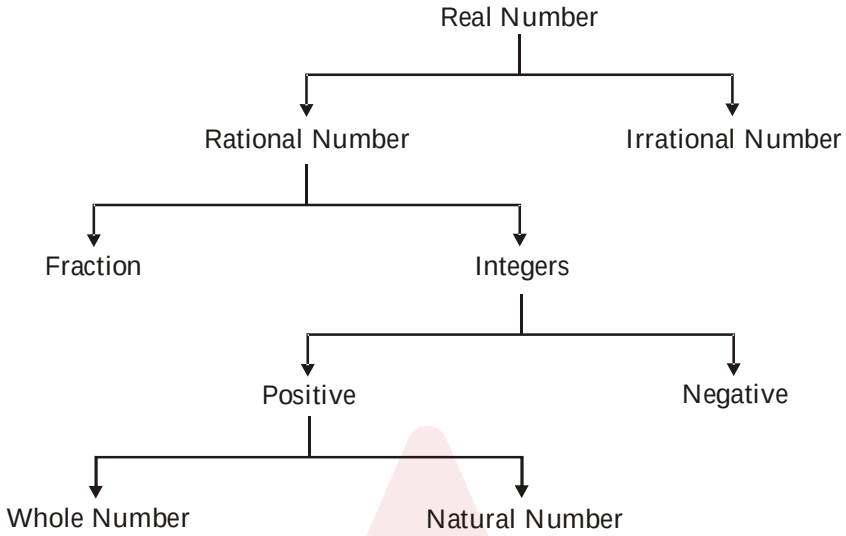
ACE SSC ARITHMETIC

Chapter 1

Number System and Simplifications



Natural Numbers → 1, 2, 3, ... ∞ Whole Numbers → 0, 1, 2, 3 ..... ∞

Integers → $-\infty$ ..... –3, –2, –1, 0, 1, 2 ..... ∞ Rational Numbers → Integers and Fractions.

Fraction: Any number that can be represented in the form of p / q, where p & q are integers & q is not equal to zero is called a rational number.

Irrational Number → Any real number that cannot be expressed as a ratio of integers, i.e as a fraction.

Example: $\sqrt{5}$, $\sqrt{8}$

Prime Number: A number which has exactly two factors 1 & itself is called a prime number.

Prime numbers from 1 – 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97 i.e. there are total 25 prime numbers up to 100.

Some results on Prime Numbers:

(i) Up to 100 total prime numbers = 25
(ii) Up to 50 total prime numbers = 15
(iii) Sum of two prime numbers is always even except 2.
(iv) Sum of three prime numbers is even if and only if one number is 2.
(v) All prime numbers are odd except 2.
(vi) 2 is only even prime number.
(vii) Each prime number has two factors 1 & itself so 1 is not prime number.
(viii) Smallest prime number of three digit is 101
(ix) Largest prime number of three digit is 997
(x) If square of any prime number (except 2 and 3) is divided by 24 then remainder is always 1.

Example: $\frac{1}{24}\times\left(11^2,\ 13^2,\ 17^2,\ 19^2,\ 23^2\right)$ = (remainder 1 in each case).

Composite No.: A number which has more than two factor is a composite number.

Example: 4, 6, 8, 9 .....

Note: 1 is neither prime nor composite number, 2 is only even prime number.

Co-Prime No.: The pair of numbers which have no common factor other than one are called co-prime numbers.

Example: (4, 5), (15, 8)

Tests of Divisibility:

(i) Divisibility by 2 : A number is divisible by 2, if its unit place is any of 0, 2, 4, 6, 8
(ii) Divisibility by 3 : A number is divisible by 3 only when the sum of its digits is divisible by 3.
(iii) Divisibility by 4 : A number is divisible by 4 if the number formed by its last two digits is divisible by 4.
(iv) Divisibility by 5 : A number is divisible by 5 if its unit digit is 5 or 0.
(v) Divisibility by 6 : A number is divisible by 6 if it is divisible by both 2 & 3.
(vi) Divisibility by 8 : A number is divisible by 8 when the number formed by its last 3 digits is divisible by 8.
(vii) Divisibility by 9 : A number is divisible by 9 if the sum of its digits is divisible by 9.
(viii) Divisibility by 10 : A number is divisible by 10 only when its unit digit is zero.
(ix) Divisibility by 11 : A number is divisible by 11, if the difference of the sum of its digits at odd places & the sum of its digits at even places is either 0 or a number divisible by 11.

Some results on division:

(i) $(x^n - a^n)$ is divisible by $(x - a)$ for all value of n.
(ii) $(x^n - a^n)$ is divisible by $(x + a)$ for even value of n.
(iii) $(x^n + a^n)$ is divisible by $(x + a)$ for odd value of n.

$$\boxed{\text{Dividend} = (\text{Divisor} \times \text{Quotient}) + \text{Remainder}}$$

Some Results on Numbers:

(i) The product of four numbers which are consecutive natural numbers is always divisible by 24.

Example: $\frac{101 \times 102 \times 103 \times 104}{24}$ or $\frac{7 \times 8 \times 9 \times 10}{24}$

(ii) The difference of square of two consecutive natural numbers is always equal to sum of those numbers.
Example: $9^2 - 8^2 = 9 + 8$, $119^2 - 118^2 = 119 + 118$

(iii) The difference of square of two consecutive odd numbers is always divisible by 8.
Example: $11^2 - 9^2 = 121 - 81 = 40$

$$\frac{40}{8} = 5.$$

(iv) The difference of square of two consecutive even numbers is always divisibly by 4.
Example: $10^2 - 8^2 = 100 - 64 = 36$

$$\frac{36}{4} = 9.$$

(v) Any digit repeated 6 times is divisible by 7, 11, 13 & 37.
Example: 5 5 5 5 5 5 or 2 2 2 2 2 2
are divisible by 7, 11, 13 & 37.

(vi) Any two digit number repeated 2 times is always divisible by 101.
Example: 3 4 3 4 or 5 6 5 6 is divisible by 101.

(vii) If P is prime number & a is an integer then $(a^P - a)$ is always divisible by P.
Example: $(5^{11} - 5)$ is divisible by 11.

(viii) If n is an odd number then $(2^{2n} + 1)$ is always divisible by 5.

(ix) If n is an even number, then $(2^{2n} - 1)$ is always divisible by 5.

(x) The product of three consecutive natural numbers is always divisible by 6.

Example: $\frac{1}{6} \times (8 \times 9 \times 10)$ or $\frac{1}{6} \times (11 \times 12 \times 13)$

(xi) The product of three consecutive natural numbers starting with even number is always divisible by 24.

Example: $\frac{1}{24} \times (8 \times 9 \times 10)$ or $\frac{1}{24}(18 \times 19 \times 20)$
↓ ↓
even even

(xii) Any number written in the form $9(10^n - 1)$ is always divisible by 3 & 9 both.

(xiii) Any natural number of the form $(n^3 - n)$ is always divisible by 6.

Unit digit : $3^4 = 81 = 1$ i.e. 1 is unit digit

$3215 \times 5163 \times 7298$

product of unit digits = $5 \times 3 \times 8 = 120$, i.e. unit digit is zero.

The unit digit of the numbers in following forms is:

$5^n = 5$	$4^{odd} = 4$	$9^{odd} = 9$
$6^n = 6$	$4^{even} = 6$	$9^{even} = 1$
$0^n = 0$		
$1^n = 1$		

Example :

(i) $234^{567} + 566^{133}$

Unit digit = 4 + 6 = 10 = 0

(ii) $249^{33} + 250^{34} + 251^{35}$

unit digit = 9 + 0 + 1 = 10 = 0

Remaining digit : (2, 3, 7, 8)

- $212^{79} \Rightarrow 2^{79/4} = 2^3 = 8$
- $378^{41925} \Rightarrow 8^{25/4} = 8^1 = 8$
- $473^{2188} \Rightarrow 3^{88/4} = 3^4 = 81 = 1$
- In case remainder is zero, then power would be 4

  Example : $214^{2164} \Rightarrow 4^{64/4} = 4^4 = 256 = 6$

Testing of prime numbers

- Test whether 191 is prime or not

  Clearly $14 > \sqrt{191}$

  Prime numbers up to 14 are 2, 3, 5, 7, 11, 13

  No one of these divides 191 exactly

  $\therefore$ 191 is a prime number.

- Test wether 221 is prime or not

  Clearly 15 is $> \sqrt{221}$

  Prime numbers up to 15 are 2, 3, 5, 7, 11, 13

  Clearly, 13 divides 221 exactly

  So, 221 is not prime.

(i) Sum of n natural numbers

$$1 + 2 + 3 + \ldots\ldots\ldots\ldots + n = \frac{n(n+1)}{2}$$

(ii) Sum of squares of n natural numbers

$$1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(iii) Sum of cube of n natural numbers

$$1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + n^3 = \left[\frac{n(n+1)}{2}\right]^2$$

Odd number : Those numbers which are not divisible by 2, are known as odd numbers

Example: 1, 3, 5, 7, ...

$$n = \frac{t_n + 1}{2}, \quad \text{where n = total number of term,} \quad t_n = \text{last term.}$$

Sum of Ist n odd numbers = n^2

Example : $1 + 3 + 5 + \ldots\ldots\ldots\ldots + 49$

$$n = \frac{49+1}{2} = 25, \quad \text{sum} = (25)^2 \quad \text{(since, n = 25)}$$

$$= 625$$

Example: Find the sum of the series

$$51 + 53 + \ldots\ldots\ldots\ldots + 99$$

$$= \frac{(\text{Last term} + \text{I}^{st}\text{ term}) \times (\text{Last term} - \text{Previous term of I}^{st}\text{ term})}{4} = \frac{(99+51)(99-49)}{4} = \frac{150 \times 50}{4} = 1875$$

Even Numbers: Those numbers which are divisible by 2 are known as even numbers.

Example : 2, 4, 6, 8, ...

$n = \frac{t_n}{2}$, Where n = total numbers of term, t_n = last term

sum of I^{st} n even numbers = n(n + 1)

Example : 2 + 4 + 6 + ... + 58

$n = \frac{58}{2} = 29$, sum = n(n + 1) = 29(29 + 1) = 870

Remainder Theorem:

1. When a_1, a_2, a_3 ..... a_n are divided by 'd' individually the respective remainders are R_1, R_2, R_3.... R_n and when $(a_1 + a_2 + a_3 ..... a_n)$ is divided by 'd' the remainder can be obtained by dividing $(R_1 + R_2 + R_3 .... R_n)$ by 'd'

   Example : Find remainder when 38 + 71 + 85 is divided by 16

   $= \frac{38+71+85}{16} = \frac{6+7+5}{16}$

   (Remainder obtained when numbers are individually divided by 16)

   $= \frac{18}{16} \Rightarrow$ Remainder $= 2$

2. When $a_1, a_2, a_3 ... a_n$ are divided by a divisor d the respective remainders obtained are $R_1, R_2, R_3 .....R_n$, and the remainder when $(a_1 \times a_2 \times a_3 .... \times a_n)$ is divided by 'd' can be obtained by dividing $(R_1 \times R_2 \times R_3 .... R_n)$ by d.

   Example : Find Remainder when 7^7 is divided by 4.

   $\frac{7^7}{4} = \frac{7\times7\times7\times7\times7\times7\times7}{4} = \frac{3\times3\times3\times3\times3\times3\times3}{4}$ (Remainder obtained individually)

   $= \frac{9\times9\times9\times3}{4} = \frac{1\times1\times1\times3}{4} \Rightarrow$ Remainder = 3

   So we can say that remainders can be added as well as multiplied.

   Some results on remainder

   - For $\frac{nx}{n}$, Remainder = 0
   - For $\frac{(nx+1)^n}{n}$, Remainder = 1
   - For $\frac{(nx-1)^{even}}{n}$, Remainder = 1
   - For $\frac{(nx-1)^{odd}}{n}$, Remainder = –1 or (n–1)

   Where x and n are any positive integers.

Recurring Decimal : A decimal number in which a digit or a set of digits repeats regularly, over a constant period, is called a recurring decimal.

Example : 2.3333..... , 7.5555.... , 1.3333.... they are represented as $2.\overline{3}$, $7.\overline{5}$, $1.\overline{3}$

(i) Pure Recurring decimal : A decimal fraction in which all the figures occur repeatedly is called a pure recurring decimal e.g 7.4444.... , 2.1111.... , 3.4545...

(ii) Mixed Recurring decimal : A decimal number in which some of the digits do not recur is called a mixed recurring decimal e.g. 0.1777, .087373...

(iii) Non recurring decimal : A decimal number in which there is no regular pattern of repitition of digits after decimal point is called non-recurring decimal e.g. 3.24662676...

Fraction : The word fraction means a part of anything. It can be expressed in the from of $\frac{p}{q}$ where p and q are integers and 'q' is not equal to '0'.

Proper fraction : When the numerator is less than the denominator, then the fraction is called a proper fraction.

Example : $\frac{7}{12}, \frac{5}{17}, \frac{12}{43}$ etc.

Improper fraction : When the numerator is greater than the denominator, then the fraction is called an improper fraction.

Example : $\frac{17}{13}, \frac{18}{14}, \frac{45}{19}$ etc.

Like fraction : Fractions having same denominator are called like fractions.

Example : $\frac{1}{9}, \frac{5}{9}, \frac{7}{9}$ etc.

Unlike fraction : Fractions having different denominators are called unlike fractions.

Example : $\frac{14}{23}, \frac{17}{43}, \frac{53}{19}$ etc.

Compound fraction : It is a fraction of a fraction.

Example : $\frac{1}{3}$ of $\frac{5}{9}, \frac{7}{9}$ of $\frac{61}{53}, \frac{9}{13}$ of $\frac{7}{19}$

Complex fraction : In such a fraction, both the numerator and the denominator are fractions.

Example : $\frac{\frac{12}{13}}{\frac{17}{21}}$, $\frac{\frac{5}{17}+\frac{13}{72}}{\frac{74}{43}+\frac{7}{9}}$

Mixed fraction : Those fractions which consist of a whole number and a proper fraction, are known as mixed fractions.

Example : $5\frac{7}{8}, 7\frac{4}{9}, 12\frac{13}{17}$ etc.

Continued fraction : It contains an additional fraction in the numerator or in the denominator.

Example : $12+\frac{1}{12+\frac{14}{65+\frac{2}{3}}}$

Decimal faction : In such a fraction, the denominator has power of 10.

Example: $0.45 = \frac{45}{100}, 0.7 = \frac{7}{10}, 0.000071 = \frac{71}{1000000}$ etc.

Types of Questions

1. A number when divided by 91 gives a remainder 17. When the same no is divided by 13, the remainder will be

Sol. $\frac{17}{13} = 4$ remainder

2. $(4^{61} + 4^{62} + 4^{63})$ is divisible by:

Sol. $4^{61}(1 + 4 + 4^2) = 4^{61} \times 21$

i.e. 21 is divisible by 3

3. Find the number of zeros in the product of $1 \times 2 \times 3 \times$ ..... $\times 99 \times 100$.

Sol. $\frac{100}{5} = 20$ and $\frac{20}{5} = 4$

i.e. total numbers of zeros = 20 + 4 = 24

4. Find the total number of zeros in the product of $1 \times 2 \times 3 \times$ ..... $\times 250$.

Sol. $\frac{250}{5} = 50$, $\frac{50}{5} = 10$ and $\frac{10}{5} = 2$

i.e. total numbers of zeros = 50 + 10 + 2 = 62

5. Find the total number of zeros in the product of $51 \times 52 \times 53 \times$ ..... $\times 100$.

Sol. $\frac{100}{5} = 20$, $\frac{20}{5} = 4$

and, $\frac{50}{5} = 10$, $\frac{10}{5} = 2$

So, total number of zeros = (20 + 4) – (10 + 2) = 12

6. Find the remainder in the following questions

(i) $\frac{5^{37}}{8}$ (ii) $\frac{2^{75}}{5}$

(iii) $\frac{517^{517}}{2}$ (iv) $\frac{2243^{165}}{5}$

(v) $\frac{7^{129}}{5}$ (vi) $\frac{8^{123}}{9}$

(vii) $\frac{2^{76}}{9}$ (viii) $\frac{19^{20} + 19^{40}}{20}$

(ix) $\frac{4^{75} + 4^{76}}{17}$ (x) $\frac{517^{517}}{5}$

Sol. (i) $\frac{5^{37}}{8} \Rightarrow \frac{\left(5^2\right)^{18} \times 5^1}{8} = \frac{25^{18} \times 5}{8} = \frac{1^{18} \times 5}{8} = 5$

(ii) $\frac{2^{75}}{5} \Rightarrow \frac{\left(2^4\right)^{18} \times 2^3}{5} = \frac{16^{18} \times 8}{5} = \frac{(1)^{18} \times 8}{5} = 3$

(iii) $\frac{517^{517}}{2} \Rightarrow \frac{1^{517}}{2} = 1$

(iv) $\frac{2243^{165}}{5} \Rightarrow \frac{3^{165}}{5} = \frac{\left(3^4\right)^{41} \times 3^1}{5} = 3$

(v) $\frac{7^{129}}{5} \Rightarrow \frac{2^{129}}{5} = \frac{\left(2^4\right)^{32} \times 2}{5} = 2$

(vi) $\frac{8^{123}}{9} \Rightarrow \frac{(-1)^{123}}{9} = 9 - 1 = 8$

(vii) $\frac{2^{76}}{9} \Rightarrow \frac{\left(2^3\right)^{25} \times 2}{9} = \frac{(-1)^{25} \times 2}{9} = \frac{-2}{9} = 7$

(viii) $\frac{19^{20} + 19^{40}}{20} \Rightarrow \frac{(-1)^{20} + (-1)^{40}}{20} = \frac{2}{20} = 2$

(ix) $\frac{4^{75} + 4^{76}}{17} \Rightarrow \frac{\left(4^2\right)^{37} \times 4 + \left(4^2\right)^{38}}{17}$

$= \frac{(-1)^{37} \times 4 + (-1)^{38}}{17} = \frac{-1 \times 4 + 1}{17} = \frac{-3}{17} = 14$

(x) $\frac{517^{517}}{5} \Rightarrow \frac{2^{517}}{5} = \frac{\left(2^4\right)^{129} \times 2^1}{5} = \frac{1^{129} \times 2}{5} = 2$

7. Find the unit digit in the following questions.

(i) $(124)^{372} + (124)^{373}$

(ii) $(4387)^{245} + (621)^{72}$

(iii) $25^{6521} + 36^{528} + 73^{54}$

(iv) $7^{71} \times 6^{63} \times 3^{65}$

(v) $(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35} - 16^4 + 259$

Sol. (i) $(124)^{372} + (124)^{373} = 6 + 4$

$\Rightarrow$ unit digit = 0

(ii) $(4387)^{245} + (621)^{72} = (7)^1 + (1)^{72} = 7 + 1$

= 8 (unit digit).

(iii) $25^{6521} + 36^{528} + 73^{54} = 5 + 6 + (3)^2 = 5 + 6 + 9 = 20$

$\therefore$ unit digit = 0

(iv) $7^{71} \times 6^{63} \times 3^{65}$

$= 7^3 \times 6^3 \times 3^1 = 3 \times 6 \times 3$

= 4 (unit digit)

(v) $(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35} - 16^4 + 259$

$= 1 + 1 - 6 + 5 - 6 + 9 = 16 - 12$

= 4 (unit digit)

Foundation

Questions

1. The sum of all those prime numbers which are less than 31 is
   (a) 119 (b) 129
   (c) 132 (d) 137
2. The sum of all even numbers between 21 and 51 is
   (a) 518 (b) 540
   (c) 560 (d) 596
3. Which of the following is one of the factors of the sum of first 25 natural numbers
   (a) 26 (b) 24
   (c) 13 (d) 12
4. The digit in the unit place of the product $(2464)^{1793} \times (615)^{317} \times (131)^{491}$ is
   (a) 0 (b) 2
   (c) 3 (d) 5
5. The digit in the unit place of $[(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35}]$ is
   (a) 1 (b) 4
   (c) 5 (d) 6
6. Find the remainder value in the following expression
   $\frac{\left(23^2 + 29^2 + 31^2 + 37^2\right)}{24}$
   (a) 13 (b) 17
   (c) 4 (d) 3
7. Find the value of given series
   $1 - 2 + 3 - 4 + 5 - 6 + \ldots\ldots\ldots\ldots + 95 - 96 + 97 - 98$
   (a) 49 (b) 53
   (c) –49 (d) –53
8. Find the total number of zeros in the following series
   $2 \times 4 \times 6 \times \ldots\ldots\ldots\ldots \times 248 \times 250$
   (a) 31 (b) 37
   (c) 39 (d) 43
9. $101 \times 102 \times 103 \times 104$ is a number which is always divisible by the greatest number in the given option.
   (a) 6 (b) 24
   (c) 48 (d) 16
10. Find the number of total prime numbers up to 100
    (a) 27 (b) 23
    (c) 25 (d) 26
11. When two numbers are separately divided by 33, the remainders are 21 and 28 respectively. If the sum of the two numbers is divided by 33, the remainder will be
    (a) 10 (b) 12
    (c) 14 (d) 16
12. In a question of division, the divisor is 7 times the quotient and 3 times the remainder. If remainder is 28, then the dividend is
    (a) 588 (b) 784
    (c) 823 (d) 1036
13. If 17^{200} is divided by 18, the remainder is
    (a) 17 (b) 16
    (c) 1 (d) 2
14. Which of the following numbers is not divisible by 18
    (a) 54036 (b) 50436
    (c) 34056 (d) 65043
15. It is given that $(2^{32} + 1)$ is exactly divisible by a certain number. Which one of the following is also definitely divisible by the same number.
    (a) $2^{96} + 1$ (b) 7×2^{33}
    (c) $2^{16} - 1$ (d) $2^{16} + 1$
16. The least number among $\frac{4}{9}, \sqrt{\frac{9}{49}}, 0.45$ and $(0.8)^2$ is
    (a) $\frac{4}{9}$ (b) $\sqrt{\frac{9}{49}}$
    (c) 0.45 (d) $(0.8)^2$
17. The number 0.121212 ... in the form $\frac{p}{q}$ is equal to
    (a) $\frac{4}{11}$ (b) $\frac{2}{11}$
    (c) $\frac{4}{33}$ (d) $\frac{2}{33}$
18. The least among the fraction $\frac{15}{16}, \frac{19}{20}, \frac{24}{25}, \frac{34}{35}$ is
    (a) $\frac{34}{35}$ (b) $\frac{15}{16}$
    (c) $\frac{19}{20}$ (d) $\frac{24}{25}$
19. If $1^3 + 2^3 + \ldots + 9^3 = 2025$, then the value of $(0.11)^3 + (0.22)^3 + \ldots + (0.99)^3$ is close to
    (a) 0.2695 (b) 2.695
    (c) 3.695 (d) 0.3695
20. Which of the following number is the greatest among all?
    $0.9, 0.\bar{9}, 0.0\bar{9}, 0.\overline{09}$
    (a) 0.9 (b) $0.\bar{9}$
    (c) $0.0\bar{9}$ (d) $0.\overline{09}$

17. The unit digit in the product $7^{71} \times 6^{63} \times 3^{65}$ is:
(a) 1 (b) 2
(c) 3 (d) 4

18. Unit's digit of the number $(22)^{23}$ is:
(a) 4 (b) 6
(c) 8 (d) 2

19. The digit in unit's place of the product $(2153)^{167}$ is:
(a) 1 (b) 3
(c) 7 (d) 9

20. If the sum of the digits of any integer lying between 100 and 1000 is subtracted from the number, the result always is:
(a) divisible by 2 (b) divisible by 9
(c) divisible by 5 (d) divisible by 6

21. In a division, the divisor is 10 times the quotient and 5 times the remainder. If the remainder is 46, then the dividend is:
(a) 4236 (b) 4306
(c) 4336 (d) 5336

22. If a and b are two odd positive integers, by which of the following integers is $(a^4 - b^4)$ always divisible.
(a) 3 (b) 6
(c) 8 (d) 12

23. A number, when divided by 136, leaves remainder 36. If the same number is divided by 17, the remainder will be:
(a) 9 (b) 7
(c) 3 (d) 2

24. A number, when divided by 899, leaves remainder 63. What will be the remainder if the same number is divided by 29 ?
(a) 3 (b) 1
(c) 5 (d) 0

25. The greatest fraction among $\frac{2}{3}, \frac{5}{6}, \frac{11}{15}$ and $\frac{7}{8}$ is:
(a) $\frac{7}{8}$ (b) $\frac{11}{15}$
(c) $\frac{5}{6}$ (d) $\frac{2}{3}$

26. If $(67^{67} + 67)$ is divided by 68. Then, the remainder is
(a) 1 (b) 67
(c) 63 (d) 66

27. $[2^2 + 3^2 + 4^2 + 5^2 + 6^2 + 7^2 + 8^2 + 9^2 + 10^2]$ is equal to
(a) 385 (b) 2916
(c) 540 (d) 384

28. If $1^3 + 2^3 + ... + 10^3 = 3025$. Then, $4 + 32 + 108 + ... + 4000$ is equal to
(a) 12000 (b) 12100
(c) 12200 (d) 12400

29. Which of the following fractions is the smallest?
(a) $\frac{7}{6}$ (b) $\frac{7}{9}$
(c) $\frac{4}{5}$ (d) $\frac{5}{7}$

30. $0.\overline{001}$ is equal to
(a) $\frac{1}{1000}$ (b) $\frac{1}{999}$
(c) $\frac{1}{99}$ (d) $\frac{1}{9}$

Difficult

1. The sum of the squares of three consecutive natural numbers is 2030. Then, what is the middle number?
(a) 25 (b) 26
(c) 27 (d) 28

2. In a division, the divisor is 10 times the quotient and 5 times the remainder. If the remainder is 40, then the dividend is
(a) 240 (b) 440
(c) 4040 (d) 4000

3. If m and n are positive integers and $(m - n)$ is an even number, then $(m^2 - n^2)$ will be always divisible by
(a) 4 (b) 6
(c) 8 (d) 12

4. Both the ends of a 99 digits number N are 2. N is divisible by 11, then all the middle digits are
(a) 1 (b) 2
(c) 3 (d) 4

5. The last 5 digits of the following expression will be
$(1!)^5 + (2!)^4 + (3!)^3 + (4!)^2 + (5!)^1 + (10!)^5$
$+ (100!)^4 + (1000!)^3 + (10000!)^2 + (100000!)$
(a) 45939 (b) 00929
(c) 20929 (d) can't be determined

6. What fraction of $\frac{4}{7}$ must be added to itself to make the sum $1\frac{1}{14}$?
(a) $\frac{7}{8}$ (b) $\frac{1}{2}$
(c) $\frac{4}{7}$ (d) $\frac{15}{14}$

7. Find the sum of the first five terms of the following series $\frac{1}{1\times4} + \frac{1}{4\times7} + \frac{1}{7\times10} + ... + \frac{1}{13\times16}$

(a) $\frac{9}{32}$ (b) $\frac{7}{16}$

(c) $\frac{5}{16}$ (d) $\frac{1}{210}$

8. The sum $(5^3 + 6^3 + ... + 10^3)$ is equal to
(a) 2295 (b) 2425
(c) 2495 (d) 2925

9. If $(10^{12} + 25)^2 - (10^{12} - 25)^2 = 10^n$, then the value of n is
(a) 20 (b) 14
(c) 10 (d) 5

10. The value of

$$\frac{3}{1^2 \cdot 2^2} + \frac{5}{2^2 \cdot 3^2} + \frac{7}{3^2 \cdot 4^2} + \frac{9}{4^2 \cdot 5^2} + \frac{11}{5^2 \cdot 6^2} + \frac{13}{6^2 \cdot 7^2}$$

$$+ \frac{15}{7^2 \cdot 8^2} + \frac{17}{8^2 \cdot 9^2} + \frac{19}{9^2 \cdot 10^2} \text{ is}$$

(a) $\frac{1}{100}$ (b) $\frac{99}{100}$

(c) $\frac{101}{100}$ (d) 1

11. $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + ... + \frac{1}{\sqrt{99}+\sqrt{100}}$ is equal to
(a) 1 (b) 5
(c) 9 (d) 10

12. When simplified, the sum

$\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + ... + \frac{1}{n(n+1)}$ is equal to

(a) $\frac{1}{n}$ (b) $\frac{1}{n+1}$

(c) $\frac{2(n-1)}{n}$ (d) $\frac{n}{n+1}$

13. If $1^2 + 2^2 + 3^2 + ... + x^2 = \frac{x(x+1)(2x+1)}{6}$, then $1^2 + 3^2 + 5^2 + ... + 19^2$ is equal to
(a) 1330 (b) 2100
(c) 2485 (d) 2500

14. $(1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + ... + 9^2 - 10^2)$ is equal to
(a) –55 (b) 55
(c) –56 (d) 56

15. The sum of the first 20 terms of the series

$$\frac{1}{5 \times 6} + \frac{1}{6 \times 7} + \frac{1}{7 \times 8} + ... \text{ is}$$

(a) 0.16 (b) 1.6
(c) 16 (d) 0.016

16. A divisor is 25 times the quotient and 5 times the remainder. The quotient is 16, the dividend is
(a) 6400 (b) 6480
(c) 400 (d) 480

17. Given that $3.718 = \frac{1}{0.2689}$. Then, $\frac{1}{0.0003718}$ is equal to
(a) 2689 (b) 2.689
(c) 26890 (d) 0.2689

18. Largest four digit number which when divided by 15 leaves a remainder of 12 and if the same number is divided by 8 it leaves the remainder 5. Such greatest possible number is:
(a) 9963 (b) 9957
(c) 9945 (d) 9999

19. Number of zeros at the end of the following expression $(5!)^{5!} + (10!)^{10!} + (50!)^{50!} + (100!)^{100!}$ is:
(a) 165 (b) 120
(c) 125 (d) None of these

20. A fraction in its lowest form is such that when it is squared and then its numerator is reduced by $\frac{1}{3}$rd and denominator is reduced to $\frac{1}{5}$th, it results as twice of the original fraction. Then the sum of numerator and denominator can be:
(a) 7 (b) 8
(c) 9 (d) 17

21. The value of the expression

$7777 + 7777 \times 7777 \times (5 \div 77) \times (11 \div 35)$:
(a) 1234321 (b) 12344321
(c) 7^{7777} (d) None of these

22. Find the last digit of $32^{32^{32}}$.
(a) 6 (b) 8
(c) 10 (d) 4

23. Find the last digit of $222^{888} + 888^{222}$.
(a) 8 (b) 4
(c) 0 (d) 6

24. Find the unit digit of 111! (fractorial 111).
(a) 0 (b) 2
(c) 3 (d) 4

25. Which is not the factor of $4^{6n} - 6^{4n}$ for any positive integer n?
(a) 5 (b) 25
(c) 7 (d) None of these

26. $19^n - 1$ is:
(a) always divisible by 9
(b) always divisible by 20
(c) is never divisible by 19
(d) only (a) and (c) are true

27. Find the remainder when $10^1 + 10^2 + 10^3 + 10^4 + 10^5 + ... + 10^{99}$ is divided by 6.
(a) 0 (b) 4
(c) 2 (d) 6

28. A number when divided by 5 gives a number which is 8 more than the remainder obtained on dividing the same number by 34. Such a least possible number is:
(a) 175 (b) 75
(c) 680 (d) does not exist

29. Total number of factors of a number is 24 and the sum of its 3 prime factors out of four, is 25. The product of all 4 prime factors of this number is 1365. Then such a greatest possible number can be :
(a) 17745 (b) 28561
(c) 4095 (d) can't be determined

30. How many numbers are there in the set S = {200, 201, 202, ..., 800} which are divisible by neither 5 nor 7?
(a) 411 (b) 412
(c) 410 (d) None of these

Previous Year Questions

1. I multiplied a natural number by 18 and another by 21 and added the products. Which one of the following could be the sum?
(a) 2007 (b) 2008
(c) 2006 (d) 2002

2. Out of six consecutive natural numbers, if the sum of first three is 27, what is the sum of the other three?
(a) 36 (b) 35
(c) 25 (d) 24

3. Which one of the following is a factor of the sum of first 25 natural numbers?
(a) 26 (b) 24
(c) 13 (d) 12

4. The sum of all the natural numbers from 51 to 100 is
(a) 5050 (b) 4275
(c) 4025 (d) 3775

5. The unit digit in the sum of $(124)^{376} + (124)^{375}$ is
(a) 5 (b) 4
(c) 2 (d) 0

6. The unit digit of the expression $25^{6527} + 36^{526} + 73^{54}$ is
(a) 6 (b) 5
(c) 4 (d) 0

7. The digit in the unit place of $[(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35} - 16^4 + 259]$ is
(a) 1 (b) 4
(c) 5 (d) 6

8. If n is even, $(6^n - 1)$ is divisible by
(a) 37 (b) 35
(c) 30 (d) 6

9. 'a' divides 228 leaving a remainder 18. The biggest two digit value of 'a' is
(a) 21 (b) 35
(c) 30 (d) 70

10. $2^{16} - 1$ is divisible by
(a) 11 (b) 13
(c) 17 (d) 19

11. A certain number when divided by 175 leaves a remainder 132. When the same number is divided by 25, the remainder is
(a) 6 (b) 7
(c) 8 (d) 9

12. $(4^{61} + 4^{62} + 4^{63})$ is divisible by
(a) 3 (b) 11
(c) 13 (d) 17

13. The digit in the unit place of the product $(2464)^{1793} \times (615)^{317} \times (131)^{491}$ is
(a) 0 (b) 2
(c) 3 (d) 5

14. $(2^{71} + 2^{72} + 2^{73} + 2^{74})$ is divisible by
(a) 9 (b) 10
(c) 11 (d) 13

15. In a division problem, the divisor is 4 times the quotient and 3 times the remainder. If remainder is 4, the dividend is
(a) 36 (b) 40
(c) 12 (d) 30

16. If a number is divisible by both 11 and 13, then it must be necessarily
(a) divisible by (11 + 13)
(b) divisible by (13 – 11)
(c) divisible by (11 × 13)
(d) 429

17. A common factor of $(13^7 + 11^7)$ and $(13^5 + 11^5)$ is
(a) 24 (b) $13^5 + 11^5$
(c) $13^2 + 11^2$ (d) None of these

18. Sum of three consecutive even integers is 54. Find the least among them.

(a) 18 (b) 15
(c) 14 (d) 16

19. The unit digit in the product $(122)^{173}$ is
(a) 2 (b) 4
(c) 6 (d) 8

20. What least number of 5 digits is divisible by 41?
(a) 10045 (b) 10004
(c) 10041 (d) 41000

21. A number divided by 13 leaves a remainder 1 and if the quotient, is divided by 5, we get a remainder of 3. What will be the remainder if the number is divided by 65?
(a) 28 (b) 16
(c) 18 (d) 40

22. If p,q,r are in Geometric Progression, then which is true among the following?
(a) $q = \frac{p+r}{2}$ (b) $p^2 = qr$
(c) $q = \sqrt{pr}$ (d) $\frac{p}{r} = \frac{r}{q}$

23. If $1 + 10 + 10^2 + ...$ upto n terms $= \frac{10^n - 1}{9}$, then the sum of the series $4 + 44 + 444 + ...$ upto n terms is
(a) $\frac{4}{9}(10^n - 1) - \frac{4n}{9}$ (b) $\frac{4}{81}(10^n - 1) - \frac{4n}{9}$
(c) $\frac{40}{81}(10^n - 1) - \frac{4n}{9}$ (d) $\frac{40}{9}(10^n - 1) - \frac{4n}{9}$

24. The decimal fraction of $2.\overline{349}$ is equal to
(a) $\frac{2326}{999}$ (b) $\frac{2326}{990}$
(c) $\frac{2347}{999}$ (d) $\frac{2347}{990}$

25. $(5^2 + 6^2 + 7^2 + ... + 10^2)$ is equal to
(a) 330 (b) 345
(c) 355 (d) 360

26. Two numbers are in the ratio 1 : 2 when 4 is added to each, the ratio becomes 2 : 3. Then, the numbers are
(a) 9 and 12 (b) 6 and 8
(c) 4 and 8 (d) 6 and 9

27. $[1^3 + 2^3 + 3^3 + ... + 9^3 + 10^3]$ is equal to
(a) 3575 (b) 2525
(c) 5075 (d) 3025

28. A number, when divided by 899, leaves remainder 63. What will be the remainder if the same number is divided by 29?
(a) 3 (b) 1
(c) 5 (d) 0

29. When 25^{25} is divided by 26, the remainder is
(a) 1 (b) 2
(c) 24 (d) 25

30. A number when divided by the sum of 555 and 445 gives two times their difference as quotient and 30 as the remainder. The number is
(a) 220030 (b) 22030
(c) 1220 (d) 1250

Foundation

Solutions

1. (b); The prime numbers Less than 31 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29
$\therefore$ required sum = 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 = 129

2. (b); Total even numbers from 1 to 50 = 25
Total even numbers from 1 to 20 = 10
Sum of even numbers = n(n + 1)
Required sum = sum of even numbers from 1 to 50 – sum of even numbers from 1 to 20
= 25(25 + 1) – 10(10 + 1)
= 25 × 26 – 10 × 11 = 540

3. (c); sum of first n natural numbers $= \frac{n(n+1)}{2}$
$\therefore$ sum of 1st 25 natural numbers
$= \frac{25 \times (25+1)}{2} = 25 \times 13$
i.e. 13 is one of the factor

4. (a); $(4)^{1793/4} \times 5 \times 1$
$4 \times 5 \times 1 = 20$ So, unit digit is 0.

5. (a); 1 + 1 – 6 + 5 = 1

6. (c); If square of any prime number is divided by 24 then remainder is always 1.
so, $\frac{(1+1+1+1)}{24} = \frac{4}{24}$ i.e 4 is unit digit.

7. (c); (1 + 3 + 5 + ... + 97) – (2 + 4 + 6 + ... + 98)
$n_1 = \frac{97+1}{2} = 49$, $n_2 = \frac{98}{2} = 49$
sum = $n_1^2 - n_2 (n_2 + 1) = 49^2 - 49 \times 50 = -49$

8. (a); $\frac{250}{2}=125$, $\frac{125}{5}=25$, $\frac{25}{5}=5$, $\frac{5}{5}=1$

i.e. required numbers of zero = 25 + 5 + 1 = 31

9. (b); 24

10. (c); 25

11. (d); Required remainder = $\frac{(21+28)}{33}=16$

12. (d); Let quotient = x

divisor = 7x also divisor = 3 × (remainder)

= 3 × 28 = 84

7x = 84, x = 12

Dividend = Divisor × Quotient + Remainder

= 84 × 12 + 28 = 1036

13. (c); Since it is form of $\frac{a^n}{a+1}$

i.e. $\frac{17^{200}}{17+1}$

∴ Remainder = 1, Since n is even positive integer

14. (d); A number is exactly divisible by 18 if it is divisible by 2 and 9 both.

since, 65043 is not divisible by 2, so it is not divisible by 18.

15. (a); by checking option

$2^{96}+1=(2^{32})^3+1^3=(2^{32}+1)(2^{64}-2^{32}+1)$

16. (b); Decimal equivalent of fractions

$\frac{4}{9}=0.44;\ \sqrt{\frac{9}{49}}=\frac{3}{7}=0.43$

$(0.8)^2=0.64$

∴ Least number = 0.43 = $\sqrt{\frac{9}{49}}$

17. (c); Expression = 0.121212 ...

