THE APTITUDE TRIAD

Mastering Quantitative, Logical, and Verbal Skills

TABLE OF CONTENTS

THE APTITUDE TRIAD

SECTION A
QUANTITATIVE APTITUDE

MODULE 1
NUMBER SYSTEM

TYPES OF NUMBERS

1. **Natural Numbers**: Counting numbers 1, 2, 3, 4, 5, and so on, are called natural numbers.

2. **Whole Numbers:** All counting numbers together with zero form the set of whole numbers. Thus,

(i) 0 is the only whole number that is not a natural number.
(ii) Every natural number is a whole number.

3. **Integers:** All natural numbers, 0 and negatives of counting numbers i.e., {…, - 3, - 2, - 1, 0, 1, 2, 3, …} together form the set of integers.

(i) Positive Integers: {1, 2, 3, 4, …} is the set of all positive integers.
(ii) Negative Integers: {- 1, - 2, - 3, …} is the set of all negative integers.
(iii) Non-Positive and Non-Negative Integers: 0 is neither positive nor negative. So, {0, 1, 2, 3, …} represents the set of non-negative integers, while {0, - 1 , - 2 , - 3 , …} represents the set of non-positive integers.

4. **Even Numbers:** A number divisible by 2 is called an even number, e.g., 2, 4, 6, 8, 10, etc.

5. **Odd Numbers:** A number not divisible by 2 is called an odd number. e.g., 1, 3, 5, 7, 9, 11 etc.

6. **Prime Numbers:** A number greater than 1 is called a prime number if it has exactly two factors, namely 1 and the number itself.
Prime numbers up to 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.
There are 25 prime numbers between 1 and 100.

Prime numbers Greater than 100: Let p be a given number greater than 100. To find out whether it is prime or not, we use the following method:
Find a whole **number** nearly greater than the square root of p. Let k > *jp.
Test whether p is divisible by any prime number less than k. If yes, then p is not prime. Otherwise, p is prime.
e.g., We have to find whether 191 is a prime number or not. Now, 14 > V191.
Prime numbers less than 14 are 2, 3, 5, 7, 11, 13.
191 is not divisible by any of them. So, 191 is a prime number.

7. **Composite Numbers:** Numbers greater than 1 which are not prime, are known as composite numbers, e.g., 4, 6, 8, 9, 10, 12.
Note:

(i) 1 is neither prime nor composite.
(ii) 2 is the only even number which is prime.
(iii) There are 25 prime numbers between 1 and 100.

8. **Co-primes:** Two numbers a and b are said to be co-primes, if their H.C.F. is 1. e.g., (2, 3), (4, 5), (7, 9), (8, 11), etc. are co-primes.

9. **Arithmetic Progression (A.P.):** If each term of a progression differs from its preceding term by a constant, then such a progression is called an arithmetical progression. This constant difference is called the common difference of the A.P.
An A.P. with first term a and common difference d is given by a, (a + d), (a + 2d), (a +3d), ...
The nth term of this A.P. is given by Tn = a (n - 1) d.
The sum of n terms of this A.P.
Sn = n/2 [2a + (n - 1) d] = n/2 (first term + last term).

10. **Geometrical Progression (G.P.):** A progression of numbers in which every term bears a constant ratio with its preceding term, is called a geometrical progression.
The constant ratio is called the common ratio of the G.P.
A G.P. with first term a and common ratio r is:
a, ar, ar^2,
In this G.P. $Tn = ar^{n-1}$
sum of the n terms, $Sn = a(1-r^n) / (1-r)$ if $r \neq 1$; $r < 1$
sum of the n terms, $Sn = a(r^n - 1) / (r - 1)$ if $r \neq 1$; $r > 1$

TESTS OF DIVISIBILITY

1. **Divisibility By 2:** A number is divisible by 2, if its unit's digit is any of 0, 2, 4, 6, 8.
Ex. 84932 is divisible by 2, while 65935 is not.

2. **Divisibility By 3:** A number is divisible by 3, if the sum of its digits is divisible by 3.
Ex.592482 is divisible by 3, since the sum of its digits = (5+9+2+4+8+2) = 30, is divisible by 3.
But, 864329 is not divisible by 3, since the sum of its digits = (8+6+4+3+2+9) = 32, is not divisible by 3.

3. **Divisibility By 4:** A number is divisible by 4, if the number formed by the last two digits is divisible by 4.
Ex. 892648 is divisible by 4, since the number formed by the last two digits is 48 is divisible 4.
But, 749282 is not divisible by 4, since 82 (last two digits) is not divisible by 4.

4. **Divisibility By 5:** A number is divisible by 5, if its unit's digit is either 0 or 5. Thus, 20820 and 50345 are divisible by 5, while 30934 and 40946 are not.

5. **Divisibility By 6:** A number is divisible by 6, if it is divisible by both 2 and 3. Ex. The number 35256 is clearly divisible by 2.
Sum of its digits = (3 + 5 + 2 + 5 + 6) = 21, which is divisible by 3. Thus, 35256 is divisible by 2 as well as 3. Hence, 35256 is divisible by 6.

6. **Divisibility By 8:** A number is divisible by 8, if the number formed by the last three digits of the given number is divisible by 8.

Ex. 953360 is divisible by 8, since the number formed by the last three digits is 360, which is divisible by 8. But, 529418 is not divisible by 8, since the number formed by the last three digits is 418, which is not divisible by 8.

7. **Divisibility By 9:** A number is divisible by 9, if the sum of its digits is divisible by 9.
Ex. 60732 is divisible by 9, since sum of digits (6 + 0 + 7 + 3 + 2) = 18, which is divisible by 9. But, 68956 is not divisible by 9, since the sum of digits = (6 + 8 + 9 + 5 + 6) = 34, which is not divisible by 9.

8. **Divisibility By 10:** A number is divisible by 10, if it ends with 0.
Ex. 96410, 10480 are divisible by 10, while 96375 is not.

9. **Divisibility By 11:** A number is divisible by 11, if the difference of the sum of its digits at odd places and the sum of its digits at even places, is either 0 or a number divisible by 11.
Ex. The number 4832718 is divisible by 11, since: (sum of digits at odd places) - (sum of digits at even places); (8 + 7 + 3 + 4) - (1 + 2 + 8) = 11, which is divisible by 11.

10. **Divisibility By 12:** A number is divisible by 12, if it is divisible by both 4 and 3.
Ex. Consider the number 34632.

(i) The number formed by last two digits is 32, which is divisible by 4,

(ii) Sum of digits = (3 + 4 + 6 + 3 + 2) = 18, which is divisible by 3. Thus, 34632 is divisible by 4 as well as 3. Hence, 34632 is divisible by 12.

11. **Divisibility By 14:** A number is divisible by 14, if it is divisible by 2 as well as 7.

12. **Divisibility By 15:** A number is divisible by 15, if it is divisible by both 3 and 5.

FACTORS AND MULTIPLES:

Factors:

When a number is said to be a factor of any other second number, then the first number must divide the second number completely without leaving any remainder. In simple words, if a number (dividend) is exactly divisible by any number (divisor), then the divisor is a factor of that dividend. Every number has a common factor that is one and the number itself.

5 * 4 = 20

For example, 4 is a factor of 24, i.e. 4 divides 24 exactly giving 6 as quotient and leaving zero as remainder. Alternatively, 6 is also a factor of 24 as it gives 4 as a quotient on division. Therefore, 24 has 1, 24, 4, 6 as its factors in addition to 2, 3, 8 and 12 and all these numbers divide 24 exactly leaving no remainder.

Multiples:

A multiple of a number is a number that is the product of a given number and some other natural number. Multiples can be observed in a multiplication table. Multiples of some numbers are as follows:

Multiples of 2 are 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, and so on.
Hence, multiples of 2 will be even numbers and will end with 0, 2, 4, 6 or 8.

Multiples of 3 are 3, 6, 9, 12, 15, 18, 21, and so on.
Multiples of 5 are 5, 10, 15, 20, 25, and so on. Every multiple of 5 has its last digit as 0 or 5.

In the above-mentioned examples, say multiples of 2, the number 2 can be multiplied by infinite numbers to find the "n" number of multiples.

Now, let us assume an example, **3 × 4 = 12**
Here, 3 and 4 are the factors of 12, 12 is multiple of 3 and 4

Thus, we can conclude that if X and Y are two numbers and;

- If X divides Y, X is a factor of Y
- If Y is divisible by X, Y is a multiple of X

Since the number 1 divides every integer, it is a common factor of every integer. Also, every number is divisible by 1 and every number is a multiple of 1.

Finding the unit's digit

Generally, a unit digit can be identified by looking at the number and identifying the rightmost number before the decimal. But in some cases, it is not so direct. In numbers with exponents, the unit digit has to be calculated. For example, to calculate the unit digit of 260 it is advisable to use an indirect method rather than calculate the exact value and then find the unit digit.

Pattern or Cyclicity:

When any number is raised to the power n, where n = 1, 2, 3..., its unit digit follows a pattern or a cycle.
For example, 21, 22, 23, 24... and so on end with 2, 4, 8, 6, 2, 4, 8, 6, 2, 4... In this case, the unit's digit repeats after every 4 powers. Therefore 21 will have the same units digit as 25, 29, 213.. all 2(4k+1), where k = 0, 1, 2, 3...

The following table gives the patterns or cycles of all natural numbers from 1 to 9:

NUMBER	CYCLE	PATTERN
1	1	1
2	4	2, 4, 8, 6
3	4	3, 9, 7, 1
4	2	4, 6
5	1	5
6	1	6
7	4	7, 9, 3, 1
8	4	8, 4, 2, 6
9	2	9, 1

Another general and one of the easier ways to find the units digit of a number in the form xy, is done with the help of the following steps:

1. Identify the unit's digit in the base 'x' and call it 'l'. {For example, if x = 24, then the unit's digit of 24 is 4. Hence l = 4.}
2. Divide the exponent 'y' by 4.
   - If the exponent y is exactly divisible by 4. i.e., y leaves a remainder 0 when divided by 4. Then,
   - the units digit of x^y is 6, if l = 2, 4, 6, 8.

- the units digit of x^y is 1, if l = 3, 7, 9.
- If y leaves a non-zero remainder r, when divided by 4 (i.e. y = 4k + r). Then,
- the units digit of $x^y = l^r$

Example: Find the Unit digit of 287^{562581}

PROBLEMS:

1. A number when divided by 5 leaves a remainder of 4, when the double (i.e., twice) of that number is divided by 5 the remainder will be:
   (a) 0 (b) 1
   (c) 3 (d) Cannot be determined

2. Find the unit's digit of the expression: 785562 x 56256 x 971250.
   (a) 4 (b) 5 (c) 6 (d) 7

3. A number 'A', when divided by 'D', leaves the remainder 18 and if another number 'B' is divided by the same divisor 'D' it leaves the remainder 11. Further, if we divide A + B by 'D' then we obtain the remainder 4. Then the common divisor 'D' is:
   (a) 21 (b) 22 (c) 15 (d) 25

4. What is the remainder when 3^{256} is divided by 13?
   (a) 1 (b) 3 (c) 9 (d) 5

5. A natural number N when successively divided by 4, 5 and 6 leaves remainders of 2, 4 and 5 respectively. What is the sum of the remainders obtained when N is successively divided by 12 and 10?
   (a) 19 (b) 20
   (c) 10 (d) Cannot be determined

6. Find the reminder when $3^{2007} + 7^{2007}$ is divided by 8.
   (a) 1 (b) 2 (c) 3 (d) None of these

7. Sum of 'n' consecutive integers is 900 less than the next 'n' consecutive integers. Find 'n'.
   (a) 30 (b) 60 (c) 90 (d) Data insufficient

8. How many prime numbers exist in $6^7 \times 35^3 \times 11^{10}$?
   (a) 30 (b) 29 (c) 27 (d) 31

9. Find the number of factors of 9321.
   (a) 3 (b) 6 (c) 8 (d) 16

10. What is the rightmost integer of the expression $65776^{759} + 54697^{467}$.
    (a) 3 (b) 5 (c) 7 (d) 9

11. Find the highest power of 40 which can completely divide 4000!
    (a) 9 (b) 99 (c) 999 (d) 9999

12. How many ways can 1146600 be written as the product of two factors?
(a) 100 (b) 108 (c) 216 (d) 273

13. The sum of all four-digit numbers which are divisible by 7 is?
(a) 7071071 (b) 77 (c) 7107073 (d) 10019996

14. The number of zeros at the end of 100! is:
(a) 36 (b) 18 (c) 24 (d) 10

15. The sum of all the factors of 45000 which are exactly the multiples of 10 is:
(a) 152295 (b) 141960 (c) 600 (d) None of these

HOMEWORK:

1. Total number of digits in the product of $4^{1111} * 5^{2222}$ is:
(a) 3333 (b) 2223
(c) 2222 (d) Cannot be determined

2. If p = N + 5 when N is the product of any three consecutive positive integers. Then:
(a) p is prime (b) p is odd
(c) p is divisible by 6 (d) either of (b) or (c)

3. What is the least number which must be multiplied to 5400 to get a perfect square?
(a) 2 (b) 3 (c) 6 (d) 10

4. What is the remainder when the square of the smallest five-digit prime number is divided by 24?
(a) 1 (b) 2 (c) 3 (d) None of these

5. How many factors of 1080 are perfect squares?
(a) 4 (b) 6 (c) 8 (d) 5

MODULE 2
HCF, LCM AND DECIMAL FRACTIONS

1. **Highest Common Factor (H.C.F.) or Greatest Common Measure (G.C.M.) or Greatest Common Divisor (G.C.D.):** The H.C.F. of two or more than two numbers is the greatest number that divides each of them exactly. There are two methods of finding the H.C.F. of a given set of numbers:

A. **Factorization Method:** Express each one of the given numbers as the product of prime factors. The product of least powers of common prime factors gives H.C.F.

B. **Division Method:** Suppose we have to find the H.C.F. of two given numbers. Divide the larger number by the smaller one. Now, divide the divisor by the remainder. Repeat the process of dividing the preceding number by the remainder last obtained till zero is obtained as the remainder. The last divisor is the required H.C.F.

2. **Least Common Multiple (L.C.M.):** The least number which is exactly divisible by each one of the given numbers is called their L.C.M.

A. **Factorization Method of Finding L.C.M.:** Resolve each one of the given numbers into a product of prime factors. Then, L.C.M. is the product of the highest powers of all the factors,

B. **Common Division Method {Short-cut Method) of Finding L.C.M.:** Arrange the given numbers in a row in any order. Divide by a number that divides exactly at least two of the given numbers and carry forward the numbers which are not divisible. Repeat the above process till no two of the numbers are divisible by the same number except 1. The product of the divisors and the undivided numbers is the required L.C.M. of the given numbers.

3. **Product of two numbers =Product of their H.C.F. and L.C.M.**

4. **Co-Primes:** Two numbers are said to be co-primes if their H.C.F. is 1.

5. **H.C.F. and L.C.M. of Fractions:**
   HCF = HCF of Numerators / LCM of Denominators
   LCM = LCM of Numerators / HCF of Denominators

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

7. **Comparison of Fractions:** Find the L.C.M. of the denominators of the given fractions. Convert each of the fractions into an equivalent fraction with L.C.M. as the denominator, by multiplying both the numerator and denominator by the same number. The resultant fraction with the greatest numerator is the greatest.

EXAMPLES:

1. Find the LCM of 72, 108, and 2100.
2. Find the LCM of 16, 24, 36, and 54.

3. Find the HCF and LCM of 2/3, 8/9, 16/81, and 10/27.
4. Find the HCF of 108, 288, and 360.
5. Find the HCF of 513, 1134, and 1215.

DECIMAL FRACTIONS

1. **Decimal Fractions:** Fractions in which denominators are powers of 10 are known as decimal fractions.
   Thus, 1/10 =1 tenth= 0.1; 1/100 = 1 hundredth = 0.01;
   99/100 = 99 hundredths =0.99; 7/1000 = 7 thousandths = 0.007, etc.

2. **Conversion of a Decimal into Vulgar Fraction:** Put 1 in the denominator under the decimal point and annex with it as many zeroes as is the number of digits after the decimal point. Now, remove the decimal point and reduce the fraction to its lowest terms.
   Thus, 0.25 = 25/100 = 1/4; 2.008 = 2008/1000 = 251/125
   A. Annexing zeros to the extreme right of a decimal fraction do not change its value.
      Thus, 0.8 = 0.80 = 0.800, etc.
   B. If the numerator and denominator of a fraction contain the same number of decimal places, then we remove the decimal sign. Thus, 1.84/2.99 = 184/299 = 8/13; 0.365/0.584 = 365/584 = 5

3. **Operations on Decimal Fractions:**
   A. Addition and Subtraction of Decimal Fractions: The given numbers are so placed under each other that the decimal points lie in one column. The numbers so arranged can now be added or subtracted in the usual way.
   B. Multiplication of a Decimal Fraction by a Power of 10: Shift the decimal point to the right by as many places as is the power of 10.
      Thus, 5.9632 x 100 = 596.32; 0.073 x 10000 = 0.0730 x 10000 = 730.
   C. Multiplication of Decimal Fractions: Multiply the given numbers considering them without the decimal point. Now, in the product, the decimal point is marked off to obtain as many places of decimal as is the sum of the number of decimal places in the given numbers.
      Suppose we have to find the product (.2 x .02 x .002).
      Now, 2 x 2 x 2 = 8
      Sum of decimal places = (1 + 2 + 3) = 6
      Hence, (.2 x .02 x .002) = .000008

TYPES OF DECIMALS:

1. **Terminating decimals** are the numbers that do not repeat and end after a certain number of decimal places. For instance, 37.42, 234.126, and so on.

2. **Non-terminating decimals** are numbers that have an endless number of digits following the decimal point. For example, 1245.6725876…. Non-terminating decimal numbers can be classified into two groups:

3. **Recurring decimal numbers** – The digits in recurring decimal numbers repeat after a fixed interval. 123.465465465 is an example of a recurring decimal number.

4. **Non-recurring decimal numbers** – The digits in non-recurring decimal numbers never repeat themselves after a specific interval. For instance, 1256.128764978…

PROBLEMS:

1. Find the smallest number that leaves a remainder of 4 on division by 5, 5 on division by 6, 6 on division by 7, 7 on division by 8, and 8 on division by 9?
   (a) 2519 (b) 5039 (c) 1079 (d) 979

2. 6 different sweet varieties of count 32, 216, 136, 88, 184, and 120 were ordered for a particular occasion. They need to be packed in such a way that each box has the same variety of sweets and the number of sweets in each box is also the same. What is the minimum number of boxes required to pack?
   (a) 129 (b) 64 (c) 48 (d) 97

3. What is the greatest number which when it divides 77, 48, and 34, leaves remainders 2, 3, and 4 respectively?
   (a) 15 (b) 14 (c) 25 (d) 30

4. What is the least number which when divided by 48, 36, and 72 leaves the remainder of 3 in each case?
   (a) 154 (b) 147 (c) 125 (d) 130

5. Find the greatest number that will divide 65, 81, and 145 leaving the same remainder in each case.
   (a) 15 (b) 14 (c) 12 (d) 16

6. Find the least number which when divided by 6, 7, and 9 leaves the remainder 1, 2, and 4 respectively.
   (a) 121 (b) 124 (c) 125 (d) 126

7. The LCM of two numbers is 500 and their HCF is 50. If one of the numbers is 100, the other number is?
   (a) 250 (b) 400 (c) 500 (d) None

8. The HCF and LCM of the two numbers are 25 and 500 respectively. If the first number is divided by 2, the quotient is 50. The second number is?
   (a) 50 (b) 100 (c) 125 (d) 250

9. Find the value of $29.94 \div 1.45$, if the value of $2994 \div 14.5 = 172$.
   (a) 17.2 (b) 1.72 (c) 172 (d) 0.172

10. Simply the value [489.1375 × 0.0483 × 1.956]/[0.0873 × 92.581 × 99.749], and then find the value closest to it.
(a) 0.06 (b) 0.6 (c) 6 (d) 0.006

11. 11.98 × 11.98 + 11.98 × m + 0.02 × 0.02 should be a perfect square for "m" equal to?
(a) 0.04 (b) 0.4 (c) 4 (d) 0.004

12. Find the unknown value in the given equation: 3889 + 12.952 –? = 3854.002
(a) 479.5 (b) 47.95 (c) 4.795 (d) 4795

13. Evaluate:
(i) 8.71 x 1.2
(ii) 3.7496 x 1.3
(iii) 0.6 x 0.06 x 0.006 x 60

14. Evaluate:
(i) 0.72 / 9
(ii) 0.0216 / 18
(iii) 4.2096 / 16

15. Evaluate: $(2.39^2 - 1.61^2) / (2.39 - 1.61)$
(a) 2 (b) 4 (c) 3 (d) 5

HOMEWORK:

1. Three numbers are in the ratio 2 : 3 : 4 and their HCF is 12. The LCM of the numbers is?
(a) 144 (b) 192 (c) 96 (d) 72

2. The sum of the HCF and LCM of the two numbers is 680 and the LCM is 84 times the HCF. If one of the numbers is 56, the other is
(a) 84 (b) 12 (c) 8 (d) 96

3. The LCM of the two numbers is 4 times their HCF. The sum of LCM and HCF is 125. If one of the numbers is 100, then the other number is
(a) 5 (b) 25 (c) 100 (d) 125

4. Arrange the fractions 5/8, 7/12, 13/16, 16/29 and 3/4 in ascending order.

5. Convert the following into vulgar fractions:
(i) 0.25
(ii) 4.004
(iii) 0.0056

MODULE 3
SIMPLIFICATION

1. A gentleman decided to treat a few children in the following manner. He gives half of his total stock of toffees and one extra to the first child, and then the half of the remaining stock along with one extra to the second and continues giving away in this fashion. His total stock exhausts after he takes care of 5 children. How many toffees were there in his stock initially?
   (a) 65 (b) 62 (c) 60 (d) 70

2. Aron bought some pencils and sharpeners. Spending the same amount of money as Aron, Aditya bought twice as many pencils and 10 less sharpeners. If the cost of one sharpener is 2 more than the cost of a pencil, then the minimum possible number of pencils bought by Aron and Aditya together is?
   (a) 30 (b) 27 (c) 33 (d) 36

3. Students in a college have to choose at least two subjects from chemistry, mathematics and physics. The number of students choosing all three subjects is 18, choosing mathematics as one of their subjects is 23 and choosing physics as one of their subjects is 25. The smallest possible number of students who could choose chemistry as one of their subjects is?
   (a) 20 (b) 19 (c) 22 (d) 21

4. While multiplying three real numbers, Ashok took one of the numbers as 73 instead of 37. As a result, the product went up by 720. Then the minimum possible value of the sum of squares of the other two numbers is?
   (a) 20 (b) 40 (c) 22 (d) 42

5. A red light flashes three times per minute and a green light flashes five times in 2 minutes at regular intervals. If both lights start flashing at the same time, how many times do they flash together in each hour?
   (a) 30 (b) 24 (c) 20 (d) 60

6. In a call centre at New Delhi, it is observed that it gets a call at an interval of every 10 minutes from California, at every 12 minutes from Texas, at the interval of 20 minutes from Washington DC and after every 25 minutes it gets the call from London. If in the early morning at 5:00 a.m. it has received the calls simultaneously from all the four destinations, then at what time will it receive the calls simultaneously from all the places on the same day?
   (a) 10:00 a.m. (b) 3:00 a.m. (c) 5:00 p.m. (d) both (a) and (b)

7. A diamond expert cuts a huge cubical diamond into 960 identical diamond pieces in a minimum number of 'n' cuts. If he wants to maximise the number of identical diamond pieces making same number of n cuts to it, so the maximum number of such diamond pieces are:
   (a) 1000 (b) 1331
   (c) 1200 (d) none of (a), (b), (c)

8. A typist starts to type the serial numbers of candidates in a list, up to 500. Minimum how many times does he need to press the keys of numerals only?

(a) 1389 (b) less than 1000 (c) 1392 (d) can't say

9. A man sells chocolates which are in the boxes. Only either a full box or half a box of chocolates can be purchased from him. A customer comes and buys half the number of boxes which the seller had plus half a box more. A second customer comes and purchases half the remaining number of boxes plus half a box. After this the seller is left with no chocolate boxes. How many chocolate boxes did the seller have, initially?
(a) 2 (b) 3 (c) 4 (d) 3.5

10. In a soap company a soap is manufactured with 11 parts. For making one soap you will get 1 part as scrap. At the end of the day, you have 251 such scraps. From that how many soaps can be manufactured?
(a) 25 (b) 20 (c) 24 (d) 22

11. A man spends 2/5th of his salary on house rent, 3/10th of his salary on food and 1/8th of his salary on conveyance. If he has Rs.1400 left with him, find his expenditure on food and conveyance.
(a) Food – Rs. 2400, Conveyance – Rs. 1000
(b) Food – Rs. 2000, Conveyance – Rs. 1600
(c) Food – Rs. 1800, Conveyance – Rs. 1200
(d) Food – Rs. 1000, Conveyance – Rs. 2

12. In Somnath Temple there are some magical bells which toll 18 times in a day, simultaneously. But every bell tolls at a different interval of time, but not in a fraction of minutes. The maximum number of bells in the temple can be:
(a) 18 (b) 10 (c) 24 (d) 6

13. When an amount was distributed among 14 boys, each of them got Rs. 80 more than the amount received by each boy when the same amount is distributed equally among 18 boys. What was the amount?
(a) Rs. 5040 (b) Rs. 5820 (c) Rs. 5802 (d) Rs. 3920

14. Three mangoes, four guavas and five watermelons cost Rs.750. Ten watermelons, six mangoes and nine guavas cost Rs.1580. What is the cost of six mangoes, ten watermelons and four guavas?
(a) 1280 (b) 1080
(c) 1180 (d) Cannot be determined

15. Reynolds offers a total of 150 pens to its customers. As per the scheme, one pen will be offered on the purchase of a "Quantitative Aptitude" book. Out of 150 pens, the cost of some pens is Rs. 3 and the cost of the rest of the pens is Rs. 5. At the most, how many customers can avail a pen of Rs. 5 as an offer from the company if the total cost of the pens cannot exceed Rs. 745.
(a) 45 (b) 120 (c) 147 (d) None of these

HOMEWORK:

1. 4/15 of 5/7 of a number is greater than 4/9 of 2/5 of the same number by 8. What is half of that number?
   (a) 275 (b) 315 (c) 240 (d) 475

2. A crate of mangoes contains one bruised mango for every 30 mangoes in the crate. If 3 out of every 4 bruised mangoes are considered unsaleable, and there are 12 unsaleable mangoes in the crate, how many mangoes are there in the crate?
   (a) 480 (b) 500 (c) 440 (d) 520

3. One third of Arun's marks in Mathematics exceeds a half of his marks in English by 30. If he got 240 marks in the two subjects together, how many marks did he get in English?
   (a) 180 (b) 60 (c) 78 (d) 110

4. $1 \div \frac{1}{1 \div \frac{1}{1 \div \frac{1}{3}}}$ is equal to:
   (a) 1/3 (b) 1 (c) 3 (d) 1 (1/3)

5. Find the value of x in $\sqrt{x + 2\sqrt{x + 2\sqrt{x + 2\sqrt{3x}}}} = x$
   (a) 1 (b) 3 (c) 6 (d) 12

MODULE 4
PERCENTAGES

FINDING THE PERCENTAGE

- The word **Percentage** is derived from the LATIN word **Per centum** which means for every **Hundred**
- **%** is the symbol used to represent Percentage

Percentage (%) = $\frac{\text{Required Value}}{\text{Total Value}} * \mathbf{100\%}$

Example 1:
In a test conducted for 50 marks. Mahesh scored 40 marks. Find his Percentage?
Solution:
We know that,

Percentage (%) = $\frac{\text{Required Value}}{\text{Total Value}} * \mathbf{100\%}$

= (40/50) * 100 = 80%

Example 2:
The total strength of a class is 60 out of which 15 students were absent. Find the percentage of students present in the class?

Solution:
Here they are asking for the Percentage of students present in the class.
Therefore, the number of Students present in the class = 60 – 15 = 45
= (45/60) * 100 %
= 75%

FRACTIONS TO PERCENTAGE CONVERSION

To convert a Fraction into Percentage, we should Multiply the Fraction with 100

Fraction	Percentage
1/1	100%
1/2	50%
1/3	33.33%
1/4	25%
1/5	20%
1/6	16.67%
1/7	14.28%
1/8	12.5%
1/9	11.11%
1/10	10%
1/11	9.09%
1/12	8.33%

Note: x% of y = y % of x

Percentage Change:

Percentage Increment = $\frac{\text{Difference}}{\text{Small Value}} * 100\%$

Percentage Decrement = $\frac{\text{Difference}}{\text{Larger Value}} * 100\%$

- Percentage Increment is always **GREATER** than Percentage Decrement

Example 3:
Weight of Ramesh increased from 75 kg to 96 kg. Find the Percentage increase in his weight?

Solution:

Percentage Increment = $\frac{\text{Difference}}{\text{Small Value}} * 100\%$

Percentage Increment = $\frac{96-75}{75} * 100\% = 28\%$

- If A is P% more than that of B, then B is less than that of A by
- **Percentage Decrement =** $\frac{P}{100+P} * 100\%$
- If A is P% less than that of B, then B is more than that of A by
- **Percentage Increment =** $\frac{P}{100-P} * 100\%$

Successive Percentage Increment & Decrement

- If a number is increased or decreased successively by x% and y% then, **net % change is given by**: $\mathbf{x + y + \frac{xy}{100}\%}$

Example 4:
Two successive increments of 10% and 20% on an article is equal to a single increment of?

