed him.
    (d) You will deny.

14. You find that your house got fire. The first thing you would do is :
    (a) Call the fire brigade for help.
    (b) Spread the fire-extinguisher and call the fire brigade.
    (c) Spread the sand.
    (d) All of these as well as possible.

ANSWERS

1. (c)   2. (a)   3. (a)   4. (b)   5. (b)   6. (b)   7. (d)   8. (c)   9. (c) 10. (d)
11. (a)   12. (a) 13. (c)   14 (d)