$=0.\overline{12}=\frac{12}{99}=\frac{4}{33}$

[Since, 12 is repeating after decimal]

18. (b); Decimal equivalent of fractions

$\frac{15}{16}=0.94,\ \frac{19}{20}=0.95,\ \frac{24}{25}=0.96,\ \frac{34}{35}=0.97$

∴ Least fraction = $\frac{15}{16}$

19. (b); Given, $1^3+2^3+...9^3=2025$

Then, $(0.11)^3+(0.22)^3+...+(0.99)^3$

$=\left(\frac{11}{100}\right)^3+\left(\frac{22}{100}\right)^3+...+\left(\frac{99}{100}\right)^3$

$=\left(\frac{11}{100}\right)^3\left(1^3+2^3+...+9^3\right)$

$=\frac{1331}{1000000}\times 2025$

[∵ $1^3+2^3+...+9^3=2025$]

$=\frac{2695275}{1000000}=2.695275\approx 2.695$

20. (b); Decimal equivalent of fractions

$0.9=\frac{9}{10},\ 0.\bar{9}=\frac{9}{9}=1,\ 0.0\bar{9}=\frac{9}{90}=\frac{1}{10}$

and $0.\overline{09}=\frac{9}{99}=\frac{1}{11}$

∴ $0.\bar{9}$ is greatest.

21. (b); Natural numbers between 3 and 200

= 200 – 3 = 197

Now divide 197 by 7

$$\begin{array}{r} 28 \\ 7\overline{)197} \\ \underline{14} \\ 57 \\ \underline{56} \\ 1 \end{array}$$

So 28 natural numbers are there

22. (d); Let the consecutive odd no. are x, x + 2, x + 4

x + x + 2 + x + 4 = 87

3x + 6 = 87

x = $\frac{81}{3}=27$

so, smallest number is 27.

23. (b); 7^{105}

Cyclicity of 7 is 4.

So $\frac{105}{4}$ = Remainder is 1.

7^1 = Unit digit

24. (c); $5^{71}+5^{72}+5^{73}$

$5^{71}(1+5+5^2)$

$5^{71}\times 31$

$5^{70}\times 155$

so 155 divides the expression completly

25. (a); We know that $2^1=2$, $2^2=4$, $2^3=8$, $2^4=16$

Remainder $=\frac{33}{4}=1$.

Unit's digit in 2^{33} = unit digit in 2^1

Hence units digit = 2

Remainder on division by 10 = 2.

Moderate

1. (c); $\frac{2}{3} \times \frac{3}{5}$ $10 > 9$ Taking greater of these two fractions and the next one; $\frac{2}{3} \times \frac{8}{11}$ $22 < 24$ Taking greater of these two fractions and the next one; $\frac{8}{11} \times \frac{7}{9}$ $72 < 77$ Taking greater of these two fractions and the next one; $\frac{7}{9} \times \frac{11}{17}$ $119 > 99$ $\frac{7}{9}$ is the largest

2. (d); $\frac{7}{12} \times \frac{13}{24}$ $\quad \frac{13}{24} \times \frac{9}{17}$

$168 > 156 \qquad 221 > 216$

$\frac{7}{12} > \frac{13}{24}$ and $\frac{13}{24} > \frac{9}{17}$

Hence descending order = $\frac{7}{12} > \frac{13}{24} > \frac{9}{17}$

3. (a); $1\frac{1}{2} + 11\frac{1}{2} + 111\frac{1}{2} + 1111\frac{1}{2} + 11111\frac{1}{2}$

$= [1 + 11 + 111 + 1111 + 11111] + \left[\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}\right]$

$= 12345 + 2\frac{1}{2} = 12347\frac{1}{2}$

4. (c); $3\frac{1}{3} + 33\frac{1}{3} + 333\frac{1}{3} + 3333\frac{1}{3} + 33333\frac{1}{3}$

$= [3 + 33 + 333 + 3333 + 33333] + \left[\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}\right]$

$= 37035 + 1\frac{2}{3} = 37036\frac{2}{3}$

5. (b); $\frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42} + \frac{1}{56} + \frac{1}{72}$

$= \frac{1}{2\times3} + \frac{1}{3\times4} + \ldots\ldots + \frac{1}{8\times9}$

$= \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \ldots\ldots + \frac{1}{8} - \frac{1}{9}$

$= \frac{1}{1}\left[\frac{1}{2} - \frac{1}{9}\right] = \frac{7}{18}$

6. (b); $\frac{1}{5.9} + \frac{1}{9.13} + \frac{1}{13.17} + \ldots\ldots\ldots \frac{1}{61.65} = ?$

Using formula:

$$\frac{+1}{\text{Difference of denominator value}}\left[\frac{1}{\text{First value}} - \frac{1}{\text{Last value}}\right]$$

$= \frac{1}{4}\left[\frac{1}{5} - \frac{1}{65}\right] = \frac{1}{4}\left[\frac{13-1}{65}\right] = \frac{1}{4}\left[\frac{12}{65}\right] = \frac{3}{65}$

7. (c); $x = \cfrac{3}{2 + \cfrac{2}{2 + \cfrac{2}{2 + \frac{2}{3}}}} = \frac{8}{3}$

$= \cfrac{3}{2 + \cfrac{2}{2 + \frac{8}{3}}} = 2 + \frac{2}{1} \times \frac{3}{8} = 2 + \frac{3}{4} = \frac{11}{4}$

$= \cfrac{3}{2 + \frac{2}{\frac{11}{4}}} = \cfrac{3}{2 + \frac{2}{1} \times \frac{4}{11}}$

$= \cfrac{3}{2 + \frac{2}{1} \times \frac{4}{11}} = 2 + \frac{8}{11} = \frac{30}{11}$

$= \frac{3}{\frac{30}{11}} = \frac{3}{1} \times \frac{11}{30} = \frac{11}{10} = 1.1$

8. (a); $x + \cfrac{1}{2 + \cfrac{1}{3 + \cfrac{1}{4 + \frac{1}{5}}}} = 12$

$12 = x + \cfrac{1}{2 + \cfrac{1}{3 + \frac{1}{\frac{21}{5}}}} = x + \cfrac{1}{2 + \cfrac{1}{3 + \frac{5}{21}}}$

Chapter 14

Data Interpretation

What is data interpretation: When data is organized into tables and charts it is done with the purpose of making it meaningful. The objective of data interpretation is to assess whether a student can understand bars and charts and Answer some questions based on them. This act of organizing and interpreting data to get meaningful information under a given set of conditions is Data interpretataion.

About data interpretation: This is the calculation intensive portion, it consists of a myrid of graph. charts and tables and analyze data. The key to crack this area is to quickly Identify the key pieces of information that you will require to work on.

Basic key that will help you to solve this topic:

- Calculation
  - Square
  - cube
  - table
  - BODMAS

  (15 –20 days calculation)
- Percentage
- Profit and loss
- Ratio and proportion
- Average

Types of Data Interpretation:

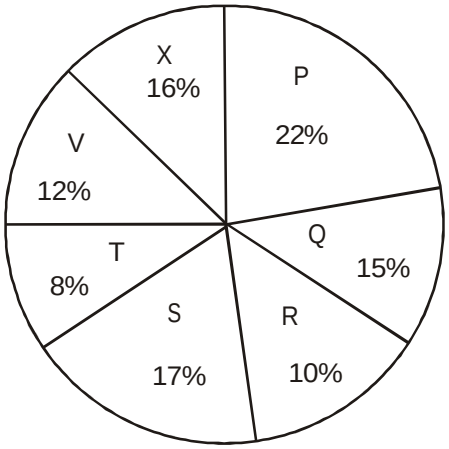
- Data table
- Line graph
- Pie charts
- Bar graph
- Mixed graph
  - Line with pie chart
  - Table with Bar
  - Table with Line, etc.
- Radar graph
- Triangular graph
- Case study (Puzzle)
  - Venn Diagram
  - Table format

Approach for data interpretation:

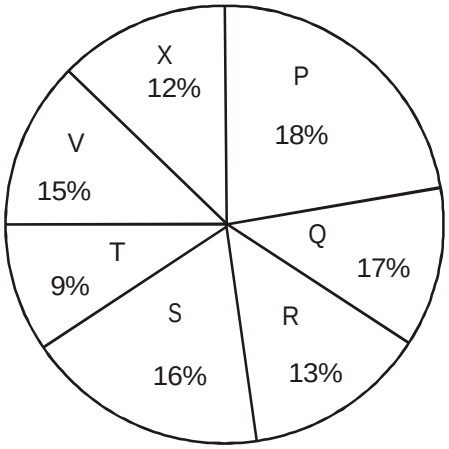
- First you look carefully at the table or graph and the direction. Note the years to which, the data refers to and the units. Sometimes the figures may be given in thousands. While the Answer may be millions Resulting in mistakes.
- The level of approximation that can be done is assessed from the choices. If the answer is wide, time should not be wasted in working out exact figures. If the choice 'none of the above exists, a close approximation may be required'.
- Read the question carefully, it will give an indication as to which row and column should be seen. A carefull reading of the question will reveal exactly what is to be done and the units in which the answer is required.
- There may be one or two very large question requiring calculations. Attempt these at the last.
- Revise bar charts, table and line graphs before attempting D.I. question remember that the D.I. section is a scoring one and also time saving.

Pie Charts or Circle Graphs:

Distribution of candidate who were enrolled in MBA and the candidate (out of those enrolled) who passed the exam in different institutes



Total number of candidates enrolled = 8550



Total number of candidates who passed the exam = 5700

1. What percentage of candidates passed the exam from institute T out of the total no. of candidate enrollled from the same institute?
   (a) 50% (b) 52.5% (c) 75% (d) 80%
2. Which institute has the highest % of candidates passed to the candidates enrolled?
   (a) Q (b) R (c) V (d) T
3. The no. of candidates passed from institute S and P together exceeds the no. of candidates enrolled from institutes T and R together by?
   (a) 228 (b) 279 (c) 399 (d) 407
4. What is % of candidates passed to the candidate enrolled for institutes Q and R together ?
   (a) 68% (b) 80% (c) 74% (d) 65%
5. What is the ratio of candidates passed to the candidates enrolled from institute P ?
   (a) 9 : 11 (b) 14 : 17 (c) 6 : 11 (d) 9 : 17

Solution 1: Required % = $\frac{9\%\text{ of }5700}{8\%\text{ of }8550}\times 100 = 75\%$

Solution 2: The % of candidates passed to candidates enrolled can be determined for each institute as under.

For Q $\Rightarrow \frac{17\%\text{ of }5700}{15\%\text{ of }8550}\times 100 = 75.56\%$; For R $\Rightarrow \frac{13\%\text{ of }5700}{10\%\text{ of }8550}\times 100 = 86.67\%$

For T $\Rightarrow \frac{9\%\text{ of }5700}{8\%\text{ of }8550}\times 100 = 75\%$; For V $\Rightarrow \frac{15\%\text{ of }5700}{12\%\text{ of }8550}\times 100 = 83.33\%$

So the highest of these is 86.67% corresponding to institutes R.

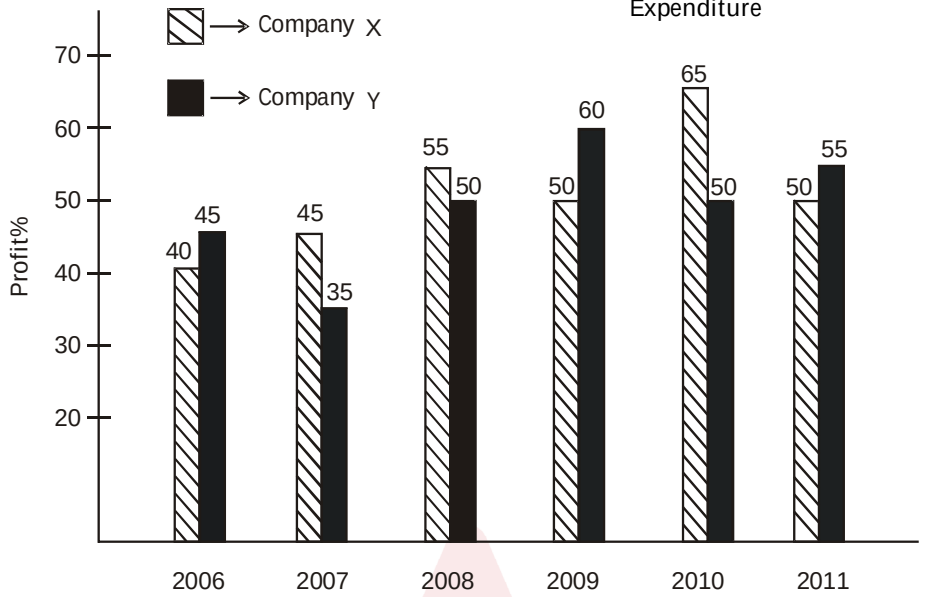
Solution 3: Required Difference = [(16% + 18%) of 5700] – [(8% + 10%) of 8550] = 1938 – 1539 = 399

Solution 4: $\frac{30\%\text{ of }5700}{25\%\text{ of }8550}\times 100 = 80\%$

Solution 5: $\frac{18\%\text{ of }5700}{22\%\text{ of }8550} = \frac{6}{11} = 6 : 11$

Bar Graph: Percentage profit earned by two companies X & Y over the given years.

$$\text{Profit\%} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



1. The income of two company X and Y in 2010 were in the rato of 3 : 4. respectively. What is the respective ratio of their expenditures in 2010?
   (a) 7 : 22 (b) 14 : 19 (c) 15 : 22 (d) 27 : 35
2. If the expenditure of company Y in 2007 was Rs 220 crore, what was its income in 2007?
   (a) Rs. 312 crore (b) Rs. 297 crore (c) Rs. 283 crore (d) Rs. 275 crore
3. If the expenditures of company X and Y in 2006 were equal and the total income of the two companies in 2006 was Rs 342 crore, what was the total profit of the two company together in 2006?
   (a) Rs. 240 crore (b) Rs. 171 crore (c) Rs. 120 crore (d) Rs. 102 crore
4. The expanditure of company X in the year 2008 was Rs 200 crore and the income of company X in 2008 was the same as its expenditure in 2011. The income of company X in 2011 was?
   (a) Rs. 465 crore (b) Rs. 385 crore (c) Rs. 335 crore (d) Rs. 295 crore
5. If the income of two company were equal in 2009, then what was the ratio of expenditure of company X to that of company Y in 2009?
   (a) 6 : 5 (b) 5 : 6 (c) 11 : 6 (d) 16 : 15

Solution 1: $\frac{165\%\text{ of } E_1}{150\%\text{ of } E_2} = \frac{3}{4} \Rightarrow$ Therefore, $\frac{E_1}{E_2} = \frac{15}{22} = 15 : 22$

Solution 2: 220 + 35% of 220 $\Rightarrow$ 220 + 77 = 297 crore

Solution 3: Let the expenditure of each companies x and y in 2006 be 100

Then we have 100 + 40 + 100 + 45 = 342 crore $\Rightarrow$ Required profit = $\frac{342}{285} \times 85 = 102$ crore

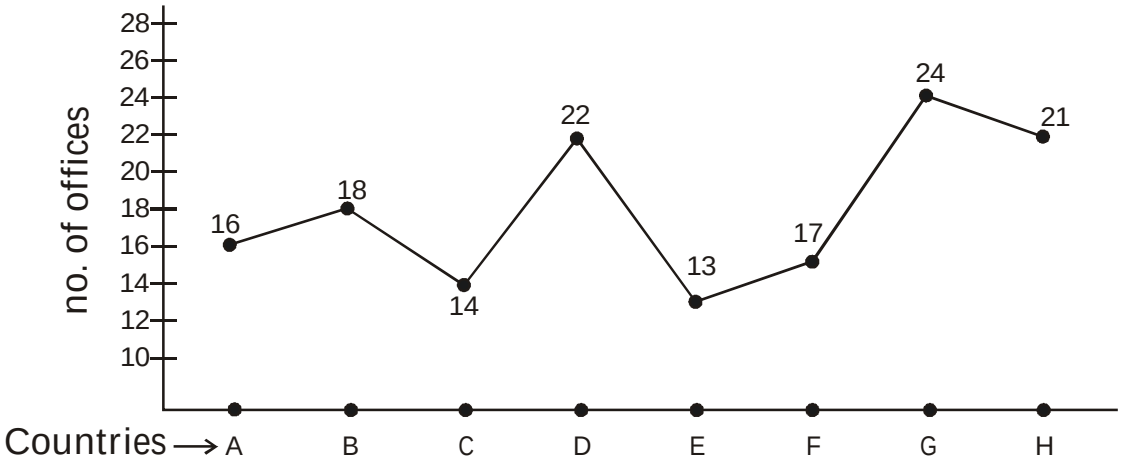
Solution 4: Expenditure of Company X in year 2008 is 200 crore, Then income of company X in year 2008
= 200 + 55% of 200 = 310 crore
Hence, the expenditure of company X in year 2011 is 310 crore,
Therefore, the required income of X in year 2011 = 310 + 50% of 310 = 465 crore

Solution 5: $\frac{150}{100}X = \frac{160}{100}Y$

be the incomes of two companies in 2009; $\frac{x}{y} = \frac{160}{150} = \frac{16}{15} = 16 : 15$

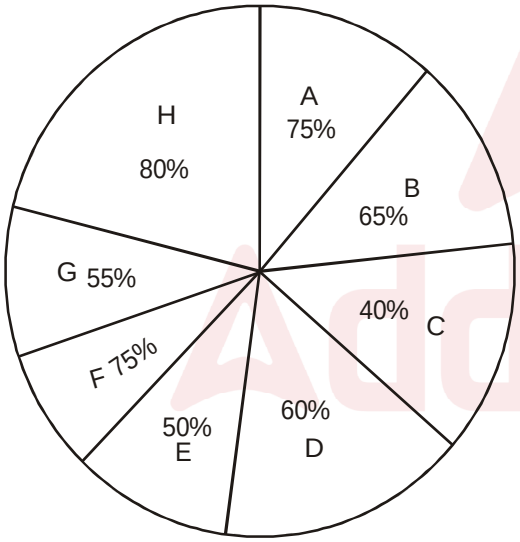
Mixed Graph:

Data Related to human resource of a multinational company (x) which has 145 offices across 8 – countries



Percentage distribution of post-graduate employees across – 8 – countries

Number of employees and respective Ratio male to female across - 8 countries



Countries	Total no. of Employees	Respective ratio of Male and Female emp.
A	2568	5 : 7
B	2880	11 : 5
C	2310	10 : 11
D	3575	3 : 2
E	2054	7 : 6
F	2788	20 : 21
G	3720	8 : 7
H	3360	9 : 5

1. If the number of male post – graduate, employees in country H is 1800 what percent of female employees in that particular country is post graduate?
   (a) 76 (b) 74 (c) 72 (d) 64
2. In which of the given countries is percentage of woman employees to number of employees (both male and female) in that country the second Lowest?
   (a) G (b) B (c) E (d) H
3. What is the respective ratio between total number of male employees in countries B and H together and total number of female employees. in countries C and D together?
   (a) 63 : 52 (b) 51 : 38 (c) 77 : 64 (d) 69 : 44
4. What is the difference between average number of post graduate employees in countries A, B and D together and Average number of Post-graduate employees in countries F, G, and H together?
   (a) 282 (b) 276 (c) 294 (d) 342
5. Which of the given countries has the highest number of average employees per offices?
   (a) F (b) H (c) B (d) C

1. What is the difference between the total number of televisions and mobile phones together and the number of calculators produced?
   (a) 534 (b) 524 (c) 514 (d) 523
2. Number of televisions produced is approximately what % of the total number of calculators and washing machines produced together?
   (a) 63% (b) 55% (c) 59% (d) 51%
3. What is the total number of pen drives, calculator and washing machines produced by the company?
   (a) 907 (b) 917 (c) 925 (d) 905

Solution: Total no. of products = 1650 $\Rightarrow$ Number of mobile phone = 24% of 1650 = 396

Number of pen drive $= \frac{1}{6}$th of 1650 = 275, Number of calculators = 14% of 1650 = 231

Remaining number of products = 1650 – (396 + 275 + 231) = 748

These remaining products i.e, 748 products are either televisions or washing machines.

Let the number of washing machine and televisions be x and y respectively then,

$x + y = 748$; $x - y = 50 \Rightarrow x = 399$, $y = 349$

Now,

Products	Number of products
Mobile phones	396
Pen drives	275
Calculators	231
Washing Machines	399
Televisions	349

Solution 1: Total no. of television & mobile phones together = 396 + 349 = 745
And No. of calculators = 231, Required difference = 745 – 231 = 514

Solution 2: No. of televisions = 349 $\Rightarrow$ Required% $= \frac{349}{630} \times 100\% \Rightarrow 55\%$

Solution 3: Total no. of pen drives, Calculators & Washing Machines = 275 + 231 + 399 $\Rightarrow$ 905

Foundation

Question

Directions (1 – 5): Study the following questions and choose the correct answer.

State wise production of different crops for the year 1993-94 (in million tonnes)

State	Rice	Wheat	Pulses
U.P.	7.18	15.97	2.76
W.B.	8.09	0.81	0.35
M.P.	3.67	3.72	2.32
Maharashtra	1.94	0.86	1.11
Haryana	1.36	4.42	0.36
All India	58.64	44.23	12.2

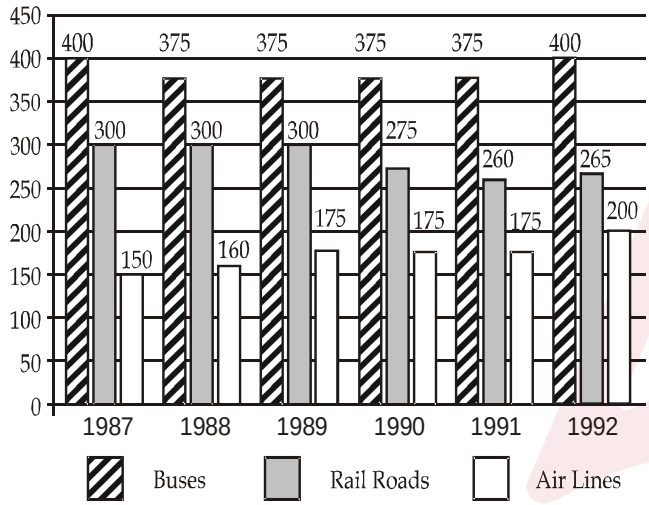
1. W.B. produces approximately what percent of the total rice produced in India?
   (a) 12.2% (b) 13.5%
   (c) 18% (d) 15%
2. The amount of wheat produced by U.P. is more than the amount of wheat produced by the other four states listed in the table, by
   (a) 6.97 m tonnes (b) 6.16 m tonnes
   (c) 5.52 m tonnes (d) 5.89 m tonnes
3. What percentage of the total wheat production was produced by states other than those who are not given in the table?
   (a) 38% (b) 42%
   (c) 48% (d) 58%
4. U.P. produced approximately what percent of the all India production of all the three crops take together?

(a) 27.75% (b) 26.2%
(c) 24.18% (d) 22.52%

5. Which of the following statements is true?
(a) U.P. was the top producer of all the three crops.
(b) M.P. ranked third in the production of all three crops.
(c) Maharashtra was the lowest producer of rice.
(d) Haryana was the lowest producer of wheat.

Directions (6 – 10): Study the following graph carefully and answer the questions that follow.

Passengers travelling by Various Modes from 1987 to 1992 (In Millions)



6. In 1989, bus passengers represented approximately what percentage of all passengers by buses, railroads, and airlines in that year?
(a) 35% (b) 45%
(c) 55% (d) 65%

7. From 1987 to 1992 (both inclusive), how many millions of passengers approximately travelled by railroad?
(a) 1000 (b) 1300
(c) 1500 (d) 1700

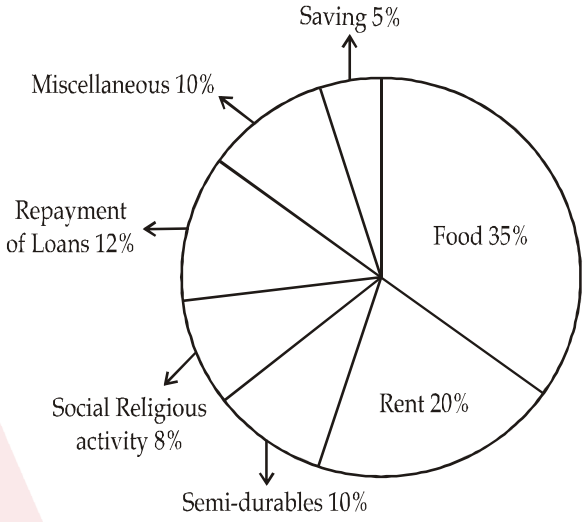
8. If in 1992 the average bus fare per passenger was $ 0.50 and if the average Airline fare per passenger was $ 50. What is the ratio between total fares of Airline passengers to total fare of bus passengers?
(a) $\frac{6}{5}$ (b) $\frac{30}{1}$
(c) $\frac{60}{1}$ (d) $\frac{50}{1}$

9. In 1991, if 25 Airline companies was there then what was the average number of passenger was serviced by each Airline companies?
(a) 6 million (b) 4 million
(c) 7 million (d) 8 million

10. The number of railroad passengers in 1992 when compared to the number of railroad passengers in 1987 were less by?
(a) 35 (b) 40
(c) 70 (d) 90

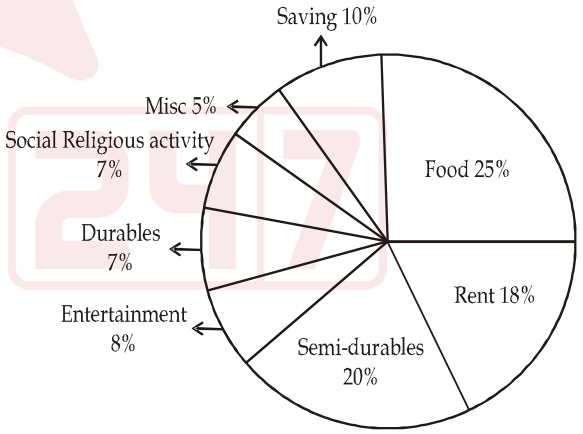
Directions (11 – 15): These questions are based on following pie graph.

Spending Pattern of an Average Worker



spending patterns of hard worker 100% = Rs. 3500

Spending Pattern of Mr. Hardworker



11. For the categories which are common for both, for which category does Mr. Hard Worker spend more than the average worker?
(a) Rent (b) Durables
(c) Semi-durables (d) Entertainment

12. How much does Mr. Hard worker spends on categories which are not included in the spending pattern of an average worker?
(a) Rs. 100 (b) Rs. 225
(c) 525 (d) Rs. 450

13. The additional saving of 5% of Mr. Hard worker come from his savings under?
(a) Food (b) Repayment of loans
(c) Misc. (d) Data inadequate

31. How much marks did Aditya get in all the subjects together?
(a) 508 (b) 477
(c) 454 (d) 537

32. What is the average marks obtained by all students together in Marathi?
(a) 72 (b) 48
(c) 28 (d) 36

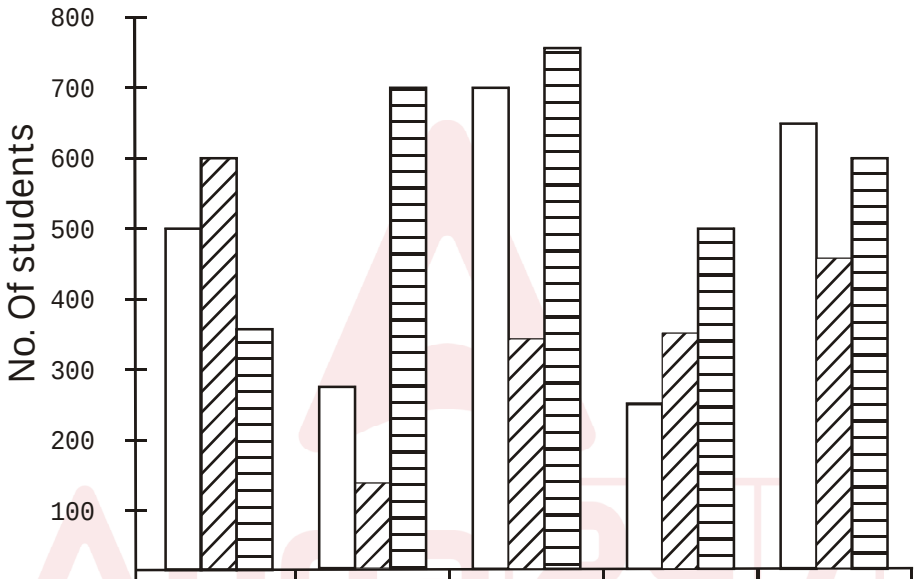
33. How many students have scored the highest marks in more than one subject?
(a) None (b) one
(c) two (d) three

34. What is Sanjay's overall percentage of marks in all subjects together?
(a) 85.92 (b) 72.64
(c) 81.44 (d) 76.32

35. Who has scored the highest marks in all the subjects together?
(a) Aditya (b) Ram
(c) Mahesh (d) Anil

Directions (36 – 40): Study the following graph carefully to answer the question that follow:

Number of Students Studying Different Subject in a College Over the Years



	2006	2007	2008	2009	2010
History	500	250	700	250	650
Geography	600	150	350	350	450
Math	350	700	750	500	600

36. What will be the ratio of student studying History in 2007, 2009 and 2006 together to those who study Math in 2007 and 2010 together?
(a) 5 : 6 (b) 10 : 13
(c) 13 : 10 (d) 6 : 5

37. What will be ratio of No. of students studying History, Geography and math all the year together?
(a) 46 : 38 : 59 (b) 47 : 37 : 57
(c) 48 : 38 : 57 (d) 47 : 38 : 58

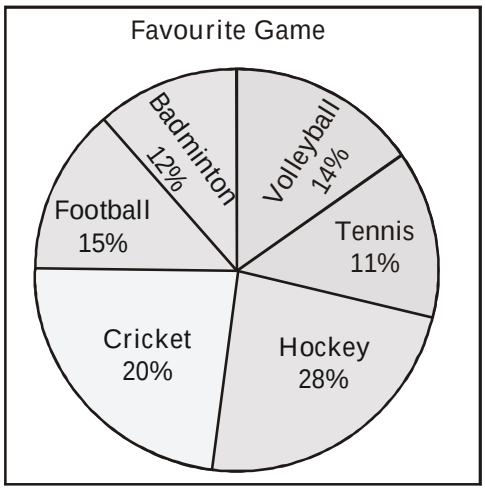
38. What will be difference between total number of student of Math & History all the year together except 2007?
(a) 200 (b) 150
(c) 100 (d) 125

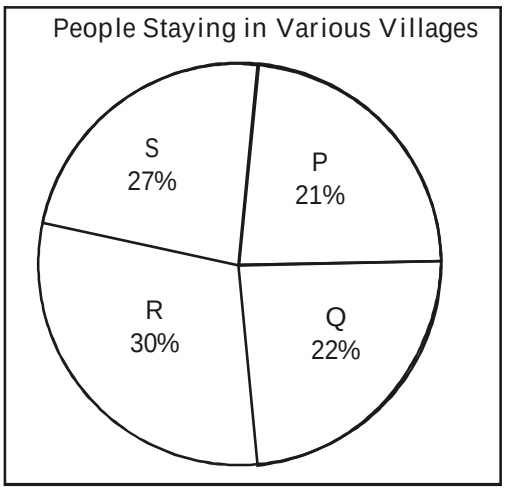
39. The number of student who study History in 2010 is approximately what percent of all the student in 2007?
(a) 60 (b) 65
(c) 68 (d) 59

40. In which of the year no. of student in all subject together is lowest?
(a) 2007 (b) 2009
(c) 2008 (d) both a and b

Directions (41 – 45): Study the following Pie-Chart carefully and answer the questions given below:

A survey conducted on 2900 Villagers Staying in Various Villages and having Various Favourite Sports





41. What is the total number of people having their favorite game Hockey and Badminton together?
(a) 1200 (b) 812
(c) 388 (d) 1160

42. How many people having favourite game Cricket?
(a) 580 (b) 420
(c) 680 (d) 480

43. If 40% of the people from village R have cricket as favourite game and 20% of the people have Tennis as favourite game. Then how many people like other game in village R?
(a) 1440 (b) 1540
(c) 1640 (d) 348

44. If the favorite game of 40% people of village R is Hockey then what will be the Ratio of people who like Hockey expect village R and total no. of people in village P?
(a) 16 : 21 (b) 21 : 16
(c) 21 : 31 (d) 31 : 21

45. 10% of the people from village R have favorite game Tennis then what is the no. of other villagers who like Tennis:
(a) 87 (b) 58
(c) 29 (d) 232

Directions (46 – 50): Study the following table carefully to answer the questions that follow:
Number (N) of Six Type of Electronic Products Sold by Six different stores in a month and the price per product (P) (price in Rs. '1000') charged by each store.

Store	A		B		C		D		E		F	
Product	N	P	N	P	N	P	N	P	N	P	N	P
L	54	135	48	112	60	104	61	124	40	136	48	126
M	71	4.5	53	3.8	57	5.6	49	4.9	57	5.5	45	4.7
N	48	12	47	18	52	15	54	11.5	62	10.5	56	11
O	52	53	55	48	48	50	54	49	59	47	58	51
P	60	75	61	68	56	92	44	84	46	76	59	78
Q	43	16	44	15	45	14.5	48	15.6	55	18.2	55	14.9

46. Number of L type products sold by store F is what percent of the number of the same type of products sold by store E?
(a) 76.33 (b) 124
(c) 83.33 (d) 120

47. What is the respective ratio of total number of N and L type of products sold by store D and the same products sold by the store A?
(a) 119 : 104 (b) 102 : 115
(c) 104 : 115 (d) 115 : 102

48. What is the average price per product charged by all the stores together for product Q?
(a) Rs. 14,700 (b) Rs. 15,700
(c) Rs. 15,200 (d) Rs. 14,800

49. What is the difference in the amount earned by store A through the sale of P type products and that earned by store B through the sale of the Q type of products?
(a) 38.4 lakhs (b) 0.384 lakhs
(c) 3.84 lakhs (d) 384 lakhs

50. What is the difference between number of all type of product sold by store D and total number of O type product sold by all the store together?
(a) 116 (b) 26
(c) 36 (d) 16

Foundation

Solutions

1. (b); Total rice production = 58.64
W. B production = 8.09

$\therefore$ Required percentage $= \frac{8.09}{58.64} \times 100$

$= 13.8 \approx 13.5\%$

2. (b); Required amount
= (15.97) – (0.81 + 3.72 + 0.86 + 4.42)
= 15.97 – 9.81 = 6.16 m tonnes

3. (b); Wheat production was produced by states other then those given in the table
= (44.23) – (15.97 + 0.81 + 3.72 + 0.86 + 4.42)
= (44.23) – (25.78) = 18.45

$\therefore$ Required % $= \frac{18.45}{44.23} \times 100 = 41.71 \approx 42\%$

4. (d); Required percentage $= \frac{7.18 + 15.97 + 2.76}{58.64 + 44.23 + 12.2} \times 100$

$= \frac{25.91}{115.07} \times 100 = 22.52\%$

5. (a); Clearly we can sea that in all of the states U.P was the top producer of all the three crops

6. (b); Required percentage $= \frac{375}{(375 + 300 + 175)} \times 100$

$= \frac{375}{850} \times 100 \approx 45\%$

7. (d); Passengers travelled by railroad
= 300 + 300 + 300 + 275 + 260 + 265 = 1700

8. (d); Required ratio $= \frac{200 \times 50}{400 \times 0.5} = \frac{10000}{200} = \frac{50}{1}$

9. (c); Average $= \frac{175}{25}$ million $= 7$million

10. (a); Required units = (300 – 265) = 35

11. (c); From both pie-charts we can say that in semi-durables hard-workers spend more then average workers.

12. (c); There are two such items - durables, Entertainmnet
= (8 + 7) % of 3500 = 15% of 3500 = 525

13. (d); We can't conclude it. Because clearly it is not mentioned any where in the question.

14. (d); New salary = 120% of 3500 = 4200
New saving amount = 700 + 10% of 3500 = 1050

$\therefore$ Saving percentage $= \frac{1050}{4200} \times 100 = 25\%$

15. (d); In the question, Information is not given.

16. (b); 1000 Rs. is $\left(\frac{1000}{6000} \times 100 = 16.66\%\right)$ of 6000.

$\therefore$ Required No of items
= House rent (1) + saving (1) = 2

17. (b); 1800 is $\left(\frac{1800}{6000} \times 100 = 30\%\right)$ of 6000

Which is equal to expense on house rent

18. (d); Annual saving $= 12 \times \frac{23}{100} \times 6000$

= 12 × 23 × 60 = 720 × 23 = 16560

19. (c); Petrol expense = 500
Let the monthly, salary be x Rs.

$\frac{10}{100} \times x = 500 \Rightarrow x = 5000$

20. (b); Total percentage of money spent on clothes and saving = 7 + 23 = 30 %
Which is equal to house-rent

21. (c); % increase $= \frac{151 - 105}{105} \times 100 = \frac{46}{105} \times 100 \approx 43\%$

22. (d); Total commulative shortfall
= 15 + 14 + 13 + 15 + 19 = 76

23. (b); Required number $= \frac{170}{97} = 1.75$

24. (d); % growth in power requirment

From 1979 – 80 to 1984 – 85 $= \frac{170 - 118}{118} \times 100$

$= \frac{52}{118} \times 100 = 44\%$

% growth in power requirment from

1974 – 75 to 1979 – 80 $= \frac{118 - 78}{78} \times 100$

$= \frac{40}{78} \times 100 = 51.2\%$

$\therefore$ % growth = (51.2 – 44) = 7% (Approx.)

25. (c); In 1979 – 80 demand was 118 which completed in 1982 – 83 means 3 years.

26. (c); Average selling in 2010 $= \frac{159}{6} \times 1000 = 26500$

Average selling in 2006 $= \frac{126}{6} \times 1000 = 21000$

Difference = 26500 – 21000 = 5.5 thousands

45. (d); People like tennis in village R $= \frac{10}{100} \times \frac{30}{100} \times 2900$

$= 29 \times 3 = 87$

No. of the villagers who like $= \frac{11 \times 2900}{100} - 87 = 232$

46. (d); Required percentage $= \frac{48}{40} \times 100 = 120\%$

47. (d); Required ratio $= \frac{61+54}{54+48} = \frac{115}{102}$

48. (b); Required average

$= \frac{43 \times 16 + 44 \times 15 + 45 \times 14.5 + 48 \times 15.6 + 55 \times 18.2 + 55 \times 14.9}{43 + 44 + 45 + 48 + 55 + 55}$

$= \frac{688 + 660 + 652.5 + 748.8 + 1001 + 819.5}{290}$

$= \frac{4569.8}{290} = 15.757$ thousand ≈ 15700

49. (a); A $\rightarrow 60 \times 75 = 4500$, B $\rightarrow 44 \times 15 = 660$

Difference = 4500 – 660 = 3840 thousands

= 38.40 Lacs

50. (d); All type of product sold by store D = 310

Total no. of O type product = 326

Difference = 326 – 310 = 16

Difficult

1. (c); Suppose the expenditures on production of sugar and wheat in 2002 are Rs. 100 each.

Then the required ratio $= \frac{140}{120} = 7 : 6$

2. (a); Suppose the amount of profit earned through the sales of sugar in 2000 and 2001 was Rs. 700 and Rs. 600 respectively.