Solution:

Net % change is given by: $\mathbf{x + y + \frac{xy}{100}\%}$

Here, both are **Increments** so we should consider **+ sign**

Net % change = $\mathbf{10 + 20 + \frac{10*20}{100}}$
= (30 + 2)%
= 32%

PROBLEMS:

1. P is eight times as large as Q. By what percent Q is less than P?
   (a) 90% (b) 87.5% (c) 60% (d) 16 (2/3)%

2. A candidate who gets 30% marks fails by 5 marks but another candidate who gets 40% marks gets 5 marks more than the passing marks. Find the maximum marks.
   (a) 50 (b) 100 (c) 150 (d) None

3. Ravi's salary is 50% more than Sunil's salary. Ravi got a raise of 40% on his salary while Sunil got a raise of 30% on his salary. By what percent is Ravi's salary more than Sunil's?
   (a) 61.53% (b) 71.64% (c) 86.47% (d) 56.92%

4. In XYZ College, 65% of students are less than 20 years of age. The number of students more than 20 years of age is 2/3rd of the number of students of 20 years of age which is 42. What is the total number of students in the College?
   (a) 75 (b) 90 (c) 130 (d) 200

5. A student attempts x number of questions. He answers 15 correctly out of the first 20 questions and of the remaining questions, he answers 1/3 correctly. If all questions have the same credit and the student gets 50 % marks, then find the value of x?
   (a) 35 (b) 40 (c) 50 (d) 55

6. In a medical certificate, by mistake, a candidate gave his height as 20% more than normal. In the interview panel, he clarified that his height was 6 feet 6 inches. Find the percentage correction made by the candidate from his stated height to his actual height.
   (a) 16.66% (b) 28.56% (c) 25% (d) 16.66%

7. The radius of a sphere is 14 cm. The cost of painting the surface of the sphere is Rs. 25 per square cm. If the radius of the sphere is increased by 20%, then the cost of painting is increased by 20%. What is the percentage increase in the total cost of painting per square cm?
   (a) 54.27% (b) 20.3% (c) 62.58% (d) 72.8%

8. The price of a car is Rs. 8,00,000. It was insured for 90% of its price. The car got completely damaged, and the insurance company paid only 80% of the insured amount. What is the price of the difference between the price of the car and the amount of insurance received?
   (a) 1,28,000 (b) 80,000 (c) 1,60,000 (d) 2,24,000

9. The population of New Foundland increases with a uniform rate of 7% per annum, but due to immigration, there is a further increase of population by 1% (however, this 1% increase in population is to be calculated on the population after the 7% increase and not on the previous year's population). What will be the percentage increase in population after 2 years?
   (a) 16.79 (b) 18.81 (c) 18.24 (d) 17.91

10. In a college election between 2 students, 10% of the votes cast is invalid. The winner gets 70% of the valid votes and defeats the opponent by 1800 votes. How many votes were casted in total?

(a) 4300 (b) 5000 (c) 5400 (d) 6600

11. A company has 14 machines of equal efficiency in its factory. The annual manufacturing expenses are Rs. 42, 000 and the establishment charges are Rs. 12,000. The annual output of the company is Rs. 70, 000. The annual output and manufacturing costs are directly proportional to the no. of machines while the shareholders get the 12.5% profit, which is directly proportional to the annual output of the company. If 7.14% machines remained closed throughout the year. Then the percentage decrease in the amount of shareholders is:
(a) 12% (b) 12.5% (c) 13% (d) 13.5%

12. In a tournament, a team has played 40 matches so far and won 30% of them. If they win 60% of the remaining matches, their overall win percentage will be 50%. Suppose they win 90% of the remaining matches, then the total number of matches won by the team in the tournament will be?
(a) 86 (b) 84 (c) 78 (d) 80

13. Hari prepares a budget to visit London. However, he spends 12% of his budget on the first 10% days of his travel when he stays in the city. He knows that he has to spend another 35% of days in city itself, after which he would travel to the countryside. What should be the minimum decrease in spending in the countryside as a percentage of his spending in the city so as to complete his travel on the initial budget itself?
(a) 33.33% (b) 30.3% (c) 25% (d) 32.23%

14. 40% of the employees of a certain company are men and 75% of the men earn more than Rs. 25,000 per year. If 45% of the company's employees earn more than Rs. 25,000 per year, what fraction of the women employed by the company earn Rs. 25,000 or less per year?
(a) 2/11 (b) 1/4 (c) 1/3 (d) 3/4

15. In an election between two candidates, a person who got 58% of total votes won the election by a majority of 960. Find the total number of votes.
(a) 6,000 (b) 7,500 (c) 8,000 (d) 9600

HOMEWORK:

1. During one year, the population of a town increased by 5% and during the next year, the population decreased by 5%. If the total population is 9975 at the end of the second year, then what was the population size in the beginning of the first year?
(a) 10000 (b) 11000 (c) 12000 (d) 15000

2. The height of a triangle has increased by 40%. What will be the maximum % increase in the length of the base so that the increase in the area is restricted to a maximum of 60 %?
(a) 50% (b) 20% (c) 14.28% (d) 25%

3. Rakesh is working in the Life Insurance Corporation of India (LIC). He was hired on the basis of commission and he got the bonus only on the first year's commission. He got the policies of 2 lakh having a maturity period of 10 years. His commission in the first, second, third, fourth and for the

rest of the years is 20%, 16%, 12%, 10% and 4% respectively. The bonus is 25% of the commission. If the annual premium is Rs. 20,000 then what is his total commission if the completion of the maturity of all the policies is mandatory:
(a) Rs. 17400 (b) Rs. 23600 (c) Rs. 15000 (d) Rs. 15500

4. If an equal number of people are born on each day, Find the approximate percentage of the people whose birthday will fall on 29th February if we are to consider people born in the 20th century (1901 – 2000) and assuming no deaths.
(a) 0.374 (b) 0.5732 (c) 0.0664 (d) None of these

5. In a local election, 2400 people were to vote for Party A or Party B. Party A was bound to win the election. However, on Election Day, 33% of the voters of Party A were kidnapped. Party B was also able to influence the remaining Party A voters and thus double the strength of its voters. In this way, Party A lost by a majority which was half of that by which it would have won had the elections been fair. How many people finally voted for Party A and Party B?
(a) 600(A), 1200(B) (b) 300(A), 600(B) (c) 450(A), 900(B) (d) 600(A), 900(B)

MODULE 5
PROFIT, LOSS AND DISCOUNTS

Cost Price

- The price at which an article has been purchased is called as Cost Price
- It is abbreviated as CP

Selling Price

- The price at which an article has been sold is called as Selling Price
- It is abbreviated as SP

Overhead Expenses

- After purchasing an article, the additional expenses like transportation, labour etc. are called as Overhead Expenses
- Overhead expenses should be added to Cost Price

Profit

- If the Selling Price is more than the Cost Price, then there will be a Profit
  i.e., SP > CP
  Profit = SP – CP
  Profit is represented as P. Profit is also called as Gain

Loss

- If the Cost Price is more than the Selling Price, then there will be a Loss
  i.e., CP > SP
  Loss = CP – SP
  Loss is represented as L

Profit Percentage

- The value of profit, when expressed as a percent of the cost price (CP), is called profit percent.
- $P\% = \frac{SP-CP}{CP} * 100\%$
- $P\% = \frac{Profit}{CP} * 100\%$
- $P\% = \frac{Profit}{SP-Profit} * 100\%$

Example 1: A cloth merchant bought 35 shirts, each at a price of Rs 280. He sold each of them for Rs. 308. Find his percentage profit.

Solution:
The profit percentage remains same for one unit as well for all the units. Thus, the calculations should be done for one unit only.
CP = Rs. 280. SP = Rs. 308.
Profit = 308 – 280 = Rs. 28. Now you need to apply the profit percentage formula for the same.
Profit percentage = 28/280 x 100 = 10%

Loss Percentage:

- Loss, when expressed as a percentage of cost price, is called loss percentage
- $L\% = \frac{CP-SP}{CP} * 100\%$
- $L\% = \frac{Loss}{CP} * 100\%$
- $L\% = \frac{Loss}{SP+Loss} * 100\%$

Example 2: An article is sold for Rs 2400 at a profit of 25 %. What would have been the actual profit or loss if it had been sold at Rs 1800?

Solution:
let us find the cost price of the same. C.P. = 2400 × 100/125 = 1920.
New selling price = Rs. 1800 ⇒ Loss = 1920 − 1800 = 120
∴ Loss percentage = 100 × 120/1920 = 6.25%.

Special Cases
If CP of A articles is equal to SP of B articles, then,

Case 1
If A > B then, we will have Profit and P% is given by, $P\% = \frac{A-B}{B} * 100\%$

Case 2
If A < B then, we will have Loss and L% is given by, $L\% = \frac{B-A}{B} * 100\%$

- If CP of two articles is same and one is sold at Profit and the other is sold at Loss & both P% and L% are equal to let's say x%, then there will be **neither Profit nor Loss**
- If SP of two articles is same and one is sold at Profit and the other is sold at Loss & both P% and L% are equal to let's say x%, then there will always be **Loss**
- $L\% = \left(\frac{x^2}{100}\right)\%$

Dishonest Dealing
- A dishonest dealer uses a False weight instead of True weight and makes Profit
- This Profit percentage is given by,
- $P\% = \frac{\text{True weight} - \text{False weight}}{\text{False weight}} * 100\%$

Marked Price
- The Price on the price tag or the label is called as Marked Price
- It is abbreviated as MP. Marked Price is also called as List Price

Discount
- The reduction on the Marked Price of an article is called as Discount
- It is abbreviated as D

Discount Percentage

- $D\% = \frac{\text{MP} - \text{SP}}{\text{MP}} * 100\%$
- Discount Percentage is always calculated on the MP

Formulas:

1. **Selling Price: (SP)**

   $\text{SP} = \frac{100 + \text{Gain \%}}{100} * \text{CP}$

2. **Selling Price: (SP)**

   $\text{SP} = \frac{100 - \text{Loss \%}}{100} * \text{CP}$

3. **Cost Price: (CP)**

   $\text{CP} = \frac{100}{100 + \text{Gain \%}} * \text{SP}$

4. **Cost Price: (CP)**

   $\text{CP} = \frac{100}{100 - \text{Loss \%}} * \text{SP}$

5. If an article is sold at a gain of say 35%, then S.P = **135% of C.P.**

6. If an article is sold at a loss of say, 35% then S.P = **65% of C.P.**

PROBLEMS:

1. If a man reduces the selling price of a fan from 400 to 380, his loss increases by 20%. What is the cost price of the fan?
   (a) 100 (b) 200 (c) 400 (d) 500

2. A vendor bought 15 oranges at Rs. 36 for 5 oranges and sold all of them at four oranges for Rs. 45. How much did the vendor earn or lose in this transaction?
   (a) Loses Rs. 4.05 per orange (b) Gain Rs. 4.05 per orange
   (c) Gains Rs. 60 overall (d) Loses Rs. 5.06 per orange

3. Ram sells onions on the streets of Chandni Chowk. Due to a recent shortfall in the supply of onions, he doubles his selling price despite the cost price remaining the same for him due to a fixed price contract. He realises that his profit triples. Find the original profit percent.
   (a) 200/3 (b) 100 (c) 316/3 (d) 120

4. Ankit bought 20 soaps and 12 toothpastes. He marked-up the soaps by 15% on the cost price of each and the toothpastes by Rs. 20 on the cost price of each. He sold 75% of the soaps and 8 toothpastes and made a profit of Rs. 385. If the cost of a toothpaste is 60% the cost of a soap and he got no return on unsold items, what was his overall profit or loss?
   (a) Loss of Rs. 355 (b) Profit of Rs. 210

(c) Loss of Rs. 250 (d) Profit of Rs. 255

5. A trader bought two horses for ₹19,500. He sold one at a loss of 20% and the other at a profit of 15%. If the selling price of each horse is the same, then their cost prices are respectively.
(a) 10,000 and 9,500 (b)11,500 and 8,000
(c) 12,000 and 7,500 (d) 10,500 and 9,000

6. The cost price of a commodity is 1,331. By selling it at a discount of 100, the dealer makes a profit of 9.09%. If he decides not to give any discount, then what will be the profit made by him?
(a) 131 (b) 121 (c) 221 (d) 231

7. The par value of the shares of company X and Y is 10. The market price of the shares are 40 and 50 respectively. Find the ratio of the return on investment for an investor if the dividends are 20% and 40% respectively. Investment in both the cases is the same.
(a) 5:8 (b) 8:5 (c) 8:13 (d) 13:8

8. The difference between a discount of 35% and two successive discounts of 20% on a certain bill was Rs. 22. Find the amount of the bill.
(a) Rs. 244.44 (b) Rs. 1,100 (c) Rs. 4,400 (d) Rs. 2,200

9. If a shopkeeper offers a discount of 20% on the list price of a washing machine, then he makes a profit of 12%. What percent profit or loss will he make if he sells it at a discount of 25% on the list price?
(a) 0.6% loss (b) 0.5% profit (c) 4.25% loss (d) 5% profit

10. Manoj marks up his goods by 40% and gives a discount of 10%. Apart from this, he uses a faulty balance also, which reads 1000 gm for 800 gm. What is his net profit percentage?
(a) 37.5% (b) 57.5% (c) 8% (d) None

11. A merchant marks up the price of an article by 40% and 45% successively. Then he gives a discount of 20% and 25% successively. Find the profit percentage earned by the merchant.
(a) 21.8% (b) 23.2% (c) 20.7% (d) 19.6%

12. Given below is a question followed by three statements. Study the statements and decide which of the statement(s) is/are necessary to answer the question.
What was the discount percentage given?
i. On selling the table for Rs 12650, 26.5 % Profit was earned.
ii. If there had been no discount, 30% would have been earned as profit.
iii. The Cost price of the table was Rs 10000
(a) Only I and II (b) Only II and III
(c) Only I and III (d) Any two of the above

13. A publisher printed 3000 copies of 'Future Shock' at a cost of Rs. 2400. He gave 500 copies free to different philanthropic institutions. He allowed a discount of 25% on the published price and gave one copy free for every 25 copies bought at a time. He was able to sell all the copies in this

manner. If the published price is Rs. 3.25, then what is his overall gain or loss percentage in the whole transaction?
(a) 113% (b) 130% (c) 162% (d) 144%

14. X goes to the shopkeeper P to purchase a plant for Rs 350 and gives him a 1000-rupee note. P does not have the change and hence goes to shopkeeper Q to get the change. He then gives X, Rs 650. Later, Q realises that the 1000-rupee note is a duplicate note and asks P to return his money. P returns the money. What is the loss incurred by P if it is given that P sold the plant at a profit of 25%?
(a) Rs. 930 (b) Rs. 2000 (c) Rs. 1070 (d) Rs. 1200

15. A pharmaceutical company manufactures 6000 strips of prescribed diabetic drugs for Rs. 800000 every month. In July 2014, the company supplied 600 strips of free medicines to the doctors at various hospitals. Of the remaining medicines, it was able to sell 4/5th of the strips at 25% discount and the balance at the printed price of Rs. 250. Assuming vendor's discount at the rate of a uniform 30% of the total revenue, the approximate percentage profit/ loss of the pharmaceutical company in July 2014 is:
(a) 5.5% profit (b) 4% loss (c) 5.5 loss (d) None of these

HOMEWORK:

1. A cloth store is offering 'Buy 3, get 1 free.' What is the net percentage discount being offered by the store?
(a) 25% (b) 33 (1/3)% (c) 20% (d) 75%

2. At what price should a shopkeeper mark a radio that costs him 1,200 in order that he may offer a discount of 20% on the marked price and still make a profit of 25%?
(a) 1,625 (b) 1,900 (c) 2,000 (d) 1,875

3. Shelly goes to a shop to purchase a doll priced at Rs.400. She is offered 4 discount options by the shopkeeper. Which of these options should she opt for to gain maximum advantage of the discount offered?
(a) Single discount of 30%
(b) 2 successive discounts of 15% each
(c) 2 successive discounts of 20% and 10%
(d) 2 successive discounts of 20% and 12%

4. A shopkeeper sells two tables, each procured at cost price p, to Aarav and Asif at a profit of 20% and at a loss of 20%, respectively. Aarav sells his table to Vimal at a profit of 30%, while Asif sells his table to Varun at a loss of 30%. If the amounts paid by Vimal and Varun are x and y, respectively, then (x - y) / p equals
(a) 1 (b) 1.2 (c) 0.7 (d) 0.50

5. A trader sells two bullocks for Rs. 8400 each neither losing nor gaining in total. If he sold one of the bullocks at 20% profit, the other is sold at a loss percentage of
(a) 16.67% (b) 20% (c) 14.28% (d) None

MODULE 6
SIMPLE AND COMPOUND INTEREST

Interest
If person A borrows some money from another person B for a certain period, then after that specified period, the borrower has to return the money borrowed as well as some additional money. This additional money that the borrower has to pay is called interest.

Principal
The actually borrowed money by A is called principal (SUM).

Rate
The interest that the borrower has to pay for every 100 rupees borrowed for every year is known as rate percent per annum. It is denoted as **R% per annum =** $\frac{R}{100}$

Time
The time for which the borrowed money has been used is called the time. It is denoted as T years.

Simple Interest
The interest is directly proportional to the principal, the rate and time for which the borrowed sum is used. If the interest on a certain sum borrowed for a certain period is reckoned uniformly, then it is called Simple Interest and denoted as S.I.

$$\textbf{S.I.} = \frac{P * R * T}{100}$$

Here, P = Principal, R = Rate and T = Time
P = Principal or the sum borrowed
R = Rate percent per annum
T = Number of years for which the borrowed money has been used.

Amount
The principal and the interest together are called the amount.

P + SI = A
Therefore, $\mathbf{P + \frac{P * R * T}{100}}$

$$A = P\left[1 + \frac{RT}{100}\right]$$

Problem 1:
Rs. 1200 is lent out at 5% per annum simple interest for 3 years. Find the amount after 3 years.

Solution:
S.I. for 3 years = $\frac{P * R * T}{100}$

S.I. for 3 years = $\frac{1200 * 5 * 3}{100}$ = 180

The annual interest would be Rs. 60
After 3 years the total value would be 1200 + 60 * 3 = 1380

Problem 2:
A certain sum of money invested at some rate of interest triples itself in 4 years. In how many years the principal will become 9 times of itself at the same rate?

Solution:
When the principal is in simple interest the interest for every year will be the same. In 3 years, the amount becomes 3 times the principal and we have
A = P + I or 3P = P + I ⇒ I = 2P
i.e. the interest is 2 times the principal in 4 years or equal to principal in 2 years.
The interest will be equal to P in 2 years. So, interest will be 8P in 16 years.
Amount after 16 years = P + 8P = 9P.
Hence, the required answer will be 16 years

Problem 3:
What is the rate of simple interest for the first 4 years if the sum of Rs. 360 becomes Rs. 540 in 9 years and the rate of interest for the last 5 years is 6%?

Solution:
Interest for the last 5 years = $\frac{P * R * T}{100} = \frac{360 * 5 * 6}{100}$ = Rs. 108
Interest for 9 years = 540 – 360 = 180
So, interest for first four years = 180 – 108 = Rs. 72
Now, rate for first four years = $\frac{72 * 100}{360 * 4}$ = 5%

Compound Interest
As discussed in the topic on 'Simple Interest', the principal (P) remains constant throughout the period for which the money (principal) is borrowed.

But, in the case of compound interest, the total interest received in the present year will be added to the original principal and for the following year, the principal will be Amount Received (Principal + interest).

(a) $A = P\left[1 + \frac{R}{100}\right]^n$ (Compounded Annually)

$A = P\left[1 + \frac{R}{2 \times 100}\right]^{2n}$ (Compounded Half-Yearly)

$A = P\left[1 + \frac{R}{4 \times 100}\right]^{4n}$ (Compounded Quarterly)

Where, R = rate per cent year (% p.a.), n = time in year and A = Amount

(b) Compound Interest (CI) = A − P

C. $I = P\left[\left(1 + \frac{R}{100}\right)^t - 1\right]$

Problem 4:
Find the compound interest (CI) on Rs. 12,600 for 2 years at 10% per annum compounded annually.

Solution:
Principal (P) = Rs.12,600, Rate (R) = 10, Number of years (n) = 2
A = P[1 +(R/100)]n
= 12600[1 + (10/100)]2
= 12600[1 + (1/10)]2
= 12600 [(10 + 1)/10]2
= 12600 × (11/10) × (11/10)
= 126 × 121 = 15246
Total amount, A = Rs. 15,246
Compound interest (CI) = A − P; = Rs. 15,246 − Rs. 12,600 = Rs. 2646

Problem 5:
At what rate of compound interest per annum, a sum of Rs. 1200 becomes Rs. 1348.32 in 2 years?

Solution:
Let R% be the rate of interest per annum.
Given, Principal (P) = Rs. 1200; Total amount after 2 years (A) = Rs. 1348.32; n = 2
We know that, A = P[1 + (R/100)]n
Rs. 1348.32 = Rs. 1200[1 + (R/100)]2
1348.32/1200 = [1 + (R/100)]2
[1 + (R/100)]2 = 134832/120000
[1 + (R/100)]2 = 2809/2500
[1 + (R/100)]2 = (53/50)2
1 + (R/100) = 53/50
R/100 = (53/50) − 1
R/100 = (53 − 50)/50; R = 300/50; R = 6; Hence, the rate of interest is 6%.

PROBLEMS:

1. Shankar deposited Rs. 9000 in a bank at a simple interest at an annual interest of 8%. How much will the amount yield him in two and a half years?
   (a) Rs. 10800 (b) Rs. 9000 (c) Rs. 1800 (d) Rs. 9350

2. Simple interest on a certain sum at a certain rate of interest for 2 years is Rs. 40 and compound interest for 2 years is RS. 40.80. Find the rate of interest and principal?
   (a) 4%, Rs. 500 (b) 4%, Rs. 400 (c) 10%, Rs. 200 (d) 20%, Rs. 80

3. Veeru invested Rs 20000 at 10% simple annual interest, and exactly after four years, Joy invested Rs 16000 at 20% simple annual interest. How many years after Veeru's investment, will their balances, i.e., principal plus accumulated interest, be equal?
(a) 10 (b) 8 (c) 14 (d) 25

4. A sum of Rs. 725 is lent at the beginning of a year at a certain rate of interest, simple interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest?
(a) 3.6% (b) 4.5% (c) 5% (d) 3.46%

5. An investment doubles itself in 15 years if the interest is compounded annually. How many years will it take to become 8 times?
(a) 35 years (b) 40 years (c) 45 years (d) 30 years

6. The difference between the SI and CI on a certain sum of money at 10 % rate of annual interest for 2 years is Rs. 649. Find the sum.
(a) Rs. 64900 (b) Rs. 63700 (c) Rs. 69400 (d) Rs. 66800

7. A sum of Rs. 1000 is to be divided among two brothers A and B such that if the interest being compounded annually is 5 % per annum, then the money with A after 4 years is equal to the money with B after 6 years. Find their shares?
(a) A - 542.83, B - 457.17 (b) A - 524.38, B - 475.62
(c) A - 538.24, B - 461.76 (d) A - 543.82, B - 456.18

8. The simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs.4000 for 2 years at 10% per annum. The sum placed on simple interest is?
(a) Rs. 1550 (b) Rs. 1650 (c) Rs. 1750 (d) Rs. 2000

9. Hari lends a sum of Rs.8000 at 20% per annum at compound interest. He obtains an amount of Rs.13824 after a certain period. After how many years will he get that amount?
(a) 2 (b) 1 (c) 4 (d) 3

10. Ramesh takes a loan of Rs 20000 from Karan at a simple interest of 20%. He agrees to clear the loan, along with the interest, in four equal instalments, each at the end of one year, for four years. But, Karan puts forward a condition that he will continue to calculate the interest on the original amount lent till Ramesh completely pays off his loan. What is the value of each instalment?
(a) Rs. 9000 (b) Rs. 9500 (c) Rs. 10000 (d) None of these

11. The compound interest on a sum for 2 years is Rs. 832 and the simple interest on the same sum for the same period is Rs. 800. The difference between the compound and simple interest for 3 years will be:
(a) Rs. 48 (b) Rs. 66.56 (c) Rs. 98.56 (d) None of these

12. At the end of 3 years, the difference between the compound interest and simple interest comes to be Rs 320. The rate of interest is 25%. Find the principal amount.
(a) Rs. 1525.50 (b) Rs. 1545.78 (c) Rs. 1550 (d) Rs. 1575.38

13. John borrowed Rs. 2,10,000 from a bank at an interest rate of 10% per annum, compounded annually. The loan was repaid in two equal instalments, the first after one year and the second after another year. The first instalment was interest of one year plus part of the principal amount, while the second was the rest of the principal amount plus due interest thereon. Then each instalment, in Rs., is?
(a) Rs. 1,21,000 (b) Rs. 1,20,000
(c) Rs. 1,22,000 (d) Cannot be determined

14. A sum of money invested for a certain number of years at 8% p.a. simple interest grows to Rs.180. The same sum of money invested for the same number of years at 4% p.a. simple interest grows to Rs.120. For how many years was the sum invested?
(a) 25 years (b) 40 years
(c) 33 years and 4 months (d) Cannot be determined

15. In the beginning of the year 2004, a person invests some amount in a bank. In the beginning of 2007, the accumulated interest was Rs.10,000 and in the beginning of 2010, the accumulated interest became Rs.25,000. The interest rate is compounded annually and the annual interest rate is fixed. The principal amount is _____:
(a) Rs. 16000 (b) Rs. 18000 (c) Rs. 20000 (d) Rs. 25000

HOMEWORK:

1. The simple interest charged on an amount of Rs. 22,500 at the end of four years is Rs. 10,800. What will be the compound interest on the same amount at the same rate at the end of two years?
(a) Rs. 14,908 (b) Rs. 5,724 (c) Rs. 26,234 (d) Rs. 8,568

2. An amount of Rs.15000 was invested in bank A and B at simple interest 15% and 10% pa respectively. If the person earned a total of Rs. 5400 as simple interest in 3 years. The amount invested in bank A and B are respectively
(a) Rs. 9000 & Rs. 6000 (b) Rs. 6000 & Rs. 9000
(c) Rs. 6500 & Rs. 8500 (d) Rs. 5000 & Rs. 10000

3. A sum of Rs. 91,000 is borrowed at 20% per annum compounded annually for two years. If it were borrowed at the rate of 100/7% per annum simple interest for four years then, find the difference between C.I and S.I
(a) Rs. 16,910 (b) Rs. 12,800 (c) Rs. 12,960 (d) Rs. 11,960

4. The population of a town was 3600 three years back. It is 4800 right now. What will be the population three years down the line, if the rate of growth of population has been constant over the years?
(a) 3200 (b) 4400 (c) 6000 (d) 7600

5. Population of a town increases at a certain rate percent per annum. Present population of the town is 3600 and in 5 years it will become 4800. How much will it be in 10 years?
(a) 5000 (b) 6000 (c) 6400 (d) 7000

MODULE 7
AVERAGES

Averages can be defined as the central value in a set of data. Average can be calculated simply by dividing the sum of all values in a set by the total number of values.

$$\textbf{Average} = \frac{\textit{Sum of quatities}}{\textit{Number of quantities}}$$

Important facts about averages:

1. If each number is increased/decreased by a certain quantity n, then the mean also increases or decreases by the same quantity.
2. If each number is multiplied/ divided by a certain quantity n, then the mean also gets multiplied or divided by the same quantity.
3. If the same value is added to half of the quantities and the same value is subtracted from other half quantities, then there will not be any change in the final value of the average.

The concept of weighted mean/average

Weighted average is an average in which each quantity to be averaged is assigned a weight. The weighted arithmetic mean is usually denoted by:

$$\bar{x} \text{ or } W = \frac{w_1x_1 + w_2x_2 + w_3x_3 + \cdots + w_nx_n}{w_1 + w_2 + w_3 + \cdots w_n}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

Here,
$\bar{x}$ or W = Weighted average
n = Number of terms to be averaged
wi = Weights applied to x values
xi = Data values to be averaged

POINTS TO REMEMBER:

1. The average of first n consecutive natural numbers is given by: $\frac{n+1}{2}$
2. The average of square of first n consecutive natural numbers is given by: $\frac{(n+1)(2n+1)}{6}$
3. The average of cubes of first n consecutive natural numbers is given by: $\frac{n(n+1)^2}{4}$
4. The average of first n consecutive even numbers is given by: n + 1

5. Also, the average of first n consecutive even numbers starting from 2 to X, where the last even number is X, is given by: $\frac{x+2}{2}$

6. The average of square of first n consecutive even numbers is given by: $\frac{2(n+1)(2n+1)}{3}$

7. Also, the average of square of first n consecutive even numbers starting from 2 to X, where the last even number is X, is given by: $\frac{(x+1)(x+2)}{3}$

8. The average of first n consecutive odd numbers is equal to n.

9. Also, the average of first n consecutive odd numbers starting from 1 to X, where the last odd number is X is given by: $\frac{X+1}{2}$

10. The average of square of first n consecutive odd numbers starting from 1 to X, where the last odd number is X, is given by: $\frac{X(X+2)}{3}$

PROBLEMS:

1. The mean of 50 numbers is 30. Later it was discovered that two entries were wrongly entered as 82 and 13 instead of 28 and 31. Find the correct mean.
(a) 36.12 (b) 30.66 (c) 29.28 (d) 38.21

2. The average weight of A, B and C is 40 kg. If the average weight of A and B is 35kg and that of B and C is 36 kg, then find the weight of B.
(a) 22kg (b) 23kg (c) 28kg (d) 30 kg

3. Average weight of 10 people is 50kg. When one person is added to the group the average weight increases by 1kg. So, what is the weight of that new person?
(a) 59 kg (b) 60kg (c) 61kg (d) 50 kg

4. Ram lives along with his wife, son and daughter-in-law. The average age of Ram's family 3 years ago was 40 years. Three years later Ram dies due to illness at the age of 53 years and at the same time his daughter in-law gave birth to Ram's grandson. If all ages are always taken as integral values, now what is the average age of Ram's family?
(a) 24.80 years (b) 26.45 years (c) 29.75 years (d) 31.90 years

5. There are twice the number of two wheelers as there are three wheelers and the number of four wheelers are equal to the number of two wheelers. The average number of wheels per vehicle is:
(a) 2 (b) 3 (c) 4 (d) 5

6. Once Ajay went to the office of Rockline Courier with 4 different envelopes. The clerk in the office measured the weights in all possible pairs. The weights obtained are 59gm, 61gm, 62gm, 63gm, 64gm and 66gm. The weight of the heaviest envelope is:
(a) 35gm (b) 36gm
(c) 34gm (d) Cannot be determined

7. In a particular week the average number of people who visited Golkonda is 40. If we exclude the holidays, then the average increases by 16. If we also exclude the day on which the maximum number of people - 112 visited Golkonda, then the average becomes 42. The number of holidays in the week is:
(a) 1 (b) 2 (c) 3 (d) 4

8. Satyajit earns 3/2 times in January, April, July and October than his average earning of Rs.600 per month in the rest of the months. As a result, his savings in January, April, July and October goes to 5/4 times of Rs. 400, which is his savings per month in the rest of the months. What is his average expenditure per month?
(a) Rs. 266.66 (b) Rs. 250 (c) Rs. 233.33 (d) Rs. 433.33

9. A travel agency has three types of vehicles viz. 4 seater auto rickshaw, 10 seater maxi cab and 20 seater minibus. The rate for each passenger (irrespective of his age or weight or seniority) for the auto rickshaw is Rs. 12, for the maxi cab is Rs.15 and for the minibus is Rs.8 for one round. The average occupancy of the seats is 100%, 80% and 75% respectively. If the travel agency has only one vehicle of each kind, then the average earning for one round of each vehicle is:
(a) Rs. 96 (b) Rs. 90 (c) Rs. 86 (d) Rs. 70

10. In hotel CLIFF, the rooms are numbered from 101 to 130 on the first floor. 221 to 260 on the second floor and 306 to 345 on the third floor. In the month of June 2002, the room occupancy was 60% on the first floor, 40% on the second floor and 75% on the third floor. If it is also known that the room charges are Rs. 200. Rs. 100 and Rs. 150 on each of the floors, then find the average income per room for the month of June 2002.
(a) Rs. 151.5 (b) Rs. 78.3 (c) Rs.88.18 (d) Rs. 65.7

11. The average weight of 5 men is decreased by 3 kgs when one of them weighing 150 kg is replaced by another person. This new person is again replaced by another person whose weight is 30 kg lower than the person he replaced. What is the overall change in the average due to this dual change?
(a) 6 kgs (b) 9 kgs (c) 12 kgs (d) 15 kgs

12. A team of miners planned to mine 1800 tons of ore during a certain number of days. Due to technical difficulties in one-third of the planned number of days, the team was able to achieve an output of 20 tons of ore less than the planned output. To make up for this, the team overachieved for the rest of the days by 20 tons. The end result was that the team completed the task one day ahead of time. How many tons of ore did the team initially plan to ore per day?
(a) 50 tons (b) 150 tons (c) 100 tons (d) 200 tons

13. On an average, 2 litres of milk and 1 litre of water are needed to be mixed to make 1 kg of shrikhand of type A, and 3 litres of milk and 2 litres of water are needed to be mixed to make 1 kg of shrikhand of type B. How many kilograms of each type of shrikhand was manufactured if it is known that 130 litres of milk and 80 litres of water were used?
(a) 20 of type A and 30 of type B (b) 30 of type A and 20 of type B
(c) 15 of type A and 30 of type B (d) 30 of type A and 15 of type B

14. There are five boxes in a cargo hold. The weight of the first box is 200 kg and the weight of the second box is 20% higher than the weight of the third box, whose weight is 25% higher than the first box's weight. The fourth box at 350 kg is 30% lighter than the fifth box. Find the difference in the average weight of the four heaviest boxes and the four lightest boxes.
(a) 51.5 kg (b) 75 kg (c) 37.5 kg (d) 112.5 kg

15. A shop sold 64 kettles of two different capacities. The smaller kettle cost a rupee less than the larger one. The shop made 100 rupees from the sale of large kettles and 36 rupees from the sale of small ones. How many kettles of either capacity did the shop sell and what was the price of each kettle?
(a) 20 kettles for 2.5 rupees each and 14 kettles for 1.5 rupees each
(b) 40 kettles for 4.5 rupees each and 24 kettles for 2.5 rupees each
(c) 40 kettles for 2.5 rupees each and 24 kettles for 1.5 rupees each
(d) Either a or b

HOMEWORK:

1. What is the average of all prime and composite numbers up to 100.
(a) 51 (b) 20 (c) 49.5 (d) 50.5

2. Average height of 5 people is 162cm. When one person is removed, then the average height of the remaining people becomes 161cm. What is the height of the person removed?
(a) 161 cm (b) 162 cm (c) 163 cm (d) 166 cm

3. The average age of 11 players of a cricket team is increased by 2 months when two of them aged 18 years and 20 years are replaced by two new players. The average age of the new players is
(a) 19 years 1 month (b) 19 years 6 month
(c) 19 years 11 month (d) 19 years 5 month

4. The average age of 10 men increases by 3 years when one of them, whose age is 54 years, is replaced by a woman. What is the age of the woman?
(a) 68 years (b) 82 years (c) 72 years (d) 84 years

5. The average age of a group of people going for a movie is 20 years. 10 new people with an average age of 10 years join the group on the spot due to which the average of the group becomes 18 years. Find the number of people initially going for the movie?
(a) 40 (b) 20 (c) 50 (d) 30

MODULE 8
ALLIGATIONS AND MIXTURES

DEFINITION OF ALLIGATIONS AND MIXTURES

Mixtures: When two or more components are mixed in a certain ratio, a mixture is created.

Alligations: It is the reverse of weighted average; i.e. If the averages of two groups are separately given and the average of the whole group is given, then we can find out the ratio between the groups.

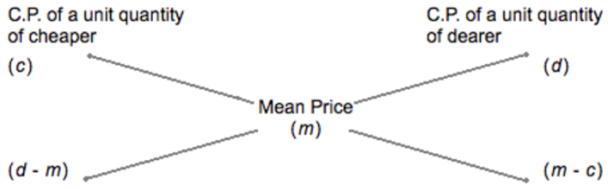
Mean Price: The cost price of a unit quantity of the mixture is called the mean price.

Rule of Alligation
Alligation is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

If two ingredients are mixed, then:

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{(\text{CP of dearer}) - (\text{Mean price})}{(\text{Mean price}) - (\text{CP of cheaper})}$$

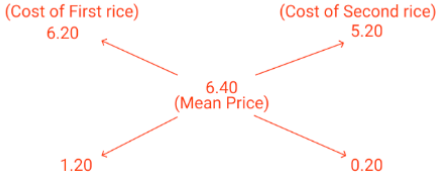
The above formula can be represented with the help of a diagram which is easier to understand. Here 'd' is the cost of dearer ingredient, 'm' is mean price and 'c' is the cost of cheaper ingredient.



∴ (Cheaper quantity) : (Dearer quantity) = (d - m) : (m - c).

Important:
Suppose a container contains x units of liquid from which y units are taken out and replaced by water. After n operations the quantity of pure liquid = [x (1-y/x)^n] units.

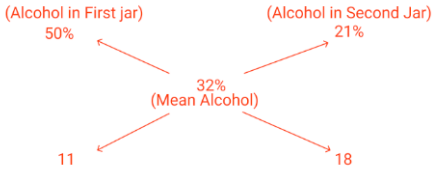
Example 1: Find the ratio in which rice at Rs. 6.20 a kg be mixed with rice at Rs. 5.20 a kg to produce a mixture worth Rs. 6.40 a kg.
Solution:
Solve using criss - cross method



Therefore the required ratio will be 1.20 : 0.20 = 6 : 1

Example 2: A jar full of whisky contains 50% alcohol. A part of this whisky is replaced by another containing 21% alcohol and now the percentage of alcohol was found to be 32%. What is the quantity of whisky replaced?

Solution:



The ratio of first and second quantities = 11 : 18
Therefore, the quantity of whisky replaced is 18/19

Example 3: From the 40 litres solution of pure milk, 5 litres of milk is replaced with equal quality of water. Again 5 litres of the mixture is substituted with 5 litres of water. This operation is repeated one more time. Find the volume of milk in the final solution.
Solution: Applying the above formula, we get:
Final volume of milk = 40 (1- 5/40)3 = 26.8 litres

Example 4: From the 40 litres solution of pure milk, 5 litres of milk is replaced with 6 litres of water. Next time, 6 litres of the mixture is replaced with 7 litres of water. Find the volume of milk in the final solution.
Solution: After the first operation, the quantity of milk and water are in the ratio 35:6. So the quantity of milk left after the first operation = 35 litres.
Now, when 6 litres of the mixture are withdrawn, the quantities of milk and water taken out will be in the ratio 35 : 6.
Therefore, the quantity of milk withdrawn = 35/41 * 6 litres
Hence the quantity of milk left = 40 * 35/41 = 34.14 litres

PROBLEMS:

1. A 3:2 milk and water solution is mixed with another 4 :1 milk and water solution. If the volumes are 400 ml and 1,000 ml respectively, then what is the ratio of milk to water in the resultant solution?
   (a) 9:5 (b) 26:9 (c) 5:26 (d) 8:21

2. In what ratio must two kinds of sugar at Rs. 1.15 and Rs. 1.24 per kg be mixed so that by selling at Rs. 1.50 per kg, 25% may be gained?
   (a) 4:5 (b) 5:4 (c) 1:1 (d) 2:3

3. A thief steals four gallons of liquid soap kept in a train compartment's bathroom from a container that is full of liquid soap. He then fills it with water to avoid detection. Unable to resist the temptation he steals 4 gallons of the mixture again, and fills it with water. When the liquid soap is checked at a station it is found that the ratio of the liquid soap now left in the container to that of the water in it is 36 : 13. What was the initial amount of the liquid soap in the container if it is known that the liquid soap is neither used nor augmented by anybody else during the entire period?

(a) 7 gallons (b) 14 gallons (c) 21 gallons (d)28 gallons

4. A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?
(a) 26 litres (b) 29.16 litres (c) 28 litres (d) 28.2 litres

5. The cost of Type 1 material is Rs. 15 per kg and Type 2 material is Rs.20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2:3, then what is the price per kg of the mixed variety of material?
(a) Rs. 19 (b) Rs. 16 (c) Rs. 18 (d) Rs. 17

6. A dishonest milkman sells his milk at cost price, but he mixes it with water and thereby gains 25%. What is the percentage of water in the mixture?
(a) 25% (b) 20% (c) 22% (d) 24%

7. Some amount out of Rs.7000 was lent at 6% per annum and the remaining was lent at 4% per annum. If the total simple interest from both the fractions in 5 years was Rs. 1600, the sum lent at 6% per annum was
(a) Rs. 2000 (b) Rs. 2200 (c) Rs. 2400 (d) Rs. 1800

8. A chemist mixes two liquids 1 and 2. One litre of liquid 1 weighs 1 kg and one litre of liquid 2 weighs 800 gm. If half litre of the mixture weighs 480 gm, then the percentage of liquid 1 in the mixture, in terms of volume, is
(a) 80 (b) 85 (c) 70 (d) 75

9. The strength of a salt solution is p% if 100 ml of the solution contains p grams of salt. Each of three vessels A, B, C contains 500 ml of salt solution of strengths 10%, 22%, and 32%, respectively. Now, 100 ml of the solution in vessel A is transferred to vessel B. Then, 100 ml of the solution in vessel B is transferred to vessel C. Finally, 100 ml of the solution in vessel C is transferred to vessel A. The strength, in percentage, of the resulting solution in vessel A is
(a) 15 (b) 12 (c) 13 (d) 14

10. A wholesaler bought walnuts and peanuts, the price of walnuts per kg being thrice that of peanuts per kg. He then sold 8 kg of peanuts at a profit of 10% and 16 kg of walnuts at a profit of 20% to a shopkeeper. However, the shopkeeper lost 5 kg of walnuts and 3 kg of peanuts in transit. He then mixed the remaining nuts and sold the mixture at Rs. 166 per kg, thus making an overall profit of 25%. At what price, in Rs. per kg, did the wholesaler buy the walnuts?
(a) 84 (b) 86 (c) 96 (d) 98

11. A sample of x litres from a container having a 60 litres mixture of milk and water containing milk and water in the ratio of 2:3 is replaced with pure milk so that the container will have milk and water in equal proportions. What is the value of x?
(a) 6 litres (b) 10 litres (c) 30 litres (d) None of these

12. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of the water is 16:65. How much wine did the cask originally hold?
(a) 30 litres (b) 26 litres (c) 24 litres (d) 32 litres

13. Two similar vessels are filled with the mixtures of water and milk in the ratio of 3: 4 and 5:3 respectively. If the mixtures are poured into a third vessel, the respective ratio of water and milk in the third vessel will be
(a) 15:12 (b) 53:59 (c) 20:9 (d) 59:53

14. In 50 L of water and milk mixture; water is 20%. A milkman gives 5 L of this mixture to a customer and then he adds 10 L of pure water in the remaining mixture. The percentage of water in the final mixture is:
(a) 38% (b) 34.54% (c) 20% (d) 46%

15. A milkman brings 100 litres of pure milk from a dairy farmer and he sells 10 litres of it to the first customer, then he refills his vessel by adding 10 litres of water. After this, he proceeds to the next house and sells 10 litres of it to the second customer and then he refills his vessel again by adding 10 litres of water. Thus, every time he sells 10 litres of milk - pure or impure - he keeps on replacing it with 10 litres of pure water. Maximum how many customers can get at least 50% milk in the mixture that they purchase from this milkman?
(a) 5 (b) 6 (c) 7 (d) None of these

HOMEWORK:

1. In a solution of 35 litres, the respective ratio of milk and water is 4:1. If 14 litres of water is added to the solution, then the ratio of milk and water in the resulting solution will be:
(a) 3:1 (b) 4:3 (c) 3:4 (d) 4:3

2. 3 litres of water are added to 11 litres of a solution containing 42% of alcohol in the water. The percentage of alcohol in the new mixture is?
(a) 25% (b) 20% (c) 30% (d) 33%

3. In a 729 litres mixture of milk and water, the ratio of milk to water is 7: 2. To get a new mixture containing milk and water in the ratio 7:3, the amount of water to be added is
(a) 81 litres (b) 71 litres (c) 56 litres (d) 50 litres

4. Mohan bought 12 kg mango at the rate of Rs.15 per kg and 18 kg mango at the rate of Rs. 12 per kg. Now both varieties are mixed and sold for Rs. 16.50 per kg. What was his total percentage gain?
(a) 20% (b) 25% (c) 162% (d) 33 1/3%

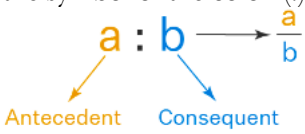
5. Some amount out of 6,000 was lent at 9% per annum and the remaining was lent at 5% per annum. If total simple interest from both amounts in 3 years was Rs. 1,350, the sum lent on 9% per annum was
(a) Rs. 3,000 (b) Rs. 2,250 (c) Rs. 3,750 (d) Rs. 4,500

MODULE 9
RATIOS, PROPORTIONS AND VARIATIONS

A comparison of two quantities by division is called a ratio and the equality of two ratios is called proportion. A ratio can be written in different forms like x : y or x/y and is commonly read as: x is to y.

Ratio

Ratio is the comparison of two quantities which is obtained by dividing the first quantity by the other. If a and b are two quantities of the same kind and with the same units, such that b is not equal to 0, then the quotient a/b is called the ratio between a and b. Ratios are expressed using the symbol of the colon (:). This means that ratio a/b has no unit and it can be written as a : b.



Proportion

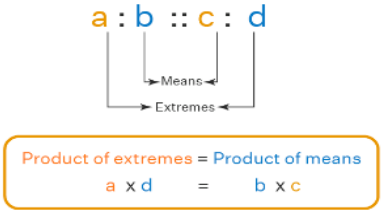
Proportion refers to the equality of two ratios. Two equivalent ratios are always in proportion. Proportions are denoted by the symbol (: :) and they help us to solve for unknown quantities. In other words, proportion is an equation or statement that is used to depict that the two ratios or fractions are equivalent. Four non-zero quantities, a, b, c, d are said to be in proportion if a : b = c : d.

Now, let us consider the two ratios 3 : 5 and 15 : 25.

Here, 3 : 5 can be expressed as 3 : 5 = 3/5 = 0.6

15 : 25 can be expressed as 15 : 25 = 15/25 = 3/5 = 0.6.

Since both the ratios are equal, we can say that these two are proportional.



There are two types of proportions:

i. Direct Proportion

Direct proportion describes the direct relationship between two quantities. If one quantity increases, the other quantity also increases and vice-versa. Thus, a direct proportion is written as $y \propto x$. For example, if the speed of a car is increased, then it covers more distance in a fixed period of time.

ii. Inverse Proportion

Inverse proportion describes the relationship between two quantities in which if one quantity increases, the other quantity decreases and vice-versa. Thus, an inverse proportion is written as $y \propto 1/x$. For example, as the speed of a vehicle is increased, it will cover a fixed distance in less time.

Note:
If a : b is a ratio, then:
$a^2 : b^2$ is a duplicate ratio
$\sqrt{a} : \sqrt{b}$ is the sub-duplicate ratio
$a^3 : b^3$ is a triplicate ratio

Important Properties of Proportion
The following are the important properties of proportion:

1. Addendo – If a : b = c : d, then a + c : b + d
2. Subtrahendo – If a : b = c : d, then a – c : b – d
3. Dividendo – If a : b = c : d, then a – b : b = c – d : d
4. Componendo – If a : b = c : d, then a + b : b = c + d : d
5. Alternendo – If a : b = c : d, then a : c = b: d
6. Invertendo – If a : b = c : d, then b : a = d : c
7. Componendo and dividendo – If a : b = c : d, then a + b : a – b = c + d : c – d

Difference Between Ratio and Proportion

RATIO	PROPORTION
It is used to compare the size of two quantities with the same unit	It is used to express the relation of two ratios.
The symbols used to express a ratio - a colon (:), slash (/)	The symbol used to express a proportion - double colon (::)
It is referred to as an expression.	It is referred to as an equation.

Important Notes on Ratio and Proportion

- Any two quantities with the same units can be compared.
- Two ratios are said to be in proportion only if they are equal.
- To check whether two ratios are equal and are in proportion, we can also use the cross-product method.
- If we multiply and divide each term of a ratio by the same number, the ratio remains the same.
- For any three quantities, if the ratio between the first and the second is equal to the ratio between the second and the third, then these are said to be in a continued proportion.
- Similarly, in the case of any four quantities in a continued proportion, the ratio between the first and the second is equal to the ratio between the third and the fourth.

PROBLEMS:

1. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{5} = \frac{3a-4b+5c}{k}$ then 'k' is:
   (a) 18 (b) 17
   (c) 13 (d) Cannot be determined

2. If $\frac{5m-4n}{5m+4n} = \frac{1}{4}$ and 3m + 2n = 24, then m and n respectively are:
   (a) 4, 16/3 (b) 13/3, 11/2 (c) 11/3, 13/2 (d) 16/3, 4

3. If Rs. 1,080 is divided among A, B, C and D in such a way that A : B = 4 : 5, B : C = 3 : 5 and C : D = 3 : 2. Who will get the maximum amount?
(a) A (b) B (c) C (d) D

4. Four numbers are in proportion. The sum of the squares of the four numbers is 50 and the sum of the means is 5. The ratio of the first two terms is 1: 3. What is the average of the four numbers?
(a) 2 (b) 5 (c) 3 (d) 6

5. The salaries of A, B and C are in the ratio 1 : 2 : 5. If the increments of 20%, 15% and 10% respectively are allowed in their salaries, then what will be the new respective ratio of their salaries?
(a) 12 : 23 : 55 (b) 11 : 23 : 55 (c) 23 : 11 : 55 (d) 12 : 55 : 23

6. The ages of Abhinav, Stephen, Vamsi and Kunal are in arithmetic progression, but not in order. The ratio of ages of Abhinav and Stephen is 6 : 5 and Vamsi to Kunal is 7 : 8. Two years later the age of Stephen and Kunal will be 2 : 3. Find the ratio of ages of Abhinav and Vamsi?
(a) 7 : 6 (b) 5 : 8 (c) 6 : 7 (d) 8 : 9

7. A bag contains one rupee, fifty paise and twenty five paise coins whose values are in the proportion 2 : 5 : 7 respectively. If the total number of coins is 800, then find the total value of coins.
(a) 130 (b) 160 (c) 280 (d) 150

8. A cat takes 14 steps for every 10 steps of a dog, but 10 steps of a dog are equal to 12 steps of a cat. What is the ratio of speed of the cat to that of the dog?
(a) 6 : 5 (b) 5 : 6 (c) 6 : 7 (d) 7 : 6

9. The value of a diamond is directly proportional to the square of its weight. A diamond unfortunately breaks into three pieces with weights in the ratio of 3 : 4 : 5 resulting in a loss of Rs. 9.4 lakhs. What is the actual value of the diamond?
(a) 28.8 lakh (b) 13.5 lakh (c) 14.4 lakh (d) 18.8 lakh

10. In a zoo, there are rabbits and pigeons. If heads are counted, there are 340 heads and if legs are counted there are 1060 legs. How many pigeons are there?
(a) 120 (b) 150 (c) 180 (d) 170

11. Distance covered by a train is directly proportional to the time taken and it also varies directly as the square root of fuel used and varies inversely as the number of wagons attached to it. A train covers 192 km journey in 20 hours when there are 10 wagons attached to it and total fuel consumption was 256 litres of diesel. Find the consumption of fuel per km when a train goes 200 km in 25 hours with 15 wagons attached to it:
(a) 1.5 l/km (b) 2 l/km (c) 2.8 l/km (d) 20 l/km

12. A has four times as much money with him as B does. Each day, A spends a constant amount of money while B earns a fourth of the amount that A spends. After 10 days the ratio of amounts with A and B is 12 : 13. After how many days will the ratio of the amounts with them be 4 : 31?
(a) 5 (b) 14 (c) 15 (d) 10

13. A and B have to write 810 and 900 pages respectively in the same time period. But A completes his work 3 days ahead of time and B completes 6 days ahead of time. How many pages did A write per hour if B wrote 21 pages more than he did each hour?
(a) 45 (b) 72 (c) 54 (d) 75

14. The distance (in metres) to which a boy can throw a stone is inversely proportional to its weight (in kg). He breaks the stone into 3 pieces whose weights (in kg) are in the ratio 1:3 : 2. He then throws the stones one by one. The sum of the distances they cover is 22 metres. To what distance can he throw the unbroken stone? (in m)
(a) 2m (b) 3m (c) 4m (d) 5m

15. The strength of a salt solution is p% if 100 ml of the solution contains p grams of salt. Each of three vessels A, B, C contains 500 ml of salt solution of strengths 10%, 22%, and 32%, respectively. Now, 100 ml of the solution in vessel A is transferred to vessel B. Then, 100 ml of the solution in vessel B is transferred to vessel C. Finally, 100 ml of the solution in vessel C is transferred to vessel A. The strength, in percentage, of the resulting solution in vessel A is?
(a) 13 (b) 14 (c) 12 (d) 15

HOMEWORK:

1. The cost of a piece of diamond varies with the square of its weight. A diamond worth Rs. 5,184 is cut into 3 pieces whose weights are in the ratio 1 : 2 : 3. Find the loss involved in the cutting.
(a) 3,068 (b) 3,088 (c) 3,175 (d) 3,168

2. An amount of Rs. 2430 is divided among A, B and C such that if their shares be reduced by Rs. 5, Rs. 10 and Rs. 15 respectively the remainders shall be in the ratio of 3 : 4 : 5 Then B's share was?
(a) 605 (b) 790 (c) 800 (d) 810

3. Suppose, C1, C2, C3, C4 and C5 are five companies. The profits made by C1, C2 and C3 are in the ratio 9 : 10 : 8 while the profits made by C2, C4, and C5 are in the ratio 18 : 19 : 20. If C5 has made a profit of ₹19 crore more than C1, then the total profit (in Rs.) made by all five companies is?
(a) 438 crores (b) 435 crore (c) 348 crore (d) 345 crore

4. The incomes of Ajay, Balu and Chandru are in the ratio of 12 : 9 : 7 and their expenditures are in the ratio 15 : 9 : 8. If Ajay saves 25% of his income, what is the ratio of the savings of Ajay, Balu and Chandru?
(a) 15 : 18 : 11 (b) 16 : 19 : 12 (c) 14 : 17 : 10 (d) 17 : 20 : 13

5. Dheeraj went to a cool corner. He gave the shopkeeper a Rs. 10 note and asked for a coke costing Rs.5. The shopkeeper returned the change to him in the denominations of Re.1, 50 paise and 25 paise. What could be the ratio of the number of coins of Re.1, 50 paise and 25 paise respectively?
(a) 2 : 3 : 1 (b) 1 : 7 : 2 (c) 6 : 1 : 3 (d) 2 : 1 : 2

MODULE 10
PARTNERSHIP

When two or more than two persons run a business jointly, they are called partners and the deal is known as partnership. The partner who only invests money is called a **Sleeping Partner** and a partner who invests money and also manages the business is called the **Working Partner**.

Important Formulas:

1. When investments of all the partners are over the same time, the gain or loss is distributed among the partners in the ratio of their investments.
   For example, A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year: (A's share of profit) : (B's share of profit) = x : y.

2. When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital x number of units of time). Now gain or loss is divided in the ratio of these capitals.
   Suppose A invests Rs. x for p months and B invests Rs. y for q months then,
   (A's share of profit) : (B's share of profit) = xp : yq.

PROBLEMS:

1. Profit of Rs. 28800 has to be divided among three partners A, B and C in the ratio 3:2:7. How much rupees should C get?
   (a) 16800 (b) 20400 (c) 18600 (d) 14400

2. Sunny and Bunny entered into a partnership just 5 months ago. The ratio of profit claimed by Sunny and Bunny is 6 : 17. If Bunny started his business 12 months ago with Rs. 1275, what is the amount contributed by Sunny?
   (a) Rs. 980 (b) Rs. 1080 (c) Rs. 1200 (d) Rs. 998

3. A sum of 3,115 is distributed among A, B and C such that, if 25, 28 and 52 are diminished from their shares respectively, the remainder shall be in the ratio 8: 15:20. Find the difference in the shares of A and C.
   (a) 1,452 (b) 867 (c) 587 (d) None of these

4. Two partner's M and N buy a car. M pays a share of 5/9th of the total cost of the car. M pays 31,540 less than N. What is the cost of the car?
   (a) 2,83,860 (b) 2,83,680 (c) 2,20,780 (d) 1,85,780.

5. Nitesh & Jitesh invested Rs.15000 and Rs.18000 respectively in a business. If the total profit at the end of the year is Rs.8800 and Nitesh being an active partner gets an additional 12.5% of the profit. Find the total profit of Nitesh.
   (a) 3,500 (b) 1,110 (c) 4,500 (d) 4,600

6. Two men X and Y started working for a certain company at similar jobs on January 1, 1950. X asked for an initial monthly salary of Rs. 300 with an annual increment of Rs. 20. Y asked for an

initial monthly salary of Rs. 200 with a rise of Rs. 15 every 6 months. Assume that the arrangements remained unaltered till December 31, 1959. Salary is paid on the last day of the month. What is the total amount paid to them as salary during the period?
(a) Rs. 93,300 (b) Rs. 87,900 (c) Rs. 93,100 (d) None of these

7. Three friends X, Y, Z started a partnership business investing money In the ratio of 5:4:2 respectively for a period of 3 years. What is the amount received by X as share in the total profit?
I. Total amount invested in the business is Rs.22,000
II. Profit was distributed after a period of 2 years
III. The average amount of profit earned per year is Rs 2,750
(a) I only (b) II only (c) III Only (d) I and II only

8. A starts a small business by investing a certain sum of money. B joins A after three months from the start of the business by investing 1.5-time A's investment. Three months after B joined the business, C joins A and B by investing half of A's investment. It was agreed that the working partner would receive 10% of the profit and the share according to the investment proportion from the rest of the profit. If total profit at the end of the year was Rs. 23750, how much will A, being the only working partner receive?
(a) Rs. 11,375 (b) Rs. 10,000 (c) Rs. 12,375 (d) Rs. 11.275

9. Ram and Shyam form a partnership (with Shyam as working partner) and start a business by Investing 4000 and 6000 respectively. The conditions of partnership were as follows:
1. In case of profits till 200,00 per annum, profits would be shared in the ratio of the invested capital.
2. Profits from 200,001 till 400,000 - Shyam would take 20% out of the profit, before the division of remaining profits, which will then be based on ratio of invested capital.
3. Profits in excess of 400,000 - Shyam would take 35% out of the profits beyond 400,000 before the division of remaining profits, which will then be based on ratio of invested capital.