This implies that 35% of expenditure on sugar in 2000 is equal to Rs. 700. Similarly, 20% of expenditure on sugar in 2001 is equal to Rs. 600.

Hence, the required ratio

$= \frac{\frac{700}{35} \times 100}{\frac{600}{20} \times 100} = \frac{700}{35} \times \frac{20}{600} = 2 : 3.$

3. (d); The sales of the wheat in 2004 was 120% of the expenditure on wheat in that year. Hence, the required expenditure

$= \frac{16.8}{120} \times 100 =$ Rs. 14 lakhs

4. (b); The required profit = 25% of Rs. 13 lakhs

= Rs. 3,25,000

5. (d); We need some more information to answer the question.

6. (d); Number of employees working in IT department

= 25% of 4200 $= \frac{4200}{4} = 1050$

7. (d); Number of employees in Marketing department

= 14% of 4200 = 588

Required % $= \frac{36}{588} \times 100 \approx 6$

8. (b); Number of employees not promoted from HR department = 18 × 42 – 82 = 756 – 82 = 674

Number of employees not promoted from Production department = 21 × 42 – 48

= 882 – 48 = 834

$\therefore$ required ratio = 674 : 834 = 337 : 417

9. (a); Total employees in Maintenance and Accounts department

= (10 + 12) = 22% of 4200 = 22 × 42 = 924

$\therefore$ required % $= \frac{46+24}{924} \times 100 = \frac{70 \times 100}{924} \approx 7.58$

10. (c); To find the department in which the highest percentage of employees are promoted we need to compare the fractions:

HR: $\frac{82}{18}$; Account: $\frac{24}{12}$; Marketing: $\frac{36}{14}$

Production: $\frac{48}{21}$; IT department: $\frac{78}{25}$;

Maintenance: $\frac{46}{10}$

Clearly, the competition is between HR and Maintenance departments.

So, finally compare $\frac{82}{18}$ and $\frac{46}{10}$

Apply cross-multiplication.

Since 82 × 10 < 18 × 46

$\therefore \frac{46}{10} > \frac{82}{18}$

$\Rightarrow$ The required % is the highest for Maintenance department.

11. (a); The required savings (in Rs. lakhs)

$$= \frac{1}{100}\begin{pmatrix}14.5\times 2.05 + 15.3\times 2.25 + 16.4\times 1.95\\ +16.2\times 2 + 18.2\times 1.75 + 22.4\times 1.70\end{pmatrix}$$

= Rs. 1.9846 lakhs = Rs. 1,98,460

12. (c);

Person	Amount on shopping (in Rs. lakhs)
Ravi	0.2993
Satish	0.3532
Arun	0.3237
Vilas	0.2900
Arif	0.2240
Suresh	0.3162

So, Satish spends maxmum on shopping

13. (b);

Person	Amount spent on health (in Rs. lakhs)
Ravi	0.3362
Satish	0.2565
Arun	0.41925
Vilas	0.4300
Arif	0.3675
Suresh	0.3094
Total	2.11885

Hence, the required percent

$$= \frac{0.3094\times 100}{2.11885} \approx 14.60\%$$

14. (d); The required percent

$$= \frac{1.75}{2.05+2.25+1.95+2.00+1.75+1.70}\times 100$$

$$= \frac{1.75}{11.7}\times 100 \approx 14.95\%$$

15. (d); The required ratio

$$= \frac{2.05\times(21.8+20.4)}{1.95\times(14.3+18.5)}$$

$$= \frac{2.05\times 42.2}{1.95\times 32.8} = \frac{86510}{63960} = 211:156$$

16. (b); Number of cars in State-2 = $700\times\frac{28}{100} = 196$

Number of diesel cars in State-2 = $196\times\frac{5}{14} = 70$

Number of cars in State-4 = $700\times\frac{26}{100} = 182$

Number of petrol cars in State-4 = $182\times\frac{1}{2} = 91$

$\therefore$ Required difference = 91 – 70 = 21

17. (a); Number of cars in State-1 = $700\times\frac{14}{100} = 98$

Number of diesel engine cars in State-1

$= 98\times\frac{3}{7} = 42$

Number of cars in State-3 = $700\times\frac{32}{100} = 224$

Number of petrol engine cars in State-3

$= 224\times\frac{3}{8} = 84$

$\therefore$ Required % = $\frac{84-42}{42} = \frac{42}{42}\times 100 = 100\%$

18. (d); Number of cars in State-3 = $700\times\frac{32}{100} = 224$

Number of diesel engine cars in State-3

$= 224\times\frac{5}{8} = 140$

Number of diesel engine cars which are AC

$= 140\times\frac{25}{100} = 35$

$\therefore$ Number of non-AC diesel cars

= 140 – 35 = 105

19. (d); Number of cars in State-3 = $700\times\frac{32}{100} = 224$

Number of petrol engine cars in State-2

$= 700\times\frac{28}{100}\times\frac{9}{14} = 126$

$\therefore$ Required difference = 224 – 126 = 98

ACE SSC ADVANCED MATHS

Chapter 1

Line, Angle and Triangle

Line and Angle

Point : An infinitely small figure of whose length breadth and height cannot be measured.

Line : A line is made up of infinite number of points and has length only

Line Segment : The part of a straight line whose both ends are fixed is called a line segment.

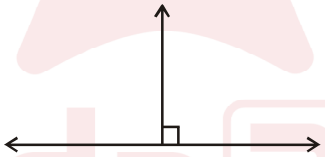
Ray : If one point of line is fixed then it called Ray. It extends indefinitely in one direction

Important Lines

Parallel lines : Two lines, lying in a plane and has no common intersecting point are called parallel lines. They never meet at any point and distance between them is always constant.

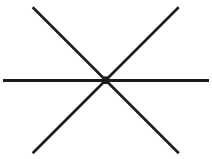
Parallel lines

Perpendicular line : Two line which intersect each other in a plane at 90° are called perpendicular line.



Perpendicular lines

Concurrent line : When more than two lines intersect at a common point, then they are called concurrect lines



Concurrent lines

Important Points to Remember:

- A line is made up of infinitely many points.
- The intersection of two of different lines is called a point.
- Concurrent lines pass through a single point.
- There are infinite no. of planes which pass through a single point.
- When more than three points lie in the same plane, they are called as coplanar else they are called as non-coplanar.
- When more than one line lie in the same plane, then these lines are called as coplanar else they are called as non-coplanar.
- Two lines which are perpendicular to any other line are necessarily parallel to each other in the same plane.

Collinear and Non - Collinear points: If three or more points lie on straight line, they are called collinear point. If three or more points do not lie on straight line, they are called non-collinear points.

Types of Angle:

According to Measurement

(i) Acute angle : Angle between two lines lies $0 < \theta < 90°$.

(ii) Right angle : Angle Measurement between two lines lies 90°.

(iii) Obtuse angle : Angle between two line lies $90° < \theta < 180°$.

(iv) Straight angle : Angle Measurement is between two line lies 180°.

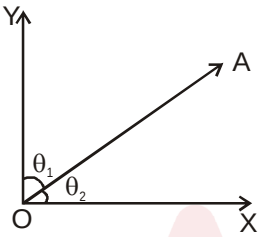
(v) Reflex angle : Angle between two line lies $180° < \theta < 360°$.

Complementary and Supplementary angle : If the sum of two angle is equal to 90°. They form a set of complementary angle. If the sum of two angles is equal to 180°, they form a set of supplementary angle

$\angle YOA$ and $\angle AOX$ is complementary angle to each other

$\theta_1 + \theta_2 = 90°$

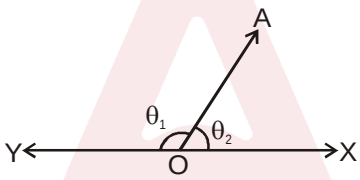
Complementary pair



$\angle YOA$ and $\angle AOX$ is supplementary angle to each other

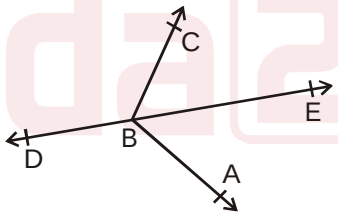
$\theta_1 + \theta_2 = 180°$

Supplementary pair

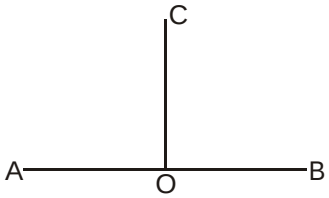


Adjacent angle : If angle having the common vertex, a common side and their uncommon sides are situated at two different side of common side.

$\angle DBC$ and $\angle DBA$ are adjacent angles. $\angle EBC$ and $\angle DBC$ are also adjacent angles.

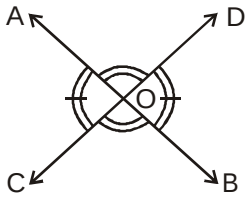


Linear pair : In figure, $\angle AOC$ and $\angle COB$ are adjacent angle and AOB is straight line. One side must be common (OC) and these two angle must be supplementary So, these type of angles are called linear pair of angle.



Vertically Opposite angle : If two straight line meet at a point, then angles facing each other are called vertically opposite angle.

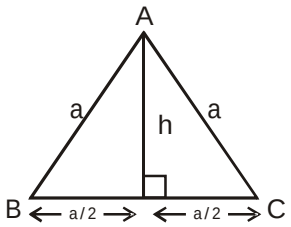
$\angle AOD = \angle COB$ and $\angle AOC = \angle DOB$.



3. Equilateral triangle

A triangle whose all sides are equal in length is called an equilateral triangle a = b = c.

- Area = $\frac{\sqrt{3}}{4}a^2$
- Height = $\frac{\sqrt{3}}{2}a$
- $\angle A = \angle B = \angle C = 60°$
- Inradius of equilateral triangle = $\frac{a}{2\sqrt{3}}$
- Circumradius of equilateral triangle = $\frac{a}{\sqrt{3}}$



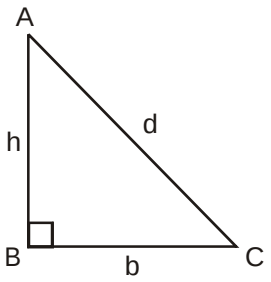
(b) According to angle

1. Right-angled Triangle

A triangle whose one angle is of 90° is called as right-angled triangle. The side opposite to the right angle is called Hypotenuse

- Area = $\frac{1}{2}$ × product of sides containing right angle

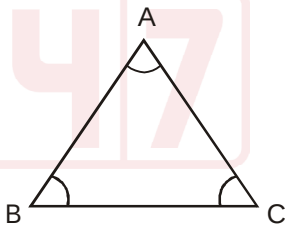
  $= \frac{1}{2} \times b \times h$
- $d^2 = h^2 + b^2$ (Pythagoras theorem)



2. Acute-Angle Triangle

Each angle of a triangle is less then 90°

$A < 90°$, $B < 90°$, $C < 90°$

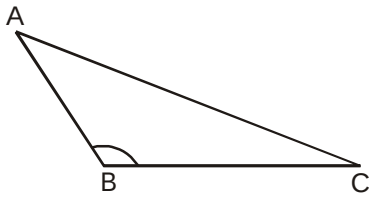


3. Obtuse-Angle Triangle

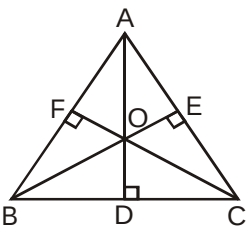
one of the angles is obtuse (i.e. greater than 90°),

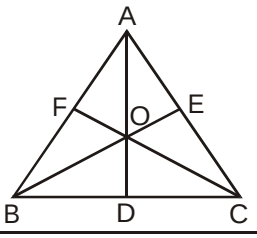
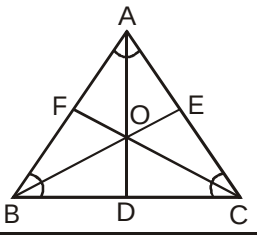
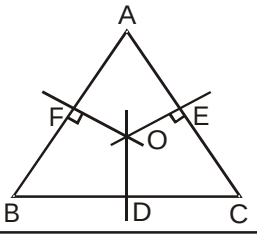
then it is called obtuse angle triangle.

$\angle B > 90°$



Important Terms

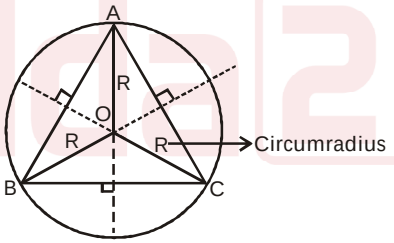
Term	Definition	Diagram
Altitude	The perpendicular drawn to a side from opposite vertex in a triangle is called an altitude of the triangle. AD, BE, CF are the altitudes	

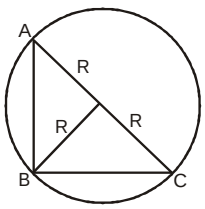
Term	Definition	Diagram
Median	The line segment Joining the mid point of a side of triangle to the vertex opposite to side is called median. Median divides the area of triangle into two equal parts $\text{Area}(\triangle ABD) = \text{area}(\triangle ADC) = \frac{1}{2}\text{area}(\triangle ABC)$	
Angle bisector	A line which bisects the angle of triangle and originates from vertex is called an angle bisector $\angle OBF = \angle OBD = \frac{1}{2}\angle ABC$	
Perpendicular side bisector	A line segment which bisects a side perpendicularly is called perpendicular bisector of side. DO, EO, FO are the perpendicular side bisectors.	

Circumcentre:

Circumcentre is the point of intersection of the perpendicular side bisectors of the triangle. Circumcentre is equidistant from its vertex and distance of circumcentre from vertex of triangle is called circumradius (R) of the triangle

The circle drawn with the circumcentre as the centre and circumradius as the radius is called the circumcircle of the triangle and it touches all the vertex of the triangle





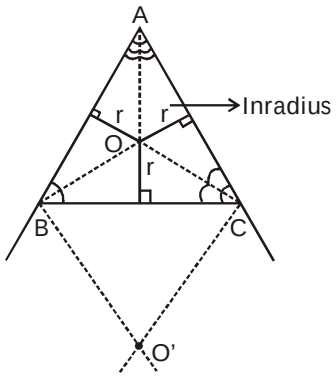
- Circumcentre of acute angle triangle always lie inside the triangle
- Circumcentre of abtuse angle triangle always lie outside the triangle and opposite to the largest angle
- Circumcentre of right angle triangle always lie at the mid point of hypotenuse
- $\angle BOC = 2\angle A$

Incentre:

Incentre is the point of intersection of the internal bisectors of the three angles.

Incentre is equidistant from the three sides of the triangle, i.e. the perpendiculars drawn from the incentre to the three sides are equal in length and are called inradius of the triangle.

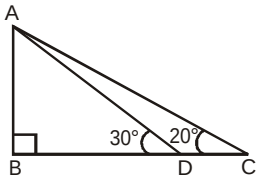
The circle drawn with the incentre as centre and inradius as the radius and it touches all the three sides of triangle from inside.



Foundation

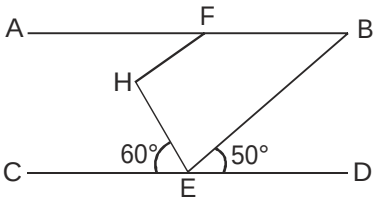
Questions

1. In the given figure, ∠ABD = 90°, ∠BDA = 30° and ∠BCA = 20°. What is the value of ∠CAD?



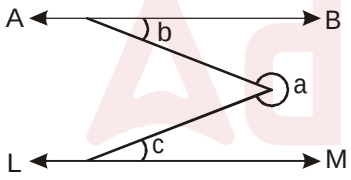
(a) 10° (b) 20°
(c) 30° (d) 15°

2. In the given figure AB is parallel to CD and BE is parallel to FH. Measure of ∠FHE is:



(a) 110° (b) 120°
(c) 125° (d) 130°

3. In the figure given below AB is parallel to LM. Angle a is equal to:



(a) π + b + c (b) 2π – b + c
(c) 2π – b – c (d) 2π + b – c

4. Which angle is two third of its complementary angle?

(a) 36° (b) 45°
(c) 48° (d) 60°

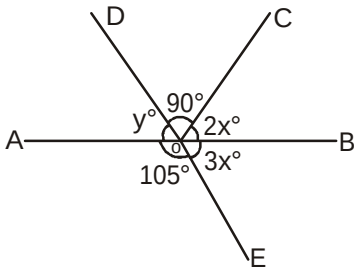
5. What is the measure of the angle which is one fifth of its supplementary part?

(a) 15° (b) 30°
(c) 36° (d) 75°

6. If each interior angle of a regular polygon is 144°, then what is the number of sides in the polygon?

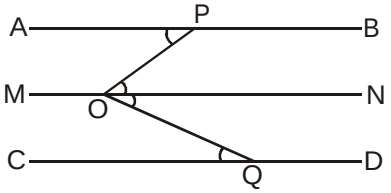
(a) 10 (b) 20
(c) 24 (d) 36

7. In the following figure AB is a straight line. Find (x + y):



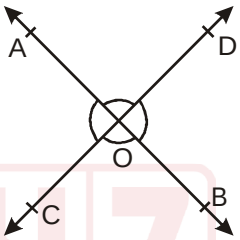
(a) 55° (b) 65°
(c) 75° (d) 80°

8. In the adjoining figure ∠APO = 42° ∠CQO = 38°. Find the value of ∠POQ:



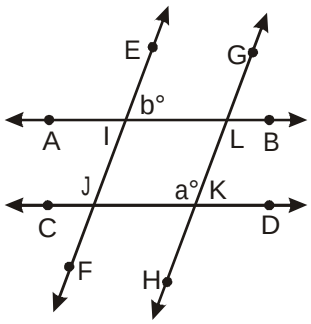
(a) 68° (b) 72°
(c) 80° (d) 126°

9. In the given figure, straight lines AB and CD intersect at O. If ∠COA = 3 ∠AOD, then ∠AOD is equal to:



(a) 40° (b) 45°
(c) 50° (d) 55°

10. In the given figure, AB | | CD and EF | | GH. Find the relation between a and b.



(a) 2a + b = 180° (b) a + b = 180°
(c) a – b = 180° (d) a + 2b = 180°

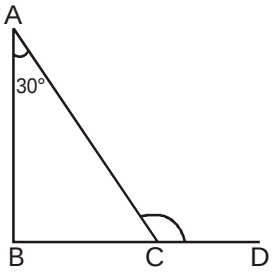
11. A, B, C, are the three angles of a Δ. If A – B = 15° and B – C = 30°, then ∠A is equal to:

(a) 65° (b) 80°
(c) 75° (d) 85°

12. In a Δ ABC, If $2\angle A = 3\angle B = 6\angle C$ then $\angle A$ is equal to:
(a) 60° (b) 30°
(c) 90° (d) 120°

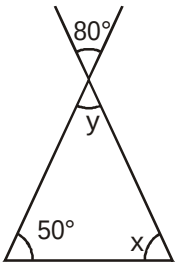
13. If one angle of a triangle is equal to the sum of the other two, then the triangle is:
(a) Right-angled (b) Obtuse-angled
(c) acute-angled (d) None of these

14. In the given figure, if $\angle ABC = 90°$, and $\angle A = 30°$, then $\angle ACD$ =



(a) 120° (b) 100°
(c) 110° (d) None of these

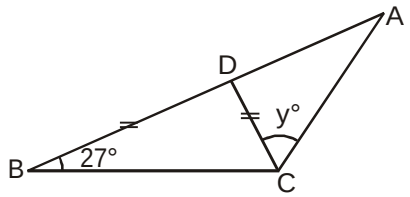
15.



Find the value of x and y
(a) x = 60°, y = 80° (b) x = 80°, y = 50°
(c) x = 50°, y = 80° (d) None of these

16. In ΔABC, $\angle A > 90°$ then $\angle B$ and $\angle C$ must be :
(a) acute (b) obtuse
(c) one acute and one obtuse
(d) Can't be determined

17. In the following figure ADBC, BD = CD = AC, $\angle ABC = 27°$, $\angle ACD = y$. Find the value of y :



(a) 27° (b) 54°
(c) 72° (d) 58°

18. The internal bisectors of the angles B and C of a triangle ABC meet at O. Then, $\angle BOC$ is equal to :
(a) $90° + \angle A$ (b) $2\angle A$
(c) $90° + \frac{1}{2}\angle A$ (d) $180° - \angle A$

19. If the angles of a triangle are in the ratio of 2 : 3 : 4, then the greatest angle of the triangle is :
(a) 75° (b) 80°
(c) 90° (d) 120°

20. Triangle ABC is such that AB = 3 cm, BC = 2 cm and CA = 2.5 cm. Triangle DEF is similar to ΔABC. If EF = 4 cm, then the perimeter of ΔDEF is :
(a) 7.5 cm (b) 15 cm
(c) 22.5 cm (d) 30 cm

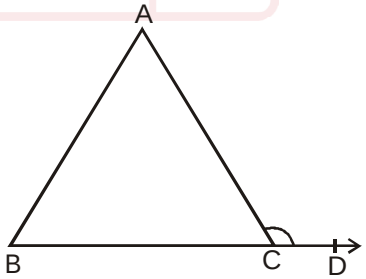
21. ABC is a triangle and DE is drawn parallel to BC cutting the other sides at D and E. If AB = 3.6 cm, AC = 2.4 cm and AD = 2.1 cm, then AE is equal to:
(a) 1.4 cm (b) 1.8 cm
(c) 1.2 cm (d) 1.05 cm

22. The line segments joining the mid points of the sides of a triangle form four triangles each of which is:
(a) similar to the original triangle
(b) congruent to the original triangle
(c) an equilateral triangle
(d) an isosceles triangle

23. In ΔABC and ΔDEF, $\angle A = 50°$, $\angle B = 70°$, $\angle C = 60°$, $\angle D = 60°$, $\angle E = 70°$ $\angle F = 50°$, then DABC is similar to:
(a) ΔDEF (b) ΔEDF
(c) ΔDFE (d) ΔFED

24. The hypotenuse of a right angled triangle is 25 cms. The other two sides are such that one is 5 cm longer than the other. Their lengths (in cm) are:
(a) 10, 15 (b) 20, 25
(c) 15, 20 (d) 25, 30

25. ABC is a triangle in which AB = AC. The base BC is produced to D and $\angle ACD = 130°$. Then, $\angle A$ equals:



(a) 80° (b) 60°
(c) 50° (d) 40°

26. D, E, F are the mid points of the sides BC, CA and AB respectively of ΔABC. Then ΔDEF is congruent to triangle:
(a) ABC (b) AEF
(c) BFD, CDE (d) AFE, BFD, CDE

27. In the triangles ABC and DEF, angle A is equal to angle E, both are equal to 40°, AB : ED = AC : EF and angle F is 65°, then angle B is:

49. O is the incentre of ΔABC and $\angle BOC = 110°$. Find $\angle BAC$
(a) 40° (b) 45°
(c) 50° (d) 55°

50. Two triangles ABC and DEF are similar to each other in which AB = 10 cm, DE = 8 cm. Then, the ratio of the areas of triangles ABC and DEF is:
(a) 4 : 5 (b) 25 : 16
(c) 64 : 125 (d) 4 : 7

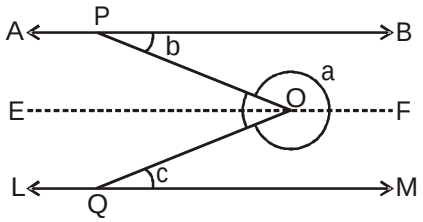
Foundation

Solutions

1. (a); $\angle BAD = 180° - (90° + 30°) = 60°$
$\angle BAC = 180° - (90° + 20°) = 70°$
$\angle CAD = \angle BAC - \angle BAD = 70° - 60° = 10°$

2. (a); $\angle BEH = 180° - (60° + 50°) = 70°$
$\angle FHE = 180° - 70° = 110°$

3. (c);



Draw EF parallel to AB.
$\angle EOP = \angle b$ $\angle EOQ = \angle c$
$\Rightarrow a = 2\pi - (\angle b + \angle c) = 2\pi - b - c$

4. (a); Let the angle be x.
its complementary angle = $(90° - x)$

$$x = \frac{2}{3}(90 - x)$$

$x = 36°$

5. (b); Let the angle be x.
According to the question:

$$x = \frac{1}{5}(180° - x) \Rightarrow x = 30°$$

6. (a); Let the number of sides be n.
According to the question:

$$\frac{(n-2)}{n}180 = 144 \Rightarrow n = 10$$

7. (b); $3x + 105° = 180°$
$3x = 75°$
$x = 25°$
$2x + 90 + y = 180°$
$2x + y = 90°$
$y = 90° - 50°, \ y = 40°$
$x + y = 25° + 40° = 65°$

8. (c); $\angle APO = 42°$ and $\angle CQO = 38°$
$\angle POQ = \angle PON + \angle NOQ$
$= \angle APO + \angle OQC = 42° + 38° = 80°$

9. (b); $\angle COA + \angle AOD = 180°$
$3AOD + AOD = 180°$
$4AOD = 180°$

$$AOD = \frac{180°}{4} = 45°$$

10. (b); $\angle a + \angle b = 180°$

11. (b); Since A, B and C are the angles of a triangle.
$\angle A + \angle B + \angle C = 180°$
Now, $\angle A - \angle B = 15°, \ \angle B - \angle C = 30°$
$\angle B = \angle C + 30°$
$\angle A = \angle B + 15 = \angle C + 45°$
$\angle A + \angle B + \angle C = \angle C + 45° + \angle C + 30 + \angle C = 180°$
$3\angle C = 105, \ \angle C = 35°$
$\angle A = 35° + 45° = 80°$

12. (c); $2\angle A = 3\angle B = 6\angle C$

$$\angle B = \frac{2}{3}\angle A, \quad \angle C = \frac{1}{3}\angle A$$

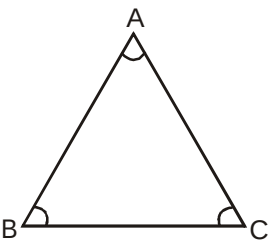
$\angle A + \angle B + \angle C = 180°$

$$\angle A + \frac{2}{3}\angle A + \frac{1}{3}\angle A = 180°$$

$$\frac{3\angle A + 2\angle A + \angle A}{3} = 180°$$

$$\angle A = \frac{180°}{6} \times 3 = \frac{180°}{2} = 90°$$

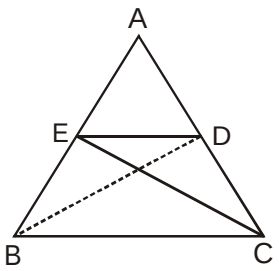
13. (a);



$\angle A = \angle B + \angle C$
We get that
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle A + \angle A = 180°$
$\Rightarrow 2\angle A = 180°, \ \angle A = 90°$

Difficult

1. (b);



$\angle B = \angle C$, $AB = AC$

In ΔBCD

$CD = BC$

$\angle BDC = \angle CBD$

$\angle BDC + \angle CBD + \angle BCD = 180°$

$2\angle BDC + 78° = 180°$

$2\angle BDC = 102°$, $\angle BDC = 51°$

In ΔBEC

$\angle BEC + \angle EBC + \angle ECB = 180°$

$\angle ECB = 180° - 78° - 78° = 24°$

$\angle ECD = 78° - 24° = 54°$

$BC = EC = CD$

In ΔECD

$\angle DEC + \angle DCE + \angle EDC = 180°$

$2\angle DEC + 54° = 180°$

$$\angle DEC = \frac{180° - 54°}{2} = \frac{126°}{2} = 63°$$

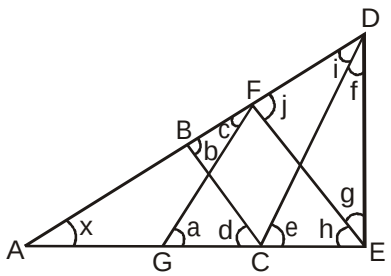
$\angle EDC = \angle DEC = 63°$

$\angle EDC = \angle EDB + \angle BDC$

$63° = \angle EDB + 51°$

$\angle EDB = 12°$

2. (c);



$AB = BC$, $d = x$

$b = x + d$, $b = 2x$

$BC = CD$, $i = b = 2x$

$EF = FG$, $a = h = 2x$

$e = x + i = x + 2x = 3x$

$CD = DE$, $g + h = e$

$g = 3x - 2x = x$

$j = x + 2x = 3x$

$\therefore$ $DE = EF$, $i + f = j$

$f = 3x - 2x = x$

Now, In ΔADE

$\angle A + \angle D + \angle E = 180°$

$x + 3x + 3x = 180°$

$7x = 180°$, $x = \frac{180°}{7}$

3. (b); $AB \| CD$

$\angle ABC = \angle BCD = x°$

In ΔBCD

$x° + y° + z° = 180°$

$$\frac{4}{3}y + \frac{8}{3}y + y = 180°$$

$$\frac{4y + 8y + 3y}{3} = 180°$$

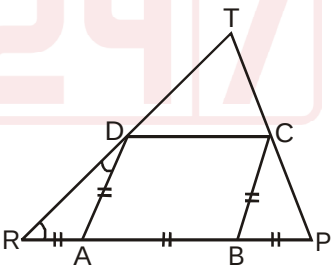
$5y = 180°$, $y = 36°$

$$x = \frac{4}{3}y = \frac{4}{3} \times 36 = 48°$$

$\angle BAC = 180° - 48° - 36°$

$\angle BAC = 180° - 84° = 96°$

4. (b);



$AR = AB = BP$ (Given)

$AR = AD$

$\angle ARD = \angle ADR$

$BP = BC$

$\angle BPC = \angle BCP$

$\angle DAB = 2\angle ARD$

$\angle CBA = 2\angle BPC$

$\angle DAB + \angle CBA = 180°$ (ABCD is a rhombus)

$2(\angle ARD + \angle BPC) = 180°$

$\angle ARD + \angle BPC = 90°$

In ΔTRP

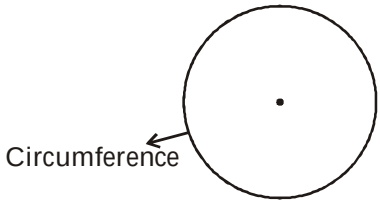
$\angle RTP + 90° = 180°$, $\angle RTP = 90°$

Chapter 2

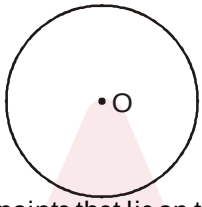
Circle

Circle : A circle is a set of points on a plane which lie at a fixed distance from a fixed point.

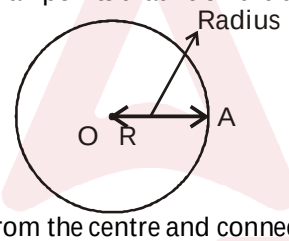
Circumference : The circumference of a circle is the distance around a circle which is equal to $2\pi r$. It is also called the perimeter of circle.



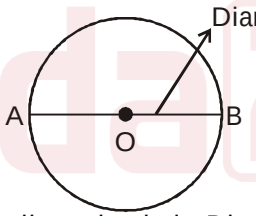
Centre : Fixed point is called the centre which is equidistant from all the points on the circumference. Here O is the center.



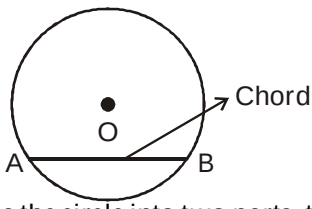
Radius : Fixed distance from the centre to all points that lie on the circumference.



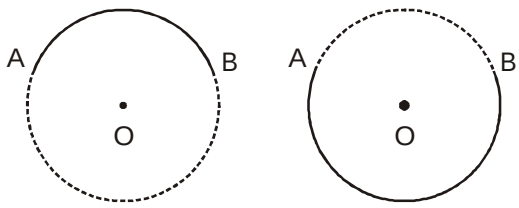
Diameter : A straight line which passes from the centre and connects two points of the circumference



Chord : A line segment whose end points lie on the circle. Diameter is also a largest chord.

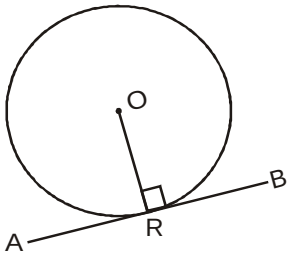


Arc : Any two points on the circle divides the circle into two parts, the smaller part is called as minor arc and the larger part is called as major arc.

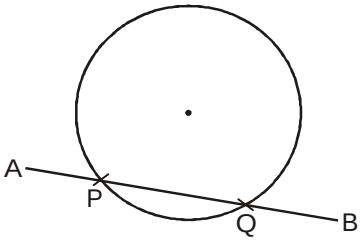


$\overset{\frown}{AB}$ → Minor arc $\overset{\frown}{AB}$ → Major arc

Tangent : A line segment which has one common point with the circumference of a circle i.e. it touches only at only one point is called as tangent of circle. AB → Tangent to circle at R.

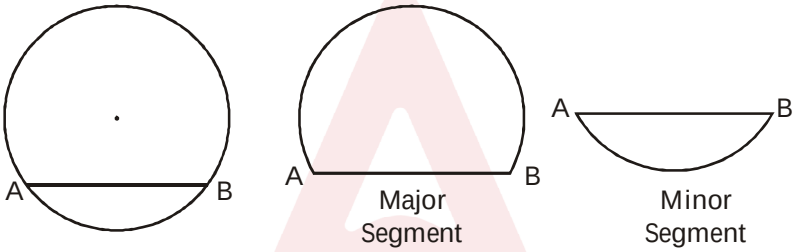


Secant : A line segment which intersects the circle in two distinct points, is called as secant. AB $\rightarrow$ Secant.

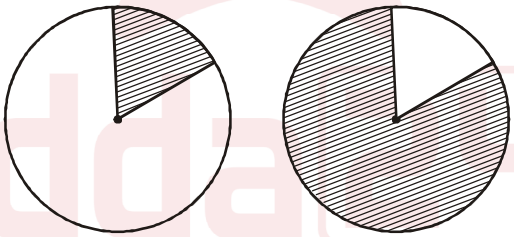


Segment : A chord divides a circle into two regions. These two regions are called the segments of a circle.

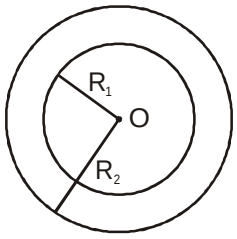
(a) major segment (b) minor segment



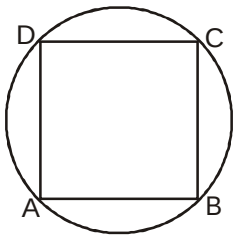
Sector : An area of circle enclosed by 2 radii and the circumference is called sector of circle.



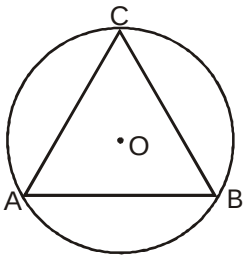
Concentric circles : Two circles having the same centre at a plane are called the concentric circles



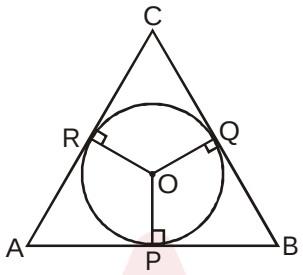
Cyclic Quadrilateral : A quadrilateral whose all the four vertices lie on the circle.

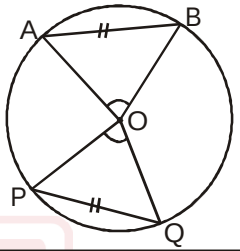
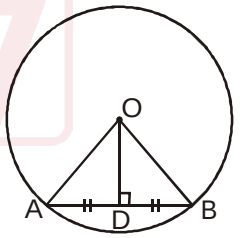
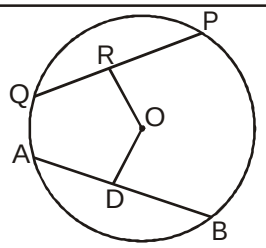
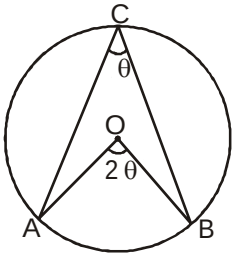


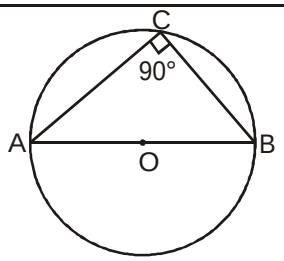
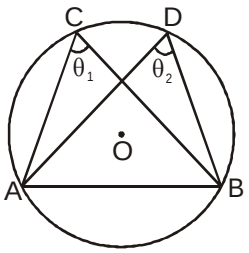
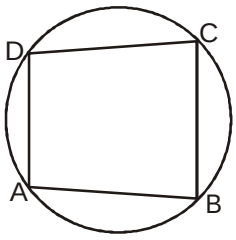
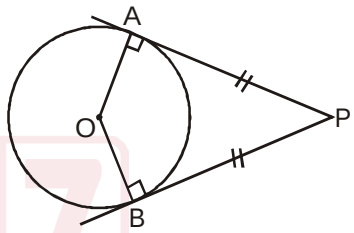
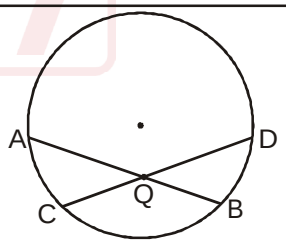
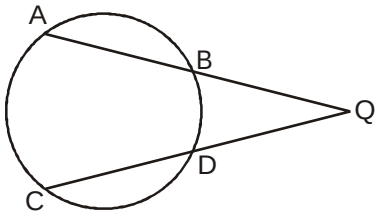
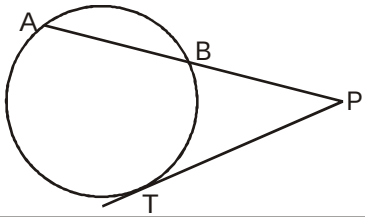
Circum-circle : A circle which passes through all the three vertices of a triangle.