If Shyam's share in a particular year was 367000, which option indicates the total business profit (in) for that year?
(a) 5,20,000 (b) 5,30,000 (c) 5,40,000 (d) 5,50,000

10. Three partners shared the profit in a business in the ratio 5 : 7 : 8. They had partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments?
(a) 5 : 7 : 8 (b) 20 : 49 : 64 (c) 38 : 28 : 21 (d) None of these

11. A, B and C are three partners in a business. Their capitals are respectively Rs 4000, Rs 8000 and Rs 6000. A gets 20% of total profit for managing the business. The remaining profit is divided among the three in the ratio of their capitals. At the end of the year, the profit of A is Rs 2200 less than the sum of the profit of B and C. How much profit, C will get?
(a) Rs.1600 (b) Rs.2400 (c) Rs.3000 (d) Rs.5000

12. A and B jointly Invest Rs. 2100 and Rs. 3100 respectively in a family business. A is an active partner and he gets 25% of the profit separately. If their business yields them a total Rs. 1,040 as profit what will be the gain of each of them?
(a) Rs. 415, Rs. 625 (b) RS. 575, Rs: 465
(c) Rs. 515, Rs. 525 (d) Rs. 560, Rs. 480

13. A and B entered into partnership with capitals in the ratio 5 : 6 After 3 months A withdraw 1 5 of his capital and B withdraw 16 of his capital. The gain at the end of 10 months was Rs 960. A's share in this profit is?
(a) Rs. 330 (b) Rs. 360 (c) Rs. 430 (d) Rs. 460

14. A and B entered into partnership with capitals in the ratio 4 : 5. After 3 months, A withdrew 1/4 of his capital and B withdrew 1/5 of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is?
(a) Rs 330 (b) Rs 360 (c) Rs 380 (d) Rs 430

15. P, R and S enter into a business with investment of Rs. 25000, Rs. 30000 and Rs.15000 respectively. A is the working partner and he gets 30% of the profit for managing the business. The balance profit is distributed in proportion to their investment investments. At the year-end P gets Rs. 200 more than R and S together. Find the share of each.
(a) 1100, 600, 300 (b) 2100, 600, 300
(c) 1500, 400, 600 (d) 600, 500, 900

HOMEWORK:

1. Three partners A, B and C invested Rs. 6,000, Rs. 7,000 and Rs. 8,000 respectively in a trading firm. Find their respective shares, if the total profit is Rs 3,360.
(a) Rs. 960, Rs. 1,120, Rs. 1,280 (b) Rs. 800, Rs. 900, Rs. 1,660
(c) Rs. 860, Rs. 1,000, Rs. 1,500 (d) Rs. 1,200, Rs. 1,080, Rs. 1,080

2. Akshay started a business by investing Rs. 36000. After 4 months Rakesh joined him with some investment. At the end of the year, the total profit was divided between them in the ratio of 9 : 7. How much capital was invested by Rakesh in the business?
(a) 44000 (b) 42000 (c) 38000 (d) 36000

3. A, B and C enter into partnership. A invests 4 times as much as B invests and B invests three-fourth of what C invests. At the end of the year, the total profit earned is ₹7,220.
What is the share of A?
(a) 1,520 (b) 1,140 (c) 4,450 (d) 4,560

4. Mary and Mike enter into a partnership by investing Rs. 700 and Rs. 300 respectively. At the end of one year, they divided their profits such that 1/3rd of the profit is divided equally for the efforts they have put into the business and the remaining amount of profit is divided in the ratio of the investments they made in the business. If Mary received Rs. 800 more than Mike did, what was the profit made by their business in that year?
(a) 1000 (b) 2000 (c) 3000 (d) 4000

5. Profits of a business are distributed among three partners A, B and C in such a way that 4 times the amount received by A is equal to 6 times the amount received by B and 11 times the amount received by C. The ratio in which the three received the amount is?
(a) 4 : 6 : 11 (b) 11 : 6 : 4
(c) (1/4) : (1/6) : (1/11) (d) 66 : 44 : 24

MODULE 11
TIME AND WORK

TIME AND WORK

Time and work problems deal with the simultaneous performance involving the efficiency of an individual or a group and the **time taken by them to complete a piece of work**. Work is the effort applied to produce a deliverable or accomplish a task.

A certain amount of time (T) is taken to complete a certain work (W). The number of units of work done per unit time is called the rate of work (R).
Hence, **Work (W) = Rate (R) * Time (T)**

Whenever some work is done, the total work itself can be taken as one unit. Hence, we assume the total work done as one unit in the problems we encounter in order to simplify the computations. In these cases, R = 1 / T or T = 1 / R. In other words, R and T are inversely proportional as RT = W, which is a fixed quantity.

Time and Work Formulas:

1. If A can do a piece of work in n days, then A's one day's work = 1/n
2. If A's one day's work = 1/n, then A can finish the work in n days.
3. If A is thrice as good a workman B, then
   - The ratio of work done by A and B = 3:1
   - The ratio of time taken by A and B to finish work = 1:3
4. Total work = No of days * Efficiency.
5. If a group of people are given salary for a job they do together, their individual salaries are in the ratio of their individual efficiencies if they work for the same number of days. Otherwise, salaries are divided in the ratio of units of work done.

Problem 1: If A does a work in 10 days and B does the same work individually in 12 days, in how many days will the work be completed if they work simultaneously?

Approach 1: Per day's work
If A can complete the work in 'x' days and B can complete the same work in 'y' days, when they work together, the time taken to complete the work is given below.
A can complete the work in 'x' days. So in one day, he will do 1/x of the work.
B can complete the work in 'y' days. So in one day, he will do 1/y of the work.
Total work done by both in one day = (1/x) + (1/y).
Hence, the total time required to do the work = (xy)/(x +y) days.

Solution:
Since A completes the entire work in 10 days, A does 1/10th of the work in 1 day.
Since B completes the entire work in 12 days, B does 1/12th of the work in 1 day.
Working simultaneously, they do 1/10 + 1/12 = 11/60 of the work in 1 day.
Thus total days taken by both working simultaneously = 60/11 days.

Approach 2: LCM Method

In this method, we assume the total amount of work to be completed as a finite divisible value and based on it, we proceed with the calculation. To make the calculation simpler, assume the total amount of work to be completed as the LCM of time taken by different people to complete the same piece of work.

Solution:

Let the amount of work be 60 units (LCM of 10 and 12).
Since A does 60 units in 10 days, he does 6 units every day.
Since B does 60 units in 12 days, he does 5 units every day.
Working simultaneously, they do 6 + 5 = 11 units each day.
Thus to complete 60 units of work, they will take 60/11 days.

The two approaches are absolutely identical; it is just that in the earlier approach the work was assumed as 1 unit instead of 60 units.

WORK EQUIVALENCE

In questions based on man-days concept, the basic assumption is that all men work with equal efficiency unless stated otherwise in the question. The relation between the number of people working N), the number of days worked (D), the number of hours worked per day (H) and the quantity of work (W) for two different cases is given below:

$$\frac{N1^{*}D1^{*}H1}{W1} = \frac{N2^{*}D2^{*}H2}{W2}$$

- The number of people working is directly proportional to the amount of work done.
- The number of days worked is directly proportional to the amount of work done.
- The number of people working is inversely proportional to the number of days worked.

Problem 2: If 56 men can do a piece of work in 42 days, then in how many days will 48 men complete the same work?
Solution: Given, 56 men can do a piece of work in 42 days.
∴ 1 man can do the same work in 56 x 42 days.
∴ 48 men can do it in 56 *4248 days = 49 days. ∴ 48 men can do it in 49 days.
We assume that the total work to be done is the same.

Problem 3: If 52 men can do a piece of work in 35 days, in how many days 28 men will do it?
Solution:
The number of men doing a work and the number of days taken are in inverse proportion.
Let the number of days taken by 28 men be 'a'
Then, 35 : a :: inverse ratio of 52 : 28
35 : a = 28 : 52
Applying the rule, product of extremes = product of means
35 × 52 = a × 28
a = (35 * 52) / 28
a = 65
Hence, 28 men can do the work in 65 days

DIVISION OF WAGES

The wages paid for any task has to be divided among the workers in the proportion to their contribution towards the completion of the task. In other words, the money earned by completing a piece of work has to be divided in the proportion of the work done by them.
If the workers have worked for the same number of days, the money can be divided in the ratio of their efficiencies. Efficiency is inversely proportional to the time taken to complete a task.

Questions based on wages are of three types:

- Same efficiency and same number of days.
- Different efficiency but same number of days.
- Different efficiency and a different number of days.

Problem 4: A can complete a task in 10 days and B can complete the same task in 15 days. A starts the work and works for only 1 day. The remaining work is completed by B. If the total wage is 1000, then What is B's share?

Solution:

Now, the question says that A can complete a task in 10 days and B can do the same in 15 days
A = 10 days, B = 15 days
Total work assumed will be:
LCM of (10 , 15) = 30
So, efficiency: A = 3 /day and B = 2 /day
A works for 1 day which means that the work done by him will be: 3 units
Work left = 30 - 3 = 27; Now 27 units is the work completed by B

Remember:

The wage is divided in the ratio of the work done.
Ratio of work = 3 : 27 = 1 : 9
So the wage will be divided in the same ratio; Wage of A : Wage of B = 1 : 9
So B's share = (9/10) x 1000 = Rs. 900

PIPES AND CISTERNS

The concept of people working with different efficiencies is used to solve problems on Pipes and Cisterns as well. The only difference is that, in this case, the work done is in terms of filling or emptying a cistern (tank) and the time is the time taken by a pipe or a leak (crack) to fill or empty a cistern respectively. If a pipe is connected with a cistern that fills it, then it is called an inlet pipe. If a pipe is connected with a cistern that empties it, then it is called an outlet pipe.

The work done filling a cistern is taken as positive and the work done in emptying a cistern is taken as negative.

- Inlet: A pipe connected with a tank or a cistern or reservoir that fills it, it is known as an inlet.
- Outlet: A pipe connected with a tank or a cistern or a reservoir, emptying it, it is known as an outlet.
- If a pipe can fill a tank in x hours, then the part filled in one hour = 1/x.
- If a pipe can empty a full tank in y hours, then the part emptied in 1 hour = 1/y.

- If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where y>x) then on opening both the pipes, the net part filled in one hour = (1/x − 1/y)
- If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where x>y), then on opening both the pipes, the net part emptied in one hour = (1/y -1/x).

Problem 5: A cistern is fitted with three taps, namely P, Q, and R. P and Q can fill a cistern in 10 and 15 minutes respectively whereas R can empty it in 12 minutes. If all the three pipes are kept open, in how much time will the cistern be filled?
Solution: Assume capacity of the tank = 60 litres
The rate at which tap P fills the cistern = 6 litres/min.
The rate at which tap Q fills the cistern = 4 litres/min and
The rate at which tap R empties the cistern = 5 litres/ min
The rate at which tap P, Q, and R fill the cistern = 5 litres/min
The time taken to fill the cistern = 12 mins

Problem 6: An inlet pipe can fill in an empty cistern in 30 minutes whereas a leak in the bottom of the cistern can empty a filled tank in 40 minutes. Find the time taken to fill the cistern when both the inlet pipe and the leak are on.
Solution: Part of the cistern that is filled each minute = 1/30 − 1/40 = 1 /120.
Thus, the entire cistern is filled in 120 minutes.

PROBLEMS:

1. Anand is twice as good a workman as Balu and is therefore able to finish a piece of work in 30 days less than Balu. In how many days they can complete the whole work; working together?
(a) 15 days (b) 20 days (c) 35 days (d) 30 days

2. A, B and C can do a piece of work in 24 days, 30 days and 40 days respectively. They began the work together, but C left 4 days before the completion of the work. In how many days was the work completed?
(a) 11 days (b) 12 days (c) 13 days (d) 14 days

3. A and B working separately can finish a work in 8 and 12 days respectively. If they work for a day alternately (beginning with A), then in how many days will the work be completed?
(a) 9 days (b) 9.5 days (c) 10 days (d) 9.8 days

4. Binod is twice as efficient as Anil. Anil can complete a piece of work in 15 days. Anil started the work and Binod joined him after a few days. The work was completed in 11 days. For how many days did Anil work alone?
(a) 8 (b) 9 (c) 10 (d) 11

5. A swimming pool is connected with three pipes to fill it. The times taken by the first, second and third pipes, individually, to fill the pool form an increasing arithmetic progression in that order. If the time taken to fill the pool by the second pipe alone is 10 hours and the time taken by the first and third pipes together to fill the pool is 1.8 hours, then the first and second pipes together can fill the pool in?

(a) 2 (1/3) hours (b) 1 (2/5) hours (c) 1 (2/3) hours (d) None of these

6. Humans and robots can both perform a job but at different efficiencies. Fifteen humans and five robots working together take thirty days to finish the job, whereas five humans and fifteen robots working together take sixty days to finish it. How many days will fifteen humans working together (without any robot) take to finish it?
(a) 36 (b) 32 (c) 45 (d) 40

7. In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Rs. 2.40 per hour for regular work and Rs. 3.20 per hour for overtime. If he earns Rs. 432 in 4 weeks, then how many hours does he work for?
(a) 145 (b) 165 (c) 175 (d) 185

8. The number of days in which Raju and Giri together can complete a piece of work is 12 days less than the time taken by Raju alone and 27 days less than the time taken by Giri alone to complete the work. If Raju and Giri completed the work in 15 days with the help of Chari and got a total compensation of Rs. 3000 for the work, then what is the share of Chari?
(a) 500 (b) 100 (c) 1500 (d) 750

9. The ratio of efficiency of A and C is 5 : 3. The ratio of the number of days taken by B and C is 2 : 3. A takes 6 days less than C when A and C complete the work individually. B and C started the work and left after 2 days. The number of days taken by A to finish the remaining work is:
(a) 4.5 (b) 5 (c) 6 (d) 9 1/3

10. Two friends A and B take a job for Rs. 10000. Had they worked individually, A would have taken 20 days while B would have taken 30 days. They started working together but after 10 days, A left the job and B completed the remaining work alone. Find the difference between their shares?
(a) 0 (b) 1000 (c) 2000 (d) 5000

11. Three people A, B and C working individually can finish a job in 10, 12 and 20 days respectively. They decided to work together but after 2 days, A left the work and the very next day, B also left the work. If they got two lakhs collectively for the entire work, find the difference of the highest and lowest share?
(a) 10000 (b) 20000 (c) 60000 (d) 70000

12. A water tank has inlets of two types A and B. All inlets of type A when open, bring in water at the same rate. All inlets of type B, when open, bring in water at the same rate. The empty tank is completely filled in 30 minutes if 10 inlets of type A and 45 inlets of type B are open, and in 1 hour if 8 inlets of type A and 18 inlets of type B are open. In how many minutes will the empty tank get completely filled if 7 inlets of type A and 27 inlets of type B are open?
(a) 46 mins (b) 48 mins (c) 50 mins (d) 52 mins

13. Four two-way pipes, A, B, C and D can either fill an empty tank or drain the full tank in 4, 10, 12 and 20 minutes, respectively. All four pipes were opened simultaneously when the tank was empty. Under which of the following conditions, the tank would be half filled after 30 minutes?
(a) Pipe A filling and pipes, B, C and D draining

(b) Pipe A draining and pipes B, C and D filling
(c) Pipes A and D draining and pipes B and C filling
(d) Pipes A and D filling and pipes B and C draining

14. A tank is fitted with pipes, some filling it and the rest draining it. All filling pipes fill at the same rate, and all draining pipes drain at the same rate. The empty tank gets completely filled in 6 hours when 6 filling and 5 draining pipes are on, but this time becomes 60 hours when 5 filling and 6 draining pipes are on. In how many hours will the empty tank get completely filled when one draining and two filling pipes are on?
(a) 10 hrs (b) 12 hrs (c) 16 hrs (d) 18 hrs

15. In the beginning, Ram works at a rate such that he can finish a piece of work in 24 hrs, but he only works at this rate for 16 hrs. After that, he works at a rate such that he can do the whole work in 18 hrs. If Ram is to finish this work at a stretch, how many hours will he take to finish this work?
(a) 12 hrs (b) 18 hrs (c) 11½ hrs (d) 22 hrs

HOMEWORK:

1. Two friends A and B were employed to do a work. Initial deadline was fixed at 24 days. Both started working together but after 20 days, A left the work and the whole work took 30 days to get completed. In how much time can B alone do the work?
(a) 40 (b) 50 (c) 60 (d) 70

2. A tank has an inlet pipe and an outlet pipe. If the outlet pipe is closed, then the inlet pipe fills the empty tank in 8 hours. If the outlet pipe is open, then the inlet pipe fills the empty tank in 10 hours. If only the outlet pipe is open, then in how many hours the tank becomes half-full?
(a) 20 (b) 30 (c) 40 (d) 45

3. A tank is connected with both inlet pipes and outlet pipes. Individually, an inlet pipe can fill the tank in 7 hours and an outlet pipe can empty it in 5 hours. If all the pipes are kept open, it takes exactly 7 hours for a completely filled-in tank to empty. If the total number of pipes connected to the tank is 11, how many of these are inlet pipes?
(a) 2 (b) 4 (c) 5 (d) 6

4. 10 men working 9 hours a day can complete a work in 24 days. How much time will it take to complete the work if 15 men are employed for 6 hours a day?
(a) 18 (b) 20 (c) 24 (d) 30

5. If 5 men and 3 boys can reap 23 hectares in 4 days and if 3 men and 2 boys can reap 7 hectares in 2 days, then how many boys must assist 7 men in order that they may reap 45 hectares in 6 days?
(a) 1 (b) 2 (c) 3 (d) 4

MODULE 12
TIME, SPEED AND DISTANCE

Relationship Between Speed, Time & Distance:
Speed = Distance/Time – This tells us how slow or fast an object moves. It describes the distance travelled divided by the time taken to cover the distance.

Speed is directly Proportional to Distance and Inversely proportional to Time.
Hence, **Distance = Speed X Time**

Time = Distance / Speed, as the speed increases the time taken will decrease and vice versa.

Using these formulas any basic problems can be solved.
However, the correct usage of units is also an important thing to consider while using formulas.

UNITS OF SPEED TIME & DISTANCE

Each Speed, Distance and Time can be expressed in different units:

- Time: seconds(s), minutes (min), hours (hr)
- Distance: meters (m), kilometers (km), miles, feet
- Speed: m/s, km/hr

So, if Distance = km and Time = hr, then as Speed = Distance/ Time; the units of Speed will be km/ hr.
Now that the units of Speed, Time & Distance are clear, let us understand the conversions related to these.

SPEED, TIME & DISTANCE CONVERSIONS

- To convert from km / hour to m / sec, we multiply by 5 / 18.
  So, 1 km / hour = 5 / 18 m / sec
- To convert from m / sec to km / hour, we multiply by 18 / 5
  So, 1 m / sec = 18 / 5 km / hour = 3.6 km / hour
  Similarly, 1 km/hr = 5/8 miles/hour

1 yard = 3 feet
1 kilometer = 1000 meters = 0.6214 mile
1 meter = 100 cm
1 mile = 1.609 kilometer
1 hour = 60 minutes = 60 * 60 seconds = 3600 seconds
1 min = 60 seconds
1 mile = 1760 yards
1 mile = 5280 feet
1 mph = (1 x 1760) / (1 x 3600) = 22/45 yards/sec
1 mph = (1 x 5280) / (1 x 3600) = 22/15 ft/sec

For a certain distance, if the ratio of speeds is a : b, then the ratio of times taken to cover the distance would be b : a and vice versa.

Example 1: A person travels from one place to another at 30 km/hr and returns at 120 km/hr. If the total time taken is 5 hours, then find the Distance.

Solution:
Here the Distance is constant, so the Time taken will be inversely proportional to the Speed. Ratio of Speed is given as 30 : 120, i.e. 1 : 4
So, the ratio of Time taken will be 4 : 1
Total Time taken = 5 hours; Time taken while going is 4 hours and returning is 1 hour.
Hence, Distance = 30 x 4 = 120 km

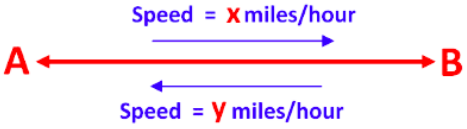
Example 2: If a man can cover 12 metres in one second, how many kilometres can he cover in 3 hours 45 minutes?
Solution:
12 m/s = 12 * 18/5 kmph
3 hours 45 minutes = 3 3/4 hours = 15/4 hours
Distance = speed * time = 12 * 18/5 * 15/4 km = 162 kms

Example 3: Nikita takes as much time in running 18 meters as a car takes in covering 48 meters. What will be the distance covered by Nikita during the time the car covers 1.6 km?

Solution:
Distance covered by Nikita = 18/48 (1.6km) = 3/8(1600) = 600 m

AVERAGE SPEED

Case 1: When Distance is Constant



$$\text{Average speed} = \frac{2xy}{x+y}$$

Where x and y are the two speeds at which the same distance has been covered. Applicable when one travels at speed 'a ' miles/hour for half the distance and speed 'b' miles/hour for the other half of the distance. In this case, the average speed is the harmonic mean of the two speeds. On similar lines, you can modify this formula for one-third distance.

Example 4: Sheena drove at an average speed of 30 miles per hour for T hours and then at an average speed of 60 miles/hr for the next T hours. If she made no stops during the trip and reached her destination in 2T hours, what was her average speed in miles per hour for the entire trip?

Solution:
Here, the time for which Sheena travelled at the two speeds is the same.
Average Speed = (a+b)/2 = (30+60)/2 = 45 miles per hour

Case 2: When Time is Constant
Average speed = (x + y)/2

Where x and y are the two speeds at which we travelled for the same time. Applicable when one travels at speed a for half the time and speed b for another half of the time. In this case, the average speed is the arithmetic mean of the two speeds.

Example 5: Sheena drove at an average speed of 30 miles per hour for the first 30 miles of a trip & then at an average speed of 60 miles/hr for the remaining 30 miles of the trip. If she made no stops during the trip what was her average speed in miles/hr for the entire trip?

Solution:
Here, the distance for which Sheena travelled at the two speeds is the same.
Average Speed = 2xy/(x+y) = 2 * 30 * 60 / (30+60) = 40 mph

PROBLEMS:

1. By walking at 3/4th of his usual speed, a man reaches the office 20 minutes later than usual. What is his usual time?
   (a) 30 min (b) 60 min (c) 70 min (d) 50 min

2. Walking at the speed of 5 km/hr from his home, Ajay misses his train by 7 minutes. Had he walked 1 km/hr faster, he would have reached the station 5 minutes before the actual departure time of the train. Find the distance between his home and the station?
   (a) 6 km (b) 8 km (c) 10 km (d) 12 km

3. A bike during a fog passed a man who was walking at the rate of 3 km/hr in the same direction. He could see the bike for 4 min and it was visible to him up to a distance of 100 m. What was the speed of the bike?
   (a) 4 1/3 km/hr (b) 4 2/3 km/hr (c) 4 1/2 km/hr (d) 4 km/hr

4. A man travels 800 km by train at 160 km/hr, 400 km by car at 50 km/hr and 200 km by cycle at 40 km/hr. What is the average speed of the journey?
   (a) 139/40 km/hr (b) 700/9 km/hr (c) 126/9 km/hr (d) 116/11 km/hr

5. A monkey tries to ascend a greased pole 14m high. He ascends 2m in the first one minute and slips 1m in the alternate minute. If he continues to ascend in this fashion, how long does he take to reach the top?
   (a) 22 min (b) 24 min (c) 25 min (d) 26 min

6. Vani jogs 9 km at a speed of 6 km per hour. At what speed would she need to jog during the next 1.5 hours to have an average of 9 km per hour for the entire jogging session?
   (a) 9 kmph (b) 10 kmph (c) 12 kmph (d) 14 kmph

7. A student rides on a bicycle at 8 km/hour and reaches his school 2.5 minutes late. The next day he increases his speed to 10 km/hour and reaches school 5 minutes early. How far is the school from his house?
   (a) 5/8 km (b) 8 km (c) 5 km (d) 10 km

8. Kumar started from Chennai at x hrs y minutes and travelled to Vellore. He reached Vellore at y hrs z minutes. If the total travel time was z hrs and x minutes, his starting time in Chennai could have been _____ (Assume clock format to be 0 to 24 hrs).
(a) 02:08 hrs (b) 13:03 hrs (c) 00:02 hrs (d) 12:01 hrs

9. Akarsh, when going slower by 15 Km/hr, reaches the destination 45 hours late. If he goes faster by 10 Km/hr from his original speed, he reaches the destination 20 hours earlier than the original time. Find the distance he covers.
(a) 8750 km (b) 9750 km (c) 1000 km (d) 3750 km

10. Amit & Bimal are at a distance of 800 m. They start towards each other with speeds of 20kmph & 24kmph. As they start, a bird sitting on the cap of Amit, starts flying towards Bimal, touches Bimal & then returns towards Amit & so on, till they meet. What is the distance travelled by the bird, if its speed is 176 kmph?
(a) 3600 m (b) 3400 m (c) 3200 m (d) 3000 m

11. When Sourav increases his speed from 20 Km/hr to 25 Km/hr, he takes one hour less than the usual time to cover a certain distance. What is the distance usually covered by him?
(a) 125 km (b) 100 km (c) 80 km (d) 120 km

12. Car A trails car B by 50 meters. Car B travels at 45km/hr. Car C travels from the opposite direction at 54km/hr. Car C is at a distance of 220 meters from Car B. If car A decides to overtake Car B before car B and C cross each other, what is the minimum speed at which car A must travel?
(a) 36 km/hr (b) 45 km/hr (c) 67.5 km/hr (d) 18 km/hr

13. Ravi takes 6.5 hours to go from city A to city B at 3 different speeds - 30 kmph, 45 kmph, and 60 kmph covering the same distance with each speed. The respective mileages per litre of fuel are 11 km, 14 km and 18 km for the above speeds. Ravi's friend Anil is an efficient driver and wants to minimise his friend's car's fuel consumption. So he decides to drive Ravi's car one day from city A to city B. How much fuel will he be able to save?
(a) 4.2 litres (b) 4.5 litres (c) 0.7 litres (d) 0.3 litres

14. A student rides on a bicycle at 8 km/hour and reaches his school 2.5 minutes late. The next day he increases his speed to 10 km/hour and reaches school 5 minutes early. How far is the school from his house?
(a) 5/8 km (b) 8 km (c) 5 km (d) 10 km

15. A starts from X at 9:00 am and reaches Y at 1:00 pm. B starts from Y at 9:00 am and reaches X at 3 pm. At what time do the two meet?
(a) 11:04am (b) 11:40am (c) 11:24am (d) None of these

HOMEWORK:

1. The ratio between the walking speeds of A and B is 3 : 4 respectively. If the time taken by B to cover a certain distance is 48 min, then find the time taken (in min) by A to cover the same distance.
   (a) 84 (b) 64 (c) 36 (d) 72

2. A train moving at two-third of its normal speed reaches the destination half an hour late. What is the normal time taken?
   (a) 1.5 hr (b) 1 hr (c) 2 hr (d) 3 hr

3. Mr. Woodsman walked into the woods at a rate of 4 km/hr and returned to his starting point at the rate of 3 km/hr. If the entire trip took him 3 ½ hr, then how far into the woods did he travel?
   (a) 7 km (b) 5 km (c) 6 km (d) 12 km

4. Ritu travelled from her house to the school at the rate of 15 kmph and walked back at the rate of 5 kmph. If the whole journey took 2 hours 40 minutes, then find the distance (in km) of the school from Ritu's house.
   (a) 10 (b) 20 (c) 30 (d) 40

5. A thief robs a house at 12 midnight, and as soon as he leaves the house, the house owner realises the robbery in the house. After 10 minutes he rings the alert alarm, and the security guard of the house starts running after the thief to catch him. If the speed of the thief is 30 km/hr and that of the security guard is 20 km/hr, then at what time will the guard catch the thief?
   (a) 00.30 hrs (b) 00.40 hrs
   (c) 00.45 hrs (d) Can never catch the thief

MODULE 13
TRAINS, BOATS AND STEAMS, RACES

Relative speed: In relative speed we have two objects moving where there is only one force acting on it. If two objects move in parallel paths in the same direction with speeds S1 and S2, with the first speed higher, the relative speed between the two will be S1 − S2.

If object 2 was ahead of object 1 by a distance d, the first object will catch up with the second in time: $T = \frac{\text{d}}{\text{S1 – S2}}$

Effectively object 2 can be imagined to be stationary at a distance d from object 1, and object 1 approaches object 2 at the relative speed S1−S2 catching it up in time T.

As in time T object 1 moves a distance of T * S1, this will be distance from the starting point of object 1 at which the two objects will meet. In reality, during this time T, object 2 will also move with its speed S2 and will meet object 1 at a point distant T * S2 from its own starting point.

Trains:

Two trains running in parallel:
The question of relative speed arises when two trains run in parallel. The main quantities that are to be found out in this type of problems are Time to pass,

a. a second train
b. a platform
c. a stationary man standing on a platform
d. a stationary passenger in another moving train or
e. a cyclist.

<u>Different cases of two trains moving in parallel:</u>

Two trains moving in same direction:
When two trains with speeds S_1 and S_2 move in parallel and in the same direction, the relative speed between the trains is the difference between their speeds, $S_1 - S_2$, assuming $S_1 > S_2$. Train 1 will then pass train 2 at this relative speed.

If L_1 and L_2 are the lengths of the two trains, to pass each other, any of the trains has to traverse a distance of $L_1 + L_2$. So time to pass each other at the relative speed in this case is,

$$\text{Time to pass} = \frac{\text{L1 + L2}}{\text{S1 – S2}}$$

Example: If the trains move at speeds 60 km/hr and 40 km/hr and the lengths are 100m and 150m then, Time to pass each other:

$$= \frac{(100 + 150)\ \text{m}}{(60 - 40)\ \text{km/hr}}$$

$$= \frac{250}{20 * 5 / 18}$$

= **45 seconds**
The first train will completely overtake the second train in 45 seconds in this case.

Two trains moving in opposite direction:
In this case the relative speed will be the sum of their individual speeds, that is,
Relative speed = $S_1 + S_2$.

In this case the time to pass would obviously be less and is,
Time to pass = $\frac{L1 + L2}{S1 + S2}$

The relative speed is the sum of speeds and this higher value is appearing in the denominator so that time taken will be proportionately less.

Example: If the trains move at speeds 60 km/hr and 40 km/hr and the lengths are 100m and 150m then, Time to pass each other:

$= \frac{(100 + 150)\ \text{m}}{(60 + 40)\ \text{km/hr}}$

$= \frac{250}{100 * 5 / 18}$

= **9 seconds**

Now we will consider a single moving train:
Various possibilities of the train passing objects are:

A platform: A platform is stationary, so speed of passing will be the train's speed itself, but the length will be the total length of the platform and the train.

For example if the platform is 200m long and the train speed and lengths are 60km/hr and 100m, required time to pass the platform will be:

$= \frac{(100 + 200)\ \text{m}}{60\ \text{km/hr}}$

$= \frac{300\ \text{m}}{60 * 5 / 18}$

= 18 secs

A stationary man standing on the platform:
A man who is not moving represents an upright line of no width.

Length to pass will be the train's length and speed will be the train's speed.

For example, the train of length 100m moving at a speed of 60km/hr will pass a stationary man standing on the platform in:

$= \frac{(100\ \text{m}}{60\ \text{km/hr}}$

$= \frac{100 \text{ m}}{60 * 5 / 18}$

= 6 seconds

A passenger sitting in another moving train:
In this case, the length to pass will be the length of the passing train, but the speed will be the relative speed of two trains. It is as if a stickman is running parallel to the first train at the speed of the second train.

For example, A first train of length 100m moving at a speed of 60km/hr passes a passenger sitting in a second train of length 150m and moving in parallel at a speed of 40km/hr in opposite direction. What will be the time for the first train to pass the passenger sitting in the second train?

Time to pass the passenger in 2nd train:

$= \frac{100 \text{ m}}{(60 + 40) \text{ km/hr}}$

$= \frac{100 \text{ m}}{100 * 5 / 18}$

= 3.6 seconds

Passing other moving objects:
A moving train may pass a man running parallel to it (a man of no width moving at relative speed), or it might well be a case of passing a cyclist moving parallel to the train (the speed of cycle will determine the relative speed, the end to end length of the cycle may be given, or if not given may be assumed to be too small for consideration).

PROBLEMS BASED ON BOATS AND STREAMS

Effective speed:
The two types of problems we will encounter in boats and streams are:
Problems based on Up Stream and Problems based on Down Stream

Upstream:
If the speed of boat (S_B) is against the speed of stream (S_S) then the effective speed (S_E) can be said as upstream speed (U.S.)
U.S. = $S_B - S_S$

Eg: Consider a boat has moved 6 km in an hour (i.e.) speed of boat, S_B = 6 km/hr and Speed of stream, S_S = 4 km/hr. Then the boat would have moved 6 km whereas the stream would have pushed it by 4 km in the opposite direction then the total distance covered is only 6 km – 4 km = 2 km.

Downstream:
If the speed of the boat (S_B) is along the speed of the stream (S_S) then effective speed can be said as downstream speed (D.S).

Eg: Consider speed of boat, S_B = 6 km/hr, Speed of stream S_S = 4 km/hr. Then the boat would have moved 6 km and the stream would have pushed the boat for another 4 km in the same direction. Hence total distance covered is 6 km+ 4 km=10 km.

Problem 1: A launch travels downstream in 3 hours to a point 42 kms away. Its return journey takes 7 hours. What are the speeds of the launch and the water current?

Solution:
Downstream speed, D.S. = $(S_1 + S_2)$ kms/hr = 42 / 3 kms/hr = 14 kms/hr
Upstream speed, U.S. = $(S_1 - S_2)$ kms/hr = 42 / 7 kms/hr = 6 kms/hr

S_1 = D.S. + U.S. / 2 = (14 + 6) / 2 = 10 kms/hr
S_2 = D.S. – U.S. / 2 = (14 – 6) / 2 = 4 kms/hr

Problem 2: While rowing upstream a man takes thrice as much time as rowing in still water at 9 miles/hr. Find the speed of the current.

Solution:
To row a fixed distance D miles the man takes T hours at speed 9 miles/hr. So,
D = 9T
Rowing upstream, his effective speed becomes (9 – S) miles/hr where the current speed is S miles/hr; rowing upstream to cover the same distance D he takes thrice the time he took in still water, that is,
3T hours.
So, D = 9T = (9 – S) 3T
or, 9 = 27 – 3S
So, the speed of the current is 6 miles/hr.

RACES

Races are an application of relative speed.
Races are of two types:

1. **Linear tracks**
2. **Circular tracks**

A. Linear Tracks:

1. **A beats B by 10 m:**
   A has won the race. B is 10 m behind A, when A finishes the race.
2. **A beats B by 10s:**
   A has won the race in 't' seconds. B needs 10s more than A to complete the race.
3. **A gives a head start of 10m in a 100m race to B:**

A has to cover 100m. B has to cover only 90m to finish the race. Hence A will start the race at start point and B will be 10m ahead of A.

4. **A gives a head start of 10s in 100m race to B:**
A starts at 't'. B starts at 't-10s', i.e. 10 seconds earlier than A.

5. **Race between A and B ends in dead heat:**
A reaches at 't'. B also reaches at 't'. i.e.; race ends at the same time.

Problem 1: In a 100 m race, A can give B 10 m and C 28 m. In the same race B can give C:

Solution:
A : B = 100 : 90
A : C = 100 : 72
B : C = (B/A) x (A/C) = (90/100) x (100/72) = 90 /72
When B runs 90 m, C runs 72 m
When B runs 100 m, C runs (72/90) x 100 = 80 m
Therefore, B can give 20 m to C

B. Circular Tracks:

If in a circular track, we have only one round then it is equal to a linear track.
The questions asked in this concept are usually of two types:

1. When do the participants meet first anywhere on the track?
2. How many times do the participants meet?
3. When do they meet at the starting point or ending point for the first time?

Before moving forth with problems let's learn some useful tips.

- Let X and Y be two runners running in a circular path of length L with speeds x m/s and y m/s respectively. If x > y then,

i) X and Y are running in the same direction, then time taken by:

X and Y to meet first time anywhere on the track	X and Y to meet first time at the starting point on the track
L / (x-y)	LCM of L/x and L/y

ii) X and Y are running in the opposite direction, then time taken by:

X and Y to meet first time anywhere on the track	X and Y to meet first time at the starting point on the track
L / (x+y)	LCM of L/x and L/y

- When the speed of Y is expressed in terms of X and X and Y are running in opposite directions such that speed of Y is n times of X then no. of meeting points of X and Y are n + 1 i.e. if speed of Y is equal to X then their meeting points are 2.

- If the no. of meeting points is known and the time required to meet at the starting point is also known then you can compute the time needed for them to meet for the first time using the formula

(Time after which they'll meet at the starting point)/no. of meeting points

- X and Y running on a circular track and in opposite directions. If the speed of X is x/y of Y, then the total number of meeting points = x + y.
- All the distant meeting points are equidistant in circular paths and same goes for time i.e. all of them take equal time and are covered in definite manner.
- A diagrammatic approach is the best technique when it comes to circular paths. It will help you visualise the question properly.

Points to note:

1. Two runners A and B whose speeds are 10 m/sec and 20 m/sec respectively. They start at the same point and they run in the same direction. When they meet for the first time:
   - Number of rounds A covered = x
   - Number of rounds B covered = x+1
2. The time taken for runners to meet at the starting point for the first time will be LCM of time taken for one round.

Note: Direction of travel doesn't matter. When three runners travel from the same point then LCM of time is their time for the first meeting.

PROBLEMS:

1. Two trains start at the same time from Pune and Delhi and proceed towards each other at 80 kmph and 95 kmph respectively. When they meet, it is found that one train has travelled 180 km more than the other. Find the distance between Delhi and Pune?
   (a) 2000 Km (b) 2150 Km (c) 2100 Km (d) 2300 Km

2. Indrayani Express leaves Pune for Bombay at 17:30 hrs and reaches Bombay at 21:30 hrs. While, Shatabdi, which leaves Bombay at 17:00 hrs reaches Pune at 20:30 hrs. At what time do they pass each other?
   (a) 19:06 hrs (b) 16:04 hrs (c) 18:23 hrs (d) 17:36 hrs

3. A goods train and a passenger train are running on parallel tracks in the same direction. The driver of the goods train observes that the passenger train coming from behind overtakes and crosses his train completely in 60 sec. Whereas a passenger on the passenger train marks that he crosses the goods train in 40 sec. If the speeds of the trains are in the ratio 1:2, find the ratio of their lengths?
   (a) 3:1 (b) 2:1 (c) 3:2 (d) 4:3

4. Two towns A and B are 500 km apart. A train starts at 8 AM from A towards B at a speed of 70 km/hr. At 10 AM, another train starts from B towards A at a speed of 110 km/hr. When will the two trains meet?
   (a) 1 PM (b) 12 Noon (c) 12.30 PM (d) 1.30 PM

5. Two cars start at the same time from one point and move along two roads at right angles to each other. Their speeds are 36 km/hour and 48 km/hour respectively. After 15 seconds the distance between them will be?
(a) 400 m (b) 150 m (c) 300 m (d) 250 m

6. A person standing on a railway platform noticed that a train took 21seconds to completely pass through the platform which was 84 m long and it took 9 seconds to pass him. The speed of the train was?
(a) 25.2 km/hour (b) 32.4 km/hour (c) 50.4 km/hour (d) 75.6 km/hour

7. The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is:
(a) 200m (b) 225m (c) 245m (d) 250 km

8. Train A travelling at 63 kmph takes 27 to sec to cross Train B when travelling in the opposite direction whereas it takes 162 seconds to overtake it when travelling in the same direction. If the length of train B is 500 meters, find the length of Train A.
(a) 400 m (b) 810 m (c) 500 m (d) 310 m

9. A boat takes 10 minutes to reach a place upstream. It can come back to the same place in 5 minutes, down the stream. If the speed of the stream is 2 m/sec, then what is the speed of the boat?
(a) 6 m/sec (b) 4 m/sec (c) 8 m/sec (d) 5 m/sec

10. A boat covers 12 km upstream and 18 km downstream in 3 hours, while it covers 36 km upstream and 24 km downstream in 6 1/2hours. What is the speed of the current?
(a) 1.5 km/hr (b) 1 km/hr (c) 2 km/hr (d) 2.5 km/hr

11. Speed of a motorboat in still water is 45kmph. If the motorboat travels 80km along the stream in 1 hour 20 minutes, then the time taken by it to cover the same distance against the stream will be:
(a) 3 hours (b) 1 hour 20 minutes
(c) 2 hours 40 minutes (d) 2 hours 55 minutes

12. In a km race, Alok beats Nikhil by 20 m or 5 sec. Find Alok's time over the course.
(a) 3 min 55 sec (b) 4 min 10 sec (c) 3 min 45 sec (d) 4 min 5 sec

13. In a 500 m race, the ratio of the speeds of two contestants A and B is 2:3 and A has a start of 170 m. Then, A wins by?
(a) 5 m (b) 10 m (c) 15 m (d) 20 m

14. Two runners A and B, are running on a circular track of length 14 km. If A and B started simultaneously from the same point but in opposite directions with speeds 15m/sec and 20m/sec respectively. What is the distance covered by A when they cross each other for the first time?
(a) 6 km (b) 8 km (c) 5 km (d) 9 km

15. X, Y and Z run around a circular track 1200 m long at respective speeds of 18, 27 and 45 km/hr. If they start at the same point and at the same time in the same direction, when will they meet again at the starting point?
(a) 8 minutes (b) 7.2 minutes (c) 7.5 minutes (d) 9 minutes

HOMEWORK:

1. A train moves past a telegraph post and a bridge 264 m long in 8 seconds and 20 seconds respectively. What is the speed of the train?
(a) 69.5 km/hr (b) 70 km/hr (c) 79 km/hr (d) 79.2km/hr

2. Two trains left from two stations P and Q towards station Q and station P respectively. 3 hours after they met, they were 675 Km apart. First train arrived at its destination 16 hours after their meeting and the second train arrived at its destination 25 hours after their meeting. How long did it take for the first train to make the whole trip?
(a) 18h (b) 25h (c) 36h (d) 45h

3. A boat goes 12 km downstream and comes back to the starting point in 3 hours. If the speed of the current is 3km/hr, then the speed (in km/hr) of the boat in still water is
(a) 12 (b) 9 (c) 8 (d) 6

4. In a race of 200 m, A beats B by 10 m and A beats C by 5 m. By how many metres would C beat B in a 200 m race?
(a) 5.13 m (b) 10.5 m (c) 12 m (d) 8 m

5. In a circular race of 900 m length, A and B start with speeds 27 km/hr and 36 km/hr respectively starting at the same time from the same point. When will they meet for the first time at the starting point when running in the opposite direction?
(a) 2 mins 50 sec (b) 6 min (c) 5 mins 40 sec (d) 7 mins

MODULE 14
PERMUTATION AND COMBINATION

Permutation and combination are the ways to represent a group of objects by selecting them in a set and forming subsets. It defines the various ways to arrange a certain group of data. When we select the data or objects from a certain group, it is said to be permutations, whereas the order in which they are represented is called combination.

What is Permutation?

In mathematics, permutation relates to the act of arranging all the members of a set into some sequence or order. In other words, if the set is already ordered, then the rearranging of its elements is called the process of permuting. Permutations occur, in more or less prominent ways, in almost every area of mathematics. They often arise when different orderings on certain finite sets are considered.

$$^{n}P_{r} = \frac{n!}{(n-r)!}$$

Properties of $^{n}P_{r}$

1. $^{n}P_{n} = n!$
2. $^{n}P_{1} = n$
3. $^{n}P_{0} = 1$
4. $^{n}P_{n-1} = n!$

What is a Combination?

The combination is a way of selecting items from a collection, such that (unlike permutations) the order of selection does not matter. In smaller cases, it is possible to count the number of combinations. Combination refers to the combination of n things taken k at a time without repetition. To refer to combinations in which repetition is allowed, the terms k-selection or k-combination with repetition are often used.

$$^{n}C_{r} = \frac{n!}{r!\,(n-r)!}$$

Properties of $^{n}C_{r}$

1. $^{n}C_{n} = 1$
2. $^{n}C_{1} = n$
3. $^{n}C_{0} = 1$
5. $^{n}C_{r} = {}^{n}C_{n-r}$

Fundamental Principles of Counting:

I. The Addition Rule

Let us have two events, namely A and B. The number of ways in which event A can occur / the number of possible outcomes of event A is n(A) and similarly, for event B, it is n(B). Also, the events A and B are mutually exclusive events i.e. they have no outcome common to each other.

Let E be an event describing the situation in which either event A occurs, OR event B occurs. Then, the number of ways in which the event E can occur or the number of possible outcomes of the event E is given by: n(E) = n(A) + n(B)

This is known as the Addition Rule of Counting. Let's clarify our concepts with a suitable example.

Question: Varun goes to a shop to buy some balls. He wishes to choose one ball from the amateur section, which had a total of five balls; or one ball from the professional section, which had a total of three balls. How many ways are possible in which he can buy a ball i.e. he can buy one ball from the amateur section OR one ball from the professional section?

Solution:

n(Varun buying a ball) = n(Varun buys one ball from the amateur section) + n(Varun buys one ball from the professional section)

n(Varun buying a ball) = ${}^5C_1 + {}^3C_1 = 5 + 3 = 8$

Thus there are 8 possible ways in which Varun can buy a ball from the store, according to his specific wishes.

II. The Product Rule (Multiplication Rule)

In similarity to the events defined as in the Addition Rule, let us have two events namely A and B; such that both are mutually independent of each other i.e. one event's outcome does not affect the other event's outcome. (We'll show this physically through our solved example)

Let E be an event describing the situation in which either event A occurs, AND event B occurs i.e. both event A and event B must occur (note the difference from the previously mentioned case). Then, the number of ways in which the event E can occur or the number of possible outcomes of the event E is given by: n(E) = n(A) × n(B)

This is The Multiplication Rule of Counting or The Fundamental Counting Principle. Let's try and understand it with an example.

Question: Varun goes to a sports shop to buy a ping pong ball and a tennis ball. There are a total of five ping pong balls and 3 tennis balls available in the shop. In how many ways can he buy a ping pong ball and a tennis ball?

Solution:

Clearly; the phenomenon of Varun buying a ping pong ball is independent of the phenomenon of Varun buying a tennis ball. Both are completely separate events!

n(Varun buying one tennis ball and a ping pong ball) = n(Varun buys a ping pong ball) * n(Varun buys a tennis ball)

n(Varun buys both one tennis ball and a ping pong ball) = ${}^5C_1 \times {}^3C_1 = 5 * 3 = 15$

Thus there are 15 different ways in which Jacob can buy a ping pong ball and a tennis ball from the shop.

Generalisation of the Addition and the Product Rule

In general, if there are several mutually exclusive events P1, P2, P3, P4……Pn…etc. with the respective number of ways given as n(P1), n(P2), n(P3), n(P4)….n(Pn), then the number of ways in which either P1 and P2 and ….. … Pn can occur is given by, n(E) = n(P1) + n(P2)…….. + n(Pn)

Similarly, if there are several mutually independent events P1, P2, P3, P4……Pn…etc. with the respective number of ways given as n (P1), n(P2), n(P3), n(P4)….n(Pn), then the number of ways in which P1 and P2 and ….. … Pn can occur is given by, n(E) = n(P1) × n(P2)…….. × n(Pn)
We must note that all the possible number of ways derived thus, all of them will represent the unique and distinct ways in which the event E will take place.

Problems on Numbers:

1. How many 5 digit even numbers with distinct digits can be formed using the digits 1, 2, 5, 5, 4?

   Solution:
   5 digit even numbers can be formed out of 1, 2, 5, 5, 4 by using either 2 or 4 in the unit's place. This can be done in 2 ways.
   Corresponding to each such arrangement, the remaining 4 places can be filled up by any of the remaining four digits in 4! / 2! = 12 ways. [5 is repeating twice hence 2! in denominator]
   Hence, the total number of words = 2 x 12 = 24.

2. How many natural numbers can be made with digits 0, 7, 8 which are greater than 0 and less than a million?

   Solution:
   The number of single digit numbers = 2
   The number of 2 digit numbers = 2 × 3 = 6
   The number of 3 digit numbers = 2 × 3 × 3 = 18
   The number of 4 digit numbers = 2 × 3 × 3 × 3 = 54
   The number of 5 digit numbers = 2 × 3 × 3 × 3 × 3 = 162
   The number of 6 digit numbers = 2 × 3 × 3 × 3 × 3 × 3 = 486
   Therefore, the total numbers = 728

Problems on letters of the alphabet:

1. How many 3-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

   Solution:
   The word 'LOGARITHMS' has 10 different letters.
   Hence, the number of 3-letter words (with or without meaning) formed by using these letters = 10P3 = 10 × 9 × 8 = 720

2. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

   Solution:
   The word 'OPTICAL' has 7 letters. It has the vowels O, I and A in it and these 3 vowels should always come together. Hence these three vowels can be grouped and considered as a single letter. That is, PTCL(OIA).
   Hence, we can assume total letters as 5 and all these letters are different.
   Number of ways to arrange these letters: 5! = 5 × 4 × 3 × 2 × 1 = 120
   All the 3 vowels (OIA) are different
   Number of ways to arrange these vowels among themselves: 3! = 3 × 2 × 1 = 6

Hence, required number of ways: $120 \times 6 = 720$

Problems on Linear Arrangements:

If there are 'n' number of people then number of ways we can arrange them is n! ways

1. Find the number of ways in which four girls and three boys can arrange themselves in a row so that none of the boys are together?

   Solution:
   Let us first seat the four girls. The girls can seat in $4P4 = 4! = 24$.
   _ G1 _ G2 _ G3 _ G4 _
   For this type of arrangement, the boys can only sit on the five blanked position. Three boys can arrange themselves in $5P3 = 5!/2! = 60$. The required number of ways $= 24 \times 60 = 1440$.
   (By multiplication theorem)

2. In how many ways can 5 children be arranged in a line such that two particular children of them are always together?

   Solution:
   We consider the arrangements by taking 2 particular children together as one and hence the remaining 4 can be arranged in $4! = 24$ ways. Again, two particular children taken together can be arranged in two ways. Therefore, there are $24 \times 2 = 48$ total ways of arrangement.

Problem on Circular arrangement:

If there are 'n' number of people then the number of ways we can arrange them is (n-1)! ways

1. Find the number of ways in which four girls and three boys can arrange themselves in a circle so that none of the boys are together?

   Solution:
   Since the condition is that none of the boys can sit together or adjacent to each other. We can get the required number of ways if we subtract the ways in which the three boys can seat up together from the total number of arrangements. The total number of ways in which the four girls and three boys can sit around the table $= (7 - 1)! = 6!$
   Let us assume that the three boys sit together. They are considered as one unit now. Here, we need to arrange only four girls and a unit of boy i.e., $4 + 1 = 5$ persons. In the circular arrangement the required number of ways $= (5 - 1)! = 4!$
   These three boys can now rearrange themselves in 3! ways. By the multiplication theorem, the number of the ways $= 4! \times 3!$
   The number of ways in which the arrangement can take place if none of the boys is seated together is $6! - (4! \times 3!) = 720 - 144 = 576$.

2. Find the number of ways in which 10 beads can be arranged to form a necklace.

   Solution:

Let us fix the position of one bead. Now, we are left with the arrangement of the remaining, 10 − 1 = 9 beads. These nine beads can arrange themselves in 9P9 = 9! ways. As there is no dependency on the position of beads in a clockwise or anticlockwise manner. The required number of ways = (9!)/2 = 181440.

Problems on Handshakes:

The formula for the number of handshakes possible at a party with n people is.

Handshakes = $\frac{n*(n-1)}{2}$

Where n is the number of people.

This is because each of the n people can shake hands with n - 1 people (they would not shake their own hand), and the handshake between two people is not counted twice.

1. In a birthday party, every person shakes hands with every other person. If there were a total of 28 handshakes in the party, how many people were present in the party?

   Solution:
   n (n−1) / 2 = 28
   n (n−1) = 28 × 2
   n (n−1) = 56
   n = 8

2. 12 people at a party shake hands once with everyone else in the room. How many handshakes took place?

   Solution:
   There are 12 people, so this is our n value.
   So, 12C2 = 66

Problems on Committees(groups):

1. There are 8 men and 10 women and you need to form a committee of 5 men and 6 women. In how many ways can the committee be formed?

   Solution:
   We need to select 5 men from 8 men and 6 women from 10 women
   Number of ways to do this
   = $^{8}C_5 \times {}^{10}C_6$
   = $^{8}C_3 \times {}^{10}C_4$ [$\because {}^{n}C_r = {}^{n}C_{(n-r)}$]
   = 56×210
   = 11760

2. From a group of 6 boys and 4 girls, how many different committees can be formed such that at least one boy should be there in the committee?

   Solution:
   We have 4 options as given below
   We can select 4 boys ...(option 1) : Number of ways to this = 6C4

We can select 3 boys and 1 girl ...(option 2) : Number of ways to this = 6C3 × 4C1
We can select 2 boys and 2 girls ...(option 3) : Number of ways to this = 6C2 × 4C2
We can select 1 boy and 3 girls ...(option 4) : Number of ways to this = 6C1 × 4C3

Total number of ways
= 6C4 + 6C3 × 4C1 + 6C2 × 4C2 + 6C1 × 4C3
= 6C2 + 6C3 × 4C1 + 6C2 × 4C2 + 6C1 × 4C1 [$\because {}^{n}C_{r} = {}^{n}C_{(n-r)}$]
= 15 + 80 + 90 + 24
= 209

3. From 2 white balls, 3 black balls and 4 red balls, 3 balls are to be selected such that at least one black ball should be there.

Solution:
We have 3 choices as given below
We can select 3 black balls...(option 1)
We can select 2 black balls and 1 non-black ball ...(option 2)
We can select 1 black ball and 2 non-black balls ...(option 3)

Number of ways to select 3 black balls = 3C3
Number of ways to select 2 black balls and 1 non-black ball = 3C2 × 6C1
Number of ways to select 1 black ball and 2 non-black balls = 3C1 × 6C2
Total number of ways
= 3C3 + 3C2 × 6C1 + 3C1 × 6C2
= 3C3 + 3C1 × 6C1 + 3C1 × 6C2 [$\because {}^{n}C_{r} = {}^{n}C_{(n-r)}$]
= 1 + 18 + 45
= 64

PROBLEMS:

1. A new flag is to be designed with seven vertical stripes using some or all of the colours yellow, green, blue and red. Then, the number of ways this can be done such that no two adjacent stripes have the same colour is:
(a) 36 x 81 (b) 16 x 192 (c) 20 x 125 (d) 24 x 216

2. In how many ways is it possible to choose a white square and a black square on a chess board so that the squares must not lie in the same row or column?
(a) 56 (b) 896 (c) 60 (d) 768

3. In a question paper, there are three multiple-choice questions. Each question has six choices with only one choice as the correct answer. What is the total number of ways in which a candidate will not get all the three answers correct?
(a) 215 (b) 216 (c) 729 (d) 728

4. How many quadrilaterals can be formed from 20 points out of which 7 are collinear?
(a) 5206 (b) 2603 (c) 1198 (d) 4250

5. How many four digit numbers, which are divisible by 6, can be formed using the digits 0, 2, 3, 4, 6, such that no digit is used more than once and 0 does not occur in the left-most position?
(a) 10 (b) 50 (c) 25 (d) 100

6. Find the number of 6-digit numbers that can be formed using the digits 1, 2, 3, 4, 5, 6 once such that the 6- digit number is divisible by its unit digit. (exclude the numbers ending in 1)
(a) 620 (b) 456 (c) 520 (d) 528

7. Find the sum of all 5 digit numbers formed by the digits 1, 3, 5, 7, 9 when no digit is being repeated.
(a) 4444400 (b) 8888800 (c) 13333200 (d) 6666600

8. In a tournament, there are 43 junior level and 51 senior level participants. Each pair of juniors play one match. Each pair of seniors play one match. There is no junior versus senior match. The number of girl versus girl matches in junior level is 153, while the number of boy versus boy matches in senior level is 276. The number of matches a boy plays against a girl is?
(a) 1098 (b) 1024 (c) 125 (d) 1728

9. If we have to make 7 boys sit with 7 girls around a round table, then the number of different relative arrangements of boys and girls that we can make so that there are no two boys nor two girls sitting next to each other is:
(a) 2 x (7!)2 (b) 7! x 7! (c) 6! x 7! (d) None of these

10. A tea party is arranged for 16 people along two sides of a long table with 8 chairs on each side. Four people wish to sit on one particular side and two on the other side. In how many ways can they be seated?
(a) 10C4 * 8! (b) 10P4 * 8!
(c) 10C4 * 6C6 *8! * 8! (d) 4! *2! *(8!)

11. A lady gives a dinner party to 5 guests to be selected from nine friends. The number of ways of forming the party of 5, given that two particular friends A and B will not attend the party together is?
(a) 56 (b) 126 (c) 91 (d) None of these

12. While packing for a business trip Mr. Kapoor has packed 3 pairs of shoes, 4 pants, 3 half-pants, 6 shirts, 3 sweaters and 2 jackets. The outfit is defined as consisting of a pair of shoes, a choice of 'lower wear' (either a pant or a half-pant), a choice of 'upper wear (it could be a shirt or a sweater or both) and finally he may or may not choose to wear a jacket. How many different outfits are possible?
(a) 567 (b) 1821 (c) 743 (d) 1701

13. In how many ways can the letters of the word 'SIMULTANEOUS' be arranged such that vowels are always together?
(a) 7!*6! / 2!*2! (b) 7!*6! (c) 6!*6! (d) 7!*6! / 2!

14. Find the rank of the word MOTHER in dictionary format.
(a) 306 (b) 307 (c) 308 (d) 309

15. The letters of the word HASTE are written in all possible orders and these words are written out as in the dictionary. Then the dictionary rank of the word HEATS is:
(a) 56 (b) 57 (c) 38 (d) 39

HOMEWORK:

1. In how many ways can 7 identical erasers be distributed among 4 kids in such a way that each kid gets at least one eraser but nobody gets more than 3 erasers?
(a) 20 (b) 14 (c) 15 (d) 16

2. In how many ways can 10 identical presents be distributed among 6 children so that each child gets at least one present?
(a) 15C5 (b) 16C6 (c) 9C5 (d) 610

3. How many integers, greater than 999 but not greater than 3000, can be formed with the digits 0, 1, 2, 3 and 4 if repetition of digits is allowed?
(a) 376 (b) 375 (c) 250 (d) 251

4. There are 5 managers, 8 team leaders, and 7 daily wagers in a chess club. A group of 6 employees will be chosen to compete in a competition. How many combinations of employees are possible if the group is to consist of exactly 3 managers?
(a) 5000 (b) 4550 (c) 4000 (d) 3550

5. What is the rank of the word PRIME, if the letters are rearranged and ordered as they are in the dictionary such that each letter is used only once.
(a) 93 (b) 92 (c) 94 (d) 95

MODULE 15
PROBABILITY

1. **Probability or Chance:** Probability or chance is a common term used in day-to-day life.
Example: We generally say, 'it may rain today'. This statement has a certain uncertainty. Probability is a quantitative measure of the chance of occurrence of a particular event.