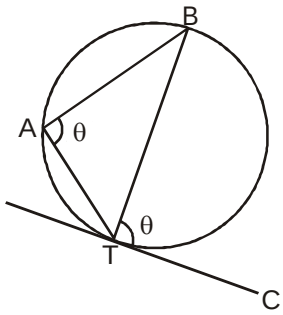
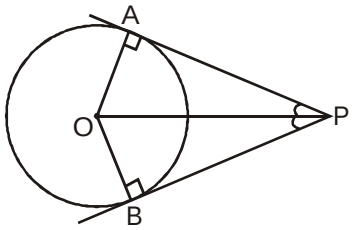
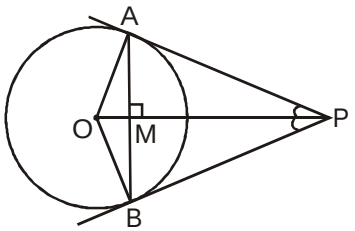


Incircle : A circle which touches all the three sides of a triangle i.e. all the three sides of a triangle are tangents to the circle is called an incircle



S. No.	Theorem	Diagram
1.	Equal Chords or Arc subtends equal angles at the centre $\overset{\frown}{PQ} = \overset{\frown}{AB}$ $\angle POQ = \angle AOB$	
2.	The perpendicular from the centre of a circle to a chord bisects the chord $OD \perp AB$ $AB = 2AD = 2BD$	
3.	Equal chords of circle are equidistant from the centre. $AB = PQ$ $OD = OR$	
4.	The angle subtended by an arc at the centre of a circle is twice the angle subtended by the arc at any point on remaining part of the circle $\angle AOB = 2m\ \angle ACB$	

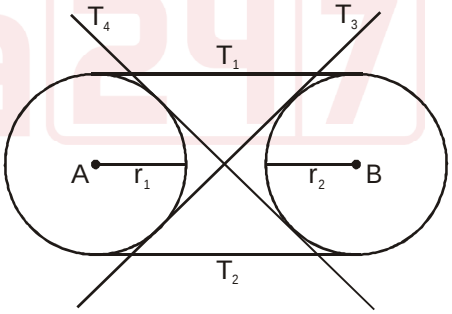
S. No.	Theorem	Diagram
5.	Angle in a semicircle is a right angle	
6.	Angles in the same segment of a circle are equal $\angle ACB = \angle ADB$ $\theta_1 = \theta_2$	
7.	The sum pair of opposite angles of a cyclic quadrilateral is 180°. $\angle DAB + \angle BCD = 180°$ $\angle ABC + \angle CDA = 180°$	
8.	The length of two tangents drawn from an external point to a circle are equal i.e. AP = BP	
9.	If two chords AB and CD of a circle, intersect inside a circle or outside a circle when when produced to at a point Q, then AQ × BQ = CQ × DQ.	 
10.	When a chord AB is produced to meet a tangent PT at external point P then $PA \cdot PB = (PT)^2$	

S. No.	Theorem	Diagram
11.	Alternate segment Theorem → when a tangent is m drawn from point of contact of chord AB, then angle between chord and tangent will be equal to the Angle formed by the chord at the alternate segment. ∠BTC = ∠TAB	
12.	The Angle formed by two tangents meeting at on external point is bisected by a straight line. joining the centre of the circle to that external point ∠BPO = ∠APO ∠POB = POA	
13.	When two tangents meet externally at point P and touch circle at A and B then PO is perpendicular bisector of AB PO ⊥ AB and AM = BM	

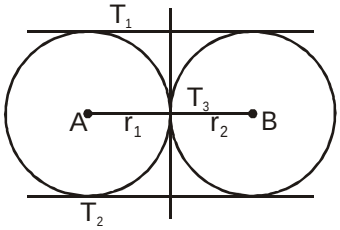
Number of common Tangents: The number of common tangent to the two circle are–

- Maximum → 4
- Minimum → Zero

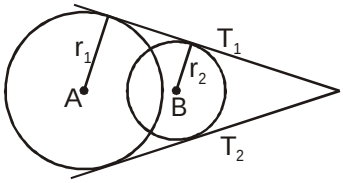
Case 1. 4 Common Tangents
Condition: $AB > r_1 + r_2$



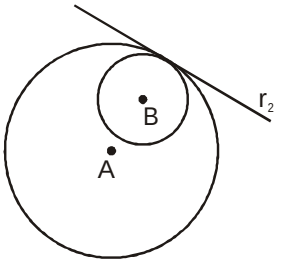
Case 2. 3 Common Tangents
Condition: $AB = r_1 + r_2$



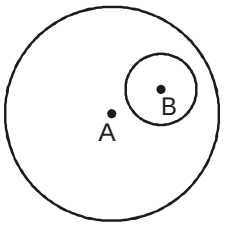
Case 3. 2 common Tangents
Condition $|r_1 - r_2| < AB < r_1 + r_2$



Case 4. 1 Common Tangent
Condition $AB \neq |r_1 - r_2|$



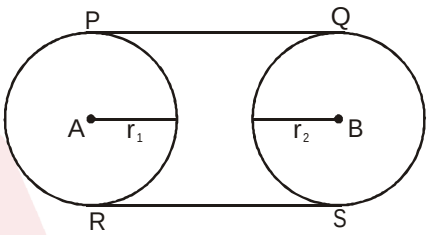
Case 5. No Common Tangent
Condition $AB < |r_1 - r_2|$



There are two types of common tangent

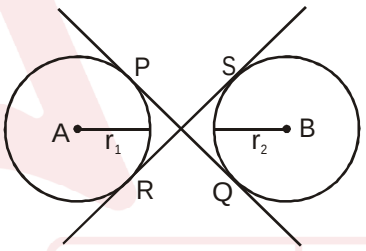
- Direct Common Tangent
- Transverse common tangent
- Length of Direct common Tangent (DCT)

$= \sqrt{(\text{Distance between centre})^2 - (r_1 - r_2)^2}$



- Length of Transverse common Tangent (TCT)

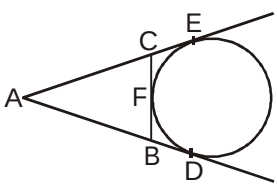
$= \sqrt{(\text{Distance between centre})^2 - (r_1 + r_2)^2}$



Foundation

Questions

1. The distance between the centres of equal circles each of radius 3 cm is 10 cm. The length of a transverse common tangent is:
   (a) 4 cm (b) 6 cm
   (c) 8 cm (d) 10 cm
2. The number of common tangents that can be drawn to two given circles is at the most:
   (a) one (b) two
   (c) three (d) four
3. In the adjoining figure AD, AE and BC are tangents to the circle at D, E, F respectively



Then,
(a) AD = AB + BC + CA (b) 2AD = AB + BC + CA
(c) 3AD=AB + BC + CA (d) 4AD = AB + BC + CA

4. The distance between the centres of the two circles of radii r_1 and r_2 is d. They will touch each other internally if:
   (a) $d = r_1$ or r_2 (b) $d = r_1 + r_2$
   (c) $d = r_1 - r_2$ (d) $d = \sqrt{r_1 r_2}$
5. Through any given set of four points P, Q, R, S it is possible to draw:
   (a) atmost one circle (b) exactly one circle
   (c) exactly two circles (d) exactly three circles
6. Two chords AB and CD of a circle intersect at E such that AE = 2.4 cm, BE = 3.2 cm and CE = 1.6 cm. The length of DE is:
   (a) 1.6 cm (b) 3.2 cm
   (c) 4.8 cm (d) 6.4 cm
7. In the adjoining figure, a smaller circle touches a larger circle internally and passes through the centre O of the larger circle. If the area of the smaller circle is 200 cm^2, the area of the larger circle in sq. cm is:

36. If O is the circumcentre of ΔABC and $\angle OBC = 35°$, then $\angle BAC$ is equal to:
(a) 55° (b) 110°
(c) 70° (d) 35°

37. If S is the circumcentre of ΔABC and $\angle A = 50°$, then the value of $\angle BCS$ is:
(a) 20° (b) 40°
(c) 60° (d) 80°

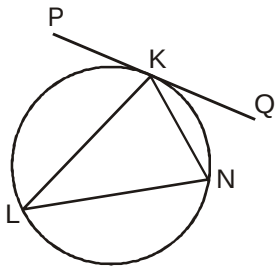
38. The distance between the centres of two equal circles, each of radius 4 cm, is 10 cm. The length of a transverse common tangent is:
(a) 8 cm (b) 10 cm
(c) 4 cm (d) 6 cm

39. A unique circle can always be drawn through x number of given non-collinear points, then x must be:
(a) 2 (b) 3
(c) 4 (d) 1

40. The length of radius of a circumcircle of a triangle having sides 3 cm, 4 cm and 5 cm is :
(a) 2 cm (b) 2.5 cm
(c) 3 cm (d) 1.5 cm

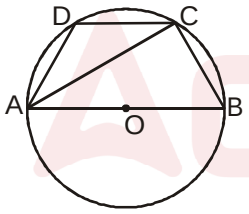
Moderate

1. In the given figure PKQ is a tangent and LN is the diameter of the circle. If $\angle KLN = 30°$ then $\angle PKL$ will be:



(a) 30° (b) 50°
(c) 60° (d) 70°

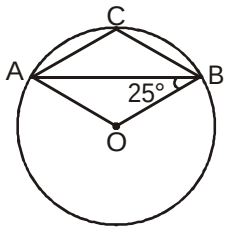
2. In the given figure $\angle ADC = 120°$ and AOB is the diameter of the circle, then $\angle BAC$:



(a) 30° (b) 40°
(c) 50° (d) 60°

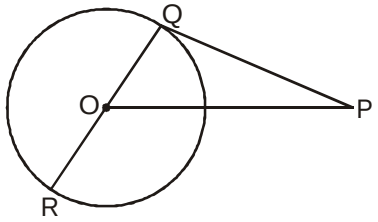
3. AB and CD are two parallel chords of a circle such that AB = 10 cm and CD = 24 cm, If the chords are on the opposite sides of the centre and the distance between them is 17 cm, then the radius of the circle is:
(a) 8 cm (b) 15 cm
(c) 11 cm (d) 13 cm

4. In the given figure, O is the centre of the circle then $\angle ACB$ will be:



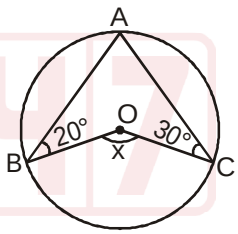
(a) 105° (b) 230°
(c) 115° (d) 100°

5. In the given figure, ROQ is the diameter of the circle. If $\angle POR = 120°$ then $\angle QPO$ will be:



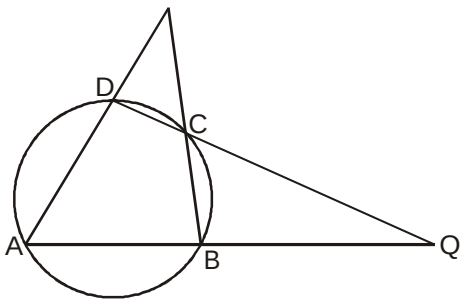
(a) 40° (b) 30°
(c) 60° (d) 50°

6. Find the value of $\angle x$ in the given figure:



(a) 120° (b) 130°
(c) 110° (d) 100°

7. In the adjoining figure $\angle A = 60°$ and $\angle ABC = 80°$, Find $\angle BQC$.



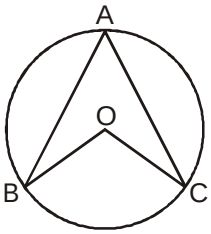
(a) 40° (b) 80°
(c) 20° (d) 30°

8. Two circles of radius 37 cm and 20 cm intersect each other at A and B. O and O' are the centres of the circles. If the length of AB is 24 cm, then OO':

(a) 149° (b) 74.5°
(c) 62° (d) None of these

20. A, B, C are three points on a circle. The tangent at A meets BC produced at T, ∠BTA = 40° and ∠CAT = 44° The angle subtended by BC at the centre of the circle is:
(a) 84° (b) 92°
(c) 96° (d) 104°

21. BC is the chord of a circle with centre O. A is a point on major arc BC as shown in the above figure. What is the value of ∠BAC + ∠OBC?



(a) 120° (b) 60°
(c) 90° (d) 180°

22. AB and CD are two parallel chords drawn on two opposite sides of the diameter such that AB = 6 cm, CD = 8 cm. If the radius of the circle is 5 cm, the distance between the chords, in cm, is:
(a) 2 (b) 7
(c) 5 (d) 3

23. Two tangents are drawn from a point P to a circle at A and B. O is the centre of the circle. If ∠AOP = 60°, then ∠APB is:
(a) 120° (b) 90°
(c) 60° (d) 30°

24. If the length of a chord of a circle, which makes an angle 45° with the tangent drawn at one end point of the chord, is 6 cm, then the radius of the circle is:
(a) $6\sqrt{2}$ cm (b) 5 cm
(c) $3\sqrt{2}$ cm (d) 6 cm

25. The radius of two concentric circles are 9 cm and 15 cm. If the chord of the greater circle be a tangent to the smaller circle, then the length of that chord is:
(a) 24 cm (b) 12 cm
(c) 30 cm (d) 18 cm

26. AB = 8 cm and CD = 6 cm are two parallel chords on the same side of the centre of a circle. The distance between them is 1 cm. The radius of the circle is:
(a) 5 cm (b) 4 cm
(c) 3 cm (d) 2 cm

27. What is the ratio of Inradius and circumradius of right angle triangle?
(a) 1 : 1 (b) 2 : 1
(c) 1 : 2 (d) None of these

28. Two circles touch each other externally at point A and PQ is a direct common tangent which touches circle at P and Q respectively. Then ∠PAQ =
(a) 45° (b) 90°
(c) 80° (d) 100°

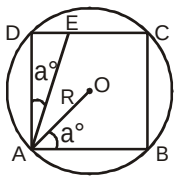
29. AB is a chord to a circle and PAT is the tangent to the circle at A. If ∠BAT = 75° and ∠BAC = 45°, C being a point on the circle, then ∠ABC is equal to:
(a) 40° (b) 45°
(c) 60° (d) 70°

30. The circumcentre of a triangle ABC is O. If ∠BAC = 85° and ∠BCA = 75°, then the value of ∠OAC is:
(a) 40° (b) 60°
(c) 70° (d) 90°

Difficult

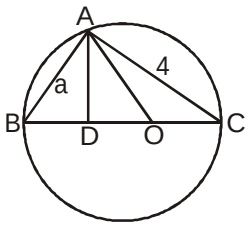
1. AB and AC are two chords of a circle such that AB = AC = 6 cm. If radius of the circle is 5 cm, then BC is:
(a) 4.8 cm (b) 9.6 cm
(c) 2.4 cm (d) 8.4 cm

2. From the figure given below find AE : AD where Area (circle) : Area (Square) = $\pi : \sqrt{3}$ O is the centre of circle and ABCD is the square inscribed in circle. R is the radius of circle



(a) $1 : \sqrt{2}$ (b) $\sqrt{2} : 1$
(c) $2 : \sqrt{3}$ (d) $\sqrt{3} : 2$

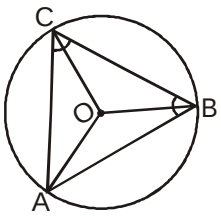
3. If in the given figure, AB = a, AC = 4 cm, while O is the centre of the circle and D is a point between O and B such that AD ⊥ BC. Find the length of OD?



(a) $\frac{4-a}{4}$ (b) $\frac{16-a^2}{2\sqrt{a^2+16}}$
(c) $\frac{4a-16}{16a-a^2}$ (d) $\frac{2\sqrt{a^2-16}}{16+a^2}$

Difficult

1. (b); In ΔOMB



Let AB = AC = a
BC = b

Area of $\Delta ABC = \frac{abc}{4R}$ where R is circumradius

for isosceles triangle = $\frac{a^2b}{4R}$

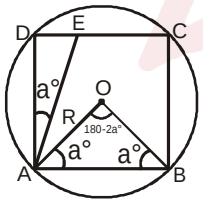
Area of triangle ABC = $\frac{1}{2} \times h \times BC$ where h is the height of isosceles triangle on BC

$h = \frac{\sqrt{4a^2 - b^2}}{2}$

$\frac{6 \times 6 \times b}{4R} = \frac{1}{2} \times b \times \frac{\sqrt{4a^2 - b^2}}{2}$

$\frac{1296}{25} = 4a^2 - b^2$, $b^2 = \frac{2304}{25}$, b = 9.6 cm

2. (c);



OA = OB = radius
$\angle OAB = \angle OBA = a°$

Area of triangle AOB = $\frac{1}{2} R^2 \sin(180 - 2a°)$

$= \frac{1}{2} R^2 \sin 2a°$

Area (square ABCD) = $4 \times \frac{1}{2} R^2 \sin 2a°$

$= 2R^2 \sin 2a$

$\frac{\text{Area(circle)}}{\text{Area(square)}} = \frac{\pi}{\sqrt{3}}$ (Given)

$\frac{\pi R^2}{2R^2 \sin 2a} = \frac{\pi}{\sqrt{3}}$

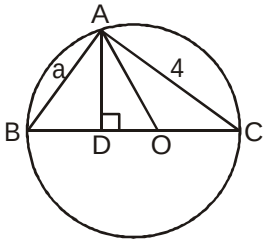
$\sin 2a = \sin 60°$

$a = 30°$

In ΔAED, $\cos a = \frac{AD}{AE}$

$\frac{AE}{AD} = \frac{2}{\sqrt{3}}$

3. (b); Let OD = x



In ΔABC
$AB^2 + AC^2 = BC^2$
$a^2 + 4^2 = BC^2$

$BC = \sqrt{a^2 + 16}$

$OB = \frac{1}{2} \times BC = \frac{1}{2}\sqrt{a^2 + 16}$

In ΔABC and ΔDBA

$\frac{AB}{BC} = \frac{DB}{AB}$

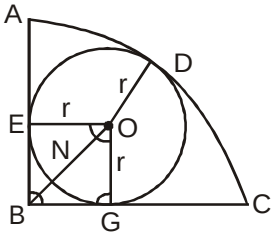
$BC.\ DB = a^2$

$DB = \frac{a^2}{BC} = \frac{a^2}{\sqrt{a^2 + 16}}$

$OD = OB - DB = \frac{1}{2}\sqrt{a^2 + 16} - \frac{a^2}{\sqrt{a^2 + 16}}$

$= \frac{1}{2}\left[\frac{a^2 + 16 - 2a^2}{\sqrt{a^2 + 16}}\right] = \frac{16 - a^2}{2\sqrt{a^2 + 16}}$

4. (a); Let radius of smaller circle = r



BE and BG are the tangent to smaller circle.

ACE REASONING ABILITY

Chapter 1

Analogy

Analogy means correspondence or similarity. This word has been derived from two words "Ana" means "Relation" and "Logy" means "Information". It shows a comparison to show a similarity between two things. The similarity shows different relation such as unit, country, work, etc.

There are some common relationships which are given below as :

TYPE – 1 :

(A) Country and capital relationship: This relationships shows that 1st object is country and 2nd object shows its capital.

For example: China : Beijing : : India : New Delhi

(a) France : Paris (b) Sri Lanka : Colombo
(c) Australia : Canberra (d) Austria : Vienna
(e) Canada : Ottawa (f) Italy : Rome
(g) Pakistan : Islamabad (h) Cuba : Havana

(B) State and capital:

For Example: Rajasthan : Jaipur.

Rajasthan is a state and its capital is Jaipur. Some more examples are given below :

(a) Tamilnadu : Chennai
(b) Assam : Dispur
(c) Bihar : Patna
(d) Gujrat :Ahmedabad
(e) Meghalaya :Shillong
(f) West bengal: Kolkata
(g) Sikkim :Gangtok
(h) U.P : Lucknow

(C) Country and currency:

Example: India : Rupee

India is related to rupee as its currency.

Some more examples are given below :

(a) Korea : Won
(b) USA : Dollar
(c) China : Renminbi
(d) Tazakistan : Somoni
(e) UK : British Pound
(f) France : Euro
(g) Nepal : Nepalese rupee
(h) Germany : Euro

(D) Country and name of parliament:

Example : USA : Congress

(a) Libya : Majilis an-Nuwwab
(b) Malaysia : Parliament
(c) South Korea : National Assembly
(d) Japan : Diet
(e) Nepal :RashtriyaPanchayat
(f) Russia : Duma
(g) UK : Parliament
(h) Bangladesh : Jatia Sansad

(E) Instrument and measurements and units :

(a) Barometer : Atmospheric pressure
(b) Hygrometer : Humidity
(c) Lactometer : Purity of milk
(d) Viscometer : Viscosity of liquid
(e) Cardiograph : Movement of heart beat
(f) Frequency : Hertz
(g) Force : Newton
(h) Time : Second

(F) Country and its national games :

Example: India : Hockey

(a) Maldives : Football
(b) Japan : Sumo
(c) USA : Baseball
(d) U.K. : Cricket
(e) South Korea : taekwondo
(f) Indonesia : Badminton
(g) China : Table tennis
(h) Sri Lanka : Volleyball

(G) Individual and group :

Example: Goods : Stock

A lot of goods called as stock.

Some more examples are given below :

(a) Bees : Swarm (b) Sheep : Flock
(c) Flowers : Bouquet (d) Robbers : Gang
(e) Musicians : Band (f) Ministers : Council
(g) Soldiers : Army (h) Grapes : Bunch

(H) Animal and its young one :

Example: Cow : Calf

Calf is the young one of cow.

Some more examples are given below:

(a) Duck :Ducklings (b) Bear : Cub
(c) Frog :Tadpole (d) Man : Child
(e) Cat : Kitten (f) Sheep : Lamb
(g) Deer : Fawn
(h) Butterfly : Caterpillar

(I) Individual/Things and their classes :

Example: Man : mammal

Man belongs to the class of mammal.

Some more examples are given below:-

(a) Snake : Reptile (b) Whale : Mammal
(c) Rat : Rodent (d) Table : Furniture
(e) Ostrich : Bird (f) Butterfly : Insect
(g) Pen : Stationery (h) Cup : Crockery

(J) Animals/Things and their sounds:

(a) Coins : Jingle (b) Money : Gibber
(c) Snake : Hiss (d) Elephant : Trumpet
(e) Hen : Cackle (f) Rain : Patter
(g) Mice : Squeak (h) Drum : Beat

(K) Male and Female:

(a) Monk : Nun (b) Wizard : Witch
(c) Stag : Doe (d) Master : Mistress
(e) Colt : Filly (f) Drone : Bee
(g) Bachelor : Spinster (h) Lord : Lady

(L) Individual and dwelling place :

Example: Bee : Hive

A bee lives in a hive.

Some more examples are given below:-

(a) Lion : Den (b) Bird : Nest
(c) Horse : Stable (d) King : Palace
(e) Soldiers : Barracks (f) Spider : Web
(g) Eskimo : Igloo (h) Owl : Owlery

(M) Games and place of playing:

Tennis : Court

Tennis is played in a court.

(a) Wrestling : Arena
(b) Cricket : Pitch
(c) Badminton : Court
(d) Race : Track
(e) Boxing : Ring

(N) Professionals and their work places;

Example: Teacher : School.

Some more examples are given below :

(a) Servant : House (b) Clerk : Office
(c) Worker : Factory (d) Mechanic : Garage
(e) Warrior : Battlefield (f) Gambler : Casino
(g) Umpire : Pitch (h) Doctor : Hospital

(O) Study and topic :

Example: Pedology : Soil.

Some more examples are given below:

(a) Pathology : Diseases
(b) Seismology : Earthquake
(c) Ornithology : Birds
(d) Mycology : Fungi
(e) Botany : Plants
(f) Cardiology : Heart
(g) Taxonomy : Classification
(h) Physiology : Human body

(P) Product and material:

Example: Jewellery : Gold

Jewellery is made of Gold.

Some more examples are given below.

(a) Rubber : Latex (b) Furniture : Lumber
(c) Fabric : Yarn (d) Paper : Pulp
(e) Jaggery : Sugarcane (f) Metal : Ore
(g) Limestone : Cement
(h) Clothes of fabrics : Cotton

(Q) Word and synonym :

Example: Inception : Beginning.

Both words are used for starting or source.

Some more examples are given below:-

(a) Paradox : Juxtaposition
(b) Vigorous : Active
(c) Proliferate : Generate
(d) Blame : Censure
(e) Adulation : Applause
(f) Diligent : Attentive
(g) Counsel : Advice
(h) Bravery : Fortitude

(R) Word and Antonym :

Example : Absolve : Accuse

(a) Accord : Disagreement (b) Bleak : Pleasant

(c) Consent : Disagree (d) Cease : Begin

(e) Efface : Maintain (f) Impute : Support

(g) Jejune : Exciting (h) Judicious : Foolish

(S) Disease and Causative Agent:

Example : Cholera : Contaminated food and water.

Some more example are given below:-

(a) Typhoid Fever : Food

(b) Tetanus : Injured surface

(c) Tuberculosis : Air

(d) Rabies : Animal Bite

(e) Influenza : Droplet infection

(f) Malaria : Mosquito

(g) Beef Tapeworm : Beef consumption

(h) Eye worm : Deerfly

TYPE : 2 ALPHABETICAL ANALOGY

Alphabetical Analogy: It is second type of Analogy where one alphabetical letter or Word related to another word or letter with a certain relationship so, we have to establish the same relation between rest part of the question to maintain the given logic.

(1) ACE : GIK : : RTV : XZB

ACE is related to GIK in these two word the letters increase with six digit same as it is RTV change into XZB after increment of 6 letters.

In Alphabet analogy the change between two words having three rules which are:-

(1) Increment and decrement in place value.

(2) Opposite alphabets.

(3) Cross-coded

1. Increment and decrement in place value :

Place value is defined as the numerical value of alphabet in alphabetical order. For example K is 11. Some example are given below.

(a) BE :GJ : : HK : MP

1st Letters BE is increased with five place value and change in GJ. Same according this rule HK after increment of 5 result will be MP.

(b) PMJ : NKH : : YUS : WSQ

(Decrement with 2 place value)

2. Opposite alphabets : The total alphabetical letters are 26, Break them in two half part.

Then,	1	2	3	4	5	6	7	8	9	10	11	12	13
	A	B	C	D	E	F	G	H	I	J	K	L	M
	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕	↕
	Z	Y	X	W	V	U	T	S	R	Q	P	O	N
	26	25	24	23	22	21	20	19	18	17	16	15	14

E	J	O	T	Y		C	F	I	L	O	R	U	X		F	L	R	X
↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓
5	10	15	20	25		3	6	9	12	15	18	21	24		6	12	18	24

- **Opposite Letters (Trick to Learn)**

AZad — Dew

BOY — FU*ll*

CraX — Grand Trank (G.T. Road)

High School — KamlaPasand (P.K.)

Indian Railway — LOve

Jack & Queen — Narendra Modi

Ex. :- LEAP : OVZK : : CELLO : XVOOL

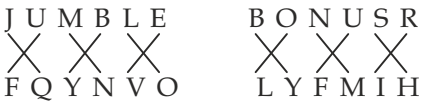
In LEAP every alphabet change with their opposite alphabet then it change as OVZK. For CELLO the result will be XVOOL.

(a) DOWN : MDLW : : TYPE : VKBG

(b) RELATION : IVOZGRLM : : CABINET : XZYRMVG

3. **CROSS-CODED :** CROSS-CODED is a term where given word is change with its letter into crossed form. It may be a combination of increment, decrement and opposite letters.

For example :- JUMBLE : FQYNU : : BONUSR : ?

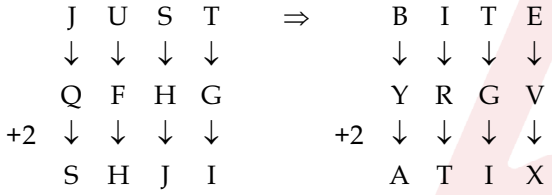


(a) WONDER ⇒ RESPECT
IVWMLD ⇒ GXVKHVI

(Cross-coding with opposite letter)

(b) JUST : SHJI : : BITE : ATIX

(Opposite letters with increment of two place value)



Type 3 : Number Analogy

Number analogy is another type of analogy. A number related to a given number in the same manner as third number pairs to another number. There are defined as mainly two types which are:-

1. Choosing a number related to a given number in the same manner as the two numbers of another given pair are related to each others.
2. Choosing a number set similar to a given number set.

For example :-

(i) 11 : 111 : : 13 : 157

11 is related to 111 as (121 - 10) = 111

and 13 is related to 157 as (169 - 12) = 157

(ii) A numerical set (40, 20, 10) is related to (32, 16, 8) as every upcoming digit is just half of previous digit.

In numerical analogy the number follow different types of logic. It can be square, cube, mathematical operation (multiplication, division etc.), sum of all numbers etc.

Note :- Always remember the logic between two number and objects must be follow any format or syntax. They have to be follow any mathematical operation and logic definitely.

Solved Examples

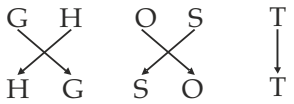
1. House : Rent : : Capital : ?
(a) Interest (b) Investment
(c) Country (d) Money

Sol. (a); House is lent on rent. Similarly, capital earns interest.

2. NUMBER : UNBMRE : : GHOST : ?
(a) HOGST (b) HOGTS
(c) HGSOT (d) HGOST

Sol. (c); Two adjacent letters are interchanged.

Similarly,



3. 18 : 30 : : 36 : ?
(a) 64 (b) 66
(c) 54 (d) 62

Sol. (b); 18 × 2 = 36 and 36 - 6 = 30.
Therefore,
36 × 2 = 72 and 72 - 6 = 66

4. France : Paris : : Italy : ?
(a) Austria (b) Havana
(c) Rome (d) Bolivia

Sol. (c); Rome is the capital of Italy.

5. West Bengal : Kolkata : : Rajasthan : ?
(a) Jaipur (b) Lucknow
(c) Dispur (d) Chennai

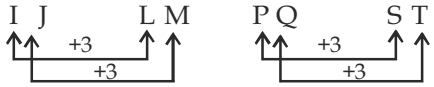
Sol. (a); Jaipur is the capital of Rajasthan.

6. 9 : 28 : : 56 : ?
(a) 3 (b) 18
(c) 112 (d) 169

Sol. (d); 9 × 3 + 1 = 28
56 × 3 + 1 = 169

7. IJ : LM : : PQ : ?
(a) TU (b) VW
(c) ST (d) US

Sol. (c);



8. Writer : Pen : : Black smith : ?
(a) Chisel (b) Saw
(c) Hammer (d) Spade

Sol. (c); Pen → main instrument for writer
Hammer → main instrument for Blacksmith

9. 30 : 16 : : 102 : ?
(a) 49 (b) 52
(c) 61 (d) 98

Sol. (b); $\frac{30}{2}+1=16; \frac{102}{2}+1=52$

10. Milk : Butter : : ? : ?
(a) Banana : Fruit (b) Wood : Paper
(c) Chilly : Spice (d) Juice : Health

Sol. (b); Butter is made from milk.
Paper is made from wood.

Practice Set

Instructions : In the following questions select the related letters / words / numbers from the given alternatives :

1. Psychology : Mind :: Ornithology : ?
(a) Sanskrit (b) Coin
(c) Mammal (d) Bird

2. Suggestion : Order :: Take : ?
(a) Give (b) Snatch
(c) Gain (d) Gift

3. Maximum : Excess :: Shy : ?
(a) Pleasant (b) Conservative
(c) Haphazard (d) Permanent

4. 169 : 13 :: 289 : ?
(a) 19 (b) 17
(c) 27 (d) 23

5. 122 : 170 :: 290 : ?
(a) 362 (b) 299
(c) 315 (d) 341

6. EGIK : WUSQ :: DFHJ : ?
(a) XVTR (b) BDFH
(c) ECGI (d) SQON

7. RED : EFS :: BLUE : ?
(a) FVMC (b) DTKA
(c) FUNC (d) GVND

8. Thread : Cloth :: Wire : ?
(a) Rope (b) Mesh
(c) Sieve (d) Telegraph

72. fertilizer : crops :: ?
(a) Teacher : Education
(b) chlorine : water
(c) Tonic : Body
(d) pesticide : rats

73. LOCKER : KMNPBDJLDFQS :: LEFT : ?
(a) KNCDSGSU (b) KMDFEGSU
(c) KMDFEGUS (d) KMDEFGUS

74. YWUS : BDFH :: WUSQ : ?
(a) DFHJ (b) FHJL
(c) JLNP (d) RTVX

75. ADCB : KNML :: EHGF : ?
(a) DGFE (b) RUST
(c) QRST (d) ZYXW

76. BCDF : GHIK :: LMNP : ?
(a) QRST (b) QRTS
(c) QRSU (d) QRSV

77.. IC : 6 :: DP : ?
(a) 14 (b) 10
(c) 12 (d) 16

78. ABCD : WXYZ :: EFGH : ?
(a) STUV (b) ZYXW
(c) VUTS (d) WXYZ

79. 83 : 25 :: 29 : ?
(a) 44 (b) 49
(c) 40 (d) 63

80. RIDE : LNBE :: HELP : ?
(a) NINP (b) BAJP
(c) JPCH (d) BJJP

Distinct Questions

81. 80 : 730 :: ? : 344
(a) 70 (b) 40
(c) 48 (d) 52

82. 130 : 154 :: 178 : ?
(a) 24 (b) 180
(c) 202 (d) 206

83.. 60 : 36 :: 100 : ?
(a) 100 (b) 10000
(c) 516 (d) 1000

84. Sty : Pig :: Byre : ?
(a) Eagle (b) Cow
(c) Tiger (d) Hen

85. 24 : 126 :: 48 : ?
(a) 433 (b) 192
(c) 240 (d) 344

86. 987 : IHG :: 654 : ?
(a) FDE (b) FED
(c) EFD (d) DEF

87. CFIL : ORUX :: DGJM : ?
(a) HJLN (b) NQST
(c) PSVY (d) RTVX

88. BEHK : YVSP :: DGJM : ?
(a) JGDA (b) ROLI
(c) WTQN (d) ZWTQ

89. 24 : 60 :: 120 : ?
(a) 160 (b) 220
(c) 300 (d) 108

90. 392 : 28 :: 722 : ?
(a) 18 (b) 28
(c) 38 (d) 48

91. 123 : 36 :: 221 : ?
(a) 52 (b) 69
(c) 72 (d) 25

92. Timid : Ass :: Cunning : ?
(a) Ant (b) Fox
(c) Rabbit (d) Horse

93. Ecstasy : Gloom :: ?
(a) Congratulations : Occasion
(b) Diligent : Successful
(c) Measure : Scale
(d) Humiliation : Exaltation

94. NUMERAL : UEALRMN :: ALGEBRA : ?
(a) LRBAGEA (b) BARLAGE
(c) LERAGBA (d) LERABGA

95. BDAC : FHEG :: NPMO : ?
(a) RQTS (b) OBJECT
(c) TRQS (d) RTQS

96. FGHI : OPQR :: BCDE : ?
(a) KLMJ (b) KLMN
(c) IUVW (d) STUW

97. PNLJ : IGEC :: VTRP : ?
(a) OMKI (b) RSTU
(c) QSRC (d) RPOM

98. 17 : 60 :: 20 : ?
(a) 57 (b) 69
(c) 81 (d) 93

99. 6 : 64 :: 11 : ?
(a) 144 (b) 169
(c) 121 (d) 124

100. 123 : 4 :: 726 : ?
(a) 23 (b) 26
(c) 14 (d) 12

30. QIOK : MMKO : : YAWC : ?
(a) USGA (b) UESG
(c) VUES (d) SUEG

31. $\frac{ABC}{F} : \frac{BCD}{I} : : \frac{CDE}{L} : ?$
(a) $\frac{DEF}{O}$ (b) $\frac{DEF}{N}$
(c) $\frac{EDF}{O}$ (d) $\frac{DEF}{M}$

32. 1 : 8 : : 27 : ?
(a) 37 (b) 47
(c) 57 (d) 64

33. 1 : 6 : : 8 : ?
(a) 11 (b) 13
(c) 12 (d) 14

34. N × M : 14 × 13 : : X × Z : ?
(a) 24 × 23 (b) 23 × 24
(c) 24 × 26 (d) 26 × 23

35. 2 : 12 : : 8 : ?
(a) 18 (b) 128
(c) 396 (d) 576

36. Secretive : Open : : Snide : ?
(a) Hidden (b) Forthright
(c) Outcome (d) Forward

37. 9 : 80 : : 100 : ?
(a) 901 (b) 1009
(c) 9889 (d) 9999

38. 324 : CBD : : 456 : ?
(a) DEF (b) FED
(c) FDE (d) EFD

39. 9 : 162 : : 8 : ?
(a) 162 (b) 128
(c) 96 (d) 112

40. 1224 : 1854 : : 2142 : ?
(a) 1648 (b) 2080
(c) 1122 (d) 981

41. IJ : LM : : PQ : ?
(a) TU (b) VW
(c) ST (d) US

42. QO : OQ : : AZ : ?
(a) AZ (b) ZY
(c) XZ (d) ZA

43. CE : XV : : MU : ?
(a) NF (b) TE
(c) XN (d) ZK

44. ? : JKHI : : TRUS : OMPN
(a) GEHF (b) GEFH
(c) LOMP (d) OPMN

45. AEJO : ZVQL : : DINS : ?
(a) WRMH (b) WSOJ
(c) WRNJ (d) WSNI

46. IRTH : HQSG : : ? : RQPO
(a) QPON (b) PQPO
(c) OPQR (d) SRQP

47. AKU : BMV : : EOY : ?
(a) FOV (b) FPX
(c) FPZ (d) FQZ

48. Which of the alternatives is odd
Abandon : give up : : ? : ?
(a) Ascent : upswing (b) Bellicose : Pacifist
(c) Capture : Arrest (d) Deliver : Relieve

49. 'Mother' is related to 'child' in the same way as 'tree' is related to-
(a) Plant (b) Fruit
(c) Root (d) Flower

50. 'Captain' is related to 'Team' in the same way as 'Leader' is related to-
(a) Chair (b) Follower
(c) Party (d) Minister

Practice Set Solutions

1. (d); Psychology is the study of mind, mental condition. Similarly, the scientific study of birds is called ornithology.

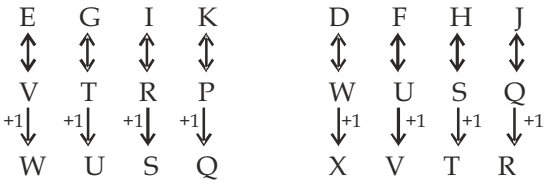
2. (b); 'Order' is of greater intensity than suggestion. Similarly, Snatch is of greater intensity than Take.

3. (b); Maximum and Excess are synonymous to each other. Similarly, Shy and Conservative are synonymous to each other.

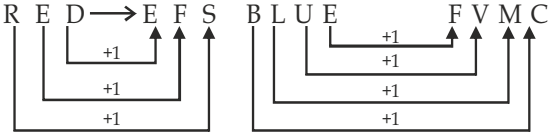
4. (b); $\sqrt{169} = 13$
Therefore,
$\sqrt{289} = \boxed{17}$

5. (a); $(11)^2 + 1 = 122$
$(13)^2 + 1 = 170$
$(17)^2 + 1 = 290$
$(19)^2 + 1 = 362$

6. (a);



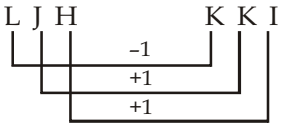
7. (a);



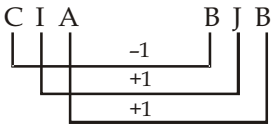
8. (b); Cloth is made from thread and mesh is made from wire.

9. (b); Scissors is used to cut cloth. Similarly, axe is used to cut wood.

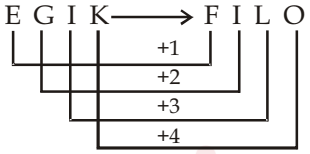
10. (a);



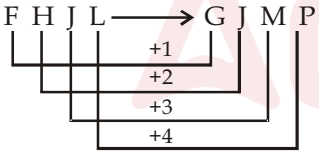
Similarly,



11. (d);



Similarly,



12. (b);

1	2	3	4	5		5	3	1	2	4
D	R	I	V	E	→	E	I	D	R	V

Similarly,

1	2	3	4	5		5	3	1	2	4
B	E	G	U	M	→	M	G	B	E	U

13. (b);

$$\begin{array}{ccc} 49 & : & 81 \\ \downarrow & & \downarrow \\ (7)^2 & & (9)^2 \end{array}$$

Similarly,

$$\begin{array}{ccc} 64 & : & 100 \\ \downarrow & & \downarrow \\ (8)^2 & & (10)^2 \end{array}$$

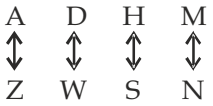
14. (a); 371 – 150 = 221

468 – 221 = 247

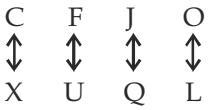
15. (a); 42 – 31 = 11

97 – 86 = 11

16. (a);



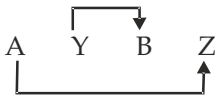
Similarly,



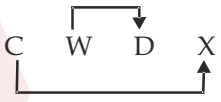
17. (c); The flow of river is controlled by constructing dam. Similarly, traffic is controlled by Signal light.

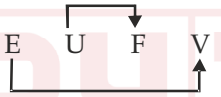
18. (a); The one who studies different varieties of birds is known as Ornithologist. Similarly, Archaeologist studies artifacts.

19. (a);

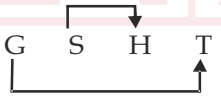


Pairs of Opposite Letters





Similarly,



20. (d);

$D \xrightarrow{-1} C \xrightarrow{+2} E \xrightarrow{+1} F$

$Q \xrightarrow{-1} P \xrightarrow{+2} R \xrightarrow{+1} S$

$X \xrightarrow{-1} W \xrightarrow{+2} Y \xrightarrow{+1} Z$

$N \xrightarrow{-1} M \xrightarrow{+2} O \xrightarrow{+1} P$

21. (b); $(4)^2 + 1 = 17$ $(6)^2 - 1 = 35$

$(12)^2 + 1 = 145$ $(14)^2 - 1 = 195$

22. (c);

+3222	+3323
+4000	+4000
7222	7323

94. (d);

1	2	3	4	5	6	7
N	U	M	E	R	A	L

It has been arranged as

2	4	6	7	5	3	1
U	E	A	L	R	M	N

Therefore,

1	2	3	4	5	6	7
A	L	G	E	B	R	A

2	4	6	7	5	3	1
L	E	R	A	B	G	A

95. (d); B D A C ⟶ F H E G (+4, +4, +4, +4)

Similarly,

N P M O ⟶ R T Q S (+4, +4, +4, +4)

96. (b); F G H I ⟶ O P Q R (+9, +9, +9, +9)

Similarly,

B C D E ⟶ K L M N (+9, +9, +9, +9)

97. (a); P N L J ⟶ I G E C (−7, −7, −7, −7)

Similarly,

V T R P ⟶ O M K I (−7, −7, −7, −7)

98. (b); $17 \times 3 + 9 = 51 + 9 = 60$

Similarly, $20 \times 3 + 9 = 60 + 9 = 69$

99. (b); $(6 + 2)^2 = (8)^2 = 64$

Similarly, $(11 + 2)^2 = (13)^2 = 169$

100. (d); $123 \Rightarrow 12 / 3 = 4$

Similarly, $726 \Rightarrow 72 / 6 = 12$

Previous Year Solutions

1. (c); X g m E ⟶ E m g X

The letters have been written in reverse order.

Therefore,

B a c K ⟶ K c a B

2. (c); G H ⟶ 7 8

The position numbers of letters in English alphabet.

Therefore,

E F ⟶ 5 6

3. (a); The letters have been written is reverse order.

C E D H → H D E C

Therefore,

P N R V → V R N P

4. (c); P Z Q W ⟶ N X O U (−2, −2, −2, −2)

Therefore,

F I S K ⟶ D G Q I (−2, −2, −2, −2)

5. (a); Light wards off Darkness. Similarly, Knowledge wards off Ignorance.

6. (b); Scissors are used to cut cloth. Similarly, Razor is used to shave the beard.

7. (c); K M L ⟶ N P O (+3, +3, +3)

Chapter 2

Odd One Out

Classification means to define groups of people or things, arrange by class or category and then find out different things or odd one out.

In this part out of a group, one people or things differ from remaining other words, they are having some common properties. They may like as a international, national level information history, science, alphabet and numerical analogy, Classification having 3 types which are below :

(a) Classify among words and people (TYPE-1)

(b) Classify among pair of word (TYPE-2)

(c) Odd one out among set. (TYPE-3)

Solved Examples

TYPE – 1 :

In this type, among four options three objects or things having same properties.

1. (a) Lawyer (b) Legislator
(c) Mayor (d) Governor

Sol. Last 3 options are related to the politics and first option does not follow. So, Lawyer is the odd one.

2. (a) Acute (b) Parallel
(c) Right (d) Obtuse

Sol. Acute, Right, obtuse are types of triangle - angle rather parallel is a property of line

3. (a) 50 (b) 120
(c) 145 (d) 37

Sol. 37 is not divisible by 5 and rest numbers are divisible by 5.

4. (a) Kanpur (b) Allahabad
(c) Varanasi (d) Mathura

Sol. All except Mathura, are situated on the bank of river Ganga.

Type – 2 :

In previous type, there is a single word or thing is given which follow same type of properties. In this type we have a pair in it, 1st object related to another object with any specific properties, we have found that pair which doesn't follow it.

1. (a) Painter : Gallery (b) Actor : Stage
(c) Worker : Factory (d) Student : Stage

Sol. Clearly, (d) is the odd one. In all other pairs, 2nd is the working place of the first.

2. (a) Ornithology : Birds (b) Mycology : Fungi
(c) Phycology : Algae (d) Biology : Botany

Sol. Clearly, answer is (d). If all other pairs, 1st is study of second field.

3. (a) 8 – 64 (b) 9 – 81
(c) 10 – 100 (d) 11 – 131

Sol. **(d);** is the answer.
$8^2 = 64$, $9^2 = 81$, $10^2 = 100$, $11^2 = 121$

Type – 3 :

In this type, pairs are given with minimum 3 digit or object which are correlated to each other with any specific property

1. (a) (3, 9, 27) (b) (5, 25, 125)
(c) (6, 36, 216) (d) (9, 81, 728)

Sol. Clearly, (d) is the odd one, which does not follow continue powers of 9.

2. (a) 5, 10, 15, 20 (b) 6, 12, 18, 24
(c) 8, 60, 10, 40 (d) 15, 30, 45, 60

Sol. Option (c) does not follow the multiples of digit 8 rather remaining have 1 : 2 : 3 : 4 ratio.

Practice Set

1. (a) CFIL (b) PSVX (c) JMPS (d) ORUX
2. (a) XW (b) PO (c) FG (d) ML
3. (a) EBD (b) QNO (c) IFH (d) YVX
4. (a) xXYA (b) hHIK (c) bBCE (d) iIMP
5. (a) Sun (b) Moon (c) Mars (d) Universe
6. (a) Faraday (b) Beethoven (c) Newton (d) Edison
7. (a) Inch (b) Foot (c) Yard (d) Quart
8. (a) Peak (b) Mountain (c) Hillock (d) Valley
9. (a) N M O L (b) PK QI (c) RISH (d) TGUF
10. (a) Reader (b) Writer (c) Publisher (d) Reporter
11. (a) Island (b) Coast (c) Harbour (d) Oasis
12. (a) Carrot (b) Potato (c) Ginger (d) Cabbage
13. (a) AUgPZ (b) YGLHT (c) MXiDV (d) KFeC
14. (a) Cheras (b) Chandelas (c) Pallavas (d) Cholas
15. (a) 66-56 (b) 101-90 (c) 41-30 (d) 33-22
16. (a) Stamp : letter (b) Ticket : Train (c) Ink : Pen (d) Car : Engine
17. (a) Army : General (b) Team : Captain (c) Creche : Infant (d) Meeting : Chairman
18. (a) Wolf (b) Cat (c) Dog (d) Fox
19. (a) 12 : 14 (b) 24 : 7 (c) 37 : 4 (d) 42 : 4
20. (a) 1 (5) 2 (b) 5 (61) 4 (c) 3 (17) 24 (d) 3 (17) 4
21. (a) 6348 (b) 5745 (c) 9309 (d) 8452
22. (a) Cuba-Havana (b) Cannada : Otty (c) France : Paris (d) Austria : Vienna
23. (a) Dollar : USA (b) Won : Korea (c) Euro : UK (d) Euro : france
24. (a) Sumo (b) Maldives (c) Cricket (d) Baseball
25. (a) Wheat (b) Rice (c) Jowar (d) Beans
26. (a) BDW (b) DFU (c) FHS (d) EVE
27. (a) TOY (b) MOB (c) DEL (d) LTO
28. (a) NOON (b) NET (c) LEVEL (d) TEA
29. (a) M 14 O (b) T 21 V (c) J 12 L (d) R 19 T
30. (a) 63 (b) 81 (c) 121 (d) 225
31. (a) TSOL (b) NUR (c) NRUT (d) MEHB
32. (a) 24 (b) 35 (c) 50 (d) 63
33. (a) 9763 (b) 8648 (c) 4721 (d) 5630
34. (a) 6481 (b) 1625 (c) 2536 (d) 1211
35. (a) 462 (b) 730 (c) 531 (d) 894
36. (a) 31 (b) 13 (c) 49 (d) 19
37. (a) 1024 (b) 2916 (c) 3969 (d) 7206
38. (a) $\frac{M}{Q} : 3$ (b) $\frac{J}{N} : 3$ (c) $\frac{E}{I} : 2$ (d) $\frac{R}{X} : 5$
39. (a) July (b) August (c) December (d) June
40. (a) 4-11-70 (b) 3-27-39 (c) 15-85-5 (d) 21-7-35
41. (a) Agni (b) Prithvi (c) INS (d) Nag
42. (a) CRPF (b) NIA (c) RAW (d) IB
43. (a) Saraswati (b) Yamuna (c) Charmanwati (d) Asikni
44. (a) 101–90 (b) 201–190 (c) 301–291 (d) 401–390
45. (a) 55–55 (b) 26–61 (c) 13–31 (d) 46–64

46. (a) $9\frac{1}{11}$ (b) $7\frac{9}{13}$
(c) $5\frac{15}{17}$ (d) $5\frac{6}{19}$

47. (a) Diesel-Bus (b) Oil- Earther light
(c) Smoke-Fire (d) Petrol-Car

48. (a) Pistol (b) Sword
(c) Gun (d) Rifle

49. (a) 55×5 (b) 15×15
(c) 5×45 (d) 9×25

50. (a) R (b) W
(c) V (d) A

51. (a) Gupta dynasty (b) Nanda dynasty
(c) Maurya dynasty (d) Chola dynasty

52. (a) Vayudoot (b) Pushkar
(c) Indian Airlines (d) Air India

53. (a) Andaman-Nicobar (b) Pondi Cherry
(c) Delhi (d) Goa

54. (a) Violet (b) Blue
(c) Green (d) White

55. (a) C R D T (b) A P B Q
(c) E U F V (d) G W H X

56. (a) Harmless (b) Guilty
(c) Innocent (d) Fearless

57. (a) 2 (b) 5
(c) 8 (d) 11

58. (a) Garden-Gardener (b) Song-Singer
(c) Art-Artist (d) Dance-Dancer

59. (a) Tabla (b) Veena
(c) Sitar (d) Ektara

60. (a) Light (b) Wave
(c) Heat (d) Sound

61. (a) Distinguish (b) Scatter
(c) Differentiate (d) Classification

62. (a) POT (b) TAB
(c) HOLDS (d) LEVEL

63. (a) ZX (b) TR
(c) IF (d) OM

64. (a) 94–7 (b) 42–6
(c) 35–5 (d) 56–8

65. (a) Pond-Lake (b) Pistol-Gun
(c) Car-Bus (d) Church-Monument

66. (a) Diligent (b) Dignified
(c) Dissident (d) Devoted

67. (a) A D G J (b) N Q T V
(c) P S V X (d) C F I K

68. (a) 64 (b) 900
(c) 343 (d) 1000

69. (a) DI (b) KQ
(c) OU (d) AG

70. (a) Long-Short (b) Black-White
(c) Head-Cap (d) Friend-Foe

71. (a) Ink (b) Paper
(c) Office (d) Pen

72. (a) dc ba (b) hg fe
(c) pq rs (d) rq po

73. (a) BF JN (b) DH LP
(c) GIMQ (d) HL PT

74. (a) (37-74) (b) (52-26)
(c) (47-84) (d) (88-44)

75. (a) Hindi (b) Tamil
(c) Punjabi (d) Urdu

76. (a) Insurance (b) Provident fund
(c) Salary (d) Shares

77. (a) Play-Actor (b) Building-Architect
(c) Craft-Artisan (d) Cloth-Skirt

78. (a) BADC (b) JILK
(c) NMPO (d) VUWX

79. (a) 357 (b) 581
(c) 698 (d) 784

80. (a) 206 (b) 125
(c) 27 (d) 8

Distinct Questions

81. (a) 325 (b) 256
(c) 369 (d) 224

82. (a) Aravali Hills (b) Mole Hills
(c) Shivalik hills (d) Nilgiri Hills

83. (a) 27 (b) 57
(c) 67 (d) 87

84. (a) 5-8 (b) 17-32
(c) 19-38 (d) 21-40

85. (a) DW (b) XC
(c) UF (d) NM

86. (a) 10.5 (b) 7.5
(c) 9 (d) 11.5

87. (a) Stethoscope (b) Microscope
(c) Telescope (d) Binocular

88. (a) Cotton (b) Terene
(c) Silk (d) Wool

89. (a) R G T F (b) M L O K
(c) C T E S (d) V D Z C

90. (a) U Z D G I (b) J O S V X
(c) R W A C E (d) F K O R T

91. (a) Confluence (b) Concourse
(c) Radiation (d) Concentration

92. (a) Carpenter (b) Goldsmith
(c) Blacksmith (d) Driver

35. (a) 400 (b) 484
(c) 625 (d) 728

36. (a) 1000 (b) 1725
(c) 2744 (d) 4125

37. (a) 12-16 (b) 45-80
(c) 30-40 (d) 36-48

38. (a) CX (b) DW
(c) JQ (d) LR

39. (a) Cyclotron (b) Basic
(c) Pascal (d) Fortran

40. (a) Rooster (b) Buck
(c) Gander (d) Peahen

41. (a) PNB (b) OBC
(c) Dena Bank (d) RBI

42. (a) Teaching (b) Counselling
(c) Instruction (d) Guidance

43. (a) (25,49) (b) (121,169)
(c) (7,169) (d) (9,25)

44. (a) HEAT (b) MEAT
(c) MEET (d) BEAT

45. (a) 8395 (b) 7245
(c) 6322 (d) 8246

46. (a) FhjL (b) PrtV
(c) KnpR (d) Cegi

47. (a) Table Tennis (b) Cricket
(c) Volleyball (d) Football

48. (a) Andhra pradesh (b) Maharashtra
(c) Kerala (d) Rajasthan

49. (a) 284 (b) 263
(c) 195 (d) 242

50. (a) 7 : 98 (b) 9 : 162
(c) 12 : 288 (d) 17 : 572

51. (a) 3 : 00 (b) 9 : 00
(c) 12 : 30 (d) 6 : 15

52. (a) Nana Shahib (b) Bakht Khan
(c) Tatya tope (d) Bahadur Shah III

53. (a) mmmqqqttt (b) bbbfffjjj
(c) cccgggkkk (d) kkkooosss

54. (a) brass (b) steel
(c) bronze (d) tin

55. (a) Ears (b) Eyes
(c) Legs (d) throat

56. (a) Sparrow (b) Kingfisher
(c) Nightingle (d) Bat

57. (a) (1,2,4,5) (b) (6,7,14,15)
(c) (4,5,10,15) (d) (3,4,8,9)

58. (a) Shirt : Dress (b) Boy : Girl
(c) Mango : Fruit (d) Table : Furniture

59. (a) Downing Street (b) White House
(c) Kremlin (d) Kirribilli House

60. (a) Race course road (b) Akbar Bhavan
(c) Hyderabad house (d) Raj Bhawan

Practice Set Solutions

1. **(b);** Except option second PSVX doesn't follows increment of letters by 3 place.

2. **(c);** The second alphabet is immediate previous letter of 1st alphabet. In option (c) it is just reverse.

3. **(b);** IFH, YVX and EBD are follow same format, that from first alphabet decrement of 3 place value and from second alphabet increment of 2 place value.

4. **(d);** IIMP does not follow second alphabet to third alphabet consecutive sequence.

5. **(d);** All three options sun, moon, mars, are present in universe.

6. **(b);** Faraday, Newton and Edison are scientist and Beethoven is a singer.

7. **(d);** Inch, foot and yard are measurement unit of length but quart is unit of volume.

8. **(d);** All except valley is related to hill field or elevated feature.

9. **(b);** Except in P K Q I, in all others there are two Pairs of opposite letters.

$N \rightarrow M$ $O \rightarrow L$
$R \rightarrow I$ $S \rightarrow H$
$T \rightarrow G$ $U \rightarrow F$

10. **(a);** Writer, publisher and reporter are related to publication field and reader is used for a person.

11. **(d);** All except Oasis related to sea and oasis is related to desert.

12. **(d);** Carrot, potato, ginger grow underground but cabbage grow above the ground.

13. **(b);** Except in YGLHT, in all others the third letter is written in small letter

14. **(b);** Cheras, pallaras and cholas related to southern part of India and chandelas are related to northern India.

15. (a); 66 – 56 = 10 101 – 90 = 11
41 – 30 = 11 33 – 22 = 11

16. (d); All except option (d), 1st object is part of 2nd object. But engine related to car, not car related to engine.

17. (c); All except option (c), 2nd object is head or main officer of the group.

18. (b); Except cat, all others belong to dog family.

19. (c); In each of pairs except (c), the product of the number is 168. Hence the answer is (c).

20. (c); In each of the alternatives except (c), the number inside it is greater than other two. Hence the answer is (c).

21. (d); All except option (d), the sum of all digit is 21.

22. (b); In each of the alternatives except (b), 2nd one is capital of first one.

23. (c); All except (c), first object is currency of second object.

24. (b); In each of alternative except (b), are name of games.

25. (d); Except Beans, all others are grains (cereals and coarse cereals)

26. (d); In each of alternatives except (d), from first letter to second letter increase by two of place value and 3rd letter is opposite of 2nd letter.

27. (d); All except (d), having middle letter a vowel.

28. (d); In each of alternatives except (d), reverse of given word also a meaningful word.

29. (c); All except option (c), middle digits is the average of place values of first and last letter.

30. (a); Except the number 63, all other numbers are perfect squares.

31. (d); All except option (d) are meaningful words in reverse order.

32. (c); In each of alternative except (c), are on digit less forming a square.

33. (c); All except option (c), the multiplication of first and second digit is third digit.

34. (d); In each of alternatives except option (d) the combination of 2-2 digit are perfect square in given number.

35. (b); All except 730, every number is divisible by digit 3.

36. (c); All except 49, every number is prime No.

37. (d); All except 7206, every number is a perfect square.

38. (c); In each of all alternative except option (c), the number is shown the number of alphabets present between given two alphabets.

39. (d); Except June, every month contain 31 days.

40. (a); Except 4-11-70, in all others the small number is a factor of the other two numbers.

41. (c); Agni Prithvi and Nag are name of Indian missile and INS term used for Naval Army.

42. (a); NIA, RAW and IB are investigation agency of India and CRPF is a part of police force.

43. (b); All except option (b), all rivers belong to the ancient India.

44. (c); All except option '3' the difference of both pair is 11.

45. (b); 55 – 55, 13 – 31, 46 – 64, 26 – 61
Odd one

46. (d); $9\frac{1}{11}=\frac{100}{11}$, $7\frac{9}{13}=\frac{100}{13}$, $5\frac{5}{17}=\frac{100}{17}$

$5\frac{6}{19}=\frac{101}{19}$ odd one .

47. (c); In the given option except 'C' first there are fuel and then are vehicles run with them but fire produces smoke.

48. (b); All except sword are related to bullet.

49. (a); 55×5=275, 15×15=225, 5×45=225, 9×25=225

50. (d); 'A' is odd because all others are consonant while 'A' is vowel.

51. (d); The other three dynasties belonged to North India, while Cholas were the rulers in south India.

52. (d); The other three are internal air ways, while Air India flies abroad also.

53. (c); The other three states/UTs are near sea beach or an island(s) in the sea.

54. (d); 'The other three are the colours of rainbow.

55. (a); Here in the three options, the first and the third and the socond and the fouth letters of alphabet are in a consecutive order.

56. (b); All the rest reflect the positive qualities of human being while Guilty reflects his negative quality.

57. (c); The other 3 numbers are prime numbers.

58. (a); One who works in garden is called gardener. All other are Artforms

59. (a); Except Tabla, all others are stringed musical-instruments.

60. (b); Except wave, all others are different forms of energy

61. (d); Classification denotes grouping

62. (c); Except HOLDS, if letters of all others words are written in reverse order, we will get another meaningful words.
POT → TOP ; TAB → BAT ; LEVEL → LEVEL

63. (c); $Z \xrightarrow{-2} X$; $T \xrightarrow{-2} R$; $I \xrightarrow{-3} F$; $O \xrightarrow{-2} M$

64. (a); Except in the number pair 94-7 in all other we get the second number by dividing the first number by 7.

65. (d); Except church - Monument, in all other pairs of words two related terms are give.

66. (c); Except Dissident, all other words imply positive attitude.

67. (a); $A \xrightarrow{+3} D \xrightarrow{+3} G \xrightarrow{+3} J$

$P \xrightarrow{+3} S \xrightarrow{+3} V \xrightarrow{+2} X$

$N \xrightarrow{+3} Q \xrightarrow{+3} T \xrightarrow{+2} V$

$C \xrightarrow{+3} F \xrightarrow{+3} I \xrightarrow{+2} K$

68. (b); $64 = 4^3$, $343 = 7^3$, $1000 = 10^3$

69. (a); $D \xrightarrow{+5} I$; $K \xrightarrow{+6} Q$

$O \xrightarrow{+6} U$; $A \xrightarrow{+6} G$

70. (c); Except in the pair of words Head-cap, in all others the two words are antonym to each other

71. (c); Except office, all others are stationery items

72. (c); $d \xrightarrow{-1} c \xrightarrow{-1} b \xrightarrow{-1} a$

$h \xrightarrow{-1} g \xrightarrow{-1} f \xrightarrow{-1} e$

$p \xrightarrow{+1} q \xrightarrow{+1} r \xrightarrow{+1} s$

$r \xrightarrow{-1} q \xrightarrow{-1} p \xrightarrow{-1} o$

73. (c); $B \xrightarrow{+4} F \xrightarrow{+4} J \xrightarrow{+4} N$

$D \xrightarrow{+4} H \xrightarrow{+4} L \xrightarrow{+4} P$

$G \xrightarrow{+2} I \xrightarrow{+4} M \xrightarrow{+4} Q$

$H \xrightarrow{+4} L \xrightarrow{+4} P \xrightarrow{+4} T$

74. (c); $37 \times 2 = 74$, $26 \times 2 = 52$, $44 \times 2 = 88$

But $47 \times 2 = 94$

75. (d); Except Urdu, all others are indigenous languages, Urdu was developed from Persian (a foreign language).

76. (c); Salary is given in lieu of work. All others are types of investment.

77. (d); Except in cloth-skirt, in all others work and worker relationship has been shown.

78. (d); $B \xrightarrow{-1} A \xrightarrow{+3} D \xrightarrow{-1} C$

$J \xrightarrow{-1} I \xrightarrow{+3} L \xrightarrow{-1} K`$

$N \xrightarrow{-1} M \xrightarrow{+3} P \xrightarrow{-1} O$

$V \xrightarrow{-1} U \xrightarrow{+2} W \xrightarrow{+1} X$

79. (c); Except 698, others are multiples of 7

$\frac{357}{7} = 51$; $\frac{581}{7} = 83$; $\frac{784}{7} = 112$

But $\frac{698}{7} = 99.71$

80. (a); Except the number 206, all other numbers are perfect cubes.

$5^3=125$, $3^3=27$; $2^3 = 8$

Distinct Solutions

81. (b); Except 256 all digit's last digit is sum of first two digit.

82. (b); Aravali, Shivalik and Nilgiri Hills are present in India and Mole Hills is a conical mound of loose soil.

83. (a); The number 27 is a perfect cube $3 \times 3 \times 3 = 27$

Note :- The number 67 may also be odd as it is a prime Number.

84. (c); $5 \times 2 - 2 = 10 - 2 = 8$

$17 \times 2 - 2 = 34 - 2 = 32$

$21 \times 2 - 2 = 42 - 2 = 40$

But $19 \times 2 - 2 = 38 - 2 = 36$

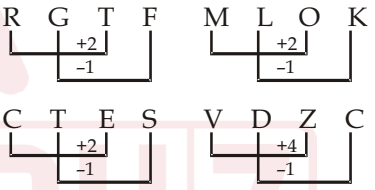
85 (a); In each of alternatives except (a), first letter is big letter as compared to second and they are opposite to each other.

86. (d); All except 11.5 number every alternatives follow a rule that is (number × 1.5 + 1.5) for example $5 \times 1.5 + 1.5 = 9$

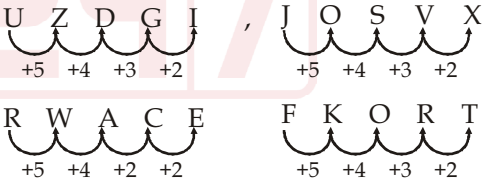
87. (a); Except Stethoscope all others are such scientific instruments that are used to view distant or small objects.

88. (b); Except Terene, all others are natural fibres.

89. (d);



90. (c);



91. (c); Radiation is different from the other three All other words show convergence.

92. (d); Except driver, all others are artisans who make something.

93. (c); $M \xrightarrow{+6} S \xrightarrow{+4} W \xrightarrow{+6} C \xrightarrow{+5} H$

$N \xrightarrow{+5} S \xrightarrow{+4} W \xrightarrow{+4} A \xrightarrow{+7} H$

$G \xrightarrow{+6} M \xrightarrow{+5} R \xrightarrow{+4} V \xrightarrow{+3} Y$

$U \xrightarrow{+5} Z \xrightarrow{+5} E \xrightarrow{+4} I \xrightarrow{+3} L$

94. (c); $E \xrightarrow{+2} G \xrightarrow{+4} K \xrightarrow{+6} Q$

$C \xrightarrow{+2} E \xrightarrow{+4} I \xrightarrow{+6} O$

$L \xrightarrow{+2} N \xrightarrow{+3} Q \xrightarrow{+6} W$

$P \xrightarrow{+2} R \xrightarrow{+4} V \xrightarrow{+6} B$

SSC English Language
A Complete Guide on English Language for SSC Examinations

Chapter
1

Nouns

Noun is the name of a person, place, thing, animal, or idea. Like Ram, happiness, chain, etc.
Noun can be classified into four groups.

Which are as follows:

(i) Proper Noun
(ii) Common Noun
(iii) Collective Noun
(iv) Material Noun

(i) Proper Noun: Proper Noun Denotes a particular person, place or thing.
For Ex – India, Calcutta, Ramesh, The Ganga, etc.

(ii) Common Noun: Common Noun is the name given in common to every person or thing of the same class or kind.
For Ex – Table, Glass, Town, King etc.

(iii) Collective Noun: Collective Noun denotes a group or collection of similar individuals considered as one complete whole.

Some of the collective nouns are given below:-

Examples of Collective Noun.

1. A **band** of musicians.
2. A **board** of directors, etc.
3. A **bevy** of girls, women, officers etc.
4. A **bunch** of grapes, keys, etc.
5. A **bundle** of sticks and hay.
6. A **caravan** of merchants, pilgrims, travellers.
7. A **chain/range** of mountains or hills.
8. A **choir** of singers.
9. A **class** of students.
10. A **retinue** of servants/ attendants.
11. A **clump/ grove** of trees.
12. A **code** of laws.
13. A **cluster/ constellation/ galaxy** of stars.
14. A **company/ regiment/ army** of soldiers.
15. A **convoy** of ships, cars etc. moving under an escort.
16. A **course** or **series** of lectures.
17. A **crew** of sailors.
18. A **crowd/ mob** of people.
19. A **curriculum** of studies.
20. A **flight** of steps, stairs.
21. A **fleet** of ships or motorcars.

22. A **flock** of geese, sheep and birds.
23. A **gang** of robbers, labourers.
24. A **garland/bunch/ bouquet** of flowers.
25. A **heap** of ruins, sand, stones.
26. A **herd** of cattle.
27. A **litter** of puppies.
28. A **pack** of hounds, cards.
29. A **pair** of shoes, scissors, compasses, trousers.
30. A **series** of events.
31. A **sheaf** of corn, arrows.
32. A **swarm** of ants, bees or flies.
33. A **train** of carriages, followers etc.
34. A **troop** of horses (cavalry)
35. A **volley** of shots, bullets.
36. A **forum** of people (discussing issues)
37. A **congregation** of people (discussing religious issues)

(iv) Material Noun: Material Noun denotes matter or substance of which a thing is made.
For Ex – Iron, Silver, Gold, Milk, etc.

(v) Abstract Noun: An Abstract Noun is usually the name of a quality, action, or state considered apart from the object to which it belongs.
For Ex –

Quality	Action	State
Goodness	Laughter	Childhood
kindness	Theft	Boyhood
Whiteness	Movement	Youth
Darkness	Judgement	Slavery
Hardness	Hatred	Sleep
Brightness	Heroism	Sickness

Abstract Noun are generally formed from verbs, Adjectives and common Nouns.

(a) From Verbs:

live	life
know	knowledge
see	sight
advise	advice
laugh	laughter
please	pleasure
grow	growth
govern	government
serve	service
obey	obedience
practise	practice
think	thought

(b) From Adjectives

brave	bravery
great	greatness
poor	poverty
young	youth
wise	wisdom
long	length
deep	depth
grand	grandeur
good	goodness
honest	honesty
just	justice
true	truth
broad	breadth
wide	width
sole	solitude
kind	kindness

(c) From Common Nouns:

boy	boyhood
infant	infancy
thief	theft
slave	slavery
friend	friendship
judge	judgement
girl	girlhood
agent	agency
hero	heroism
bond	bondage
leader	leadership
coward	cowardice

<u>The Noun- Number</u> (Singular/Plural)

On the basis of number, there are two types of noun.

(a) Singular Noun

(b) Plural Noun

Singular Noun: A noun that is used to denote a single (one) person or thing is called singular Noun.

For Ex – Boy, girl, man, bird, tree, etc.

Plural Noun: A noun that is used to denote more than one person or thing is called plural Noun

For Ex – Boys, girls, men birds, trees, etc.

There are some rules which must be followed to ensure grammatical accuracy.

Rule 1: Hyphenated noun does not have plural form.

Ex – (a) He gave me two **hundred-rupees** notes. (change 'rupees' into 'rupee')

(b) He stays in **five-stars** hotels. (change 'stars' into 'star')

Rule 2: Certain nouns/words are used in colloquial English in India which is wrong as the word is literally translated from English to Hindi.

Ex –

Wrong	**Correct**
1. Cousin brother / Cousin sister	**1.** Cousin
2. Pick pocketer	**2.** Pick pocket
3. Good name	**3.** Name
4. Big blunder	**4.** Blunder (means a big mistake)
5. Strong breeze	**5.** Strong wind (Breeze is always light and gentle)
6. Bad dream	**6.** Nightmare
7. Proudy	**7.** Proud
8. According to me	**8.** In my opinion

We generally get confused while using the following nouns:-

(a) **Floor** (the flat surface of a room)
(b) **Skill** (we acquire it by learning)
(c) **Envy** (a wish to possess that the other person has.)

(a) **Ground** (surface of the earth)
(b) **Talent** (A natural ability)
(c) **Jealousy** (a feeling that arises out of fear of losing that you have.)

How Plural is formed

Generally, the Plurals of nouns are formed by adding 's' to the singular form.

For Ex –

boy — boys
Bird — birds
Ship — ships
Pencil — pencils
Cassette — cassettes

Girl — girls
Cow — cows
Desk — desks
Book — Books
Film — films

But, there are some rules of changing singular nouns into plural ones.

Rule 1: If —s, —ss, —sh, —ch, —x and —z are the last letters of noun, put —es to the end to make them plural.

Singular	Plural	Singular	Plural
Class	Classes	Mass	Masses
Kiss	Kisses	Toss	Tosses
Miss	Misses	Bus	Buses
Brush	Brushes	Dish	Dishes
Bush	Bushes	Watch	Watches
Bench	Benches	Match	Matches
Branch	Branches	Tax	Taxes
Box	Boxes	Topaz	Topazes

But, in case of Stomach (Pronounced as Stomak), Monarch (Pronounced as Monark) only s is needed at their end to make them plural.

Stomach Stomachs
Monarch Monarchs

Rule 2: If there is —O in the end of a noun, put —es to the end for plural.

Singular	Plural	Singular	Plural
Hero	Heroes	Zero	Zeroes
Volcano	Volcanoes	Mango	Mangoes
Mosquito	Mosquitoes	Echo	Echoes
Potato	Potatoes	Buffalo	Buffaloes
Negro	Negroes	Cargo	Cargoes
Bingo	Bingoes		

There are some exceptions where only —s is needed for a plural one in —o ending nouns.

Singular	Plural	Singular	Plural
Photo	Photos	Piano	Pianos
Dynamo	Dynamos	Canto	Cantos
Quarto	Quartos	Momento	Momentos
Solo	Solos	Stereo	Stereos

Rule 3 : If there are double vowels to the end of noun, put only —s to the end of that noun for plural.

Singular	Plural	Singular	Plural
Radio	Radios	Ratio	Ratios
Studio	Studios	Portfolio	Portfolios
Cuckoo	Cuckoos	Bamboo	Bamboos

Rule 4 : If —y is the last letter of a noun and that —y is preceded by a consonant, then change y into ies for the plural forms.

Singular	Plural	Singular	Plural
Spy	Spies	Baby	Babies
History	Histories	Lady	Ladies
Fly	Flies	Sky	Skies
Story	Stories	City	Cities
Army	Armies	Pony	Ponies

Rule 5 : If —y is the last letter of a noun and that —y is preceded by a vowal, put only –s to the end of that noun for plural.

Singular	Plural	Singular	Plural
Lay	Lays	Bay	Bay
Ray	Rays	Prey	Preys
Key	Keys	Storey	Storeys
Tray	Trays	Day	Days
Clay	Clays	Play	Plays

Rule 6 : If —f or —fe are the last letters of a noun, then change —f or —fe into 'ves'.

Singular	Plural	Singular	Plural
Knife	Knives	Life	Lives
Wife	Wives	Thief	Thieves
Leaf	Leaves	Loaf	Loaves
Calf	Calves	Handkerchief	Handkerchieves
Wolf	Wolves	Shelf	Shelves
Self	Selves		

Yet, there are some exceptions to this rule, such as:

Singular	Plural	Singular	Plural
Proof	Proofs	Roof	Roofs
Chief	Chiefs	Reef	Reefs
Gulf	Gulfs	Belief	Beliefs
Grief	Griefs	Brief	Briefs
Serf	Serfs	Dwarf	Dwarfs
Hoof	Hoofs	Strife	Strifes

Rule 7 : It is found that a few nouns form their plural by changing the inside vowel of the singular form.

Singular	Plural	Singular	Plural
Man	Men	Woman	Women
Tooth	Teeth	Goose	Geese
Mouse	Mice	Louse	Lice
Foot	Feet		

Rule 8 : There are a few nouns that form their plural by adding en to the singular.

Singular	Plural	Singular	Plural
Ox	Oxen	Child	Children

Rule 9 : There are some nouns which have their singular and plural forms alike.

Singular	Plural	Singular	Plural
Swine	Swine	Sheep	Sheep
Deer	Deer	Trout	Trout
Salmon	Salmon	Pair	Pair
Dozen	Dozen	Score	Score
Gross	Gross	Stone (unit)	Stone

Rule 10: There are some nouns which are only used in the plural. They take plural verb with them.

(a) Names of instruments which have two parts forming a kind of pair.
For Ex – Ballows, spectacles, scissors, tongs, pincers etc.

(b) Names of certain articles of dress.
For Ex – Trousers, breeches, drawers etc.

(c) Certain other nouns.
For Ex – Annals, thanks, proceeds (of a sale), tidings, environs, nuptials, obsequies, assets, chattels, odds, amends, seals, shambles, vegetables, troops, particulars, aborigins, alms, ashes, arrears, dregs, eaves, earnings, sweepings, etc.

Rule 11: There are some plural forms of nouns which are actually singular. They take singular verb with them.
For Ex – Innings, mathematics, news, civics, politics, physics, ethics, economics, mechanics, summons, measles, mumps, rickets, singles, billiards, athletics etc.
For Ex – Mathematics is an easy subject. (Mathematics is singular number)

If plural looking subjects are particularised or possessed, they becomes as plural nouns.

(a) **My Mathematics** are strong.
↓
Possessed
↓
Plural Number

(b) **The politics** of our state are dirty.
↓
Particularised
↓
plural number

(c) The **summons** was issued by the magistrate

↓

singular number

Rule 12: The following nouns are always used in singular number.

For Ex – Scenery, machinery, poetry, stationery, sultry, jewellery, crockery, luggage, baggage, breakage, haltage, percentage, knowledge, postage, wastage, furniture, information, traffic, coffee, dust etc.

Rule 13: Certain Collective Nouns, though singular in form, are always used as plurals.

For Ex – Poultry, cattle, vermin, people, gentry, police and peasantry etc.

Rule 14: In Compound Nouns, we make their pural forms only by adding 's' to the main word.

Singular	Plural
Father-in-law	Fathers-in-law
Daughter-in-law	Daughters-in-law
Mother-in-law	Mothers-in-law
Commander-in-chief	Commanders-in-chief
Step-daughter	step-daughters
Maid-servant	Maid-servants
Looker-on	Lookers-on
Passer-by	Passers-by
Man-of-war	Men-of-war
Coat-of-mill	Coats-of-mill

Now, look at these examples:

Singular	Plural
Man killer	Man killers
Chief Minister	Chief Ministers
Woman hater	Woman haters
Cupful	Cupfuls
Handful	Handfuls
Drawback	Draw backs

Rule 15: Noun borrowed from other languages in English have their special rules to change them into plural.

Singular	Plural	Singular	Plural
Datum	Data	Ditum	Dita
Erratum	Errata	Bacterium	Becteria
Referendum	Referenda	Momorandum	Memoranda
Agendum	Agenda	Medium	Media
Sanatorium	Sanatoria	Criterion	Criteria
Phenomenon	Phenomena	Oasis	Oases
Thesis	These	Hypothesis	Hypotheses
Analysis	Analyses	Crisis	Crises
Index	Indice/Indices		

Rule 16: Some—um ending Latin nouns take only —s in plural form.

Singular	Plural
Harmonium	Harmoniums
Forum	Forums
Pendulum	Pendulums
Stadium	Stadiums
Quorum	Quorums
Premium	Premiums

Rule 17: Noun + Proposition + the same noun remain always singular in use.

For Ex –

Village after village —correct
Match after match —correct
Row upon row —correct
Word for word. —correct
But,
Villages after villages —wrong
Matches after matches —wrong
Rows upon rows —wrong
word for words —wrong

Rule 18: The digits, some words and abbreviations take their plural form in the following ways:

Singular	Plural
70	70s
21	21s
if	ifs
M.A.	M.As (not M.A.'s)
B.A.	B.As (not B.A.'s)
M.L.A.	M.L.As (not M.L.A.'s)
M.P.	M.Ps

Rule 19: Some nouns have two meanings in the singular but only one in plural.

	Singular	Plural
Light	1. radiance 2. a lamp	Lights : Lamps
Practice	1. habit 2. exercise of a profession	Practices : habits
Powder	1. dust 2. a dose of medicine in fine grains like dust	Powders : doses of medicine
People	1. nation 2. Men and women	Peoples : nations

Rule 20: Some nouns have two forms for the plural, each with a somewhat different meaning.