2. **Experiment:** An experiment is an operation which can produce well-defined outcomes.

3. **Random Experiment:** If all the possible outcomes of an experiment are known but the exact output cannot be predicted in advance, that experiment is called a random experiment.

Examples:

(i) **Tossing of a fair coin:** When we toss a coin, the outcome will be either Head (H) or Tail (T).

Problem 1: Two fair coins are tossed simultaneously. What is the probability of getting only one head?
Solution: When 2 coins are tossed, the possible outcomes can be {HH, TT, HT, TH}.
Thus, the total number of possible outcomes = 4
Getting only one head includes {HT, TH} outcomes.
So, number of desired outcomes = 2
Therefore, probability of getting only one head = 2/4 = 1/2

Problem 2: Three fair coins are tossed simultaneously. What is the probability of getting at least 2 tails?
Solution: When 3 coins are tossed, the possible outcomes can be:
{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}.
Thus, total number of possible outcomes = 8
Getting at least 2 tails includes {HTT, THT, TTH, TTT} outcomes.
So, number of desired outcomes = 4
Therefore, probability of getting at least 2 tails = 4/8 = 1/2

(ii) **Throwing an unbiased die:** Die is a small cube used in games. It has six faces and each of the six faces shows a different number of dots from 1 to 6. Plural of die is dice.
When a die is thrown or rolled, the outcome is the number that appears on its upper face and it is a random integer from one to six, each value being equally likely.

Problem 3: Find the probability of throwing a total of 8 in a single throw with two dice.
Solution: Two Dice are thrown, the total possible outcomes = 36.
Favourable outcomes = 5 i.e. (2, 6), (6, 2), (3, 5), (5, 3), (4, 4).
Therefore, Probability = 5 / 36

Problem 4: A dice is thrown, what is the probability that the number obtained is a prime number.
Solution: Dice is thrown, the total possible outcomes = 6.
Favourable outcomes = 3 i.e. (2, 3, 5). Probability = 3 / 6 = 1 / 2

(iii) **Drawing a card from a pack of shuffled cards:** A pack or deck of playing cards has **52 cards** which are divided into four categories as given below.

1. Spades (♠)
2. Clubs (♣)
3. Hearts (♥)
4. Diamonds (♦)

Each of the above-mentioned categories has **13 cards**, 9 cards numbered from 2 to 10, an Ace, a King, a Queen and a Jack. **Hearts and Diamonds** are **red faced** cards whereas **Spades and Clubs** are **black faced** cards. **Kings, Queens and Jacks are called face cards:**

Problem 5: Find the probability of getting a numbered card when a card is drawn from the pack of 52 cards.
Solution: Total Cards = 52.
Numbered Cards = (2, 3, 4, 5, 6, 7, 8, 9, 10) 9 from each suit $4 \times 9 = 36$
P (E) = 36/52 = 9/13

Problem 6: A card is drawn at random from a pack of 52 playing cards. Find the probability that the card drawn is
(i) a king
(ii) neither a queen nor a jack.
Solution: Total no. of cards = 52
So total no. of possible outcomes, n(S) = 52

a. Let E1 denotes the event of getting a king.
No. of kings in the pack = 4
n(E1) = 4
P(getting a king) = no. of favourable outcomes / total no. of possible outcomes of E
= n(E1)/ n(S)
= 4/52; = 1/13
Hence the required probability is 1/13.

b. Let E2 denotes the event of getting neither a queen nor a jack.
No. of queens and jack in the pack = 8
Remaining no. of cards = 52 - 8 = 44
n(E2) = 44
P(neither a queen nor a jack) = no. of favourable outcomes / total no. of possible outcomes of E
= n(E2)/ n(S)
= 44/52; = 11/13

(iv) **Taking a ball randomly from a bag containing balls of different colours.**

Problem 7: There are 5 green 7 red balls. Two balls are selected one by one without replacement. Find the probability that first is green and second is red.
Solution: P (G) × P (R) = (5/12) x (7/11) = 35/132

4. **Sample Space:** Sample Space is the set of all possible outcomes of an experiment. It is denoted by S.

Examples:

(i) When a coin is tossed, S = {H, T} where H = Head and T = Tail

(ii) When a dice is thrown, S = {1, 2 , 3, 4, 5, 6}

(iii) When two coins are tossed, S = {HH, HT, TH, TT} where H = Head and T = Tail

5. **Event:** Any subset of a Sample Space is an event. Events are generally denoted by capital letters A, B, C, D etc.

Examples:

(i) When a coin is tossed, outcome of getting head or tail is an event

(ii) When a die is rolled, outcome of getting 1 or 2 or 3 or 4 or 5 or 6 is an event

6. **Equally Likely Events:** Events are said to be equally likely if there is no preference for a particular event over the other.

Examples:

(i) When a coin is tossed, Head (H) or Tail is equally likely to occur.

(ii) When a dice is thrown, all the six faces (1, 2, 3, 4, 5, 6) are equally likely to occur.

7. **Mutually Exclusive Events:** Two or more than two events are said to be mutually exclusive if the occurrence of one of the events excludes the occurrence of the other

This can be better illustrated with the following examples:

Note: If A and B are mutually exclusive events, $A \cap B = \phi$ where ϕ represents empty set.

(i) When a coin is tossed, we get either Head or Tail. Head and Tail cannot come simultaneously. Hence occurrences of Head and Tail are mutually exclusive events.

(ii) When a die is rolled, we get 1 or 2 or 3 or 4 or 5 or 6. All these faces cannot come simultaneously. Hence occurrences of particular faces when rolling a die are mutually exclusive events.

(iii) Consider a die is thrown and A be the event of getting 2 or 4 or 6 and B be the event of getting 4 or 5 or 6. Then A = {2, 4, 6} and B = {4, 5, 6}

Here $A \cap B \neq \phi$. Hence A and B are not mutually exclusive events.

8. **Simple Events:** In the case of simple events, we take the probability of occurrence of single events.

Examples:

(i) Probability of getting a Head (H) when a coin is tossed.

(ii) Probability of getting 1 when a die is thrown.

9. **Probability of an Event**

Let E be an event and S be the sample space. Then probability of the event E can be defined as:

$$P(E) = \frac{n(E)}{n(S)}$$

where P(E) = Probability of the event E, n(E) = number of ways in which the event can occur and n(S) = Total number of outcomes possible

Examples:

(i) A coin is tossed once. What is the probability of getting Head?
Total number of outcomes possible when a coin is tossed = n(S) = 2 (∵ Head or Tail)
E = event of getting Head = {H}. Hence n(E) = 1

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{2}$$

(ii) Two dice are rolled. What is the probability that the sum on the top face of both the dice will be greater than 9?
Total number of outcomes possible when a die is rolled = 6 (∵ any one face out of the 6 faces)
Hence, total number of outcomes possible two dice are rolled, n(S) = 6 × 6 = 36
E = Getting a sum greater than 9 when the two dice are rolled
= {(4, 6), {5, 5}, {5, 6}, {6, 4}, {6, 5}, (6, 6)}
Hence, n(E) = 6

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

10. **Important Formulas**
P(S) = 1
0 ≤ P (E) ≤ 1
P(ϕ) = 0 (∵ Probability of occurrence of an impossible event = 0)

11. **Addition Theorem**
Let A and B be two events associated with a random experiment. Then, P(A U B) = P(A) + P(B) – P(A ∩ B)
If A and B are mutually exclusive events, then P(A U B) = P(A) + P(B) because for mutually exclusive events, P(A ∩ B) = 0

12. **Multiplication Rule**
When two events, A and B, are independent, the probability of both occurring is:
P(A and B) = P(A ∩ B) = P(A) × P(B)

Example: Two dice are rolled. What is the probability of getting an odd number in one die and getting an even number in the other die?
Total number of outcomes possible when a die is rolled, n(S) = 6 (∵ any one face out of the 6 faces)
Let A be the event of getting the odd number in one die = {1,3,5}.
=> n(A)= 3

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

Let B be the event of getting an even number in the other die = {2,4, 6} => n(B)= 3

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

Required Probability, P(A ∩ B) = P(A).P(B) = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Let A be any event and A^ be its complementary event (i.e., A^ is the event that A does not occur). Then:
P (A^) = 1 – P(A)

13. **Odds on an Event**
Let E be an event associated with a random experiment. Let x outcomes are favourable to E and y outcomes are not favourable to E, then

Odds in favour of E are $x : y$, i.e., $\frac{x}{y}$ and

Odds against E are $y : x$, i.e., $\frac{y}{x}$

$$P(E) = \frac{x}{x+y}$$

$$P(\bar{E}) = \frac{y}{x+y}$$

Example:
What are the odds in favour of and against getting a 1 when a die is rolled?
Let E be an event of getting 1 when a die is rolled
Outcomes which are favourable to E, x=1
Outcomes which are not favourable to E, y=5

$$\text{Odds in favour of getting 1} = \frac{x}{y} = \frac{1}{5}$$

$$\text{Odds against getting 1} = \frac{x}{y} = \frac{y}{x} = \frac{5}{1}$$

14. **Conditional Probability**
Let A and B be two events associated with a random experiment. Then, probability of the occurrence of A given that B has already occurred is called conditional probability and denoted by P(A/B)

Example: A bag contains 5 black and 4 blue balls. Two balls are drawn from the bag one by one without replacement. What is the probability of drawing a blue ball in the second draw if a black ball is already drawn in the first draw?

Let A be the event of drawing black ball in the first draw and B be the event of drawing a blue ball in the second draw. Then, P (B/A) = Probability of drawing a blue ball in the second draw given that a black ball is already drawn in the first draw.
Total Balls = 5 + 4 = 9
Since a black ball is drawn already, total number of balls left after the first draw = 8, total number of blue balls after the first draw = 4

$$P(B/A) = \frac{4}{8} = \frac{1}{2}$$

PROBLEMS:

1. A number is selected at random from the numbers 1, 2, 3…… 50. What is the probability that the number is a multiple of either 6 or 9?
   (a) 1/4 (b) 2/3 (c) 1/3 (d) 2/4

2. There are five hotels in a town. If 3 men check into the hotels in a day then what is the probability that each check into a different hotel?
   (a) 60/53 (b) 60/35 (c) 3/8 (d) 5/9

3. In a drawer there are 4 white socks, 3 blue socks and 5 grey socks. Two socks are picked randomly. What is the possibility that both socks are of same colour?
   (a) 4/11 (b) 1 (c) 2/33 (d) 19/66

4. On rolling a dice 2 times, the sum of 2 numbers that appear on the uppermost face is 10. What is the probability that the first throw of dice yields 5?
   (a) 2/36 (b) 1/36 (c) 1/6 (d) 1/5

5. Three cards are drawn successively, without replacement from a pack of 52 well shuffled cards. What is the probability that the first two cards are kings and the third card drawn is an ace?
   (a) 2/5530 (b) 3/5525 (c) 2/5525 (d) 4/5525

6. A family has two children. Find the probability that both the children are girls given that at least one of them is a girl?
   (a) 1/4 (b) 2/3 (c) 1/3 (d) 2/4

7. Find the probability of drawing a king, a queen, and a jack in order from a pack of cards in three consecutive draws, without replacement?
   (a) 1635139 (b) 64132600 (c) 12179 (d)162179

8. What is the probability of getting 2 Kings and 1 Queen when 3 cards are picked from a pack of 52 cards without replacement?
   (a) 4852*51*513 (b) 48*352*51*50 (c) 4523 (d) 452 *3

9. A 5- digit number if formed by the digits 1, 2, 3, 4 and 5 without repetition. What is the probability that the numbers thus formed are a multiple of 4?
   (a) 3/5 (b) 1/5 (c) 7/25 (d) 24/119

10. Ajay throws three dice in a special game of Ludo. If it is known that he needs 15 or higher in this throw to win, then find the chance of his winning the game.
    (a) 5/54 (b) 17/216 (c) 13/216 (d) 15/216

11. A man and his wife appear in an interview for two vacancies in the same post. The probability of husband's selection is (1/7) and the probability of wife's selection is (1/5).
    (i) What is the probability that only one of them is selected? _____
    (ii) What is the probability that both of them are selected? _____

(iii) What is the probability that none of them is selected? _____
(iv) What is the probability that at least one of them is selected? _____

12. From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings?
(a) 1/15 (b) 25/57 (c) 35/256 (d) 1/221

13. What is the probability that four S's come consecutively in the word MISSISSIPPI?
(a) 4/165 (b) 2/165 (c) 3/165 (d) 1/165

14. Three of six vertices of a regular hexagon are chosen at random. The probability that triangle with three vertices is equilateral, is equal to?
(a) 1/5 (b) 2/5 (c) 1/10 (d) 1/20

15. If all the rearrangements of the word AMAZON are considered, what is the probability that M will feature between the 2As?
(a) 1/3 (b) 1/6 (c) 2/5 (d) 3/8

HOMEWORK:

1. What is the possibility of having 53 Thursdays in a non-leap year?
(a) 1/7 (b) 6/7 (c) 1/365 (d) 53/365

2. A box contains 50 balls, numbered from 1 to 50. If three balls are drawn at random with replacement, what is the probability that the sum of the numbers is odd?
(a) 1/2 (b) 1/3 (c) 2/7 (d) 1/5

3. In a four-game match between Monica and Chandler, the probability that Chandler wins a particular game is 2/5 and that of Monica winning a game is 3/5. Assuming that there is no probability of a draw in an individual game, what is the chance that the match is drawn
(a) 213/625 (b) 211/625 (c) 216/625 (d) 1/4

4. There are 5 envelopes corresponding to 5 letters. If the letters are placed in the envelopes at random, what is the probability that all the letters are not placed in the right envelopes?
(a) 119/120 (b) 50/60 (c) 23/24 (d) 45/55

5. Doctors have devised a test for leptospirosis that has the following property: For any person suffering from lepto, there is a 90% chance of the test returning positive. For a person not suffering from lepto, there is an 80% chance of the test returning negative. It is known that 10% of people who go for testing have lepto. If a person who gets tested gets a +ve result for lepto (as in, the test result says they have got lepto), what is the probability that they actually have lepto?
(a) 7/10 (b) 8/11 (c) 1/3 (d) 1/2

MODULE 16
DATA INTERPRETATION

Data Interpretation is the process of reviewing provided data and using these data for calculating the required value. The data can be provided in various forms like in table format, pie chart, line graph, bar graph, or a combination of these.

Tips and Tricks for solving questions on Data Interpretation:

- Read the questions carefully
- Try to analyze the given data before solving the problems
- Do not make assumptions with regards to the data given
- For making simplification easier, consider approximate values

PROBLEMS:

Directions (Qs. 1 to 5): Study the following table and answer the questions based on it.

The table given below shows the data related to the performance of 6 batsmen in a cricket tournament.

Name of the batsman	Number of matches played in the tournament	Average runs scored in the tournament	Total balls faced in the tournament	Strike rate
Anil	8	-	-	130
Bradman	20	81	-	-
Ganguly	-	38	400	114
Dravid	-	-	-	72
Irfan	28	55	1280	-
Faulkner	-	-	-	66

Note:

i. Strike rate (Total runs scored/ Total balls faced) x 100
ii. All the given batsmen could bat in all the given matches played by them.
iii. Few values are missing in the table (indicated by -). A candidate is expected to calculate the missing value, if it is required to answer the given question, on the basis of the given data and information.

1. The respective ratio between the total number of balls faced by Dravid and that by Faulkner in the tournament, is 3 : 4. Total number of runs scored by Faulkner in the tournament is what percent more than the total runs scored by Dravid in the tournament?
(a) 22 2/9 % (b) 32 4/9% (c) 18 8/9% (d) 24 4/9%

2. If the runs scored by Irfan in the last 3 matches of the tournament are not considered, his average runs scored in the tournament will decrease by 9. If the runs scored by Irfan in the 26th and 27th

match are below 128 and no two scores among these 3 scores are equal, what are the minimum possible runs scored by Irfan in the 28th match?
(a) 137 (b) 135 (c) 141 (d) 133

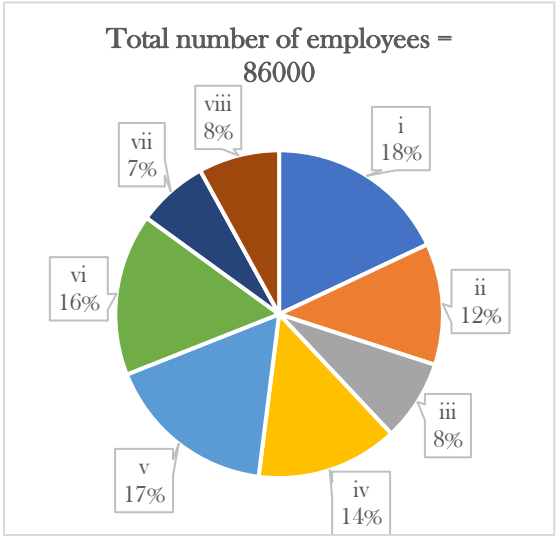
3. In the tournament, the total number of balls faced by Anil is 74 less than the total number of runs scored by him. What is the average run scored by Anil in the tournament?
(a) 42.5 (b) 39.5 (c) 38 (d) 40.5

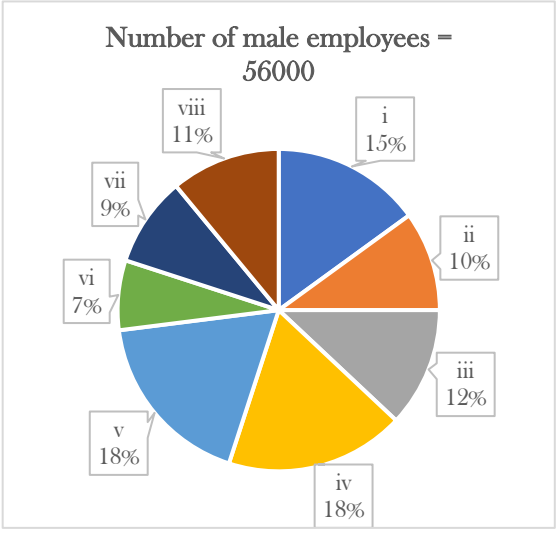
4. Bradman faced an equal number of balls in the first 10 matches he played in the tournament and the last 10 matches he played in the tournament. If his strike rate in the first 10 matches and the last 10 matches of the tournament are 120 and 150 respectively, then what is the total number of balls faced by him in the tournament?
(a) 1150 (b) 1400 (c) 1200 (d) 1000

5. What is the number of matches played by Ganguly in the tournament?
(a) 10 (b) 16 (c) 12 (d) 18

Directions (Qs. 6 to 10): Study the following chart and answer the questions based on it.

The pie – chart given below shows the percentage of employees of a company working in 8 different countries.





6. What is the ratio between the number of male employees and female employees in country II?
(a) 70:53 (b) 70:31 (c) 70:59 (d) 53: 70

7. What is the approximate average number of male employees in countries I, II and III?
(a) 9670 (b) 6970 (c) 6907 (d) 6977

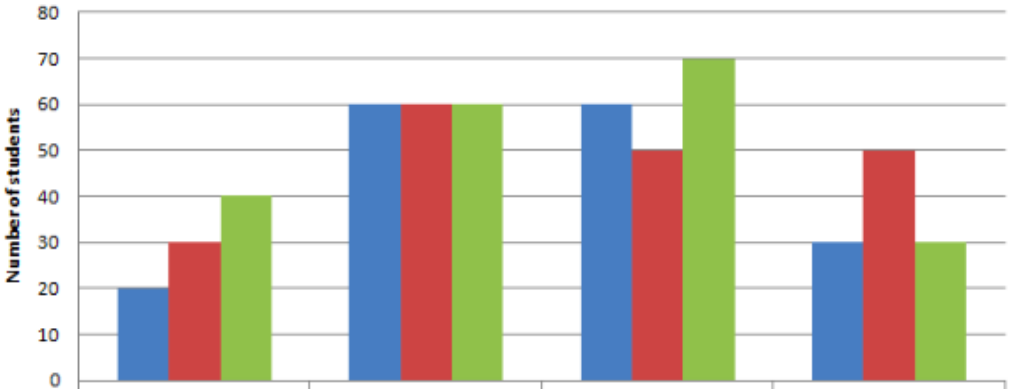
8. What is the average number of female employees in the countries IV and VII?
(a) 1370 (b) 1070 (c) 1570 (d) 1470

9. If an increase of 40% is made in the average number of female employees, working in countries II, III and IV, then their resulting average number will be?
(a) 2280 (b) 3192 (c) 3294 (d) 3680

10. By what approximate percent is the total number of employees in countries V, VI and VII more than the number of male employees working in the countries II, III and IV?
(a) 50.2% (b) 53.6% (c) 55% (d) 48%

Directions (Qs. 11 to 15): Study the following graph and answer the questions based on it.

The sub-divided bar diagram given below depicts the number of students who passed and failed the exams in the given years in a high school (H.S).



	1st division	2nd Division	3rd Division	Fail
2008	20	60	60	30
2009	30	60	50	50
2010	40	60	70	30

11. The percentage of students who passed the exam from 1st division in 2008 considering all the three divisions was?
(a) 27% (b) 32% (c) 15 3/8% (d) 11 13/17%

12. The pass percentage in 2008 was?
(a) 67% (b) 73% (c) 792/3% (d) 82 6/17%

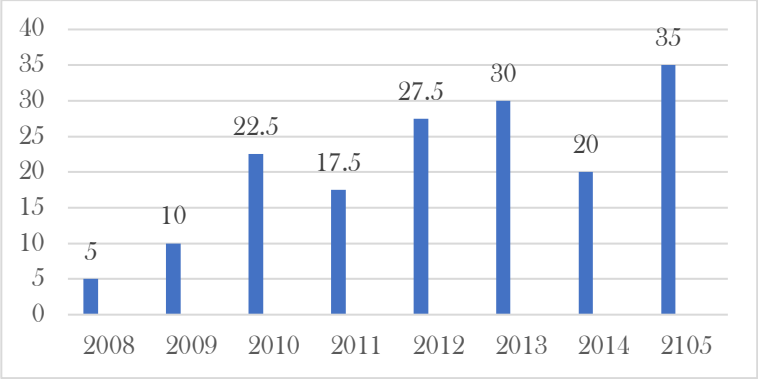
13. In which year the school had the best pass percentage?
(a) 2008
(b) 2009
(c) 2010
(d) The percentage of pass candidates is the same for the three years.

14. The number of students passed in third division in the year 2008 was?
(a) 50 (b) 60 (c) 70 (d) 80

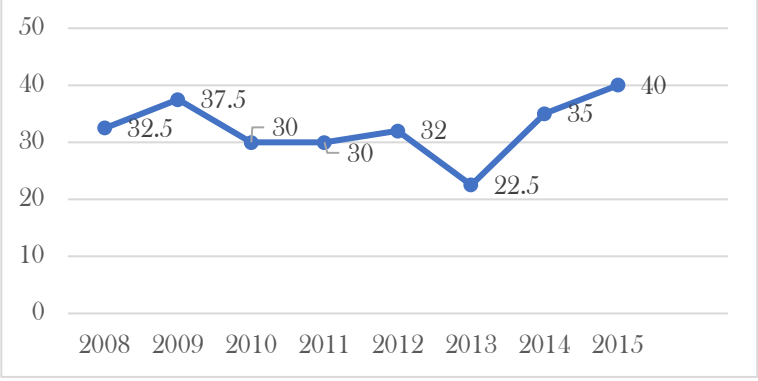
15. The percentage of the students passed in 2nd division in the year 2010 was?
(a) 30% (b) 40% (c) 50% (d) 60%

Directions (Qs. 16 to 20): Study the following graph and answer the questions based on it.

The bar graph given below shows the number of candidates who appeared (in '000) in a competitive examination during the period 2008 to 2015



The line graph given below shows the percentage of candidates who qualified in the examination during the period 2008 to 2015.



16. What is the respective ratio between the average number of candidates qualified in 2008, 2009 and 2010 and the average number of candidates qualified in 2013, 2014 and 2015?
(a) 94 : 157 (b) 97 : 222 (c) 93 : 173 (d) 92 : 159

17. In which of the following years was the number of candidates qualified in the competitive examination the lowest during the period 2008 to 2015?
(a) 2008 (b) 2011 (c) 2009 (d) 2014

18. Which year witnessed the maximum percentage change in the number of qualified candidates over the previous year?

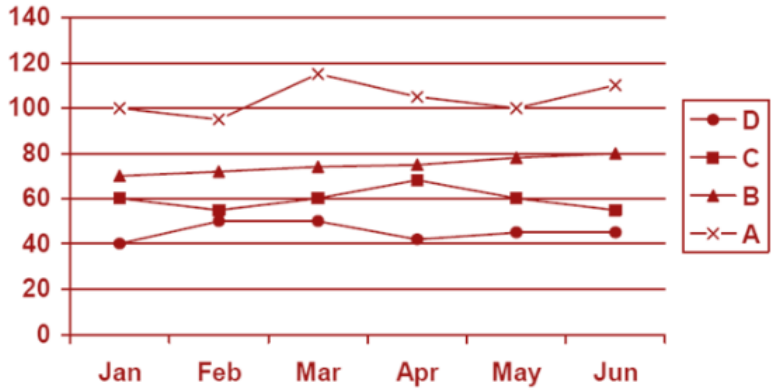
(a) 2012 (b) 2015 (c) 2014 (d) 2009

19. How many candidates qualified in 2013?
(a) 6750 (b) 7650 (c) 9900 (d) 5750

20. The number of candidates qualified in 2010 was what percentage of the number of candidates appeared in 2009?
(a) 68.5 (b) 70 (c) 32.5 (d) 67.5

Directions (Qs 21 - 25): Study the following graph and answer the questions based on it.

The graph below shows the end of the month market values of 4 shares for the period from January to June.



21. Which share showed the greatest percentage increase in market value in any month during the entire period?
(a) A (b) B (c) C (d) D

22. In which month was the greatest absolute change in market value for any share recorded?
(a) March (b) April (c) May (d) June

23. In which month was the greatest percentage increase in market value for any share recorded?
(a) February (b) March (c) April (d) May

24. An individual wishes to sell 1 share of C and 1 share of D to buy 1 share of A at the end of a month. At which month-end would the individual's loss from this decision, due to share value changes, be the most?
(a) February (b) March (c) April (d) June

25. An individual decides to sell 1 share of C and 1 share of D to buy 1 share of A at the end of the month. What can be the individual's greatest gain from this decision, due to share value changes?
(a) 5 (b) 10 (c) 15 (d) none

MODULE 17
AGES

Ages is defined as a period of time that a person has lived or a thing has existed. Problems based on ages generally consist of information of ages of two or more persons and a relationship between their ages in present/future/past. Using the information, we are asked to calculate the ages of one or more people in present/future/past.

1. The most important thing is to read the question carefully and gradually form the equation which shall help you answer the question.
2. Basic things like addition, subtraction, multiplication and division will help a candidate reach the answer and no complicated calculations are required to answer such questions.
3. Arrange the values given by placing them correctly in an equation by giving variables to the unknown values
4. Once the equation has been formed, solve the equation to find the answer.
5. The final step is to recheck the answer obtained by placing it in the equation formed to ensure that no error has been made while calculating.

Important formulas:

- If you are assuming the current age to be x, then the age after n years will be (x+n) years.
- If you are assuming the current age to be x, then the age before n years will be (x-n) years.
- If the age is given in the form of a ratio, for example, p : q, then the age shall be considered as qx and px.
- If you are assuming the current age to be x, then n times the current age will be (x*n) years
- If you are assuming the current age to be x, then 1/n of the age shall be equal to (x/n) years

PROBLEMS:

1. Tony is 15 years older than John. If 6 years ago, Tony was 3 times as old as John, then find Tony's present age.
   (a) 28.5 years (b) 27.5 years (c) 25 years (d) 24.9 years

2. Sara is 80 years old and Nazma is 70 years old. How long ago was the ratio of their ages 3 : 2?
   (a) 20 years (b) 30 years (c) 40 years (d) 50 years

3. One year ago, the ratio of Loraine's and Elizabeth's age was 5 : 6 respectively. After 4 years, this ratio becomes 6 : 7. How old is Elizabeth?
   (a) 25 years (b) 26 years (c) 31 years (d) 35 years

4. Age of the mother 20 years ago was 3 times the age of her son. After 20 years, the mother's age will be twice that of the son. Find the ratio of their present ages.
   (a) 2 : 1 (b) 9 : 5 (c) 7 : 4 (d) 7 : 3

5. In a family, a couple has a son and a daughter. The age of the father is five times that of his son and the age of the daughter is half of her mother. The husband is ten years older to his wife and his son is ten years younger than the daughter. What is the age of the father?