Singular	Plural
Brother	Brothers : Sons of the same parent Brethren : members of a society of a community.
Cloth	Cloths : kinds or pieces of cloth. Clothes : garments.
Die	Dies : stamps for coining. Dice : small cubes used in games.
Fish	Fishes : taken separately. Fish : collectively
Genius	Geniuses : persons of great talent Genii : spirits
Index	Indexes : tables of contents to books Indices : signs used in algebra
Penny	Pennies : number of coins. Pence : amount in value

Rule 21: Some nouns have one meaning in the singular and more than one in the plural.

Singular	Plural	
Colour : hue	Colours :	1. Hues 2. the flag of a regiment
Custom : habit	Customs :	1. habits. 2. Duties levied on imports.
Effect : result	Effects :	1. results 2. property
Manner : method	Manners :	1. methods 2. correct behaviour
Moral : a moral lesson	Morals :	1. moral lessons 2. conduct
Number : quantity	Numbers :	1. quantities 2. verses
Pain : Suffering	Pains :	1. sufferings 2. care, exertion
Premise : proposition	Premises :	1. propositions 2. buildings.
Quarter : fourth part	Quarters :	1. Fourth part. 2. Lodgings

Singular	Plural	
Spectacle : a sight	Spectacles :	1. sights. 2. Eye-glasses
Letter : letter of the alphabet	Letters :	1. letters of the alphabet 2. epistles 3. literature
Ground : earth	Grounds :	1. enclosed land 2. attached to house 3. reasons dregs

Rule 22: Some nouns change their meaning when we make them plural.

Singular	Plural
Air : atmosphere	Airs : affected manners
Alphabet : letter	Alphabets : languages
Advice : counsel	Advices : information
Abuse : bad language	Abuses : Evil
Compass : extent, range	Compasses : an instrument for drawing circles
Force : strength	Forces : military forces
Good : benefit, well-being	Goods : merchandise
Physic : medicine	Physics : natural science
Practice : habit	Practices : traditions
Iron : a kind of metal	Irons : fetters
Light : radiant	Lights : lamps
Respect : regard	Respects : compliments
Work : duty	Works : creations

Rule 23: **(a)** Abstract Nouns have no plural.
For Ex – Hope, charity, love, kindness, happiness, hatred etc.
When such words do appear in the plural, they are used as common nouns.
For Ex – Kindness = acts of kindness.
Provocations = instances or cases of provocation.

(b) There are also some names of substances or materials which are never used in plurals. They are called **Material Nouns.**
For Ex – Copper, iron, tin, wood etc.
But, when these words are used in the plural, they become Common nouns and also, their meanings are changed.
For Ex – Coppers-Copper coins.
Irons —fetters.
Tins —cans made of tin.
Woods —forests.

The Noun – Gender

In grammar, gender is the sexual classification of noun.
Gender can be divided into four categories.

Which are as follows:

(i) Masculine Gender (which denotes male sex)

(ii) Feminine Gender (Which denotes female sex)

(iii) Common Gender (which denotes both male and female)

(iv) Neuter Gender (which denotes no sex and is used for non-living things)

Rules for changing masculine nouns into feminine nouns:

(1) By using a different word.

For Ex –

Masculine	Feminine	Masculine	Feminine
Father	Mother	Brother	Sister
Husband	Wife	Boy	Girl
Uncle	Aunt	Pappa	Mamma
Nephew	Niece	Man	Woman
King	Queen	Gentleman	Lady
Sir	Madam	Son	Daughter
Cock	Hen	Boar	Sow
Stag	Hind	Swan	Nymph
Widower	Widow	Fox	Vixen
Beau	Bettle	Gander	Goose
Bachelor	Maid, Spinster	Drone	Bee
Horse (or Stallion)	Mare	Bullock	Heifer
Hart	Roe	Buck	Doe
Wizard	Witch	Bull (or Ox)	Cow
Earl	Countess	Groom	Bride
Drake	Duck		
Colt	Filly		
Dog (or Hound)	Bitch		
Monk (or Frian)	Nun		
Lad	Lass		

(2) By adding a syllable (—ess, —ine, —trix, —a, etc.)

For Ex –

Masculine	Feminine	Masculine	Feminine
Lion	Lioness	Heir	Heiress
Host	Hostess	Poet	Poetess
Priest	Priestess	Mayor	Mayoress
Patron	Patroness	Peer	Peeress
Benefactor	Benefactress	Conductor	Conductress
Negro	Negress	Enchanter	Enchantress
Instructor	Instructress	Founder	Foundress
Waiter	Waitress	Traitor	Traitress
Seamster	Seamstress	Tempter	Temptress
Songster	Songstress	Preceptor	Preceptress
Murderer	Murderess	Sorcerer	Sorceress

Ex – **(a)** Everyone's concern is no one's concern.

(b) Everydoby's business is nobody's business.

- If 'else' is used with anybody/ no body etc, 'apostrophe' will be used with 'else'.

Ex – **(a)** I can rely on your words, not **somebody else's.**

(b) I obey your orders and **nobody else's.**

(Here, it will be wrong to write somebody's else/nobody's else.)

(4) Dative Case: It noun or Pronoun has been called or addressed, It is called Dative Case.

For Ex – Shivam, Go there.

Read loudly, Priya.

Exercise

Directions: Read each sentence to find out whether there is any grammatical error in it. The error, if any, will be in one part of the sentence. The number of that part is the answer. If there is no error, the answer is '4' i.e. No error, (Ignore the errors of punctuation, if any).

1. Jaya Jyostsna went (1)/to her friend's house (2)/and gave her two ten-rupees note. (3)/No error (4).

2. There was (1)/no money in the bank in Dhananjay's (2)/ and Mritunjay's joint account. (3)/No error (4)

3. Thousand (1)/of rupees were (2)/ spent by him. (3)/No error (4)

4. The machineries are (1)/not functioning properly (2)/ these days. (3)/No error (4)

5. The poetries (1)/of R.N. Tagore has been taught (2)/ in the class. (3)/No error (4)

6. Thousand of people (1)/had already been killed (2)/in the accident near Fatuha. (3)/No error (4)

7. Five thousand (1)/rupee is a large amount (2)/ for everybody. (3)/No error (4)

8. There is (1)/no place (2)/in the compartment. (3)/ No error (4)

9. Mr. Sharma is one of the (1)/best teacher (2)/ in our school. (3)/No error (4)

10. One of the important lesson (1)/he taught me was to save (2)/at least thirty percent of my gross income. (3)/No error (4)

11. The table's legs (1)/have been (2)/elaborately carved. (3)/ No error (4)

12. None of the student (1)/in the class scored below the (2)/ given cut-off marks. (3)/No error (4)

13. He is (1)/one of the tallest boy (2)/in the class. (3)/No error (4)

14. I have (1)/many works (2)/ to do. (3)/ No error (4)

15. Mritunjay prefers (1)/extra sugars in (2)/ his tea. (3)/No error (4)

16. All the child playing (1)/at the beach ran towards Sam when (2)/ they heard him shout. (3)/No error (4)

17. Cattles are (1)/ not allowed to (2)/ enter this place. (3)/No error (4)

18. It is a pity that (1)/even five years old boys are (2)/engaged in hazardous factories. (3)/ No error (4)

19. I visited Anna's and Steve's house (1)/ twice but found (2)/ the couple absent. (3)/No error (4)

20. A ton's weight (1)/ is too heavy for anyone to (2)/ carry on his head. (3)/No error (4)

21. He did not approve (1)/ of his son raising stupid questions and thereby (2)/ vexing the teacher. (3)/No error (4)

22. America's problems (1)/ are, however, not so serious (2)/ and awful as India. (3)/No error (4)

23. The Finance Minister boasts of improving (1)/ the economic condition of (2)/ the country's. (3)/No error (4)

24. For your sake as well as for your wife (1)/ we all wish that you may (2)/ get that job. (3)/No error (4)

25. The expert mason reported to the owner of the hotel that (1)/ there was no question (2)/ of the wall's falling down. (3)/No error (4)

26. As we are told, this idea of Mrs. Gandhi's (1)/ was totally valid in the (2)/present condition of India. (3)/ No error (4)

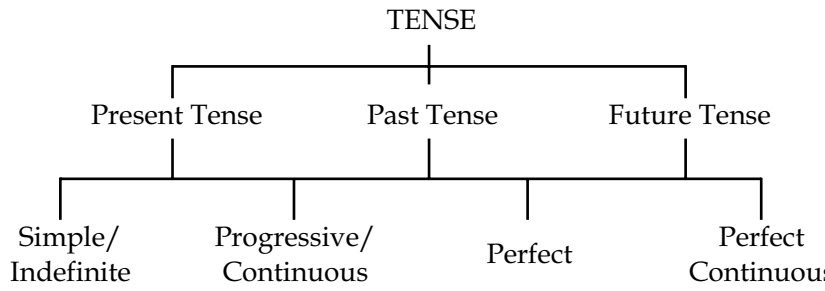
27. The teacher said to us that one ought (1)/ to work hard in order (2)/ to attain one goal. (3)/No error (4)
28. Being sure of his success, he told his friends that (1)/ he would never forget (2)/ even his enemies names. (3)/No error (4)
29. Very few soldiers dared to turn (1)/ a deaf ear to their (2)/ Commander's-in-Chief orders. (3)/No error (4)
30. Your son's-in-law's friends is seriously ill (1)/ and he wants you (2)/ to see him as soon as possible. (3)/ No error (4)

Solutions

1. **(3);** Use 'ten-rupee note'in place of 'ten-rupees note'.
2. **(2);** Use 'Dhananjay' in place of 'Dhananjay's'.
3. **(1);** Use 'Thousands' in place of 'Thousand'.
4. **(1);** Use 'The machinery is' in place of 'The machineries are' because machinery is an 'Uncountable Noun.
5. **(1);** Use 'The poetry' in place of 'The poetries'.
6. **(1);** Use 'Thousands of people' in place of 'Thousand of people'.
7. **(2);** Use 'rupees' in place of 'rupee'.
8. **(2);** Use 'room' in place of 'place'. The word 'room' is used with some nouns like train, bus, car, ship, aeroplane etc.
There is no place for you in this car. (x)
There is no room for you in this car. (✓)
9. **(2);** Use 'teachers' in place of 'teacher'.
10. **(1);** Use 'lessons' in place of 'lesson'.
11. **(1);** Use 'The legs of the table' in place of 'The table's legs'.
12. **(1);** Use 'None of the students' in place of 'None of the student'.
13. **(2);** Use 'boys' in place of ''boy'.
14. **(2);** Use 'Much work' or 'a lot of work' in place of 'Many works' because 'work' is an uncountable noun.
15. **(2);** Use 'sugar' in place of 'sugars'.
16. **(1);** Use 'All the children' in place of 'All the child'.
17. **(1);** Use 'cattle' in place of 'cattles'.
18. **(2);** Use 'five year old boys' in place of 'five years old boys'.
19. **(1);** Use 'Anna and Steve's' in place of 'Anna's and Steve's'.
20. **(4);** No error.
21. **(2);** Use 'son's' in place of 'son'.
22. **(3);** Use 'India's' in place of 'India'.
23. **(3);** Use 'country' in place of 'Country's'.
24. **(1);** Use 'wife's' in place of 'wife'.
25. **(3);** Use 'the falling down of the wall' in place of 'the wall's falling down'.
26. **(1);** Use 'Gandhi' in place of 'Gandhi's'.
27. **(3);** Use 'One's' in place of 'One'.
28. **(3);** Use enemies' in place of enemies.
29. **(3);** Use 'Commander-in-Chief's' in place of 'Commander's-in-Chief'.
30. **(1);** Use 'son-in-law's' in place of 'son's-in-law'.

Chapter
3

Tenses



On the basis of time of an action performed, we can divide sentences into the following three tenses:

(i) Present Tense (ii) Past Tense (iii) Future Tense

Again on the basis of state of an action performed, we can further classify each tense into the following four parts:

(i) Simple Indefinite Tense
(ii) Progressive/ Continuous Tense
(iii) Perfect Tense
(iv) Perfect Continuous Tense

Present Tense

This Tense expresses an action that is currently going on or habitually performed or a state that currently or generally exists. We can classify present Tense into the following four parts:

(i) Present Indefinite (Simple Present)
(ii) Present Continuous (Present Progressive)
(iii) Present Perfect
(iv) Present Perfect Continuous

(i) Present Indefinite Tense

This Tense is called Present 'Indefinite' Tense because in this Tense, the action is simply mentioned and nothing can be said about its completeness. This Tense is used to express an action which occurs on regular basis.

Structure

For Singular:

→ Sub + V_1 + s/es + Obj. (Affirmative)
For Ex – She writes a letter

→ Sub + does not + V_1 + Obj. (Negative)
For Ex – She does not write a letter.

→ Does + Sub + V_1 + Obj. + '?' (Interrogative)
For Ex – Does she write a letter?
→ Does + Sub + not + V_1 + Obj + '?' (Interrogative - Negative)
For Ex – Does she not write a letter?

For Plural:

→ Sub + V_1 + Obj (Affirmative)

For Ex – They play cricket.

→ Sub + do not + V_1 + Obj (Negative)

For Ex – They do not play cricket.

→Do + Sub + V_1 + Obj + '?' (Interrogative)

For Ex – Do they play cricket?

→ Do + Sub + not + V_1 + obj + '?' (Interrogative - Negative)

For Ex – Do they not play cricket?

Note: I is treated as 'Plural' in Present Tense.
For **Ex –** I eat dinner at 8 O'clock daily.

Uses:

1. **To show Habitual Actions**
   For Ex – (a) He goes out for a walk every day.
   (b) My father visits temple thrice a week.
2. **To show General truth/Universal truth/ permanent truth etc.**
   For Ex – (a) The sun rises in the east.
   (b) Wate r boils at 100°C.
3. **To show imperative sentences.**
   For Ex – (a) Always obey your parents.
   (b) Do not play on the road.
4. **In exclamatory sentences which start with 'Here' and 'There'**
   For Ex – (a) Here comes the train!
   (b) There rings the bell!
5. **In newspaper headlines and commentary of sports.**
   For Ex – (a) India launches a satellite.
   (b) Sachin hits a boundary.
6. **To describe the events that occurred in past in a dramatic way.**
   For Ex – (a) India uproots the British Empire.
   (b) Alexander defeats Paurus.
7. **This Tense is also used to express professional activities.**
   For Ex – (a) A barber cuts hair.
   (b) A confectioner sells sweets.

(ii) Present Continuous Tense

This Tense is used to express action that is currently in progress.

Structure

For Singular:

→ Sub + is + V_1 ing + Obj (Affirmative)

For Ex – She is singing a song.

→ Sub + is not + V_1 ing + Obj (Negative)

For Ex – She is not singing a song

→ **Is + Sub + V_1 ing + Obj + '?' (Interrogative)**
For Ex – Is she singing a song?

→ **Is + Sub + not + V_1 ing + Obj + (Interrogative – Negative)**
For Ex – Is she not singing a song?

For Plural:

→ **Sub + are + V_1 ing + Obj. (Affirmative)**
For Ex – They are playing cricket.

→ **Sub + are not + V_1 ing + Obj. (Negative)**
For Ex – They are not playing cricket.

→ **Are + Sub + V_1 ing + Obj + '?' (Interrogative)**
For Ex – Are they playing cricket?

→ **Are + Sub + not + V_1 ing + Obj + '?' (Interrogative – Negative)**
For Ex – Are they not playing cricket?

Note: 'Am' is used as helping verb with I.
For Ex – I am reading a novel.

Uses:

1. **To show a continuous action.**
   For Ex – (a) She is playing chess.
   (b) They are not driving a car.
2. **To show those actions which have following words**
   "Now, these days, now-a-days, still, at this time, at this moment, at present."
   For Ex – (a) Is she still reading?
   (b) My mother is reading the Mahabharata now.
3. **To denote a change of present state/situation into another.**
   For Ex – (a) Cars are becoming costlier day by day.
   (b) She is getting more and more complicated.
4. **To show those events/ actions that will take place in near future.**
   For Ex – (a) I am going on vacations tomorrow.
   (b) She is getting married next week.

(iii) Present perfect Tense

This Tense is used to express those actions that have been finished recently.

Structure

For singular:

→ **Sub + has + V_3 + Obj (Affirmative)**
For Ex – She has bought a house.
→ **Sub + has not + V_3 + Obj (Negative)**
For Ex – She has not bought a house.

→ **Has + Sub + V_3 + Obj + '?' (Interrogative)**
For Ex – Has she bought a house?

→ **Has + Sub + not + V_3 + Obj + ? (Interrogative – Negative)**
For Ex – Has she not bought a house?

For Plural:

→ **Sub + have + V_3 + Obj (Affirmative)**
For Ex – They have completed their work.

→ **Sub + have not + V_3 + Obj (Negative)**
For Ex – They have not completed their work.

→ **Have + Sub + V_3 + Obj + '?' (Interrogative)**
For Ex – Have they completed their work?

→ **Have + Sub + not + V_3 + Obj + ? (Interrogative – Negative)**
For Ex – Have they not completed their work?

Note: I is used as 'Plural' in this type of Tense
For Ex – I have submitted my assignment

Uses:

1. **To show the action that has just ended**
   For Ex – (a) I have written a letter
   (b) Ishan has gone to Mumbai.
2. **In sentences which consist the following:**
   "This/That/It is the first/second/third/best/worst".
   For Ex – (a) This is the worst novel, I have ever read.
   (b) It is the best book, I have ever read.
3. **To show those sentences which have the following words.**
   "Already, so far, as yet, yet, upto now, just, just now, recently, ever, lately"
   For Ex – (a) I have already taken my lunch.
   (b) Have you ever been to London?

Note: Generally, Present Perfect Tense does not take an adverb of Past time.
For Ex – 'I have seen Amit yesterday' is wrong.
⇒ Simple past is used when an adverb of past is mentioned.
Therefore, the correct usage of sentence given above should be as follows:
'I saw Amit yesterday.'

(iv) Present perfect Continuous

This type of Tense is used to express those actions that had begun in the past and are still in progress.

Structure:

For Singular:

→ **Sub + has been + V_1 ing + Obj. + since/for + Time being. (Affirmative)**
For Ex – (a) Ram has been living here since 1993
(b) Ram has been living here for last ten years.

→ **Sub + has not been + V_1 ing + Obj. + since/for + Time being. (Negative)**
For Ex – (a) Ram has not been living here since 1993.
(b) Ram has not been living here for last ten years.

→ **Has + Sub + been + V_1 ing + Obj + since/for + Time being + '?' (Interrogative)**

For Ex – (a) Has Ram been living here since 1993?

(b) Has Ram been living here for last ten years.

→ **Has + Sub + not + been + V_1 ing + Obj + since/for + Time being + '?' (Interrogative - Negative)**

For Ex – (a) Has Ram not been living here since 1993?

(b) Has Ram not been living here for last ten years.

For Plural:

→ **Sub + have been + V_1 ing + Obj. + since/for + Time being. (Affirmative)**

For Ex – (a) They have been singing since morning.

(b) They have been singing for two hours.

→ **Sub + have not been + V_1 ing + Obj. + since/for + Time being. (Negative)**

For Ex – (a) They have not been singing since morning.

(b) They have not been singing for two hours.

→ **Have + Sub + been + V_1 ing + Obj. + since/for + Time being + '?' (Interrogative)**

For Ex – (a) Have they been singing since morning?

(b) Have they been singing for two hours?

→ **Have + Sub + not + been + V_1 ing + Obj. + since/for + Time being + '?' (Interrogative - Negative)**

For Ex – Have they not been singing for two hours?

Note: 'I' is used as plural in this tense

For Ex – I have been cleaning the room since morning.

Note: (a) 'since' is used to represent 'Point of time'

(b) 'for' is used to represent 'Period of time'

Uses:

1. **To show those actions that had begun in the past and are still in progress.**
   For Ex – The baby has been sleeping since morning.
2. **It can be used with time phrases like "for, since, long, how long, all the time, all week, etc.**
   For Ex – (a) For how long have you been eating?
   (b) She has been crying all the time.

Past Tense

This Tense expresses an action that has happened or a state that previously existed

Like present Tense, Past Tense can also be classified into following four parts:"

(a) Past Indefinite (Simple Past)

(b) Past Continuous (Past Progressive)

(c) Past Perfect

(d) Past Perfect continuous

(i) Past Indefinite Tense

This Tense is used to express an action that happened or finished in the past.

Structure:

The structure of sentence with singular/plural subject remains same in Past Indefinite Tense.

(iv) Future Perfect Continuous Tense:

This Tense is used to express an action that continues upto some point of time in future.

Structure:

→ Sub + will have been + V_1 ing + Obj. + Since/for + Time being (Affirmative)

For Ex – She will have been washing clothes for 3 hours.

→ Sub + will not have been + V_1 ing + Obj + since/for + Time being (Negative)

For Ex – Will not have been washing clothes for 3 hrs.

→ Will + Sub + have been + V_1 ing + Obj + Since/for + time being + '?' (Interrogative)

For Ex – Will she have been washing clothes for 3 hours?

→ Will + Sub + not + have been + V_1 ing + Obj + since/for + time being + '?' (Interrogative – Negative)

For Ex – Will she not have been washing clothes for 3 hrs?

Note: Future perfect progressive denotes continuous action while future perfect denotes completed action.

For Ex – (a) By the end of this month, I will have been travelling for 6 months (Continuous action)

(b) By the end of this month, I will have travelled for 6 months (Completed Action)

Exercise

Directions: Read each sentence to find out whether there is any grammatical error in it. The error, if any, will be in one part of the sentence. The number of that part is the answer. If there is no error, the answer is '4' i.e. No error, (Ignore the errors of punctuation, if any).

1. The question is (1)/so complicated that (2)/it could not besolved immediately. (3)/No error (4)
2. Ragesh finished his work (1)/just before you came to see him (2)/ at his residence. (3)/No error (4)
3. Rakesh asked me (1)/why was I angry at his remarks (2)/which he had not made deliberately. (3)/No error (4)
4. If I would have spoken to my father (1)/as you spoke to me (2)/ he would have beaten me. (3)/No error (4)
5. Foolishly Dhananjay threw (1)/some water on the electric heater (2)/when it catches fire (3)/ and he got a shock. (4)/No error (5)
6. The enmity between the (1)/ two groups had reached a level (2)/where reconciliation has (3)/ become impossible. (4)/No error (5)
7. If Deepak had been with us (1)/ from the beginning (2)/we would be much happier. (3)/ No error (4)
8. As soon as Sujeet saw the tiger, (1)/ he run (2)/and climbed up the tree. (3)/No error (4)
9. Rakesh has already gone (1)/ before the (2)/roof fell down to the earth. (3)/ No error (4)
10. The film started (1)/ before we reached (2)/because we were late. (3)/ No error (4)
11. When you will find out (1)/ any solution to this problem you will become able (2)/ to finalise the project. (3)/ No error (4)
12. Whenever you are coming here, (1)/ you bring a lot of (2)/ sweets for me.(3)/ No error (4)
13. A misogynist is a person (1)/ who is hating woman but a philogynist is a person (2)/ who loves woman. (3)/ No error (4)
14. Now-a-days he teaches physics (1)/ because the teacher of physics (2)/ has been absenting himself for a month.(3)/ No error (4)

15. 'It is high time (1)/ you are starting this work.' (2)/ my friend said to me.(3)/ No error (4)
16. Many of my friends (1)/ wished to come here today but (2)/ none of them arrived yet.(3)/ No error (4)
17. She says that she will take (1)/ her umbrella (2)/ in case it will rain.(3)/ No error (4)
18. When I will be thirty (1)/ most of my friends (2)/ will be above thirty five, be sure. (3)/ No error (4)
19. This is, indeed, (1)/ the first time in my life that I hear (2)/ such an interesting story.(3)/ No error (4)
20. Before the alarm (1)/ had stopped ringing (2)/ John had pulled up the shade. (3)/ No error (4)
21. I have been knowing (1)/ him for ten years but I don't know (2)/ where he lives.(3)/ No error (4)
22. If he had a few hours to spare, (1)/ he would spend (2)/ them in a public library. (3)/ No error (4)
23. If I would have done this, (1)/ I would have done wrong and would have disappointed (2)/ many of my friends.(3)/ No error (4)
24. I wish he saw you (1)/ when you were (2)/ living in England.(3)/ No error (4)
25. I lived here since 1980, (1)/ therefore I know everything (2)/ about the city. (3)/ No error (4)
26. If we had Mohan in our team, we (1)/ would have won the match (2)/ against your team. (3)/ No error (4)
27. If I was you I would have told (1)/ the Chairman to keep (2)/ his mouth shut. (3)/ No error (4)
28. The victim tried to tell up (1)/ what has happened (2)/ but his words were not audible. (3)/ No error (4)
29. She was with me uptil now, (1)/ so don't rebuke her (2)/ for getting late. (3)/ No error (4)
30. Had he come even a moment earlier, (1)/ he would have (2)/ found me there.(3)/ No error (4)

Solutions

1. (3); Use 'it cannot be' in place of 'it could not be'. The given sentence is in present tense so use of 'can' is correct.

2. (1); Use 'Rajesh had finished his work' in place of 'Rajesh finished his work. Past perfect tense is used to describe past event.

Example-

The patient died before the doctor came.
(x)

The patient had died before the doctor came. (✓)

3. (2); Use 'why I was angry' in place of 'why was I angry'.

4. (1); Use 'If I had' in place of 'If I would have'.

5. (3); Use 'when it caught fire' in place of 'when it catches fire'.

6. (3); Use 'had' in place of 'has'.

7. (3); Use 'would have been' in place of 'would be'.

8. (2); Use 'he ran' in place of 'he run'.

9. (1); Use 'Rakesh had already gone' in place of 'Rakesh has already gone'.

10. (1); Use 'The film had started' in place of 'The film started'.

11. (1); Use 'you find' in place of 'you will find'.

12. (1); Use 'you come' in place of 'you are coming'.

13. (2); Use 'who hates' in place of 'who is hating'.

14. (1); Use 'he is teaching' in place of 'he teaches'.

15. (2); Use 'You started' in place of 'You are starting'.

16. (3); Use 'has arrived' in place of 'arrived'.

17. (3); Use 'it rains' in place of 'it will rain'.

18. (1); Use 'I am thirty' in place of 'I will be thirty'.

19. (2); Use 'I have heard' in place of 'I hear'.

20. (2); Use 'Stopped' in place of 'had stopped'.

21. (1); Use 'have known' in place of 'have been knowing'.

22. (4); No error.

23. (2); Use 'had done' in place of 'would have done'.

24. (1); Use 'had seen' in place of 'saw'.

25. (2); Use 'have lived' in place of 'lived'.

26. (2); Use 'we had had Mohan' in place of 'we had Mohan'.

27. (2); Use 'were' in place of 'was'.

28. (1); Use 'had' in place of 'has'.

29. (3); Use 'has been' in place of 'was'.

30. (4); No error.

ACE SSC GENERAL AWARENESS

Chapter 1

Ancient History

PALEOLITHIC OR OLD STONE AGE (5,00,000 B.C. – 10,000 B.C.)

- In India, the Palaeolithic Age developed in the Pleistocene period or the Ice Age and was spread.
- In practically all parts of India except the alluvial parts of Ganga and Indus.
- Food gathering and hunting were the main occupations of the people of this phase. They had no knowledge of agriculture, fire or pottery of any material.
- Man during this period used tools of unpolished, undressed rough stones and lived in cave and rock shelters.
- They mainly used hand axes, cleavers, choppers, blades, scrapers and burin.
- Their tools were made of hard rock called 'quartzite'.
- Hence Paleolithic men are also called 'Quartzite Men'.
- Homo sapiens first appeared in the last phase of Paleolithic age.
- The Paleolithic Age in India has been divided into three phases according to the nature of stone tools used by the people and also according to the nature of change in the climate – Early or lower Paleolithic, Middle Paleolithic and Upper Paleolithic.
  (a) The Early Paleolithic Age covers the greater part of the Ice Age. Its characteristic tools are hand axes, cleavers and choppers. Such tools have been found in Soan and Sohan river valley (now in Pakistan) and in the Belan Valley in the Mirzapur district of UP. In this period climate became less humid.
  (b) Middle Paleolithic Phase is characterized by the use of stone tools made of flakes mainly scrapers, borers and blade like tools. The sites are found in the valleys of Soan, Narmada and Tungabhadra rivers. During this phase, Pithecanthropus or Homo erectus evolved.
  (c) In the Upper Paleolithic Phase, the climate became warm and less humid. This stage is marked by burins and scrapers. Such tools have been found in AP, Karnataka, Maharashtra, Bhopal and Chhota Nagpur plateau.
  - The Old Stone Age sites are widely found in various parts of the Indian subcontinent and are generally located near water sources.
  - In the Old Stone Age, food was obtained by hunting animals and gathering edible plants and tubers. Therefore, these people are called as hunter-gatherers.
  - The hunting of large animals would have required the combined effort of a group of people with large stone axes. Their way of life became modified with the passage of time since they made attempts to domesticate animals, make crude pots and grow some plants.
  - A few Old Stone Age paintings have also been found on rocks at Bhimbetka in Madhya Pradesh and other places. The period before 10000 B.C. is assigned to the Old Stone Age.
  - Some of the famous sites of Old Stone Age in India are:
  (a) The Soan valley and Potwar Plateau on the northwest India;
  (b) The Siwalik hills on the north India;
  (c) Bhimbetka in Madhya Pradesh;
  (d) Adamgarh hill in Narmada valley;
  (e) Kurnool in Andhra Pradesh; and
  (f) Attirampakkam near Chennai.

- At Chopani-Mando in the Belan valley of the Vindhyas and the middle part of the Narmada valley a sequence of occupation from all the three stages of the Paleolithic to Neolithic stage have been found in sequence. Chopani Mando is an important site where fossil animal bones have been found.
- The Son and the adjacent Belan valley (Mirzapur, UP) provide a sequence of artifacts from lower Paleolithic to Neolithic.

MESOLITHIC OR MIDDLE STONE AGE (10,000 B.C. – 6000 B.C.)

- The next stage of human life is called Mesolithic or Middle Stone Age which falls roughly from 10000 B.C. to 6000 B.C. and was the transitional phase between the Paleolithic Age and Neolithic Age.
- Various Mesolithic sites are found in the Chhotanagpur region, Central India and also south of the Krishna River.
- Mesolithic remains are found in Langhanj in Gujarat, Adamgarh in Madhya Pradesh and also in some places of Rajasthan, Uttar Pradesh and Bihar.
- In the sites of Mesolithic Age, a different type of stone tools is found. These are tiny stone artifacts, often not more than five centimeters in size. These characteristic tools of the Mesolithic Age are known as Microliths-pointed, cresconic blades, scrapers, etc, all made of stone.
- The paintings and engravings found at the rock shelters give an idea about the social life and economic activities of Mesolithic people. The hunting-gathering pattern of life continued during this period.
- However, there seems to have been a shift from big animal hunting to small animal hunting and fishing. The use of bow and arrow also began during this period.
- Also, there began a tendency to settle for longer periods in an area. Therefore, domestication of animals, horticulture and primitive cultivation started.
- The last phase of this age saw the beginning of plain cultivation. Animal bones are found in these sites and these include dog, deer, boar and ostrich.
- Occasionally, burials of the dead along with some microliths and shells seem to have been practiced.

NEOLITHIC AGE (6000 B.C. – 1000 B.C.)

- A remarkable progress is noticed in human civilization in the Neolithic Age. In the world context, the New Stone Age began in 9000 B.C.
- The only Neolithic settlement in the Indian subcontinent attributed to 7000 B.C. lies in Mehrgarh, which is situated in Baluchistan, a province of Pakistan.
- In India, Neolithic Age is not earlier than 6000 BC and at some places in South and Eastern India; it is as late as 1000 B.C.
- These include the Kashmir valley, Chirand in Bihar, Belan valley in Uttar Pradesh and in several places of the Deccan.
- The important Neolithic sites are:
  (a) Burzahom and Gufkral in J&K (famous for pit dwelling, stone tools and graveyard in house),
  (b) Maski, Brahmagiri, Tekkalakota in Karnataka, Paiyampatti in Tamil Nadu,
  (c) Piklihal and Hallur in AP,
  (d) Garo hills in Meghalaya,
  (e) Chirand and Senuwar in Bihar (known for remarkable bone tools),
  (f) Amri, Kotdiji, etc.
- Koldihawa in UP revealed a threefold cultural sequence: Neolithic, Chalcolithic and Iron Age.
- The chief characteristic features of the Neolithic culture are the practice of agriculture, domestication of animals, polishing of stone tools and the manufacturing of pottery.
- The cultivation of plants and domestication of animals led to the emergence of village communities based on sedentary life.
- There was a great improvement in technology of making tools and other equipments used by man.
- Stone tools were now polished and theses polished axes were found to be more effective tools for hunting and cutting trees.
- Mud brick houses were built instead of grass huts.
- Neolithic people knew about making fire and making pottery, first by hand and then by potters wheel. They also painted and decorated their pottery.

- Pottery was used for cooking as well as storage of food grains.
- Large urns were used as coffins for the burial of the dead.
- There was also improvement in agriculture. Wheat, barley, rice, millet were cultivated in different areas at different points of time.
- Neolithic sites in Allahabad district are noted for the cultivation of rice in the sixth millennium B.C. Domestication of sheep, goats and cattle was widely prevalent.
- Cattle were used for cultivation and for transport.
- The people of Neolithic Age used clothes made of cotton and wool.

CHACOLITHIC OR METAL AGE

- The end of the Neolithic Period saw the use of metals of which copper was the first and a culture based on the use of stone and copper arrived.
- Such a culture is called Chalcolithic which means the stone-copper phase.
- The new technology of smelting metal ore and crafting metal artifacts is an important development in human civilization.
- But the use of stone tools was not given up. Some of the micro-lithic tools continued to be essential items.
- People began to travel for a long distance to obtain metal ores which led to a network of Chalcolithic cultures and the Chalcolithic cultures were found in many parts of India.
- Generally, Chalcolithic cultures had grown in river valleys.
- Gold was probably one of the earliest discoveries, but it served as a material for ornaments only.
- Important sites of this phase are spread in Rajasthan, Maharashtra, West Bengal, Bihar, MP, etc.
- In South India the river valleys of the Godavari, Krishna, Tungabhadra, Pennar and Kaveri were settled by farming communities during this period. Although they were not using metals in the beginning of the Metal Age, there is evidence of copper and bronze artifacts by the end of second millennium B.C.
- Several bronze and copper objects, beads, terracotta figurines and pottery were found at Paiyampalli in Tamil Nadu.
- The Chalcolithic people used different types of pottery of which black and red pottery was most popular.
- These people were not acquainted with burnt bricks and generally lived in thatched houses.
- It was a village economy.
- The Chalcolithic age is followed by Iron Age. Iron is frequently referred to in the Vedas.
- The Iron Age of the southern peninsula is often related to Megalithic Burials.
- Megalith means Large Stone.
- The burial pits were covered with these stones. Such graves are extensively found in South India.
- Some of the important megalithic sites are Hallur and Maski in Karnataka, Nagarjunakonda in Andhra Pradesh and Adichchanallur in Tamil Nadu.
- Black and red pottery, iron artifacts such as hoes and sickles and small weapons were found in the burial pits.

INDUS VALLEY CIVILIZATION IN INDIA

- The Indus Valley Civilization was an ancient civilization thriving along the Indus River & the Ghaggar-Hakra River in what is now Pakistan & north-western India.
- According to radio-carbon dating, it spread from the year 2500 – 1750 BC.
- Dayaram Sahni first discovered Harappa (on Ravi) in 1921. R.D. Banerjee discovered Mohenjodaro or 'Mound of the Dead' (on Indus) in 1922. Sir John Marshal played a crucial role in both these.
- Harappan Civilization forms part of the proto history of India & belongs to the Bronze Age.
- Copper, bronze, silver, gold were known but not iron.
- The Indus-Valley people were well-acquainted with the use both of cotton & wool.

Domestication of animals:

- Stock breeding was important in Indus culture. Besides sheep & goats, dogs, humped cattle, buffalo & elephant was certainly domesticated. The camel was rare & horse was not known.

Town Planning:

- Elaborate town-planning. It followed the Grid System. Roads were well cut, dividing the town into large rectangular or square blocks.
- Used burnt bricks of good quality as the building material. Elsewhere in the contemporary world, mud-bricks were used.
- In Mohenjodaro, a big public bath (Great Bath) measuring 12 m by 7 m & 2.4 m deep, has been found. Steps led from either end to the surface, with changing rooms alongside. It was probably used for ritual bathing.
- Underground Drainage System.

Major Cities & Their Features:

- Mohenjodaro (Sind) is situated on the right bank of the Indus. Great Granary, Great bath, Assembly halls, Shell strips, Pashupati Mahadev/Proto Shiva(Seal), Bronze image of Dancing girl, Steatite image of Bearded man, Clay figure of Mother goddess found in Mohenjodaro.
- Chanhudaro lies on the left bank of the Indus about 130 km south of Mohenjodaro. City without a citadel, Inkpot, Imprints of dog's paw on Brick, Terracotta model of a bullock cart, Bronze toy cart are important archeological findings of Chanhudaro.
- Kalibangan (Rajasthan) was on the banks of the river Ghaggar which dried up centuries ago. Ploughed field surface, 7 Fire alters, decorated bricks, wheels of a toy cart, Mesopotamian cylindrical seal are found in Kalibangan.
- Lothal is at the head of the Gulf of Cambay. Important excavations are Dockyard, Fire alters, Terracotta figurine of Horses, Double Burial, Terracotta Model of a ship, Dying vat, Persian/Iranian seal, Painted Jar(Bird And Fox).
- Banawali (Haryana) was situated on the banks of the now extinct Saraswati River. Important features of Lothal are lack of grid pattern town planning, lack of systematic drainage pattern, Toy Plough, Clay figures of Mother Goddess.
- Surkotoda (Gujarat) is at the head of the Rann of Kutch. Important archeological excavations are Bones of Horse, Oval Graves and Pot Burials.
- Dholavira (Gujarat) excavated is in the Kutch district. Bronze Images (Charioteer with Chariot, ox, elephant and rhinoceros) are important excavations.

Trade & Commerce in Indus Valley Civilization:

- There was no metallic money in circulation & trade was carried through Barter System.
- Weights & measures of accuracy existed in Harappan culture (found at Lothal). The weights were made of limestone, steatite, etc. & were generally cubical in shape.
- 16 was the unit of measurement (16, 64,160, 320).
- A dockyard has been discovered at Lothal. Rangpur, Somnath & Balakot functioned as seaports. Sutkagendor & Sutkakoh functioned as outlets.

Indus Valley Civilization Script:

- The script is not alphabetical but pictographic (about 600 undeciphered pictographs).
- The script has not been deciphered so far, but overlaps of letters show that it was written from right to left in the first line & left to right in the second line. This style is called 'Boustrophedon'.

VEDIC CULTURE (1500 BC-600 BC)

The Vedic Civilization was the culture and traditions of the society prevalent during the Vedic age (1500- 600 BCE).

Vedic Literature:

The term Veda means "superior knowledge" in Sanskrit.
Four major Vedas constitute the vedic literature. They are – Rig Veda, Yajur Veda, Sam Veda, and Atharva Veda.
Rig Veda – Earliest veda. Has 1028 hymns in praise Gods.
Yajur Veda – Has details of rules to be followed during sacrifices
ama Veda – Has a collection of songs. The origins of Indian music are traced to it.
Atharva Veda – has a collection of spells and charms.
Besides these Vedas, there were Brahmanas, Upnishads, Aryankas, and epics- Ramayana and Mahabharata.
Brahmanas – Prose about vedic hymns, rituals and philosophies.
Aryankas – Deal with mysticism, rites and rituals.
Upnishads – Philosophical texts dealing with soul, mysteries of nature.
Ramayana was authored by Valmiki.
Mahabharata was written by Ved Vyasa.

Classification of Vedic Period:

The period of Vedic Civilization (1500-500 BCE) is divided into two broad parts –
Early Vedic Period (1500-1000 BC), also known as Rig Vedic Period.
Later Vedic Period (1000- 600 BC).

Political Organisation in Vedic Age:

In Early Vedic Age: 'Kula' was the basic unit of political organization. Multiple families together of kinship formed a 'grama'. Group of villages were called 'visu', headed by 'vishayapati'. The highest political and administrative unit was 'jana' or tribe. There were several such tribal kingdoms – Bharatas, Matsyas, Yadus and Purus. There were two bodies- Sabha(council of elders) and Samiti(general assembly of people).

Society in Vedic Civilization: The Rig Vedic society was basically patriarchal. The basic unit of society was 'graham' or family, its head was called as 'grahapathi'. Apala, Viswavara, Ghosa and Lopamudra were women poets.
Women could attend the popular assemblies. No child marriage, sati practice
ocial divisions were not rigid. Varna system in vedic civilization.

Economic Conditions in Vedic Civilization: The Rig Vedic Aryans were pastoral, cattle rearing people. After they permanently settled in North India they began agriculture. Carpenters produced chariots and ploughs. A variety of articles with copper, bronze and iron were made by workers. Spinning was an important occupation – cotton and woolen fabrics. Goldsmiths made ornaments. The potters made different kinds of vessels for domestic use.
Trade was conducted by barter system in begining but later shifted to use of gold coins called 'nishka' for large transactions. Rivers acted as means of transport.
Coins: Besides 'nishka', 'satamana'– gold coins and 'krishnala'– silver coins were also used as a media of exchange.

Religion in Vedic Period: Rig Vedic Aryans worshiped natural forces like earth, fire, wind, rain and thunder by personifying them into many gods. Some important Rig Vedic gods – Prithvi (Earth), Agni (Fire), Vayu (Wind), Varuna (Rain) and Indra (Thunder). And 'Indra' was most popular. 'Agni' – an intermediary between the gods and the people.
'Varuna' – the upholder of natural order.
Female Gods – 'Aditi' and 'Ushas'. No temples and no idol worship. Prayers were offered to gods for rewards.

BUDDHISM IN INDIA

- Buddha Born in 563 BC on the Vaishakha Poornima Day at Lumbini (near Kapilavastu) in Nepal.
- His father Suddhodana was the Saka ruler.
- His mother (Mahamaya, of Kosala dynasty) died after 7 days of his birth. Brought up by stepmother Gautami.
- Married at 16 to Yoshodhara. Enjoyed the married life for 13 years & had a son named Rahula.
- Left his palace at 29 (with Channa, the charioteer & his favourite horse, Kanthaka) in search of truth (also called 'Mahabhinishkramana' or The Great Renunciation) & wandered for 6 years.
- Attained 'Nirvana' or 'Enlightenment' at 35 at Gaya in Magadha (Bihar) under the Pipal tree.
- Delivered the first sermon at Sarnath where his five disciples had settled. His first sermon is called 'Dharmachakrapravartan' or 'Turning of the Wheel of Law'.
- Attained Mahaparinirvana at Kushinagar (identical with village Kasia in Deoria district of UP) in 483 BC at the age of 80 in the Malla republic.

Buddhist Councils:

- The monks gathered 4 times after the death of Buddha & the effect of these events had their effect on Buddhism.
- **First Council:** At Rajgriha, in 483 BC under the chairman ship of Mehakassaapa (King was Ajatshatru). Divided the teachings of Buddha into two Pitakas – Vihaya Pitaka & Sutta Pitaka. Upali recited the Vinaya Pitaka & Ananda recited the Sutta Pitaka.
- **Second Council:** At Vaishali, in 383 BC under Sabakami (King was Kalasoka). Followers divided into Sthavirmadins & Mahasanghikas.
- **Third Council:** At Pataliputra, in 250 BC under Mogaliputta Tissa (King was Ashoka). In this, the third part of the Tripitaka was coded in the Pali language.
- **Fourth Council:** At Kashmir (Kundalvan), in 72 AD under Vasumitra (King was Kanishka). Vice-Chairman was Ashwaghosha). Divided Buddhism into Mahayana & Hinayana sects.

Buddist Literature:

- Buddhist scriptures in Pali are commonly referred to as Tripitakas, i.e. **'Threefold Basket'.**
- **Vinaya Pitaka:** Rules of discipline in Buddhist monasteries.
- **Sutta Pitaka:** Largest, contains collection of Buddha's sermons.
- **Abhidhamma Pitaka:** Explanation of the philosophical principles of the Buddhist religion.

JAINISM IN INDIA

- There were 24 tirthankaras (Prophetsor Gurus), all Kshatriyas.
- First was Rishabhanath (Emblem: Bull).
- The 23rd Tirthankar Parshwanath (Emblem: Snake) was the son of King Ashvasena of Banaras. His main teachings were: Non-injury, Non-lying, Non-stealing, Non-possession.
- The 24th & the last Tirthankar was Vardhman Mahavira (Emblem: Lion).

Ancient History Multiple Choice Questions

1. The Arthashastra was written by
   (a) Chanakya (b) Kalidasa
   (c) Harsha Vardhana (d) Vatsyayana
2. Who wrote the Panchatantra?
   (a) Vyasa (b) Vishnu Sharma
   (c) Valmiki (d) Yajnavalkya
3. Alexander defeated _____ in the battle of Hydaspes.
   (a) Porus
   (b) Chandragupta Maurya
   (c) Herakles
   (d) Eudemus
4. Ramcharitmanas is an epic poem written in which language?
   (a) Santali (b) Munda
   (c) Awadhi (d) Sanskrit
5. From which monument, Gautama Buddha propagated his divine knowledge of Buddhism to the world?
   (a) Humayun's Tomb (b) Sarnath Stupa
   (c) Qutub Minar (d) Red Fort Complex
6. Alexander the Great was born in _____.
   (a) 356 BC (b) 189 BC
   (c) 189 AD (d) 356 AD
7. Oil paint was first used for Buddhist paintings by Indian and Chinese painters in western _____ sometime between the fifth and tenth centuries.
   (a) Iraq (b) Afghanistan
   (c) Pakistan (d) India
8. Kalinga War was fought in the year _____
   (a) 1604 BC (b) 261 BC
   (c) 731 AD (d) 1113 AD
9. Chandragupta Maurya was born in _____.
   (a) 340 BC (b) 563 BC
   (c) 189 BC (d) 99 BC
10. Ashoka was an emperor of the _____ Dynasty.
    (a) Mughal (b) Chola
    (c) Maurya (d) Gupta
11. Who built the Group of Monuments at Mahabalipuram?
    (a) Chola Kings (b) Pallava Kings
    (c) Chera Kings (d) Chalukya Kings
12. Bimbisara was the king of which dynasty?
    (a) Haryanka (b) Maurya
    (c) Shunga (d) Nanda
13. Ajanta Caves in Maharashtra have rock-cut cave monuments of which religion?
    (a) Sikhism (b) Buddhism
    (c) Christianity (d) Hinduism
14. Whose reign in Indian History is called the Golden Age of India?
    (a) Mughal Empire (b) Maratha Empire
    (c) Gupta Empire (d) Maurya Empire
15. The Buddha has been eulogized as an ocean of wisdom and compassion in
    (a) Buddha-Charita (b) Jataka tales
    (c) Amarakosha (d) The Light of Aisa
16. Tripitakas are related to
    (a) Buddhism (b) Jainism
    (c) Hinduism (d) Zoroastrians
17. The Digambaras and Shvetambaras differ primarily with regard to their
    (a) Choice of god
    (b) Totally different philosphy
    (c) Dress
    (d) Rituals
18. When did the first Huna invasion take place?
    (a) 358 AD (b) 458 AD
    (c) 558 AD (d) 658 AD
19. Chandragupta (322–298 BC) was the ruler of which dynasty?
    (a) Maurya (b) Mewar
    (c) Mughal (d) Peshwas
20. Ajatashatru was the son of
    (a) Brahmadatta (b) Bindusara
    (c) Bimbisara (d) Chetaka
21. Ashoka converted to which religion after the Kalinga war?
    (a) Jainism (b) Buddhism
    (c) Christianity (d) Judaism
22. Chandragupta Maurya was an ardent follower of _____.
    (a) Sikhism (b) Jainism
    (c) Buddhism (d) Jewism
23. Chanakya was the chief advisor of _____.
    (a) Babur
    (b) Chandragupta Maurya
    (c) Akbar
    (d) Kautilya
24. What is the name of the preaching mudra or gesture, in which the Buddha is depicted delivering his first sermon, in the Gandhara Sculptures?
    (a) Abhaya (b) Dharmachakra
    (c) Dhyana (d) Bhumisparsha

286. The word Jina from which the Jainism has originated stands for
(a) great (b) detached
(c) non-violence (d) conqueror of senses

287. Who was the greatest Buddhist commentator of the Bhuddhist canonical literature?
(a) Nagarjuna (b) Ashvaghosha
(c) Vasumitra (d) Buddhaghosha

288. A dominant majority of the images at Ajanta are those of
(a) Lord Shiva (b) The Buddha
(c) Hanuman (d) Parvati

289. Who, among the following rulers, organised the Second Buddhist Assembly?
(a) Ajatashatru (b) Kalasoka
(c) Ashoka (d) Ananda

290. The term "Tirthankaras" is associated with
(a) Hinduism (b) Jainism
(c) Buddhism

291. The last in the succession of Jaina Tirthankaras was
(a) Parsvanatha (b) Rishabha
(c) Mahavira (d) Manisubruta

292. Hieun Tsang found Jainism flourishing in
(a) Orissa (b) Kashmir
(c) Bengal (d) Bihar

293. In which of the following Pitak the code of conduct is mentioned which is followed by Buddhist follower?
(a) Sutta Pitaka (b) Abhidhamma Pitaka
(c) Vinay Pitaka (d) None of the above

294. Who amongst the following is known as the Light of Asia?
(a) Jesus Christ (b) Lord Buddha
(c) Prophet Mohammad (d) Zarathustra

295. At which place, did Gautam Buddha give his first sermon?
(a) Vaishali (b) Vallabhi
(c) Rajgriha (d) Sarnath

296. Who presided over the fourth Buddhist council in Kashmir?
(a) Asvagosha (b) Upagupta
(c) Vasumitra (d) Mahakasyapa

297. Where did Ashoka send his son Mahendra as a Buddhist missionary to?
(a) Ceylon (b) Nepal
(c) Tibet (d) Khotan

298. Mention the place where Buddha attained enlightenment
(a) Rajgriha (b) Bodhgaya
(c) Kapilavastu (d) Sarnath

299. Hathigumpha inscription is attributed to which of the following emperors?
(a) Ashoka (b) Chandragupta II
(c) Samudragupta (d) Kharavela

300. Chola Empire was divided into:
(a) Mandalams, Nadu, Kurram & Valanadu
(b) Mandalams, Nadu, Malkhand & Avanti
(c) Mandalams, Bhoomi, Avanti &Valanadu
(d) Mandalams, Nadu, Kurram & Malkhand

Solutions

1. (a); The Arthashastra is the title of a handbook for running an empire, written by Kautilya (also known as Chanakya, c. 350-275 BCE) an Indian statesman and philosopher, chief advisor and Prime Minister of the Indian Emperor Chandragupta, the first ruler of the Mauryan Empire.
2. (b); Vishnu Sharma wrote Panchatantra
3. (a); Alexander defeated Porus in the battle of Hydaspes.
4. (c); Ramcharitmanas is an epic poem wriiten in Awadhi language
5. (b); Gautam Buddha delivered his first sermon to five disciples at Sarnath. Sarnath Stupa monument is built on site where Gautama Buddha propagated his divine knowledge of Buddhism to the world
6. (a); Alexander III of Macedon commonly known as Alexander the Great. He was born in Pella in 356 BC and succeeded his father Philip II to the throne at the age of twenty
7. (b); Oil paint was first used for Buddhist paintings by Indian and Chinese painters in western Afghanistan sometime between the fifth and tenth centuries
8. (b); The Kalinga War (262 – 261 BCE) was fought between the Maurya Empire under Ashoka and the state of Kalinga, an independent feudal kingdom located on the east coast, in

the present-day state of Odisha north of Andhra Pradesh

9. (a); Chandragupta Maurya was born in 340 BC in Pataliputra, in modern-day Bihar. His background is, however, uncertain. Some claim that he was born to a Nanda prince and his maid-servant, Mura, from the Shudra caste, while others state that he belonged to the Moriya tribe of Peacock-tamers
10. (c); Ashoka was an Indian emperor of the Maurya Dynasty, who ruled almost all of the Indian subcontinent from c. 268 to 232 BCE
11 (b); Mahabalipuram is the ancient sea port of the famous Pallava kingdom. According to the inscriptions, the monuments of Mahabalipuram was constructed by Pallava kings Mahendravarman I (600 to 630 AD), his son Narasimhavarman I (630 to 668 AD) and their descendants.
12. (a); Bimbisara (ruled 544-491 B.C.E.) was a king of the Magadha empire and belonged to Haryanaka dynasty, which ruled until approximately 326 B.C.E. when Alexander the Great invaded India. He ruled an area of what is now Bihar and Bengal with his capital at modern day Rajgir
13. (b); The Ajanta Caves are a series of 29 Buddhist cave temples in Ajanta, India, some of which date from the 2nd century BC. Encompassing both Theravada and Mahayana Buddhist traditions, the Ajanta caves preserve some of the best masterpieces of Buddhist art in India
14. (c); The Gupta Empire stretched across northern, central and parts of southern India between c. 320 and 550 CE. The time of the Gupta Empire is referred to as Golden Age of India in science, mathematics, astronomy, religion and philosophy
15. (c); Buddha has been eulogized as an Ocean of Wisdom and Compassion in Amarkosha. The Amarakosha is a thesaurus of Sanskrit written by the ancient Indian scholar Amarasimha
16. (a); The Tripitakas are sacred books for Buddhists
17. (c); Digambara monks do not wear any clothes. Svetambara "white-clad" is a term describing its ascetics practice of wearing white clothes
18. (b); First Huna invasion take place in 458AD
19. (a); Chandragupta Maurya (reign: 322–298 BCE) was the founder of the Maurya Empire in ancient India.
20. (c); Ajatashatru was a king of the Haryanka dynasty of Magadha in North India. He was the son of King Bimbisara and was a contemporary of both Mahavira and Gautama Buddha
21. (b); Ashoka conerted to Buddhism after Kalinga war
22. (b); Chandragupta Maurya was the founder of the Mauryan empire. He succeeded in conquering most of the Indian subcontinent. With his accession to the throne Janism assumed a new phase in the Indian history
23. (b); Chanakya was an Indian teacher, philosopher, economist, jurist and royal advisor. He is traditionally identified as Kauṭilya or Vishnugupta, who authored the ancient Indian political treatise, the Arthashastra
24. (c); In Buddhism, Dharmachakra mudra expresses the continuous energy (symbolized by a wheel/chakra) of the cosmic order. This mudra is associated with Buddha's first sermon, or teaching
25. (d); The Mauryas. With the rise of the Mauryan empire (321 BC-185 BCE), Patna, then called Pataliputra became the seat of power and nerve center of the Indian subcontinent
26. (a); King Ghatotkacha Gupta was the second ruler of the Guptadynasty. He ruled from 280 AD – 319 AD. King Ghatotkacha, was a pre-imperial king of Northern India. He was the son of Maharaja Sri Gupta, the founder of Gupta Dynasty
27. (d); The Indus Valley Civilisation (IVC), or Harappa Civilisation, was a Bronze Age civilisation (3300–1300 BCE; mature period 2600–1900 BCE) mainly in the northwestern regions of South Asia, extending from what today is northeast Afghanistan to Pakistan and northwest India

Section – C
Biology

Chapter 1

Introduction

Biology- Branch of science in which living beings are studied. Biology has two main branch :
(a) **Botany -** study of different aspects of plants. Theophrastus is known as father of Botany.
(b) **Zoology -** study of various aspects of animals. Aristotle is called Father of Biology as well as Zoology.

Important Terms of biology :

- **Anatomy-** Study of internal structure of organism.
- **Agrology –** Soil science dealing specially with production of crop.
- **Agronomy-** Science of soil management and production of crop.
- **Agrostology –** Study if grass**.**
- **Arthrology-** Study of joins**.**
- **Apiculture-** rearing of honey bee for honey**.**
- **Anthropology-** Study of origin, development and relationship between the culture of past and present human.
- **Anthology –** Study of flower and flowering plant.
- **Angiology-** Study of blood vascular system including arteries and veins.
- **Andrology-** Study of male reproductive organ.
- **Bryology-** Study of bryophytes.
- **Biometrics –** Statical study of biological problem.
- **Biomedical engineering-** Production and designing of spare part for man for overcoming various defects in man .e.g. artificial limbs, Iron lung, Pacemaker etc.
- **Biotechnology-** Technology connected with living being for wilful manipulation on molecular level.
- **Bacteriology-** Study of bacteria.
- **Cytology–** Study of cell.
- **Cryobiology –** It is the study of effect of low temperature on organisms and their preservation.
- **Clone –** Celones are genetically identical individuals in a population.
- **Cardiology –** Study of heart.
- **Clone –** Clones are genetically identical individuals in a population.
- **Demography-** Study of population.
- **Diffusion-** Random movement of molecule / ion or gases from a region of higher concentration to lower concentration.
- **Diffusion-** Random movement of molecule / gas / ion from reign of higher concentration to lower concentration.
- **Dermatology –** Study of skin.
- **Dendrochronology-** Counting and analyzing annual growth rings of tree to know its age.
- **Ecology –** Study of inter- relationship between living and their environment.
- **Evolution-** Study of origin of life, variation and formation of new species.
- **Embryology-** It is the study of fertilization and development if zygote.
- **Eugenics –** Study of factors connected with the improvement of race.
- **Euthenics –** Treatment of defective in heredity through genetics engineering.
- **Ethnology** – Study of science dealing with different races of human.
- **Ethology –** Study of animal behavior.
- **Etiology –** Study of life cycle of pathogen.
- **Entomology-** Study of insects.
- **Exobiology-** Study of possibility of life in space.

- **Floriculture-** Cultivation of plant for their flower.
- **Food technology-**Scientific processing, preservation, Storage and transportation of food.
- **Forensic science –** Application of science for identification of various facts civilian.
- **Fishery-** catching, breeding, rearing and marketing of fishes.
- **Forestry-** Development and management of forest.
- **Fermentation-** process of incomplete oxidation that occur in microbes and other cells in absence of oxygen, leading to the for nation of ethyl alcohol.
- **Genetics-** Study of variation and transmission of characters from parents to their young ones.
- **Growth –** Permanent increase in the weight and volume or size of an organism.
- **Gynecology-** Study of female reproductive organ.
- **Gerontology-**Study of ageing.
- **Gastroenterology-** Study of alimentary canal or stomach, intestine and their disease.
- **Hypertonic-** when two solution have differcut sdute concentration. The sol at ion which have higher concentration is called hypertonic.
- **Hypotonic-** in two solation which have lawer solute con centration is called hypotonic.
- **Home thermic-** Animals who have a constant body temperature are called home thermo cot warmblooded animal.
- **Histology-** Study of tissue with the help of microscope.
- **Hydroponics-** Study of growing plant without soil in water which contain nutrient.
- **Haematology**- Study of blood
- **Hepatology-** Study of liver.
- **Ichthyology-** Study of fishes**.**
- **Immunology-** Study of immunity or resistance of body to disease.
- **Metazoans-** All multicellular animals are called metazo
- **Monoecious-** Plant which have both male and female flower.
- **Morphology –** Study of external structure.
- **Microbiology-** Study of Micro- Organism like virus bacteria algae fungi and protozoa.
- **Molecualr biology-** Study of molecule found in the body of living organism.
- **Medicine-** Study of treating disease by drug.
- **Mammography –** Brach of science which deal test of breast cancer.
- **Mycology –** Study of fungi.
- **Neurology** – Study of nervous system.
- **Neonatology-** Study of new born.
- **Nephrology-** Study if kidneys.
- **Osmosis-** movement of water moledcule across semipermeable membrane from the region of its higher concentration to the region of lower communication.
- **Odontology-** Study of teeth and gum.
- **Osteology-** Study of bones.
  Oncology- Study of cancer and tumours**.**
- **Obstetrics-** Science connected with care of pregnant woman before, during and after child birth.
- **Ornithology-** Study of birds.
- **Ophthalmology-** Study of eyes.
- **Orthopaedics-** Diagnosis and repair of disorders of locomotery system.
- **Phytoplanktons-** Microscopic organism which passively float on the surface of water.
- **Parasite-** organism which depend on other living for their food and shelter.
- **Poikilothermic-** Organism which change their body temperature according to surrounding. These are also called cold blooded animal.

Chapter
2

Cells & Tissues

Cell: It is the basic structural unit of life.
Cells were first **discovered** by **Robert Hooke.**
The smallest cell is 0.1 to 0.5 micrometre in bacteria. The largest cell measuring 170 mm ×130 mm, is the egg of an ostrich.

Amoeba acquires its food through **endocytosis.**

1. **Prokaryotes cells -** cells that have no defined nucleus
   Eg: Bacteria & Blue-green Algae
2. **Eukaryote -** cells which have definite nucleus
   Eg: Other than Bacteria & Blue-green Algae

Compounds called **proteins** and **phospholipids** make up most of the cell membrane.

Diffusion-It is a process of movements of substance from a region of high concentration to a region where its concentration is low. Water also obeys the law of diffusion.
Eg: Substances like Co_2 and O_2 can move across the cell membranes by a process called diffusion.

Osmosis: The movement of water molecules is called **osmosis**. Osmosis is a special case of diffusion through a selectively permeable membrane.

Types of Osmosis:

1. **Hypotonic:** More water will come into the cell than will leave. The cell is likely to swell up.
2. **Isotonic:** The amount going in is the same as the amount going out of the cell. The cell will stay the same size.
3. **Hypertonic:** More water leaves the cell than enters it. Therefore the cell will shrink.
   When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as **plasmolysis.**

Cytoplasm: It is the fluid that fills a cell. Scientists used to call the fluid protoplasm.

Ribosomes: It synthesis protein, and Endoplasmic reticulum sent these protein in various part of the cell. Whereas Smooth Endoplasmic reticulum helps in the manufacture of fats. It a made up of ribonucleic acid.

Functions of these proteins and fats:

- Protein and fat (lipid) help in building the cell membranes. This process is known as **membranes biogenesis.**
- Smooth Endoplasmic reticulum plays a crucial role in detoxifying many poisons and drugs.

Golgi apparatus: It is another packaging organelle like the endoplasmic reticulum
Functions:

- It is the organelle that builds lysosomes (cells digestion machines).

Lysosomes (suicidal bag): It is a kind of waste disposal system of the cell.

Mitochondria (power house): The energy required for various chemical activities headed for life is released by mitochondria in the form of ATP (adenosine tri-phosphate) molecules.

- **ATP is known as the energy currency of the cell.**
- Mitochondria are strange organelles in the sense that they have their own DNA and ribosomes, therefore mitochondria are able to make their own protein.
- Mitochondria is absent in bacteria and the red blood cells of mammals and higher animals.

Centrioles: centrioles are concerned with cell division. It initiates cell division.

Plastids: These are present only in plant cells.
Types of plastids:-
- **Chromoplast**(colour plastides) impart colour to flowers and fruits.
- **Leucoplasts**(white or colourless plastids) present in which starch, oils and protein are stored.
- **Plastids** are self-replicating. i.e. they have the power to divide, as they contain DNA, RNA and ribosomes.
- Plastides contains the pigment chlorophyll that is known as **chloroplast**. It is the site for photo synthesis.
non –living parts with in the cell :-

Vacuoles: it is a fluid filled spaces enclosed by membranes. Its size in animal is small and in plant it is big. Amino acids and sugars are stored in vacuoles.

Granules: It is not bounded by any membranes. It store fats, proteins and carbohydrates.

Cell nucleus: The cell nucleus acts like the brain of the cell. It helps control eating, movement and reproduction. Not all cells have a nucleus.
The nucleus contain, the following components :

(a) Nuclear envelope (nuclear membrane)

(b) Chromatin : When the cell is in resting state there is something called **chromatin** in the nucleus. Chromatin is made up of DNA, RNA and nucleus protein. DNA and RNA are the nucleus acids inside the cell. When the cell is going to divide, the chromatin become very compact. It condenses when the chromatin comes together we can see the chromosomes.

(c) Chromosomes: Chromosomes make organisms what they are. They carry all the information used to help a cell grow, thrive and reproduce.
- Chromosomes are made up of DNA.
- Segments of DNA in specific patterns are called **genes**.
- In prokaryotes, DNA floats in the cytoplasm in an area called the **nucleoid**.
- Chromosomes are not always visible. They usually sit around uncoiled and as loose shards called **chromation.**
- Chromosomes are usually found in pairs.
- Human Beings probably have 46 chromosomes (23 pairs).
- Peas only have 12, a dog has 78 chromosomes.
- The number of chromosomes is not related to the intelligence or complexity of the creature.

(d) Nucleolus: It is a dense spherical granule contained within the nucleus.It stores proteins.

Cell Division
Organisms grow and reduce through **cell division**.
There are two methods of replication **mitosis** and **meiosis**.

(a) Mitosis: It duplicates its DNA and the two new cells (daughter cells) have the same pieces and generic code. There are five steps in this process. **You should remember the term PMATI.** It breaks down to :

1. Prophase

2. Metaphase
3. Anaphase
4. Telophase
5. Interphase.

The main theme of **meiosis** is that there are two cell division. Mitosis has one division.

Some important facts regarding cells :

- Nerve cells in animals are the longest cells.
- Smallest human cell is red blood cell.
- Largest human cell is female ovum.
- The single largest cell in the world is of an ostrich.
- The smallest cells are those of the mycoplasma.
- Every minute about 3 million cells in our body die.
- Sieve tube in plants and the mature mammalian red blood cells do not have a nucleus.
- The red blood cell carries respiratory gases.
- Sieve cells in plants transport nutrients in plants.
- The lysosomal enzymes of the sperm cells digest the limiting membranes of the ovum (egg). Thus the sperm is able to enter the ovum.
- During the transformation of tadpole into frog. The embryonic tissues like gills and tail are digested by the lysosome.
- Mitochondria contain DNA, hence capable of replication.
- Matrix is a transparent, homogenous semi-fluid substance. In its active state. It remains saturated with water.

TISSUE

Epithetical Tissue

(i) On the basis of cell layers
   (a) When an epithelium has a single layer of cells it is called a simple epithelium.
   (b) Where as a multiple tier of cells are known as stratified epithelium.

(ii) On the basis of simple shape of cells:

- **Cuboidal :** its occurrence is in kidney tubules, salivery glands, inner lining of the cheek. Its main function is to give mechanical strength.

- **Columnar :** its occurrence is in sweat gland, tear gland, salivary gland its main function is to gives mechanical strength concerned with secretions.

- **Squamous :** when it forms a living as that of blood vessels, it is called endothelium.

Its main function is to protect the underlying parts from injury, entry of germs, etc.

- **Connective tissue :** Its main function is to bind and support other tissues.
  There are a few types of connective tissue.

Connective Tissue

Chapter 5

Endocrine System

Hormones

The endocrine system is made up of glands that produce and secrete hormones, chemical substances produced in the body that regulate the activity of cells or org These hormones regulate the body's growth, metabolism (the physical and chemical processes of the body), and sexual development and function.
Exocrine glands (not part of the endocrine system) secrete products that are passed outside the body. Sweat glands, salivary glands, and digestive glands are examples of exocrine glands.
Hormones are grouped into three classes based on their structure:

1. Steroids
2. Peptides
3. Amines

The Nervous and Endocrine Systems

The pituitary gland (often called the master gland) is located in a small bone cavity at the base of the brain. A stalk links the pituitary to the hypothalamus, which controls release of pituitary hormones. The pituitary gland has two lobes: the anterior and posterior lobes.

Too little or two much GH (Growth hormone) can cause **dwarfism or gigantism**, respectively.
Prolactin is secreted near the end of pregnancy and prepares the breasts for milk production.

THE POSTERIOR PITUITARY

ADH (Antidiuretic hormone) controls water balance in the body and blood pressure. Oxytocin is a small peptide hormone that stimulates uterine contractions during childbirth.

Thyroid secretion is usually higher in winter than in summer.

Endocrines: The Postal System of Communication and Co-Ordination

- Hormones are chemical substances manufactured by organs called endocrine glands or ductless glands. **Ductless glands** are also sometimes called 'exocrine glands'.

ENDOCRINE GLANDS OF THE BODY

Adrenal gland

The adrenal glands (also known as suprarenal glands) are endocrine glands that produce a variety of hormones including adrenaline.
They are found above the kidneys.

Hypothalamus

The hypothalamus is a portion of the brain that contains a number of small nuclei with a variety of functions.
Function: Link the nervous system to the endocrine system via the pituitary gland.

Pituitary gland

It is an endocrine gland about the size of a pea and weighing 0.5 grams in hum
Hormones secreted from the pituitary gland help control:

- growth,
- blood pressure,
- certain functions of the sex organs,

Biology Multiple Choice Questions

1. Which is the largest organ in human beings?
   (a) Skin (b) Large Intestine
   (c) Small Intestine (d) Liver
2. Delonix regia Rafin is the scientific name of -
   (a) Banyan (b) Gulmohar
   (c) Tamarind (d) Chiku
3. Amoeba belongs to the phylum -
   (a) Protozoa (b) Annelida
   (c) Porifera (d) Platyhelminthes
4. Diabetes is caused by -
   (a) Excess of insulin
   (b) Low production of Insulin
   (c) Malfunction of liver
   (d) Higher production of bilirubin
5. Tectona grandis Linn is the scientific name of -
   (a) Guava (b) Teak
   (c) Amla (d) Chiku
6. Sea-Anemones belongs to the phylum?
   (a) Arthropoda (b) Cnidaria
   (c) Porifera (d) Mollusca
7. Deficiency of which of the following causes non-clotting of blood?
   (a) Vitamin C (b) Vitamin K
   (c) Vitamin E (d) Vitamin B12
8. The process of producing energy in plants is known as -
   (a) Absorption (b) Reduction
   (c) Photosynthesis (d) Transpiration
9. Which Virus causes Chicken Pox?
   (a) Rubella Virus
   (b) Varicella zoster virus
   (c) Rabies
   (d) Variola Virus
10. Yellow fever is a disease spread through which of the following?
    (a) Flies (b) Mosquito
    (c) Rat (d) Cockroach
11. Mangroves are plants that have -
    (a) Modified Roots (b) Modified Stems
    (c) Respiratory Roots (d) Respiratory Stems
12. Rodentia Sciurus is the scientific name of -
    (a) Rat (b) Platypus
    (c) Squirrel (d) Beaver
13. Which of the following is a symptom of haemophilia?
    (a) Night Blindness (b) No clotting of Blood
    (c) Rickets (d) Loss of haemoglobin
14. The process of pollination by birds is also known as -
    (a) Hydrophily (b) Entomophily
    (c) Embryophily (d) Ornithophily
15. Spiders belong to the phylum -
    (a) Mollusca (b) Annelida
    (c) Cnidaria (d) Arthropoda
16. Which of the following is induced by Oncogene?
    (a) Polio (b) Cancer
    (c) Diarrhoea (d) Dengue
17. Azadirachata indica is the scientific name of -
    (a) Neem (b) Teak
    (c) Silver Oak (d) Tulsi
18. Octopus belongs to the phylum -
    (a) Mollusca (b) Cnidaria
    (c) Echinodermata (d) Chordata
19. Medulla oblongata is a part of which of the following?
    (a) Heart (b) Brain
    (c) Lungs (d) Stomach
20. _____ is a typically one celled, reproductive unit capable of giving rise to a new individual without sexual fusion.
    (a) Egg (b) Spore
    (c) Sperm (d) Seed
21. Bacteria was discovered by -
    (a) Antonie van Leeuwenhoek(b) Belarus
    (c) Hugo de Vries(d) Robert Brown
22. Scurvy (bleeding of gums) is caused by deficiency of which vitamin?
    (a) Vitamin K (b) Vitamin B2
    (c) Vitamin C (d) Vitamin A
23. Achras sapote is the scientific name of
    (a) Custard Apple (b) Gulmohar
    (c) Tamarind (d) Chiku
24. Prawn belongs to the phylum
    (a) Arthropoda (b) Cnidaria
    (c) Echinodermata (d) Chordata
25. Pulses are a rich source of which of the following?
    (a) Carbohydrates (b) Proteins
    (c) Minerals (d) Vitamin A

(c) Glucoma (d) Uremia

681. An example of hormone is -
(a) Cytosine (b) Renin
(c) Oxytocin (d) Peprin

682. To reduce tooth decay most toothpastes contain a -
(a) Bromide (b) Fluoride
(c) Iodide (d) Chloride

683. The part of brain which controls emotional reactions in our body is -
(a) Hypothalamus (b) Cerebrum
(c) Meninges (d) Thalamus

684. An organism that transmits disease from one individual to another is called -
(a) Hybrid (b) Fragment
(c) Vector (d) Clone

685. Which endocrine gland is found in chest cavity?
(a) Pineal gland (b) Thymus gland
(c) Adrenal gland (d) Thyroid gland

686. Blue Revolution is related to:
(a) Space research (b) Poultry
(c) Drinking water (d) Fisheries

687. BOD stands for:
(a) Biological oxidation demand
(b) Biological oxygen decomposition
(c) Biochemical oxygen demand
(d) Biotic oxidation demand

688. Minamata disease is caused by pollution of water by:
(a) Lead (b) Tin
(c) Methyl Isocyanate (d) Mercury

689. Amino acids are required for the synthesis of:
(a) Alkaloids (b) Lipids
(c) Proteins (d) Carbohydrates

690. Transpiration increases in:
(a) Hot, dry and windy condition
(b) Hot, damp and windy condition
(c) Cool, damp and windy condition
(d) Cool, dry and still condition

691. What is the Kyoto Protocol?
(a) It is an agreement among countries to take steps for reducing acid rain
(b) It is an agreement among countries to take steps for planting trees to control pollution
(c) It is an agreement among countries to start using nuclear energy
(d) It is an agreement among countries to take steps for reducing green house gases emission

692. The longest bone in the human body is -
(a) Ulna (b) Humerus
(c) Femur (d) Tibia

693. An instrument for measuring blood pressure is called -
(a) Barometer (b) Spirometer
(c) Sphygmomanometer (d) Haemocytometer

694. The vitamin most readily destroyed by heat is -
(a) Riboflavin (b) Ascorbic acid
(c) Tocopherol (d) Thiamine

695. Rickets is the deficiency disease of vitamin-D, in which the affected part is the -
(a) Skin (b) Hair
(c) Bone (d) Blood

696. Normal blood pressure reading of an adult human:
(a) 80/140 mm Hg (b) 120/80 mm Hg
(c) 130/90 mm Hg (d) 160/95 mm Hg

697. 'Red Data Book' provides an account of
(a) Endangered plants only
(b) Fossil plants
(c) Endangered plants and animals
(d) Extinct animals only

698. Which one of the following is an autotroph?
(a) Butterfly (b) Algae
(c) Grasshopper (d) Mushroom

699. In B.C.G. Vaccine the word 'C' stands for:
(a) Calmette (b) Cough
(c) Chlorine (d) Cadmium

700. Point out the incorrect pair:
(a) Green Revolution–Agricultural Development
(b) White Revolution – Dairy Development
(c) Blue Revolution – Development of Fisheries
(d) Golden Revolution – Milk Development

Solutions

1. (a); The skin is the largest organ of the body, with a total area of about 20 square feet. The skin protects us from microbes and the elements, helps regulate body temperature, and permits the sensations of touch, heat, and cold

2. (b); Delonix regia Rafin is the scientific name of Gulmohar.

3. (a) Amoeba is a genus that belongs to protozoa, which are unicellular eukaryotes organisms with membrane-bound cell organelles.

4. (b); Diabetes is caused by the immune system destroying the cells in the pancreas that make insulin. This causes diabetes by leaving the body without enough insulin to function normally
5. (b); Teak is a tropical hardwood tree of species Tectona grandis linn. The species is placed in the family Lamiaceae. Tectona grandis is a large, deciduous tree that is dominant in mixed hardwood forests. It has small, fragrant white flowers and papery leaves that are often hairy on the lower surface.
6. (b); Sea-Anemones belongs to the phylum Cnidaria.
7. (b); Vitamin K deficiency causes the non-clotting of blood.
8. (c); Plants produce energy from light through a process known as photosynthesis.
9. (b); Chickenpox, also known as varicella, is a highly contagious disease caused by the initial infection with varicella zoster virus(VZV).
10. (b); The disease is caused by the yellow fever virus and is spread by the bite of an infected female mosquito. It infects only humans, other primates, and several species of mosquitoes.
11. (c); A mangrove is a shrub or small tree that grows in coastal saline or brackish water. They have respiratory roots.
12. (c); Rodentia Sciurus is scientific name of Squirrel.
13. (b); Haemophilia, is a mostly inherited genetic disorder that impairs the body's ability to make blood clots, a process needed to stop bleeding.
14. (d); Ornithophily or bird pollination is the pollination of flowering plants by birds.
15. (d); Spiders are air-breathing arthropods that have eight legs and chelicerae with fangs that inject venom.
16. (b); Oncogenes were first discovered as cancer-causing viruses, they also are found in all normal cells. The original, unmutated wild-type allele of an oncogene is known, strictly, as the proto-oncogene. The mutant versions are the cancer-causing oncogenes.
17. (a); Azadirachta indica, commonly known as neem, nimtree or Indian lilac, is a tree in the mahogany family Meliaceae.
18. (a); Octopus belongs to the phylum Mollusca.
19. (b); The medulla oblongata helps regulate breathing, heart and blood vessel function, digestion, sneezing, and swallowing. This part of the brain is a center for respiration and circulation.
20. (b); In biology, a spore is a unit of sexual or asexual reproduction that may be adapted for dispersal and for survival, often for extended periods of time, in unfavourable conditions. Spores form part of the life cycles of many plants, algae, fungi and protozoa.
21. (a); Bacteria was discovered by Antonie van Leeuwenhoek.
22. (c); Scurvy is caused due to deficiency of Vitamin C.
23. (d); Achras sapote is the scientific name of Chiku.
24. (a); Prawn belongs to the phylum Arthropoda
25. (b); Pulses are a rich source proteins.
26. (a); The plant cell wall is composed of cellulose. Cellulose is a structural carbohydrate and is considered a complex sugar because it is used in both protection and structure.
27. (c); Mycology is the branch of biology concerned with the study of fungi, including their genetic and biochemical properties, their taxonomy and their use to humans.
28. (a); The epidermis, the outermost layer of skin, provides a waterproof barrier and creates our skin tone.
29. (a); A legume is a plant or its fruit or seed in the family Fabaceae. Legumes are grown agriculturally, primarily for their grain seed called pulse, for livestock forage and silage, and as soil-enhancing green manure. Many legumes have root nodules that provide a home for symbiotic nitrogen-fixing bacteria called rhizobia.
30. (c); Earthworms belongs to the Annelida Phylum.
31. (a); Ringworm of the skin (tinea corporis) is most commonly caused by the fungus Trichophyton rubrum, which spreads from one person to another.
32. (b); Mangifera Indica is scientific name of Mango.
33. (c); Crabs belongs to the phylum Arthropoda.
34. (b); Nearsightedness, also known as myopia, is a common type of refractive error where close objects appear clearly, but distant objects appear blurry.