(a) 50 years (b) 45 years (c) 40 years (d) 35 years

6. 5 years ago, the sister's age was 5 times the age of her brother and the sum of present ages of sister and brother is 34 years. What will be the age of her brother after 6 years?
(a) 15 years (b) 13.5 years (c) 12 years (d) 20 years

7. The average age of a couple was 24 years. After their 1st and 2nd children (twins) were born, the average age of the family became 13.5 years. The average age of the family just after the 3rd child was born was 13.2 years. The average age of the family after the 4th child was born was 16 years. The current average age of the family is 19 years. What is the current age of the twin children?
(a) 14 years (b) 15 years (c) 11 years (d) 12 years

8. In an apartment complex, the number of people aged 51 years and above is 30 and there are at most 39 people whose ages are below 51 years. The average age of all the people in the apartment complex is 38 years. What is the largest possible average age, in years, of the people whose ages are below 51 years?
(a) 27 (b) 28 (c) 26 (d) 25

9. Ten years ago, the ages of the members of a joint family of eight people added up to 231 years. Three years later, one member died at the age of 60 years and a child was born during the same year. After another three years, one more member died, again at 60, and a child was born during the same year. The current average age of this eight – member joint family is nearest to?
(a) 23 years (b) 22 years (c) 21 years (d) 24 years

10. One year ago, the ratio of Hina and Priya ages was 2 : 3 respectively. After five years from now, this ratio becomes 4 : 5. How old is Priya now?
(a) 5 years (b) 25 years (c) 10 years (d) 15 years

11. The ratio of Sara's age 4 years ago and Veena's age after 4 years is 1 : 1. Presently, the ratio of their ages is 5 : 3. Find the ratio between Sara's age 4 years hence and Veena's age 4 years ago.
(a) 1 : 3 (b) 3 : 1 (c) 4 : 3 (d) 3 : 4

12. "I am ten times as old as you were, when I was as old as you are", said a man to his son. Find out their present ages, if the sum of their ages is 124 years?
(a) Father = 50; Son = 14 (b) Father = 40; Son = 24
(c) Father = 60; Son = 4 (d) Father = 80; Son = 44

13. What is the age of Teja?
A: Four years ago, Raju was as old as Teja is at present.
B: Sita's present age is two times of Raju's present age.
C: The average age of Teja and Sita is 19 years.
(a) Any two statements are sufficient to give the answer
(b) Only C is sufficient
(c) All of three statements are necessary to give the answer
(d) Even using all the three statements, answer cannot be found

14. When I was married 10 years ago my wife was the 6th member of the family. Today my father died and a baby was born to me. The average age of my family during my marriage was the same as it is today. What was the age of Father when he died?
(a) 50 years (b) 60 years (c) 70 years (d) 65 years

15. A woman says, "If you reverse my own age, the figures represent my husband's age. He is, of course, senior to me and the difference between our ages is one-eleventh of their sum." The woman's husband's age is?
(a) 45 (b) 24 (c) 42 (d) 54

HOMEWORK:

1. The sum of the ages of 5 children born at the intervals of 3 years each is 100 years. What is the age of the youngest child?
(a) 4 years (b) 8 years (c) 10 years (d) 12 years

2. The ages of three friends are in the ratio 11 : 5 : 13. What is the age of the youngest friend if the sum of their ages is 116 years?
(a) 21 years (b) 20 years (c) 19 years (d) 22 years

3. Amit is 60 years old and Sharvesh is 80 years old. How many years ago was the ratio of their ages 4 : 6?
(a) 10 years (b) 15 years (c) 20 years (d) 25 years

4. A is as much younger than B as he is older than C. If the sum of the ages of B and C is 50 years, what is definitely the difference between B and A's age?
(a) 1 year (b) 2 years (c) 25 years (d) Data inadequate

5. On a ruler's tombstone, it is said that one sixth of his life was spent in childhood and one twelfth as a teenager. One seventh of his life passed between the time he became an adult and the time he married; five years later, his son was born. Alas, the son died four years before he did. He lived to be twice as old as his son did. How old did the ruler live to be?
(a) 64 (b) 72 (c) 82 (d) 84

THE APTITUDE TRIAD

SECTION B
LOGICAL REASONING

MODULE 1
BLOOD RELATIONS

The questions related to blood relations involve various family members and their relations. The questions provide some information related to the different members of the family and we are required to identify the relationship between those particular members.

Type of questions:
The blood relation questions have several variations to test the understanding and interpretation capabilities of the students. The question types are divided into three categories such as:

- Direct conversation-based questions
- Puzzle based questions
- Symbols (or Code) based questions

The types can further be classified as:

- Single person blood relation and
- Mixed blood relation

The single person blood relation involves the relationship between two people only. The questions can be either direct or indirect. In mixed-blood relation, the relation between several members and hierarchy are considered. The different variations of questions are explained below along with an example each.

1. **Direct conversation-based questions:**
In direct conversation-based blood relation questions, a problem statement (in the form of conversation) is given and a particular relation is asked from the conversation. In general, these questions are single person blood relation types i.e. involving the relationship between two persons only. An example will illustrate this better.

Example 1:
Showing a photo of a man, Priya says, "His mother's only daughter is my mother". How is Priya related to the man in the photo?
Solution: Analyzing the sentence, it can be deduced that Priya's mother is the sister of the man in the photo. So, the man is the Uncle of Priya or Priya is the niece of that man.

2. **Puzzle Based Questions:**
In this type of question, the statements are given in the form of puzzles. The relations are mostly of mixed blood relation type and the candidates are required to decode the entire statement and identify the relationship between the given entities. Here is an illustration to explain this well.

Example 2:
A is B's sister. C is B's mother. D is C's father. E is D's mother. Then, how is A related to D?
Solution: A is the sister of B and B is the daughter of C.
So, A is the daughter of C. Also, D is the father of C.
So, A is the granddaughter of D.

3. **Symbol Based Questions**

Also known as coded blood relation questions, these involve a set of codes and the candidates are required to decode the sentences (or codes) to identify the relation of the given entities. Taking an example,

Example 3:

A + B indicates A is the brother of B;
A − B indicates A is the sister of B and
A x B indicates A is the father of B

Which of the following means that C is the son of M?

a) M − N x C + F
b) F − C + N x M
c) N + M − F x C
d) M x N − C + F

Solution:

Option A: N x C indicates N is the father of c. Hence it is wrong.
Option B: C is the brother of N who is the father of M. Hence it is wrong.
Option C: F x C indicates F is the father of C. Hence it is wrong.
Option D: M is the father of N who is the sister of C. Hence, C and N are siblings and C is the brother of F so, C is male, Hence C is the son of M. Option D is the correct answer.

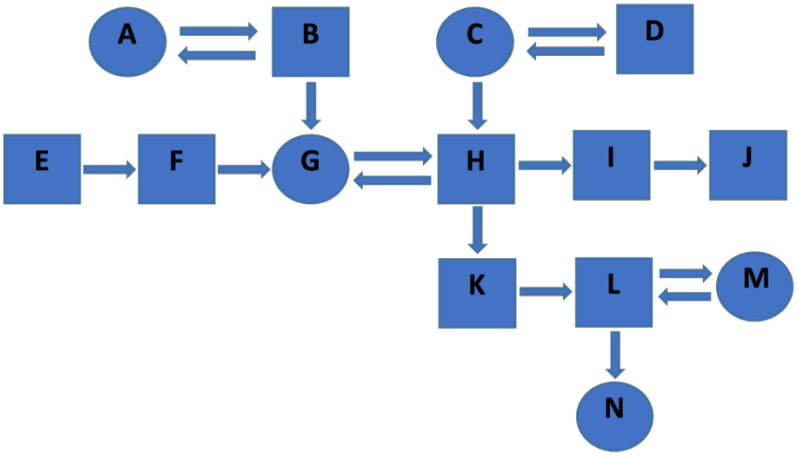
Pointers to remember before solving the blood relations:

- You cannot assume the gender of the person based on the name.
- If the statement says X is the son of Y, the gender of Y cannot be determined unless mentioned in the question.
- In puzzle-based questions, a web of relations can be formed, so do not solve such questions in a haste.
- These questions are scoring and easy to solve, so do not panic if the question seems lengthy.
- In case of coding-decoding blood relation, use a pictorial description to solve the question. This will make the symbols and relation more clear.

Family Tree

A family tree is a pictorial representation of genealogical data. The following points help in drawing a family tree.

1. All the female members of the family are represented by a circle. The name of the person is written inside the circle for convenience.
2. All the male members of the family are represented by a square. The name of the person is written inside the square for convenience.
3. The relation between two members of the family is shown by connecting a double-headed arrow.
4. The spouse relation is represented by the two ends of a double-headed arrow.
5. All the family members of the upper generation are represented above in the family tree. Ex: father, mother, uncle, aunt etc. The logic can be extended by representing the grandparents above the parents in the family tree. Ex: grandfather and grandmother.
6. All the family members of the same generation are represented in the middle of the family tree. Ex: brothers, Sisters, cousins, wife, husband, etc.
7. All the family members of the next generation are represented below in the family tree. Ex: Daughter, son, niece, nephew.



Observations from the family tree

1. K and L are brothers and M is the wife of L.
2. N is the daughter of L and M.
3. G is the mother of K and She has two brothers, E and F.
4. H is the father of K and the son of C and D.
5. A and B are husband and wife and are the parents of G, E and F.

Relationships at a glance:

Type of Relationship	Terminology in Use
Mother's or Father's son	Myself/Brother
Mother's or Father's daughter	Myself/Sister
Mother's or Father's brother	Uncle
Mother's or Father's sister	Aunt
Mother's or Father's father	Grandfather
Mother's or Father's mother	Grandmother
Son's wife	Daughter-in-law
Daughter's husband	Son-in-law
Husband's or wife's sister	Sister-in-law
Husband's or wife's brother	Brother-in-law
Brother's son	Nephew
Brother's daughter	Niece
Uncle or aunt's son or daughter	Cousin
Sister's husband	Brother-in-law
Brother's wife	Sister-in-law
Grandson's or Granddaughter's daughter	Great-granddaughter

PROBLEMS:

1. Sam's father is the only son of James's father. How is James related to Sam?
   (a) Father (b) Brother
   (c) Uncle (d) Cannot be determined

2. Geetha is the mother-in-law of Seetha who is the sister-in-law of Shyam. Kishore is father of Aditya, the only brother of Shyam. How is Geetha related to Shyam?
   (a) Mother-in-law (b) Aunt (c) Wife (d) Mother

3. Introducing Amit, Priyanshi said, "His brother's father is the only son of my grandfather". How is Priyanshi related to Amit?
   (a) Sister (b) Daughter (c) Mother (d) Niece

   Questions 4 and 5: Read the given information and answer the questions that follow.
   L, M, N, O, P and Q are six members of a family. N is not the mother of M but M is the son of N. L and N are a married couple. P is the brother of N. Q is the brother of M. O is the daughter of L.

4. Which of the following is a pair of females?
   (a) L, O (b) M, O (c) N, L (d) M, L

5. P's wife is _____.
   (a) L (b) N
   (c) Q (d) Cannot be determined

6. A ● B means A is the brother of B; A ★ B means A is the daughter of B; A ■ B means A is the sister of B. If A ■ B ■ C ★ D ★ E ● F ● G, then how many males and females are there respectively?
   (a) 4, 3 (b) 3, 4
   (c) 5, 2 (d) Cannot be determined

7. a @ b means a is the daughter of b; a # b means a is the husband of b; a $ b means a is the brother of b.
   From the above information, if A @ B $ C @ D $ E @ F $ G, then what is the present generation of A? Assume that the oldest generation in this group is the first generation.
   (a) 2nd (b) 3rd (c) 4th (d) None of these

8. If 'P + Q' means 'P is the brother of Q,' 'P * Q' means 'P is the wife of Q' and 'P @ Q' means 'P is the daughter of Q' then which of the following represents 'A is the son of D'?
   (a) A @C * B + D (b) A + C @ B * D (c) A*B + C @ D (d) A @ B * C + D

9. If 'P + Q' means 'P is the father of Q', 'P * Q means 'P is the sister of Q' and 'P / Q means 'P is the brother of Q', then which of the following represents 'N is the nephew of M'?
   (a) M * A / B + N (b) M * A + N / B (c) M / N + B (d) N + B / M

10. If 'P+Q' means 'P is the mother of Q', 'P/Q' means 'P is the daughter of Q' and 'P – Q' means 'P is the sister of Q', then which of the following represents 'A is the husband of B'?

(a) B + A – N (b) B / A + N (c) B + N / A (d) B / A / R

Questions 11 to 13: Read the given information and answer the questions that follow.
Amitabh has a family of eight members. Prakash is the eldest male member of the family. Radhika is the daughter-in-law of Ramya and sister-in-law of Dhanush and Surya. Apart from Amitabh and Prakash, only Dhanush is a male member in the family. Surya is the aunt of Amitabh's two daughters Diya and Anu.

11. How is Anu related to Dhanush?
(a) Grandmother (b) Mother (c) Niece (d) Aunt

12. Find the relation between Radhika and Diya?
(a) Sister-in-law
(b) Aunt – Niece
(c) Grandmother – Granddaughter
(d) Mother – Daughter

13. Who is the husband of Radhika?
(a) Amitabh
(b) Dhanush
(c) Prakash
(d) Cannot be determined

Questions 14 and 15: Read the given information and answer the questions that follow.
A, B, C, D, E, F and G are seven members in a family, out of which there are four males and three females. There are two singers, two dancers, one painter, one actor and one writer. No lady is either a painter or an actor. C is a dancer and is married to A, who is a painter. F, the actor, is married to D, who is neither a dancer nor a writer. No two ladies have the same profession. B is the sister of G, who is a singer.

14. What is E's profession?
(a) Singer
(b) Dancer
(c) Singer (or) Dancer
(d) Data Inadequate

15. Which of the following is the group of males?
(a) A, B, F and G (b) E, F, D and G (c) A, C, E and F (d) A, E, F and G

16. There are 6 members (A, B, C, D, E, F) in a family who are spread across 3 generations. There are two couples in the family and no one from the third generation is married. E is the wife of C. F and B are the only people belonging to their generation and they are also a couple. There are 4 male members in the family. Which of the following must be true?
(a) D is the grandson of A
(b) A and D belong to the same generation
(c) There is no female in the third generation
(d) E is the father of F

Questions 17 to 20: Read the given information and answer the questions that follow.
Mr. Rajat Chopra and his wife Nikita Chopra have 3 sons whose names are Ramesh, Suresh and Umesh. Mishra family is a neighbour of the Chopra's. Mr. Amit Mishra and his wife Neha Mishra have 2 daughters whose names are Payal and Ruchi. The two neighbouring families go to Kerala for a vacation. They decided to go boating but no boat could carry more than 3 members. So,

they hired 3 boats. None of the children knows how to row a boat, so at least one of the adults has to be there on each boat. Moreover, no boat has all three members of the same family.

17. If the three children from the Chopra family ride in different boats, then which of the following is definitely false?
(I) Rajat and Nikita are rowing in the same boat.
(II) Amit and Neha are rowing in the same boat.
(a) I Only (b) II Only (c) Both I and II (d) Neither I nor II

18. If Nikita and Amit are on the same boat, then which of the following cannot be the combination of people on any boat?
(a) Ramesh, Neha, Ruchi (b) Neha, Ramesh, Suresh
(c) Neha, Ruchi, Umesh (d) Neha, Suresh, Rajat

19. If Neha and Ruchi are on the same boat, which of the following could be a list of people on another boat?
(a) Ramesh, Amit, Payal (b) Ramesh, Suresh, Amit
(c) Ramesh, Payal, Suresh (d) Amit, Payal, Nikita

20. If Rajat and Amit are in the same boat and each of the three brothers are on different boats, then which of the following is necessarily true?
(a) Every boat has both males and females on it. (b) One of the boats has only females on it.
(c) One of the boats has only males on it. (d) The two sisters are on the same boat.

Questions 21 to 25: Read the given information and answer the questions that follow.
There is a family of six members A, B, C, D, E and F. There are two married couples in the family and the family members represent three generations. Each member has a distinct choice of a colour amongst Green, Yellow, Black, Red, White and Pink. No lady member likes either Green or White. C, who likes Black colour, is the daughter-in-law of E. B is the brother of F and son of D and likes Pink. A is the grandmother of F and F does not like Red. The husband has a choice for green colour, his wife likes Yellow.

21. Which of the following is true about F?
(a) Brother of B (b) Sister of B
(c) Either sister or brother of B (d) Daughter of C

22. Which of the following is one of the married couples?
(a) DA (b) AC (c) CD (d) None of these

23. How many male members are there in the family?
(a) Two (b) Three
(c) Four (d) Cannot be determined

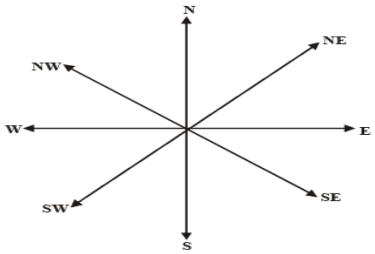
24. Which of the following is the colour combination of one of the couples?
(a) Yellow-Red (b) Green-Black (c) Red-Yellow (d) Yellow-Green

25. Which of the following is the colour preference of A?
(a) Yellow (b) Either Yellow or Red
(c) Cannot be determined (d) None of these

MODULE 2
DIRECTION SENSE TEST

General Directions:

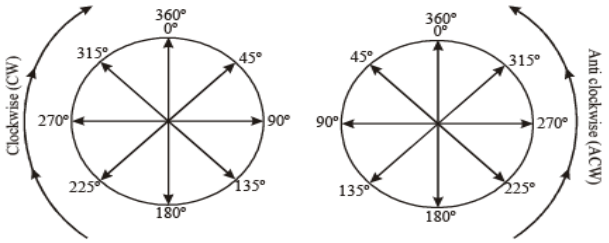
In general, there are four main directions i.e. North, South, East, and West. Apart from these four, there are four additional directions derived from the main ones. They are called North-East, North-West, South-East, and South-West. A chart is given below for reference.



Angle of Movement:

For solving questions based on the angle of movement, it is necessary to know the rotations which are given below

1. **The movement towards the right is called clockwise (CW) movement.**
2. **Movement towards the left is called anti-clockwise (ACW) movement.**



Points to remember:

1. At the time of sunrise if a man stands facing the east, his shadow will be towards west, i.e. behind him.
2. At the time of sunset the shadow of an object is always to the east.
3. If a man stands facing the North, at the time of sunrise his shadow will be towards his left, and at the time of sunset it will be towards his right.
4. At 12:00 noon, the rays of the sun are vertically downward hence there will be no shadow.
5. The shortest distance from a particular point after traveling a distance of x meters in the horizontal direction and a distance of y meters in the vertical direction is equal to $\sqrt{x^2 + y^2}$
6. The angle between any two main (or cardinal) directions is 90° but the angle between one main and one cardinal direction is 45°.

PROBLEMS:

1. Four friends Akshay, Bunty, Chanti, and Deepu live in the same locality. Their house of Bunty is to the east of Akshay's house but to the north of Chanti's house. The house of Chanti is to the west of Deepu's house. Deepu's house is in the direction of Akshay's house?

(a) South-East
(b) North-East
(c) East
(d) Data is inadequate

2. Rahul put his timepiece on the table in such a way that at 6 P.M. hour hand points to North. which direction the minute hand will point at 9.15 P.M.?
(a) South-East (b) South (c) North (d) West

3. If A x B means A is to the south of B; A + B means A is to the north of B; A % B means A is to the east of B; A - B means A is to the west of B; then in P % Q + R - S, S is in which direction with respect to Q?
(a) South-West (b) South-East (c) North-East (d) North-West

4. A river flows West to East and on the way turns left and goes in a semi-circle round a hillock, and then turns left at right angles. In which direction is the river finally flowing?
(a) North (b) South (c) East (d) West

5. If the South-East becomes North, North-East becomes West, and so on. What will the West become?
(a) South-East (b) North-West (c) North-East (d) South-West

6. A man is facing north. He turns 45 degrees in the clockwise direction and then another 180 degrees in the same direction and then 45 degrees in the anticlockwise direction. Which direction is he facing now?
(a) North (b) East (c) West (d) South

7. A child is looking for his father. He went 90 meters in the east before turning to his right. He went 20 meters before turning to his right again to look for his father at his uncle's place 30 meters from this point. His father was not there. From there, he went 100 meters north before meeting his father on a street. How far did the son meet his father from the starting point?
(a) 80 m (b) 90 m (c) 100 m (d) 110 m

8. Kunal walks 10 km toward the North. From there he walks 6 Km towards the South. Then, he walks 3 Km towards the east. How far and in which direction is he with reference to his starting point?
(a) 5 Km North
(b) 5 Km South
(c) 5 Km East
(d) 5 Km North - East

9. One evening before sunset two friends Amit and Gaurav were talking to each other face to face. If Gaurav's shadow was exactly to his left side, which direction was Amit facing?
(a) North
(b) South
(c) West
(d) Data Inadequate

10. Pooja traveled 100 km towards the South, then she took two turns of 45° each in a clockwise direction, and then she took one turn of 45° in the anti-clockwise direction. In which direction was she traveling finally?
(a) West (b) North (c) South-east (d) South-west

11. Ranjith cycles 5km north, 6 km east, 13 km south, and 5km west, 8 Km north. How far is Ranjith from his initial point?
(a) 2 Km (b) 1 Km (c) 3 Km (d) 0 Km

12. Ganesh cycles towards the South-West a distance of 8 m, then he moves towards the East a distance of 20 m. From there he moves towards North East a distance of 8 m, then he moves towards the West a distance of 6 m. From there he moves towards the North-East a distance of 2 m. Then he moves towards the West a distance of 4 m and then towards the South-West 2 m and stops at that point. How far is he from the starting point?
(a) 12 m (b) 10 m (c) 8 m (d) 6 m

13. A is standing 20 km to the West of B on a straight road. A and B start walking simultaneously eastwards and westwards respectively and both cover a distance of 5 km. Then A turns to his left and walks 10 km. B turns to his right and walks 10 km at the same speed. Then both turn to their left and cover a distance of 5 km at the same speed. What will be the distance between them?
(a) 10 km (b) 30 km (c) 20 km (d) 25 km

14. Sujit traveled 15 km to the west, then turned right and traveled 8 km. He turned left and traveled 9 km, then turned back and traveled 13 km. Then he turned right and traveled 8 km. How far is he from the starting point?
(a) 17 km (b) 9 km (c) 11 km (d) 7 km

15. Riya is standing at point B, facing South-West. She turns 315 degrees in the clockwise direction. Which direction will she be facing now?
(a) West (b) South-East (c) South-West (d) South

16. Rajesh is facing the South. He turns 180° followed by a turn of 45° in a clockwise direction. If he takes another turn of 135° in an anti-clockwise direction, then which direction is he facing now?
(a) East (b) North (c) South (d) West

17. If 3 O'clock in a watch. If the minute hand points towards the North east then the hour hand will point towards.
(a) Southwest (b) Southeast (c) Northwest (d) Northeast

18. One day, Raviraj left home and cycled 20 Km southwards, turned right and cycled 10 km and turned right and cycled 20 Km and turned left and cycled 20 Km. How many kilometers will he have to cycle to reach his home straight?
(a) 50 Km (b) 30 Km (c) 40 Km (d) 60 Km

19. Village Q is to the North of village P. Village R is to the East of Village Q. Village S is to the left of village P. In which direction is Village S with respect to Village R?
(a) West (b) South-West (c) South (d) North-West

20. One morning after sunrise, Suresh was standing facing a pole. The shadow of the pole fell exactly to his right. To which direction was he facing?
(a) East (b) South (c) West (d) Data Inadequate

MODULE 3
SERIES

NUMBER SERIES

The arrangement of numbers in a certain order, in which some numbers are placed wrongly in the series and some numbers are missing is called a number series.

Types of Number Series:

1. **Series consisting of Perfect Squares:**
   A series based on Perfect squares is most of the times based on the perfect squares of the numbers in a specific order & generally one of the numbers is missing in this type of series.
   Example: 324, 361, 400, 441, ?
   Solution: 324 = 18^2 , 361 = 19^2, 400 = 20^2, 441 = 21^2, 484 = 22^2

2. **Perfect Cube Series:**
   It is based on the cubes of numbers in a particular order and one of the numbers is missing in the series.
   Example: 512, 729, 1000, ?
   Solution: 8^3, 9^3, 10^3, 11^3

3. **Geometric Series:**
   It is based on either descending or ascending order of numbers and each successive number is obtained by dividing or multiplying the previous number by a specific number.
   Example: 4, 36, 324, 2916, ?
   Solution: 4 x 9 = 36; 36 x 9 = 324; 324 x 9 = 2916; 2916 x 9 = 26244

4. **Arithmetic Series:**
   It consists of a series in which the next term is obtained by adding/subtracting a constant number to its previous term.
   Example: 4, 9, 14, 19, 24, 29, 34 in which the number to be added to get the new number is 5.

5. **Two-stage Type Series:**
   In a two-step Arithmetic series, the differences of consecutive numbers themselves form an arithmetic series.
   Example: 1, 3, 6, 10, 15.....
   Solution: 3 - 1 = 2; 6 - 3 = 3; 10 - 6 = 4; 15 - 10 = 5....
   Now, we get an arithmetic sequence 2, 3, 4, 5.....
   Hence 6 will be added to the last number given, so the answer would be 15 + 6 = 21

6. **Mixed Series:**
   This particular type of series may have more than one pattern arranged in a single series or it may have been created according to any of the unorthodox rules.
   Example:10, 22, 46, 94, 190, ?
   Solution: 10 x 2 = 20 +2 = 22; 22 x 2 = 44 + 2 = 46; 46 x 2 = 92 + 2 = 94; 94 x 2 = 188 + 2 = 190; 190 x 2 = 380 + 2 = 382. So, the missing number is 382.

7. **Arithmetic – Geometric Series:**
   As the name suggests, the Arithmetic –Geometric series is formed by a peculiar combination of Arithmetic and Geometric series. An important property of Arithmetic - Geometric series is that the differences of consecutive terms are in Geometric Sequence.

Example: 1, 4, 8, 11, 22, 25, ?
Solution: Series Type +3 , × 2 (i.e. Arithmetic and Geometric Mixing)
1 + 3 = 4, 4 × 2 = 8, 8 + 3 = 11, 11 × 2 = 22, 22 + 3 = 25, 25 × 2 = 50

8. **Twin/Alternate Series:**
As the name of the series specifies, this type of series may consist of two series combined into a single series. The alternating terms of this series may form an independent series in itself.
Example: 3, 4, 8, 10, 13, 16, ? ?
Solution: As we can see, there are two series formed
Series 1: 3, 8, 13 with a common difference of 5
Series 2: 4, 10, 16 with a common difference of 6
So, the next two terms of the series should be 18 & 22 respectively.

LETTER SERIES:
In Letter Series, a string of alphabets, either in a single file or in combination form a sequence. This sequence comes together following a definite rule. Then it is expected to detect this rule and answer the questions. It can be forward, first half forward, second half forward, backward, first half backward, second half backward, multiple letter segments in changed order, word formation and letter position in word or series, etc.

1. **The Alphabet:**
There are 26 letters in the English language and in that, the letters from A to M, that is 13 letters are considered as the 1st half. While the letters from N to Z form the second half of the alphabet. Thus, you have to remember this concept of the first half and second half in the alphabet.
A to M (First half) = 1 to 13; N to Z (Second half) = 14 to 26

2. **Position number of letters in English:**

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

3. **Position number of letters in English alphabets in reverse:**

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

4. **Concept of EJOTY:**
The positions of alphabets can be remembered with the help of this simple concept, you can easily find out the position of any letter without much effort. But it is advisable that you learn the positions of different letters in the alphabet.

E	J	O	T	Y
5	10	15	20	25

For example, we are asked to find the 24th letter from the left side of the alphabet. We already know that the 25th letter from the left-hand side is Y, now we need to find the letter before Y and that is X. By using this simple method, we can easily find out the position of any letter in the alphabet. Memorizing the positions & sequence of letters is a basic way to solve any questions of this type, so you should try to memorize these positions. For this particular reason, you should practice EJOTY.

5. **Concept of VQLGB:**
Just like the concepts of EJOTY, the concept of VQLGB represents the position of the alphabet counting from the right at an interval of 5 letters.

V	Q	L	G	B
5	10	15	20	25

6. **From A Z (A to Z) letters are called 'left to right' or 'to right' in English alphabets.**

7. **From Z A (Z to A) letters are called 'right to left' or 'to left' in the English alphabet.**

Types of Letter series:

1. **One-lettered series:**
In lettered series, each term contains one letter and follows a certain pattern.
Example: B, F, J, N, ____
Solution: B = 2, F = 6, J = 10, N = 14. Here the difference between the letter is 4. So, the answer is 14 + 4 = 18 which is R.

2. **Two-lettered series**
In Two lettered series each term contains two letters and follows a certain pattern. We have to find out the next term according to that pattern.
Example: BY, CX, EV, GT, KP, __
Solution: The given series is a mixed series. The letters B, C, G, and K are the letters in prime value positions. Hence, the next letter is M. The second letter in each group forms an opposite pair of the first letter in that group. Hence, the next pair in the series is MN.

3. **Three-lettered series**
In Three lettered series each term contains three letters and follows a certain pattern. We have to find out the next term according to that pattern.
Example: What is the next letter in the series CNL, BLI, AJF, ZHC, ___
Solution: C = 3, B = 2, A = 1, Z = 26. (Decreasing by 1) So next letter is 25, which is Y.
N = 14, L = 12, J = 10, H = 8. (Decreasing by 2) So the next letter is 6, which is F.
L = 12, I = 9, F = 6, C = 3. (Decreasing by 3) So the next letter is 26, which is Z.