ACE SSC

Computer Knowledge

CHAPTE – 01

BASIC COMPUTER

ORGANIZATION OF COMPUTER

History of Computer - Before the invention of Computer, Calculator was introduced. Main difference between Calculator and Computer is that Computer can do logical operations and calculators can't do logical operations.
ABACUS - Abacus was developed in china in 2600 B.C by some Chinese people. The Word Abacus means calculating board. This apparatus used a series of moveable beads or rocks. The positions changed to enter a number and again to perform mathematical operations.

The abacus, also called a counting frame, is a calculating tool used for performing arithmetic processes. It is made of a beads or stones placed in grooves or strung on rods. Abacus is a Latin word that has its origins in the Greek words abax or abakon (meaning "table" or "tablet").

Leonardo DaVinci was credited with the invention of the world's first mechanical calculator in 1500. In 1642, Balise Pascal invented Adding Machine. Blasie Pascal's supporter think that Mechanical Calculator was introduced by Pascal.

Napier's Bones - John Napier was a mathematician who became famous for his invention of logarithms. John Napier built device for the purpose of multiplication in 1617 A.D The device was known as Napier's bones. His bones are set of eleven rods side by side products and quotients of large numbers can be obtained. The sticks were called bones because they were made of bone of ivory.

Charles Babbage was known as Father of computer. He invented Two machines. (i) In 1822, introduced Difference Engine. (ii) In 1834, introduced Analytical Engine. It was first demonstrated in Paris Museum.

First Digital Computer - ENIAC was the first digital computer. The ENIAC was invented by J. Presper Eckert and John Mauchly at the University of Pennsylvania and began construction in1943 and was not completed until 1946. It occupied about 1,800 square feet and used about 18,000 vacuum tubes as a storing device to store data, weighing almost 50 tons.

First computer with RAM - MIT introduces the Whirlwind machine March 8, 1955, a revolutionary computer that was the first digital computer with magnetic core RAM and real-time graphics.

The first minicomputer - In 1960 Digital Equipment Corporation released its first of many PDP computers the PDP-1.
The first laptop - First Laptop was introduced in 1981 by Adom Osborne and the company "EPSON" manufactured first Laptop.

The first computer company - The first computer company was the Electronic Controls Company and was founded in 1949 by J. Presper Eckert and John Mauchly, the same individuals who helped create the ENIAC computer. The company was later renamed to EMCC or Eckert-Mauchly Computer Corporation and released a series of mainframe computers under the UNIVAC name.
The first multimedia computer - In 1992 Tandy Radio Shack becomes one of the first companies to release a computer based on the MPC standard with its introduction of the M2500 XL/2 and M4020 SX computers.
The first Apple computer - Steve Wozniak designed the first Apple known as the Apple-I computer in 1976.

COMPUTER FUNDAMENTAL

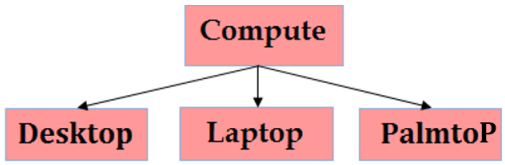
Computer -A computer is a device that accepts information and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed. Computer i.e a combination of two words ''compute'' + ''er''. Compute means calculation and er means device.

In other word Computer is an electronic device. It can perform all type of mathematical and logical operation. It can accept data, store data, process data, retrieve data and print data.

Computer System:- A computer system is a set of components that works together to accomplish one or more task.

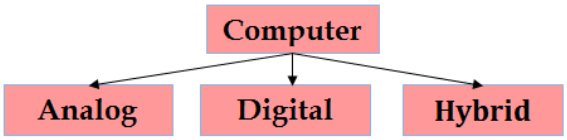
Computers are available in different sizes, shapes and weights. Due to different size and shapes they perform different task from one another. They are classified into various category on the basis of physical size, function and processing and storing capacity.

On the basis of physical size, computers are divided into three parts:-



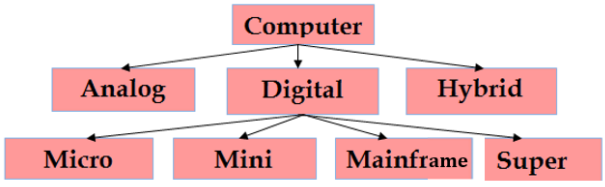
1. **Desktop:-** A computer designed for home and personal use. You cannot carry this computer like Laptop. It is a personal computer (PC) i.e for regular use at a single location.
2. **Laptop:-** A laptop computer is a portable computer and also known as Notebook. One can carry anywhere like briefcase. Another type of laptop is known as Net-book. Netbook is very popular among business man. One can use Net-book for small application like word-processing, accounting, presentation, internet accessing etc.
3. **Palmtop:-** A small computer that fits on one's palm. Palmtop is also called PDAs, hand help computers and pocket computers.

   Another classification of computer, on the basis of function, computers are divided into three parts:-



1. **Analog computer:-** Analog Machine was introduced by Lord Kelvin. In Analog computers numerical data are represented by measurable physical variables, such as electrical voltage, pressure, temperature etc. A thermometer is a simple analog computer. As the temperature varies, the mercury moves correspondingly.
2. **Digital computer:-** A computer that accepts and processes data in the form of number(0-9) and characters (A-Z) that has been converted into binary code. Most computers are digital.
3. **Hybrid computer:-** The feature of analog and digital machines are combined to create a hybrid computers. You can see hybrid computers in hospitals, geological department etc.

   One more classification of computer on the basis of processing speed and storing capacity, computers are divided into four parts. It is also known as types of Digital computer:-



1. **Micro computers:-** Micro computers known as Personal computers(PC). These are small, relatively inexpensive computers designed for personal use in home or office. It has lowest storing and processing speed. Users can use Micro Computers directly in Home, Office or Public places. Note that user uses micro computer that are digital and also can be laptop or Desktop.

2. **Mini computers:-** Mini computers are powerful computer as compare to micro computers. It has higher memory, provide faster operating speeds and larger storage capacities than microcomputer and used as server. Minicomputer system known as small mainframe computer system. A mini computer is a multiprocessing system capable of supporting from 2 to 200 users simultaneously.
3. **Mainframes computers:-** A mainframes computer is different from micro and mini. It has very high memory and processing speed and used as server (can support thousands of users). A mainframe is a high-performance computer used for large-scale computing purposes.

4. **Super Computers:-** Super computer is a different type of computer and can be used for complex type of application. e.g : scientific research, weather forecasting, weapon designing etc. India's first super computer PARAM-10000 developed by C-DAC, PUNE in 1998. Another super computers are Padam-Param (Param series), EKA, SAGA-220 etc. India;s fastest Super Computer is EKA designed by TATA.

COMPUTER OF FIRST GENERATION

ENIAC:- Electronic Numerical Integrator and Calculator

- It was first general purpose computer.
- Invented by John P. Eckret and John Mauchley in 1946
- Vacuum tube was used as a storage device (18000 V.T)
- Weight was around 70 tons

EDSAC:- Electronic Delay Storage Automatic Calculator

- It was invented by Maurice wilkies in 1949

EDVAC:- Electronic Discrete Variable Automatic Computer (1950)

UNIVAC:- Universal Advance Computer

- It was first commercial purpose computer.
- Invented by John P. Eckret and John Mauchley in 1952
- Vacuum tube was used as a storage device (around 28000 V.T)

Units uses in computers to store and process data:-

Bit :- The full form of Bit is "Binary Digit " or "Binary Integer". A bit is a single digit number in base-2 ('0 or 1') and is the smallest unit of computer data.

4 bit	=	1 nibble
8 bit	=	1 byte
1024 byte	=	1 Kilo byte
1024 Kilo byte	=	1 Mega byte
1024 Mega byte	=	1 Giga byte
1024 Giga byte	=	1 Tera byte
1024 Tera byte	=	1 Peta byte
1024 Peta byte	=	1 Exa byte
1024 Exa byte	=	1 Zetta byte
1024 Zetta byte	=	1 Yotta byte

CHARACTERISTICS OF COMPUTER

Computers are playing a main role in our everyday life. It solves the human problems very quickly as well as accurately. The important characteristics of a computer are:-

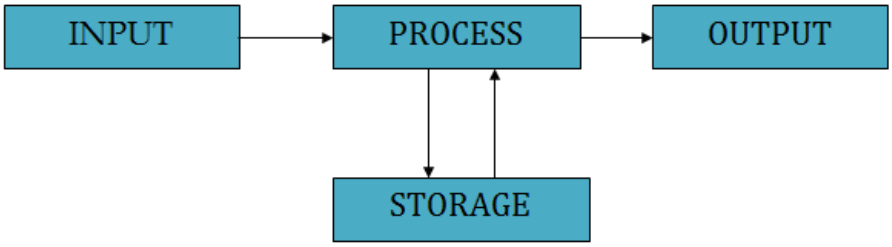
- **Speed:-** Computer is very fast and it takes only few seconds for calculations or you can say the speed of computer in terms of microsecond (10^{-6} part of a second) or nanosecond (10^{-9} part of a second).
- **Accuracy:-** The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. The accuracy level is determined on the basis of design of computer. The errors in computer are due to human and inaccurate data. Everything or Result depends on the users input.
- **Storage Capacity:-** A computer has a very large capacity to store information. The Computer has an in-built memory where it can store a large amount of data. To store data in computer, hard disk is used. You can also store data in secondary storage devices such as floppies, which can be kept outside your computer and can be carried to other computers.
- **Reliability:-** Computers are considered to be very reliable machines. The computer respond as the per the instruction keyed into it. They do not make mistakes on their own. Computers error occurs when humans make errors while programming the computers. Reliability is the main key of computer.
- **Versatility:-** It means the capacity to perform completely different type of work. You may use your computer to prepare payroll slips. Next moment you may use it for inventory management or to prepare electric bills.
- **Diligence:-** A computer is free from tiredness. It can work for hours without creating any error. If millions of calculations are to be performed, a computer will perform every calculation with the same accuracy

Applications of a Computer :- Computers have become very popular in all fields. Here are some of areas where they are widely used. Some are given as below:

- **Education :-** Computers give students more flexibility with their studies. Computers are also used by teachers to prepare lessons, report card and as a reference tool.
- **Medicine:-** A large number of computerized equipment is used for medical tests in hospitals and clinics. They can be used for storing medical records of patients visiting big hospitals. Doctors can access these records of patients to diagnose.
- **Business :-** Every company or organization require computers for budgeting, accounting, billing, reporting, presentations etc. This information must be constantly maintained and updated. Computers are also used for sales forecasting, production, planning etc.
- **Science and Technology :-** Scientist and Engineers use the computers as a tool to experiment, design, and develop their ideas/projects. Architects use computer to design structures. Nuclear test can be simulated without damaging the environment. Computer aided designing (CAD) and Computer aided Engineering (CAE) are becoming very popular.

- **Communication :-** Today, computer is available in many office and homes and therefore there is a need to share data and programs among various computers with the advancement of data communication facilities. Using Internet facility, you can send E-mail to your friends and relatives.
- **Banking :-** Computers are being used in banks for carrying out everyday transactions like online enquiry of customers' balance, cheque verification and updating of balance, calculating interests etc. All progressive bank have installed Automated Teller Machines (ATM) to enable the customers to draw money from their accounts, money transfer etc.
- **Weather Forecasting:-** Data is collected from weather stations and satellites all over the world. Changes in weather and direction of winds can be analyzed with the help of computers. Timely prediction may avoid damage due to natural disasters.
- **Entertainment :-** Through computers, you can play various games, create your own music, watch cartoons or films, listen to your favorites music etc. Cartoons films are created very easily through computer animation. . Special effects like fire, battle earthquake, etc can be created for films.
- **Defence:-** In defence, computers can be very useful. Modern weapons and missiles are totally computer controlled.

Basic Structure of a computer System:- Computer's follows input → process → output cycle (IPO CYCLE) in order to perform a task. Input means giving data to computers and computer process as per the input, after processing it gives the output.



IPOS CYCLE:- It is how computer intake data , process the data, output information and then saves the information. I stands for input, P stands for processing, O stands for output, and S stands for storage.

- **Input :-** Input is the raw data entered into a computer from the input devices. It is the collection of numbers, letters, images, etc. Keyboard, Mouse, scanner, webcam, etc are some examples of the input devices.
- **Process :-** Process is the operation of data or information as per given instruction. It is totally internal process of the computer system. CPU (Central processing Unit) is the main processing device of the computer.
- **Output :-** Output is the result of processed data given by computer after data processing. we can save these results in the storage devices for the future use. Monitor, Printer, Speaker are the main output devices.
  The five basic operations that a computer performs are accepting data as a input, processing of data, outputting the information, storage of these data and process control.

ERROR, BUG and DEFECT

Error: it is deviation from logic, syntax or execution. Or programmatically mistake leads to error. A programmer can remove the error from the program.

Bug: A fault in a program which causes the program to perform in an unintended or unanticipated manner. Or Deviation from the expected result. A QA team or software tester can find the bug. Famous bug-millennium bug. (data Problem) i,e, Y2K Bug

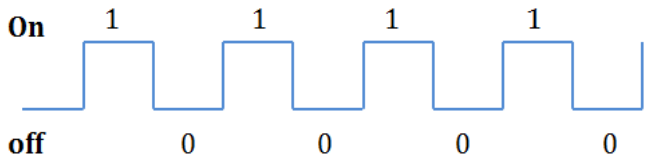
Defect: Mismatch between the requirements. From user point of view it effects the business directly. E.g instantly halt in the system.

Glitch: A minor malfunction, mishap, or technical problem on computer system known as Glitch.

DATA REPRESENTATION IN COMPUTER

Most computers are digital

- Recognize only two discrete states: on or off. On means 1 and off means 0.
- Computers are electronic devices powered by electricity, which has only two states, on or off



Data in computer is represent in binary form. To understand data representation one has to know four number system.

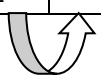
1. **Decimal number system:** In this system we use ten different symbol to represent any number. Therefore it's base is ten. Following are the symbol use in this system. 0, 1, 2, 3, 4, 5, 6, 7,8, 9. (0-9)
2. **Binary number system:** In this system we use only two symbols are used. i.e 0, 1. There it's base is two.
3. **Octal:** In this system eight symbol is used i.e 0, 1, 2, 3, 4, 5, 6, 7. Therefore it's base is eight. (0-7)
4. **Hexadecimal:** In this system sixteen symbol is used i.e 0 1 2 3 4 5 6 7 8 9 A B C D E F. Therefore it's base is sixteen. (0-F)

Conversion From one number system to another

1. **Decimal Conversion:**
   - **A. Decimal to binary:** Divide the given decimal number by 2 till possible and write the remainder in reverse order.

     E.g. I. $(225)_{10}$ = $(11100001)_2$

2	225	1
2	112	0
2	56	0
2	28	0
2	14	0
2	7	1
2	3	1
2	1	



$(225)_{10} = (11100001)_2$

B. Decimal to octal: Divide the given decimal number by 8 till possible and write the remainder in reverse order.

E.g. $(225)_{10} = (341)_8$

8	225	1
8	28	4
8	3	

C. Decimal to hexa: Divide the given decimal number by 16 till possible and write the remainder in reverse order.

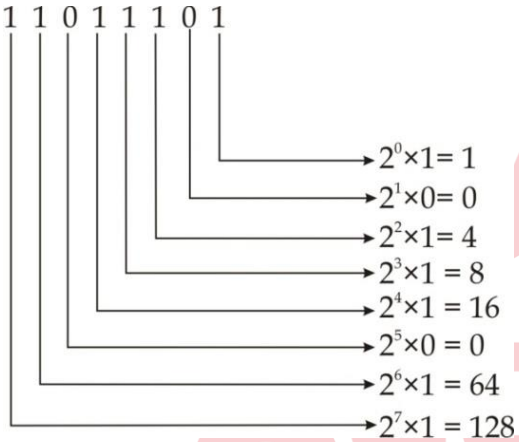
E.g. $(225)_{10} = (E1)_{16}$

16	225	1
	14	

2. Binary Conversion

A. Binary to Decimal

$(11011101)_2 = (221)_{10}$



$1+0+4+8+16+0+64+128 = (221)_{10}$

B. Binary to Octal: to find the octal value from the binary number,

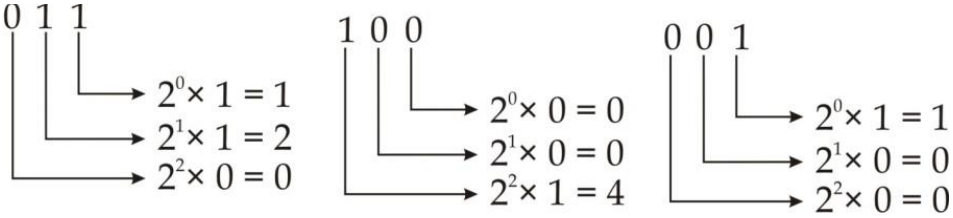
First method: - convert binary number into decimal number and then divide the decimal number by 8.

Second method: - make the group of three numbers and then find the individual value of that group

E.g. $(11100001)_2 = (341)_8$

011 100 001 -------- 1st group 001, second group 100 and 3rd group 011.

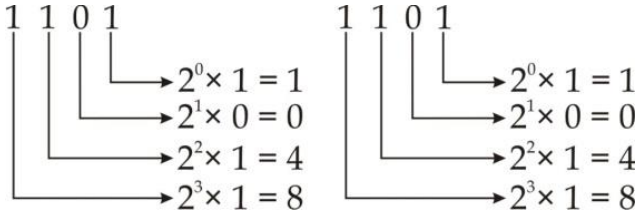
Individual value 001 = 1, 100 = 4, 011 = 3



$(0+2+1 = 3) \quad (4+0+0 = 4) \quad (0+0+1 = 1) = (341)_8$

C. Binary to Hexadecimal

$(11011101)_2$ = $(DD)_{16}$

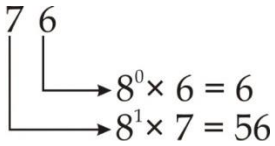


(1+0+4+8) (1+0+4+8) = $(1313)_{16}$ = $(DD)_{16}$

3. Octal Conversion

A. Octal to Decimal

$(76)_8$ = $(62)_{10}$

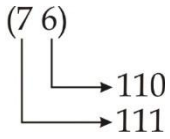


To find the decimal number from the octal number, position all the number and then multiply with them

B. Octal to Binary

To convert Octal number to binary, find the binary of individual number in the pair of three digit.

$(76)_8$ = $(111110)_2$

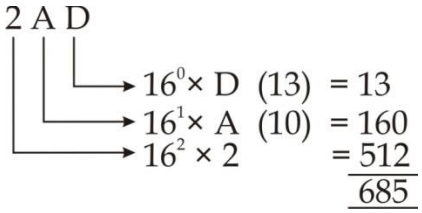


4. Hexa Decimal Conversion

A. Hexadecimal to Decimal

To find the decimal number from the hexadecimal number, position all the number and then multiply with them.

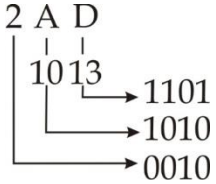
$(2AD)_{16}$ = $(685)_{10}$



B. Hexadecimal to Binary

To convert octal number to binary, find the binary of individual number in the pair of four digit.

$(2AD)_{16}$ = $(001010101101)_2$



Keyboard Shortcuts

❖ **Windows Shortcut**

F1:	Help
CTRL+ESC:	Open Start menu
ALT+TAB:	Switch between open programs
ALT+F4:	Quit program
SHIFT+DELETE:	Delete item permanently

❖ **Shortcut command by using Windows button**

Windows Logo+L:	Lock the computer
Windows Logo:	Start menu
Windows Logo+R:	Run dialog box
Windows Logo+M:	Minimize all
SHIFT+WindowsLogo+M:	Undo minimize all
Windows Logo+E:	Windows Explorer
Windows Logo+D:	Minimizes all open windows and displays the desktop

❖ **Internet Explorer Short cut:-**

CTRL+B	Open the organize favorites dialog box
CTRL+E	Open the Search Bar
CTRL+F	Start the find utility
CTRL+H	Open the History Bar
CTRL+I	Open the favorites Bar
CTRL+L	Open the Open dialog box
CTRL+N	Start another instance of the browser with same web address
CTRL+O	Open the open dialog box (same as CTRL+L)
CTRL+P	Open the Print dialog box
CTRL+R	Update the current Web Page
CTRL+W	Close the current Window
Ctrl + Mouse wheel	Zooms in and out of document.

To do this	Press
Go to "Tell me what you want to do"	Alt+Q
Open	Ctrl+O
Save	Ctrl+S
Close	Ctrl+W
Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Select all	Ctrl+A
Bold	Ctrl+B
Italic	Ctrl+I
Underline	Ctrl+U
Decrease font size 1 point	Ctrl+[

Increase font size 1 point	Ctrl+]
Centre text	Ctrl+E
Left align text	Ctrl+L
Right align text	Ctrl+R
Justify align text	Ctrl+J
Cancel	Esc
Undo	Ctrl+Z
Re-do	Ctrl+Y
Zoom	Alt+W, Q, then tab in Zoom dialog box to the value you want.
Copy formatting from text.	Ctrl+Shift+C
Apply copied formatting to text.	Ctrl+Shift+V

Create and edit documents

To do this	Press
Split the document window.	Alt+Ctrl+S
Remove the document window split.	Alt+Shift+C or Alt+Ctrl+S
Save a document.	Ctrl+S

Delete text and graphics

To do this	Press
Delete one character to the left.	Backspace
Delete one word to the left.	Ctrl+Backspace
Delete one character to the right.	Delete
Delete one word to the right.	Ctrl+Delete
Cut selected text to the Office Clipboard.	Ctrl+X
Undo the last action.	Ctrl+Z
Cut to the Spike. (Spike is a feature that allows you to collect groups of text from different locations and paste them in another location).	Ctrl+F3

Find, replace and go to specific items in the document

To do this	Press
Open the search box in the **Navigation** task pane.	Ctrl+F
Replace text, specific formatting, and special items.	Ctrl+H
Go to a page, bookmark, footnote, table, comment, graphic, or other location.	Ctrl+G
Switch between the last four places that you have edited.	Alt+Ctrl+Z

Work with documents in different views

To do this	Press
Switch to Read Mode view	Alt+W, F
Switch to Print Layout view.	Alt+Ctrl+P
Switch to Outline view.	Alt+Ctrl+O
Switch to Draft view.	Alt+Ctrl+N

Change Paragraph Alignment

To do this	Press
Remove a paragraph indent from the left.	Ctrl+Shift+M
Create a hanging indent.	Ctrl+T
Reduce a hanging indent.	Ctrl+Shift+T
Remove paragraph formatting.	Ctrl+Q

Insert Special Characters

To insert this	Press
A field	Ctrl+F9
A line break	Shift+Enter
A page break	Ctrl+Enter
A column break	Ctrl+Shift+Enter
An em dash	Alt+Ctrl+Minus Sign (on the numeric keypad)
An en dash	Ctrl+Minus Sign (on the numeric keypad)
An optional hyphen	Ctrl+Hyphen
A nonbreaking hyphen	Ctrl+Shift+Hyphen
A nonbreaking space	Ctrl+Shift+Spacebar
The copyright symbol	Alt+Ctrl+C
The registered trademark symbol	Alt+Ctrl+R
The trademark symbol	Alt+Ctrl+T
An ellipsis	Alt+Ctrl+Period
A single opening quotation mark	Ctrl+`(single quotation mark), `(single quotation mark)
A single closing quotation mark	Ctrl+' (single quotation mark), ' (single quotation mark)
Double opening quotation marks	Ctrl+` (single quotation mark), Shift+' (single quotation mark)
Double closing quotation marks	Ctrl+' (single quotation mark), Shift+' (single quotation mark)
An AutoText entry	Enter (after you type the first few characters of the AutoText entry name and when the ScreenTip appears)

TCP	Transmission Control Protocol
FTP	File Transfer Protocol
TFTP	Trivial File Transfer Protocol
SFTP	Secure File Transfer Protocol
SMTP	Simple Mail Transfer Protocol
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
UDP	User Datagram Protocol
ARP	Address Resolution Protocol
Tel Net	Telecommunication Networking
POP3	Post Office Protocol Version3
BGP	Border Gateway Protocol
P2P	Point to Point Protocol
PPP	Peer to Peer Protocol
IP	Internet Protocol
SNMP	Simple Network Management Protocol
NTP	Network Time Protocol
SIP	Session Initiation Protocol
DHCP	Dynamic Host Configuration Protocol
IMAP4	Internet Message Access Protocol Version 4
RARP	Reverse Address Resolution Protocol
SSH	Secure Shell
MIME	Multipurpose Internet Mail Extension
SMIME	Secure MIME
ALGOL	Algorithmic Language
ANSI	American National Standard Institute
ATM	Asynchronous Transfer Mode
AS	Autonomous System
BASIC	Beginners All Purpose Symbolic Instruction Code
BIOS	Basic input Output System
BPS	bit Per Second
DNS	Domain Name Server
EDI	Electronic Data Interchange
URL	Uniform Resource Locator
GIF	Graphics Interchange Format
ASCII	American Standard Code for Information Interchange
ASP	Active Server Pages
BCC	Blind Carbon Copy
CC	Carbon copy
CAD	Computer Aided Design
CDMA	Code Division Multiple Access
GSM	Global System for Mobile Communication
CMOS	Complementary Metal Oxide Semi-Conductor
CMYK	Cyan Magenta Yellow Block
GPS	Global Positioning System

GUI	Graphical User Interface
HDMI	High Definition Multimedia Interface
GIGO	Garbage in Garbage Out
LIFO	Last In First Out
FIFO	First In First Out
PING	Packet Internet Gopher
HDD	Hard Disc Drive
NIC	Network Interface Controller/Cord
HDTV	High Definition Television
ISP	Internet Service Provider
JPEG	Joint Picture Expert Group
LCD	Liquid Crystal Display
LED	Light Emitting Diode
TFT	Thin Film Transistor
CRT	Cathode Ray Tube
MIDI	Musical Instrument Digital Interface
MPEG	Moving Picture Expert Group
PDA	Personal Digital Assistants
PDF	Portable Document Format
ARPANET	Advanced Research Projects Agency Network
SQL	Structured Query Language
USB	Universal Serial Bus
VIRUS	Vital Information Resource Under Siege
VOIP	Voice Over Internet Protocol
IVR	Interactive Voice Response
WIFI	Wireless fidelity
WIMAX	Worldwide Interoperability for Microwave Access
ADSL	Asymmetric Digital Subscriber Line
API	Application Program Interface
ARP	Address Resolution Protocol
RARP	Reverse ARP
ICANN	Internet Corporation of Assign Names & Numbers
DPI	Dots Per Inch
DSL	Digital Subscriber Line
FAT	File Allocation Table
MANET	Mobile Ad-Hoc Network
MIPS	Million Instruction Per Second
BIPS	Billion Instruction Per Second
TIPS	Trillion Instruction Per Second
NAT	Network Address Translation
IEEE	Institute of Electrical and Electronic Engineer
IMAP	Internet Message Access Protocol
ISDN	Integrated Servers Digital Network
ISO	International Standard Organization/ International Org for Standardization
DHTML	Dynamic Hyper Text Markup Language
MAC	Media Access Control
CAN	Campus Area Network
PAN	Personal Area Network

SAN	Storage Area Network
CNM	Circulatory Network Mode
IPV4	Internet Protocol Version 4
IPV6	Internet Protocol Version 6
DBMS	Data Base Management System
MODEM	Modulator Demodulator
RAM	Random Access Memory
ROM	Read Only Memory
SMPS	Switch Mode Power Supply
OMR	Optical Mark Reader / Recognition
OCR	Optical Character Reader / Recognition
BCR	Bar Code Reader
MICR	Magnetic Ink Character Reader / Recognition
PCB	Printer Circuit Board
SRAM	Static RAM
DRAM	Dynamic RAM
PROM	Programmable ROM
EPROM	Electrically PROM
EEPROM	Electrically Erasable PROM
HDD	Hard Disc Drive
FDD	Floppy Disc Drive
CD	Compact Disc
DVD	Digital Video/Versatile Disc
BRD	Blu Ray Disc
HVD	Holographic Versatile Disc
ACID	Atomicity Consistency Isolation Durability
WYSIWYG	What you see is what you get

GLOSSARY

A

- **Access time -** The amount of time it takes for requested information to be delivered from disks and memory.
- **Antivirus software -** A program designed to look for and destroy viruses that may infect the memory of a computer or files stored on a computer.
- **Artificial intelligence (AI) -** Computer systems that attempt to imitate human processes for analyzing and solving problems.
- **Accumulator -** A local storage area called a Register, in which the result of an arithmetic or logic operation is formed.

B

- **BIT -** It is basic unit of computers. It has two values 1 & 0 only.
- **BYTE -** Combination of 8 Bits.
- **Basic Input Output System (BIOS) -** Also known as ROM BIOS. It provides an abstraction layer for the hardware, i.e., a consistent way for application programs and operating system to interact with input/output devices.
- **Bug -** A software bug is an error, flaw, failure, or fault in a computer program or system produces an incorrect or unexpected result.
- **Bus -** A pathway along which electronic signals travel between the components of a computer system.

C

- **Cookie -** A packet of information that travels between a browser and the web server.
- **Crash -** Your computer or application no longer works correctly and so you "loose" all the work you've done since the last time you saved.
- **Command -** An instruction that causes a program or computer to perform a function.
- **Cache -** It is a memory storage area that keeps frequent use data readily available to the computer so that the computer does not retrieve them from slow storage devices.
- **Clock Speed** - The speed of computer is measured in clock speed. High clock speed is synonymous with high processing capability. It is measured in Megahertz (MHz).
- **Column -** A vertical block of cells in a table or spreadsheet.

D

- **Delete -** To remove an item of data from a file or to remove a file from the disk.
- **Debugging -** Locating and eliminating defects in a program.
- **Desktop -** The electronic work area on a display screen.
- **Dots Per Inch (DPI) -** It is defined as the measure of the resolution of a printer and scanner, or monitor.
- **Domain Name -** A unique name that identifies a particular website and represents the name of the server where the web pages reside.

E

- **Edit -** To make certain changes in existing data.
- **Ethernet Card -** A network adapter that enables a computer to connect to an Ethernet.

F

- **Fax -** A shortened form of the word facsimile. A copy of a document transmitted electronically from one machine to another.
- **File transfer protocol (FTP) -** A set of guidelines or standards that establish the format in which files can be transmitted from one computer to another.
- **Firewall -** A security system usually consisting of hardware and software that prevents unauthorized persons from accessing certain parts of a program, database, or network.
- **Flash Memory** - It is a type of non-volatile computer storage chip that can be electrically erased and reprogrammed. It was developed by EEPROM.

G

- **Gateway -** A machine that links two networks using different protocols.
- **Gigabyte -** A measurement of the storage capacity of a device. One gigabyte represents 1024 megabytes.
- **Google –** search engine on the web.
- **Gopher -** A protocol used for locating and transferring information on the internet. It is an internet search tool that allows users to access textual information.
- **GUI -** Graphical User Interface uses icons and menus to carry out commands such as opening files, delete files, move files etc..
- **Graphic Interchange Format (GIF) -** A simple file format for pictures and photographs that are compressed so that they can be sent quickly.

H

- **Hard copy -** Text or graphics printed on paper; also called a printout.
- **Hard disk -** A rigid type of magnetic medium that can store large amounts of information.

- **Hyperlink -** An image or portion of text on a webpage which is linked to another webpage.
- **Hub-**A network device that connects multiple computers on a LAN so that they can communicate with another network and the internet.
- **Header -** Repetitive information that appears at the top (the head) of every page of a document.
- **Hypertext transfer protocol (HTTP) -** The protocol used on the World Wide Web that permits Web clients (Web browsers) to communicate with Web servers

I

- **Icons-**In a graphical user interface (GUI), a small, pictorial, on screen representation of an object, such as a document, program, folder or disk drive.
- **Instant messaging (IM) -** A chat program that lets people communicate over the Internet in real time.
- **Internet protocol (IP) address** - A unique set of numbers that identifies a computer over a network.
- **Internet service provider (ISP) -** An organization that provides access to the Internet for a fee.
- **Intranet -** A private network established by an organization for the exclusive use of its employees. Firewalls prevent outsiders from gaining access to an organization's intranet

J

- **JPEG -** Joint Photographic Experts Group. A format for storing complex graphics in compressed form.
- **Justification -** Aligning lines of text at the left margin, the right margin, both margins, and the centre. Text aligned at both margins is considered fully justified.

K

- **Keyboard -** The device used to enter information into a computer.
- **Kilobyte -** A measurement of the storage capacity of a device. One kilobyte represents 1024 bytes.

L

- **LAN -** A local area network (LAN) is a computer network that interconnects computers within a limited area such as a home, school, computer laboratory, or office building, using network media.
- **Laptop computer -** A portable computer. Also known as a notebook computer.
- **Landscape Orientation –** The positioning of the page so that the information is printed across the long dimension of the page.
- **Liveware -** It is a term to describe the human system, opposed to hardware or software in a computer.

M

- **Macro virus -** A type of virus that attaches itself to documents or word processing templates.
- **Malware -** Software that disrupts normal computer functions or sends a user's personal data without the user's authorization.
- **Memory -** The part of a computer that stores information.
- **MemoryCell -** A circuit in memory that represents a single bit of information.
- **Mass Storage -** Storage systems that provide access to hundreds of billions of bytes of stored data. They are often referred to as Archival Storage because of the very large volumes of historical or backup data they can store.
- **MIPS -** An acronym derived from millions of instructions per second. Used to measure the speed of a processor.
- **Morphing -** The transformation of one image into another image.
- **Mobile Commerce (m-Commerce) -** A form of e-commerce that has the ability to conduct monetary transactions via a mobile device such as a cell phone.

- **Mozilla -** a web browser and successor to Netscape Communicator.
- **Multitasking -** The ability of a computer to execute more than one program at a time.

N

- **NIBBLE -** Combination of four bits.
- **Network -** A system of interconnected computers.
  They are of three types i. e. LAN, MAN, WAN.
- **Network Interface Card (NI(c) -** This is a part of the computer that allows it to talk to other computers via a network protocol like TCP/IP.
- **Node -** A computer which is attached to the network. Each node has its own address on the network so that it can be uniquely identified and can communicate with other nodes on the same or different network.

O

- **Offline -** Refers to the state in which a computer is temporarily or permanently unable to communicate with another computer.
- **Online -** Refers to the state in which a computer is ready to communicate with other computers.
- **Open source software -** Software that makes the underlying source code available to all users at no charge.
- **Operating system (OS) -** Software that manages the internal functions and controls the operations of a computer.

P

- **Palmtop computer -** A portable computer smaller than a notebook (or laptop) computer that fits on the palm of your hand. Also called a handheld computer.
- **Password -** A user's secret identification code, required to access stored material. A procedure intended to prevent information from being accessed by unauthorized persons.
- **Piracy -** The illegal copying of software or other creative works.
- **Peripherals -** A connectable device that has an auxiliary function outside the permanent system configuration such as plotters, printers and graphic displays.
- **Phishing -** A type of computer fraud that tries to trick users into revealing their passwords and other confidential information.
- **Pixel -** A smallest picture element of a digital image. The smaller the pixels, the higher the resolution.
- **Port -** An electrical connection on the computer into which a cable can be plugged so that the computer can communicate with other devices such as printer or modem.
- **Protocol -** A set of rules and regulations that coordinates the exchange of information over the network.
- Portrait orientation - Positioning paper so that information is printed across the short dimension of the paper.

Q

- **Query -** An alternate pipe form of operating system, which handles data in the form of messages rather than bytes.
- **Qwerty -** It is one of the standard computer keyboard, with the character Q, W, E, R, T, Y on the top row of letters on the keyboard.

R

- **Response time -** The time a computer takes to execute a command.
- **Retrieve -** To call up information from memory or storage so that it can be processed in some way.
- **Record -** A collection of all the information pertaining to a particular subject.
- **Row -** A horizontal block of cells in a table or spreadsheet.

- **Resolution -** Measurement of the degree of sharpness of a displayed image. It is defined as number of pixels per square inch on a computer generated display.
- **Register -** A temporary storage unit for quick, direct accessibility of a small amount of data for processing.

S

- **Save As –** Give the file a name and/or store the file in a certain place.
- **Save -** Tell the computer to create a file on disk that has the information you've put into the document.
- **Scroll bar -** Allows you to move around through your document.
- **Shut down - To** quit all applications and turn off the computer.
- **Spam -** unwanted repetitious messages, such as unsolicited bulk e-mail.
- **Scanner -** An input device that can copy a printed page into a computer's memory, thus doing away with the need to type the copy.
- **Screen saver -** A program that changes the screen display while the user is away from the computer.
- **Server -** A computer that manages a shared resource and provides a set of shared user services to the clients.
- **Search Engine -** Software that searches, gathers and identifies information from a database based on an index, keywords or titles.
- **Spam -** Unwanted repetitious messages, such as unsolicited bulk e-mail.
- Soft copy - Information shown on the display screen.
- **Sort -** To arrange fields, records, or files in a predetermined sequence.
- Surfing the Net - Browsing through various Web sites on the Internet in search of interesting things.

T

- **Trash -** Place where you put files and folders that you want to delete or get rid of.
- **Topology -** The structure of the network, including physical connections such as wiring schemes and logical interactions between network devices.
- **Track -** A ring on a disk where data can be written.
- **Telnet -** A protocol for remote computing on the internet that allows a computer to act as a remote terminal on another machine, anywhere on the internet.
- **Touchpad -** The device on a laptop computer that takes the place of a mouse.
- **Touch screen technology -** The technology that permits a user to perform a function simply by touching the screen on an appropriate spot.

U

- **Uninterrupted Power Supply (UPS) -** A Battery powered backup system that provides enough electricity to a computer during a power outage so that a user can save files before shutting down the computer.
- **Universal Serial Bus (USB) -** A common standard for connecting multiple peripherals to a computer as needed.
- **Upload -** To transfer information from a client computer to a host computer.

V

- **Virus -** A piece of computer code designed as a prank or malicious act to spread from one computer to another by attaching itself to other programs.

W

- **WAP -** Wireless Application Protocol is a specification for a set of communication protocol used to allow wireless devices to access the internet and other utilities.
- **Web browser -** Software that permits a user with a click of a mouse to locate, display, and download text, video, audio, and graphics stored in a host computer on the Web.
  The most common Web browsers now in use are Internet Explorer, Google Chrome and Mozilla Firefox.

- **Web site -** One or more related pages created by an individual or an organization and posted on the World Wide Web.
- **Wi-Fi (Wireless fidelity) -** A process that permits high-speed wireless transmission of data.
- **Word processing -** The electronic process of creating, formatting, editing, proofreading, and printing documents.
- **Workstation -** A desktop computer that runs applications and serves as an access point in a local area network.

Z

Zombie - A computer that has been hijacked by a cracker without the owner's knowledge and used to perform malicious tasks on the Internet.