4. **Continuous pattern series**
In this type, a series of small/capital letters are given which follow a particular pattern. However, some letters are missing from the series. The series follows a specific pattern and candidates are required to find the letters which should come in place of the blank spaces or question marks.
Example: _ tu _ rt _ s _ _ usrtu _
Solution: rsurts
The series rtus/rtus/rtus/rtus. Thus, the pattern 'rtus' is repeated.

5. **Mixed series (Alpha-numeric series)**
In this type, the series is based on the combination of both letters and numbers. Each term in the series follows a certain pattern based on either the alphabetical position of the letters or the numbers in different correlations.
Example: Find the next term in the alpha-numeric series:
A2Z, C3X, E5V, G7T, I11R, K13P, ?
Solution: First, let us look at the first letters in each set: A, C, E, G, I, K – the pattern here is +2
Next, let us look at the last letters in each set: Z, X, V, T, R, P - the pattern here is -2

Next, let us look at the numbers in the given series. The series formed by the numerals are prime numbers i.e. 2, 3, 5, 7, 11, 13. So the next prime number is 17.
So, the missing term would be M17N

PROBLEMS:

NUMBER SERIES

1. 18, 37, 76, 155, ___, 633, 1272
   (a) 322 (b) 314 (c) 341 (d) 250

2. -1, 0, 1, 0, 2, 4, 1, 6, 9, 2, 12, 16, ? ? ?
   (a) 11, 18, 27 (b) -1, 0, 3
   (c) 3, 20, 25 (d) Cannot be ascertained

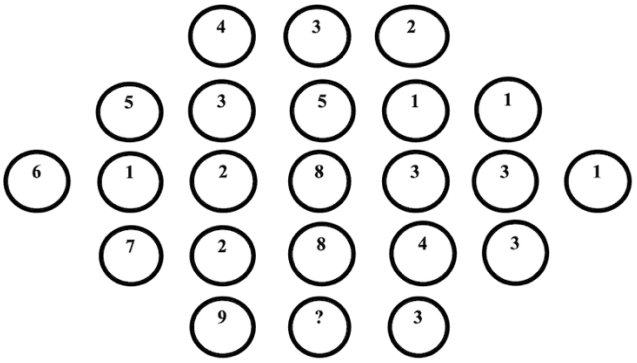
3. Find the odd man out: 253, 136, 352, 324, 631, 244
   (a) 324 (b) 136 (c) 352 (d) 631

4. Find the odd man out: 16, 25, 36, 72, 144, 196, 225
   (a) 225 (b) 196 (c) 72 (d) 36

5. 17, 19, 23, 29,? , 37
   (a) 31 (b) 33 (c) 35 (d) 37

6. Find the wrong term in the series: 10, 26, 74, 218, 654, 1946, 5834
   (a) 654 (b) 26 (c) 1946 (d) 218

7. What number should replace the question mark?



   (a) 1 (b) 4 (c) 12 (d) 6

8. Find the missing number in the following set:

2	4	6	8	10
2	14	34	?	98

   (a) 30 (b) 62 (c) 42 (d) 78

9. In this number grid insert the missing number at the sign of interrogation.

8	4	9	5
5	7	3	4
3	4	5	8
39	44	60	?

(a) 62 (b) 72 (c) 60 (d) 70

10. 2, 3, 18, 115, 854, ?
(a) 7776 (b) 7767 (c) 6676 (d) 6667

11. Find the odd man out: 35, 19, 11, 7, 5, 4.5, 3.5
(a) 3.5 (b) 4.5 (c) 19 (d) 7

12. 21, 77, 165, 285, ?
(a) 437 (b) 869 (c) 591 (d) 525

13. 15, 51, 216, 1100, ?, 46452
(a) 6530 (b) 6560 (c) 6630 (d) 6650

14. 4, 18, 100, 294, _____
(a) 1000 (b) 1100 (c) 1210 (d) 1452

15. 2, 30, 130, 350, ___
(a) 512 (b) 520 (c) 729 (d) 738

16. 12, 54, 144, 300, 540, 882, ?
(a) 1234 (b) 1314 (c) 1344 (d) 1446

17. Find the next number in the following series: 2, 6, 12, 20, 30, 42, 56, ?
(a) 61 (b) 64 (c) 72 (d) 70

18. Find the odd man out: 125, 106, 88, 76, 65, 58, 53
(a) 125 (b) 106 (c) 88 (d) 76

19. Find the odd man out: 1, 3, 10, 21, 64, 129, 356, 777
(a) 3 (b) 64 (c) 129 (d) 356

20. Find the odd man out: 3, 7, 15, 39, 63, 127, 255, 511
(a) 15 (b) 39 (c) 63 (d) 127

LETTER SERIES

1. Which letter should be the tenth letter to the left of the ninth letter from the right, if the first half of the alphabets of English is reversed?
(a) D (b) F (c) E (d) I

2. What is the next term in the following series? ABE, BCF, CDG, DEH, EFI, _____
(a) FGK (b) FGJ (c) FGL (d) None of these

3. Find the missing term: ABXW, EFTS, ?, MNLK
(a) IJOP (b) IJPO (c) JIOP (d) JIPO

4. Find the next term in the series: R, K, F, C, ?
(a) A (b) D (c) E (d) I

5. Find the missing term: PKC, SPF, XSK, AXN, __, IFV
(a) CAQ (b) FCS (c) FAS (d) CFS

6. Find the next terms in the following series: N, O, M, P, L, Q, K, R, _ _ _
(a) J, S, I (b) G, S, I (c) G, S, J (d) G, T, J

7. What is the next term in the following series: O, T, T, F, F, S, S, ____
(a) P (b) T (c) E (d) R

8. Find the next letter in the following sequence: y, w, v, t, r, p, n, ?
(a) m (b) l (c) k (d) j

9. The word CONGRATULATIONS is first written in reverse order and then written in alphabetical order. The letters remaining in the same position are?
(a) 0 (b) 1 (c) 2 (d) 3

10. Complete the series: E-5, G-7, I-9, K-11, ?
(a) L-13, N-14 (b) L-12, M-14 (c) M-13, O-15 (d) K-12, M-14

11. In the question below, three incomplete rows of letters/numerals are given which correspond to each other in some way. Find the letters/numerals which come in the vacant places marked by "?"

-	A	D	A	C	B	-	-	B	D	C	C
1	3	-	-	1	2	4	2	-	-	-	-
a	-	-	b	-	-	c	d	?	?	?	?

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

12. Select the correct option to fill in the blank space/s:
c_bba_cab_ac_ab_ac
(a) b,c,b,a,c (b) c,a,b,c,b (c) a,c,c,b,c (d) a,c,b,c,b

13. Find the missing alphabet.

H	C	?
B	F	E
P	R	T

(a) Y (b) O (c) D (d) G

14. Select the correct option to fill in the blank space/s:
D_F_DEE_D_EF_DE_F
(a) EFFDED (b) EFFDDF (c) EFFDFE (d) None of these

15. Complete the following series: TBLD, VEPI, XHTN, ?
(a) ZJVP (b) ZVJP (c) ZKXS (d) ZKXP

16. What is the next letter in the series? U, F, Q, J, M, N, ?
(a) I (b) T (c) O (d) M

17. Replace the question mark with the right option: BZ, HT, NN, ? , ZB
(a) LF (b) SX (c) TH (d) TI

18. The letters skipped between adjacent letters are in the order of 1, 2, 3, 4… Which alternative follows this rule?
(a) EFJNS (b) EGJOS (c) EGJNS (d) EGJNT

19. Find the missing term:
ABCDEFG, GABCDEF, FGABCDE, ?
(a) EFGABCD (b) GABCDEF (c) EFGABCDE (d) FGABCDE

20. What is the next term in the following series?
ZYXWTSRQNMLK
(a) I (b) G (c) H (d) J

MODULE 4
CODING AND DECODING

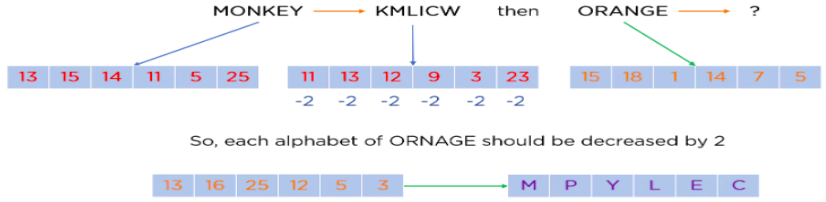
Coding is a process used to encrypt a word, a number in a particular code or pattern based on some set of rules. Decoding is a process to decrypt the pattern into its original form from the given codes.

Types of Coding-Decoding with examples:

1. **Letter Coding**

Letter Coding is a type in which the letters are replaced with other letters.

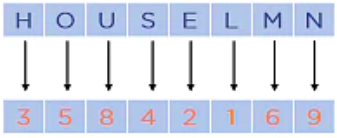
Example 1: MONKEY is coded as "KMLICW", then what should be the code for ORANGE?
Solution: To solve these kinds of problems, you have to remember that every alphabet has a specific number. So, according to the question,

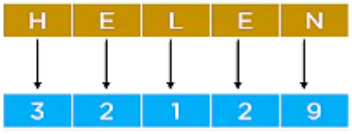


So, ORANGE would be coded as MPYLEC.

2. **Number Coding**

In the Number Coding section of reasoning ability, the candidate will have to observe and guess the hidden code of two or more sets of numbers. Once the parent code is known, the candidate will have to use this code to generate other numbers.
Example 2: If "HOUSE" is coded as 35842, and LEMON is coded as 12659, then what would be the code for HELEN?
Solution: The code of every letter is already specified in the question itself, so no need to use fixed codes of the letters.





3. **Substitution Coding**

In substitution coding, it assigns particular objects to code names. Then a question is asked to solve the answer in the same pattern. Now, have a look at the example for a clear understanding.
Example 3: If 'white' is called 'red', and 'red' is called 'blue', 'blue' is called 'green', 'green' is called 'yellow', 'yellow' is called 'black', and what is the colour of blood?
Solution: As we know, the blood is red. So if you observe the above question, it is mentioned that red is called blue. So, the colour of blood is blue.

4. **Mixed Letter Coding**

In this type of question, three or four complete messages are provided in the coded language, and the code for the particular word is asked. To analyze such codes, and if any two messages bearing the common word, are picked. The common code word will be that word.

Example 4: In a code language, 'ha ka bow' means 'how are you'; 'ka te ma' means 'where are they'; 'se re tho' means 'good and bad'. **What does 'are' stand for?**
If you observe the question, the word 'ka' is mentioned that both the 1st and 2nd statements and the corresponding common word is 'are'.
So, according to mixed letter coding, 'are' stands for 'ka'.

5. **Mixed Number Coding**
In this mixed number-coding question, three or four complete messages are given in the coded language, and the code number for a particular word is asked.

Example 5: If 'the monster hunter' is coded as 324, 'will be the' is coded as 476, and 'they are in' is coded as 158. Which digit represents 'the'?
Solution: If you observe the question in two statements, 'the' is repeated, and in both the two statements, the only repeated letter is 4.
So, as per mixed number coding, the exact code for 'the' is '4'.

PROBLEMS:

1. If, 1111 = r, 2222 = t, 3333 = e, 4444 = n, 5555 =?
(a) w (b) x (c) y (d) z

2. If in a coded language, 45 = 41, 23 = 13, 52 = 29, 71 = 50, then what will 29 = ?
(a) 23 (b) 26 (c) 53 (d) 85

3. GOOD is coded as 164 and BAD is coded as 21. If UGLY is coded as 260 then JUMP will be coded as?
(a) 240 (b) 140 (c) 136 (d) 180

4. If MAPLE is coded as VOKZN then how will CAMEL be coded?
(a) OVNZF (b) OUNZX (c) OVNZX (d) XZNVO

5. If SAVOURY is coded as OVUARSY then how will RADIATE be coded?
(a) AIDARET (b) IDARATE (c) ARIADTE (d) IDAATRE

6. If BURNER is coded as CASOIS then how will ALIMENT be coded?
(a) BKJLFMU (b) EKOLIMS (c) EMONIOU (d) BRJSFTU

7. In a certain code CORDIAL is written as SPDCMBJ. How is SOMEDAY written in that code?
(a) NPTDEBZ (b) NPTFZBE (c) NPTDZBE (d) None of these

Directions for Qs. 8 to 12: Study the following information and answer the given questions:
In a certain code 'best way to win' is written as 'ad mi ja no', 'the way to hell' is written as 'ku ja ig ad'. 'win of the day' is written as 'be ku zo mi' and 'to sell of night' is written as 'be li ya ja'.

8. What is the code for 'sell'?
(a) be (b) li (c) ya (d) Cannot be determined

9. 'mi' is the code for?
(a) to (b) win (c) way (d) of

10. What is the code for 'best'?
(a) ad (b) mi (c) no (d) ja

11. Which of the following may represent 'hell is way'?
(a) ad re ig (b) ig li re (c) re ad be (d) ig py ya

12. Which of the following represents 'of the way'?
(a) rni be no (b) ku be ad (c) ku be ya (d) mi ku be

13. If the word 'EXAMINATION' Is coded as 56149512965, then the word GOVERNMENT' is coded as:
(a) 7645954552 (b) 7654694562 (c) 7645965426 (d) 7654964526

14. In a certain code language "TERMINAL" is written as "NSFUMBOJ" and "TOWERS" is written as "XPUTSF". How is "MATE" written in that code?
(a) FUBN (b) UFNB (c) BNFU (d) BNDS

15. In a certain code TEMPORAL is written as OLDSMBSP. How is CONSIDER written in that code?
(a) RMNBSFEJ (b) BNMRSFE (c) RMNBJEFS (d) TOPDQDCH

Directions for questions 16 to 19: In each of the following questions, a word is represented by only one set of numbers as given in any one of the alternatives. The sets of numbers given in the alternatives are represented by two classes of alphabets as in the two given matrices. The columns and rows of Matrix I are numbered from 0 to 4 and those of Matrix II from 5 to 9. A letter from these matrices can be represented first by its row and then the column number e.g., in the matrices for questions 1 to 4, M can be represented by 14, 21, etc.; O can be represented by 20, 32, etc. Similarly, you have to identify the correct set for the word given in each question.

Matrix I

	0	1	2	3	4
0	F	O	M	S	R
1	S	R	F	O	M
2	O	M	S	R	F
3	R	F	O	M	S
4	M	S	R	F	O

Matrix II

	5	6	7	8	9
5	A	T	D	I	P
6	I	P	A	T	D
7	T	D	I	P	A
8	P	A	T	D	I
9	D	I	P	A	T

16. MOST
(a) 40, 44, 22, 89
(b) 33, 20, 11, 79
(c) 21, 00, 03, 88
(d) 02, 13, 34, 56

17. ROAD
(a) 42, 32, 79, 58
(b) 23, 32, 98, 99
(c) 11, 13, 67, 69
(d) 04, 20, 55, 78

18. STOP
(a)10, 56, 44, 97
(b) 41, 68, 01, 77
(c) 22, 75, 32, 86
(d) 33, 99, 42, 59

19. FOAM
(a) 24, 01, 55, 22
(b) 00, 01, 67, 33
(c) 12, 13, 67, 23
(d) 43, 52, 56, 33

20. In a certain code, WORKABLE is written as VOYZPILD, how will BLUNDERS be written in same code?
(a) CMVOEST
(b) TSEOVMC
(c) YOFMWVIH
(d) HIVWMFOY

21. If white is called blue. blue is called red, red is called yellow, yellow is called green, green is called black, black is called violet and violet is called orange, what would be the colour of human blood?
(a) Red (b) Green (c) Yellow (d) Violet

22. If 'sky' is called 'star', 'star' is called 'cloud', 'cloud' is called 'earth', 'earth' is called 'tree', and 'tree' is called 'book', then where do the birds fly?
(a) Cloud
(b) Sky
(c) Star
(d) Data Inadequate

23. In a certain language, 'sun shines brightly' is written as 'ba lo sul', 'houses are brightly lit' as 'kado ula ari ba' and 'light comes from sun' as 'dopi kup lo nro'. What is the code for sun and bright?
(a) ba sul (b) sul lo (c) lo ba (d) ba nro

24. In a particular language, "TOM KUN SUD" means 'Boys are playing'; 'KUN JO MOP" means 'Boys and Girls' and "MUT TOM KO" means 'Life is Beautiful'. How is Boys coded as?
(a) TOM (b) KUN (c) MUT (d) JO

25. In a certain code language, 'dom pul ta' means 'bring hot food', 'pul tir sop' means 'food is good' and 'tak da sop' means 'good bright boy'. Which of the following does mean 'hot' in that language?
(a) dom
(b) pul
(c) ta
(d) Cannot be determined

MODULE 5
ANALOGY

Analogy is a topic of Logical Reasoning where two things are compared and conclusions are drawn based on their similarities.

Types of Analogy Reasoning:

1. **Numerical Analogy (Odd One Out)** – A set of options may be given based on a certain pattern, and one of them may be unlikely to follow the pattern, and students need to choose the odd one out.
   Example 1: From the given options, find the pair which is similar to the given pair: 8:4
   27:9, 216:32, 72:24, 45:5, 37:13
   Solution: The pattern followed is "Cube of a number: square of the same number"
   So, (2×2×2) : (2×2) = 8:4 ; Similarly, (3×3×3) : (3×3) = 27:9

2. **Numerical Analogy (Choose a similar pair)** – An analogy may be given in the question and students may have to find a similar analogy, based on the same pattern from the given options.
   Example 2: 11 : 121 :: 13 : ___
   Solution: The answer is clearly 169 as $11^2 = 121$. Therefore, $13^2 = 169$

3. **Alphabetical/Word Analogy (Odd One Out)** – Options for different word analogies may be given, in which one may not be following the set pattern, students need to find that odd one out from the given options.
   Example 3: From the given options, choose the odd one out.
   Bangladesh : Taka, Brazil : Real, Cyprus : Dollar, Iran : Rial, Japan : Yen
   Solution: Cyprus: Dollar; All the other options given are correct in terms of country and currency. The currency of Cyprus is Euro

4. **Alphabetical/Word Analogy (Choose a similar pair)** – An analogy may be given based on a set pattern and students may have to find the word analogy pair from the given options, which follows the exact same pattern.
   Example 4: What shall come in place of the (?) Questions mark?
   Flow: River:: Stagnant: ?
   Options: Canal, Dam, Ocean, Pool
   Solution: Pool; Water in river flows whereas the water in a pool is stagnant

PROBLEMS:

LETTER ANALOGY:

1. RT : QU :: VX : ?
   (a) WY (b) TW (c) YW (d) UY

2. HJIK : MONP :: PRQS : ?
   (a) UVWX (b) UWVX (c) UXWV (d) UWXV

3. AU : EQ :: EO : ?
(a) FJ (b) IK (c) LN (d) GN

4. MAD : JXA :: RUN : ?
(a) OSQ (b) PRJ (c) ORK (d) UJX

5. NUMBER : UNBMRE :: GHOST : ?
(a) HGSOT (b) TSOGH (c) OGHST (d) SOTGH

6. TNGP : 2014716 :: LPDT : ?
(a) 2041612 (b) 1216204 (c) 2116420 (d) 1216420

7. BUCKET : ACTVBDJLDFSU :: BONUS : ?
(a) ACMNMOTVRT (b) SUNOB
(c) ACNPMOTVRT (d) ACMNMOTURT

8. TZ : GA :: QR : ?
(a) KN (b) RS (c) NQ (d) JI

9. HIJK : 6481100121 :: OPQR : 225256289324
(a) 22525628932 (b) 22525628324 (c) 225256289324 (d) 22256289324

10. ZSTK : WOQG :: RVMP : ORJL
(a) LJOR (b) ORLJ (c) ORJL (d) JLOR

NUMBER ANALOGY:

11. 986 : 53 :: 725 : ?
(a) 25 (b) 39 (c) 34 (d) 35

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

13. 25 : 175 :: 32 : ?
(a) 150 (b) 170 (c) 162 (d) 160

14. 25 : 343 :: 32 : ?
(a) 125 (b) 216 (c) 512 (d) 81

15. 85 : 55 :: 95 : ?
(a) 81 (b) 65 (c) 72 (d) 25

16. 74 : 65 :: 36 : ?
(a) 39 (b) 54 (c) 45 (d) 90

17. 3 : 10 :: 8 : ?

(a) 10 (b) 13 (c) 17 (d) 14

18. 17 : 19 :: 47 : ?
(a) 53 (b) 59 (c) 41 (d) 34

19. 57 : 126 :: 267 : ?
(a) 546 (b) 545 (c) 550 (d) 549

20. 210 : 130 :: 212 : ?
(a) 131 (b) 132 (c) 133 (d) 134

WORD ANALOGY:

21. Air : Ubiquitous :: Fire : ?
(a) Explosion (b) Oxygen (c) Water (d) Luminosity

22. Monotony : Variety :: Crudeness : ?
(a) Refinement (b) Raw (c) Sobriety (d) Simplicity

23. Roentgen is related to X-rays in the same way as Becquerel is related to _____?
(a) Uranium (b) Gamma Rays (c) Fission (d) Radioactivity

24. Horse : Gallop :: Duck : ?
(a) Strut (b) Waddle (c) Prowl (d) Trot

25. Tectonics : Building :: Taxidermy : ?
(a) Classification (b) Conserving (c) Stuffing (d) Collecting

26. TRIAL : JURY :: ?
(a) Dispute: Arbiter (b) Poll: Contestant
(c) Championship: Spectator (d) Conference: Speaker

27. Connoisseur : Art :: Gourmet : ?
(a) Food (b) Money (c) Drink (d) Flesh

28. Diamond : Baseball :: Court : _____
(a) Poker (b) Jury (c) Grass (d) Squash

29. Dawn : Dusk :: Inauguration : ?
(a) Invitation (b) Valediction (c) Repetition (d) Organization

30. MIRROR : 90 : : TERROR: ?
(a) 90 (b) 93 (c) 94 (d) 91

MODULE 6
SEATING ARRANGEMENT

The seating arrangement is the logical arrangement of either objects or people in a logical manner. One has to either perform the arrangement to answer the questions or decode the predefined arrangement by applying logical analysis.

1. **Linear arrangement:**
   The arrangement here is in linear form i.e. the group should be arranged in a line. A single row forms the linear arrangement.
   Ex: The row of travellers in a train, students in a prayer hall, etc.

2. **Rectangle arrangement:**
   This type of arrangement is almost similar to the circular arrangement the only notable difference being instead of a round table there is a rectangular table in between the group of people sitting.

3. **Circular arrangement:**
   In this arrangement, the group is seated around a round table.
   There are two types of circular arrangement:
   (i) **Facing the centre:** In this arrangement, every object or person in the arrangement will be facing the centre of the circle. Example: Group discussion, playing cards, etc.
   (ii) **Facing outwards:** In this arrangement, every object or person in the arrangement will be facing outwards. Example: Playing musical chairs.

4. **Double-row arrangement:**
   Normally, in this type of arrangement, there are two groups of people. You need to arrange one group in one row and the second group in another row. The people in this arrangement normally face each other.

Important concepts:
These questions have two types of information:

1. **Direct information:** This is the information that is clearly mentioned in the statement of the question. This is the information that you will use when you start solving the questions.
2. **Indirect information:** After filling in the direct information you will look for the connection between different parts of the information. These connections form indirect information.

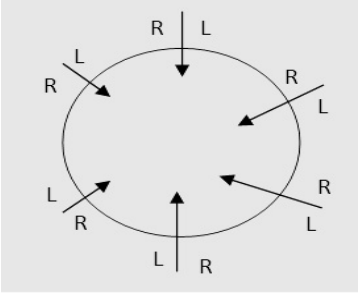
Linear Arrangements:
While arranging the persons, the direction to which the people are facing is very important.
Let us take the case of linear arrangements. Here if it is stated that there are five persons sitting facing North then the arrangement will be like

On the other hand, if these people are sitting facing South, then the arrangement will be like

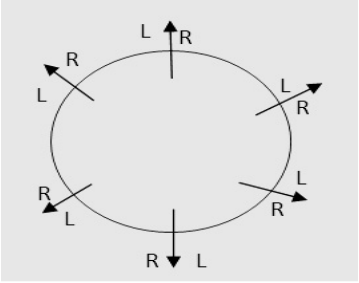
Similarly, if the arrangement is a double row arrangement, then one group of people will be facing north and the second will face south and the directions will be taken as similar to the above figures.

Circular Arrangements:

In the case of circular arrangements questions, or rectangular arrangements, the persons may be facing the centre of the circle or they may be looking away from the centre. If they are looking towards the centre, then the right-hand side will be in the anticlockwise direction and left-hand side will be in the clockwise direction as shown below:



If the persons are looking away from the centre then the right-hand side will be in the clockwise direction and left-hand side will be in the anti-clockwise direction as shown below:



The same concept of directions follows if the persons are sitting around a rectangular table.

PROBLEMS:

Directions for questions 1 and 2: Five boys Ashwin, Dipesh, Eshan, Chetan, and Bipin, and five girls Parul, Komal, Radha, Savita, and Vimla sit in two rows facing towards each other. All the boys are in one row and all the girls are in the other row. Eshan who is to the immediate right of Bipin and opposite Parul is not at an end. Radha, who is immediately to the right of Komal and opposite Chetan, is at one of the ends. Ashwin is opposite Komal who is third to the right of Savita. Dipesh and Vimla are not opposite each other.

1. Who is opposite to Dipesh?
   (a) Komal (b) Savita (c) Parul (d) Radha

2. Who is to the immediate right of Parul?
   (a) Radha (b) Savita (c) Vimla (d) Komal

Directions for questions 3 to 7: Eight friends, viz. Manu, Ritu, Tinku, Rishi, Alka, Rohan, Sony, and Akash, sit in a row having chairs numbered one to eight in ascending order from left to right. They all are facing North. Tinku sits on chair number six. There are exactly two people between Tinku and Manu. Ritu and Akash always sit adjacent to each other. Sony sits adjacent to neither Manu nor Tinku. Alka never sits on a chair having an odd number on it. Neither Ritu

nor Akash sits on chair number four. There is only one person between Rohan and Ritu. Alka sits on the right (not necessarily immediate right) of Rishi and Rishi never sits adjacent to Rohan.

3. Who among the following sit at extreme ends?
(a) Sony, Ritu (b) Akash, Rishi (c) Monu, Ritu (d) Akash, Sony

4. Who among the following sits on the immediate right of Alka?
(a) Manu (b) Rohan (c) Ritu (d) Akash

5. How many people are sitting between Ritu and Manu?
(a) One (b) Two (c) Three (d) Four

6. Who among the following is different from the others, based on the given seating arrangement?
(a) Sony – Manu (b) Alka-Akash (c) Rohan-Ritu (d) Ritu - Sony

7. If (from left to right) the first person interchanges his position with the person at fifth position and the second person interchanges his position with the person at sixth position and so on, which of the following will be the fifth from the right end in the new arrangement?
(a) Ritu (b) Tinku (c) Akash (d) Rishi

Directions for questions 8 and 9: L, M, N, O, P, Q, R, and S are sitting around a square table in such a way that four of them sit at four corners of the square while four sit in the middle of each of the four sides. The ones who sit at the four corners face the centre while those who sit in the middle of the sides face outside. Two females sit in the middle of the sides and two at the corners.

- L sits second to the left of R.
- R sits in the middle of one of the sides.
- N sits fourth to the right of his wife and his wife is not an immediate neighbour of L or R.
- M sits third to the right of her husband.
- M does not sit at any of the corners.
- Only O sits between M and S.
- S is the husband of L.
- P is a male.

8. Which of the following is true with respect to the given seating arrangement?
(a) No two males are immediate neighbours of each other.
(b) R and S face each other in the seating arrangement.
(c) L sits in the centre of one of the sides of the square table.
(d) Q is a male and sits diagonally opposite to P.

9. Who amongst the following is the wife of N?
(a) O (b) Q (c) M (d) R

Directions for questions 10 to 14: Eight friends, P, Q, R, S, T, V. W, and Y are sitting around a square table in such a way that four of them sit at four corners of the square while four sit in the middle of each of the four sides. The one who sits at the four corners faces the centre while those who sit in the middle of the sides face outside. S sits third to the right of P. P faces the

centre. Y is not an immediate neighbour of P or S. T sits third to the right of R. R does not sit in the middle of any of the sides and also R is not an immediate neighbour of Y. Only one person sits between P and V. Q is not an immediate neighbour of V.

10. If all the persons are made to sit in alphabetical order in a clockwise direction, starting from P, the positions of how many (excluding P) will remain unchanged as compared to their original seating positions?
(a) None (b) One (c) Two (d) Four

11. Which of the following is true regarding Y?
(a) T is not an immediate neighbour of Y
(b) Y sits in the middle of one of the sides
(c) R sits second to left of Y
(d) P and V are immediate neighbours of Y.

12. Who amongst the following sits fourth to the left of V?
(a) Y (b) R (c) T (d) Q

13. What is the position of Q with respect to R?
(a) Immediately to the right
(b) Second to the left
(c) Third to the left
(d) Third to the right

14. Three of the following four are alike in a certain way and so form a group. Which is the one that does not belong to that group?
(a) T (b) W (c) V (d) Q

Directions for questions 15 to 18: Six people - Huma, Isha, Kunal, Lakhan, Mala, and Naveen-are managers in different departments namely Marketing, Finance, Operation, IT and Customer Care of a company - not necessarily in the same order. They are sitting around a circular table facing the centre of the table. Huma is sitting to the left of the HR Manager. Lakhan is sitting third to the right of the Finance Manager. The Marketing Manager is sitting opposite the Customer Care Manager. Kunal, who is the Operation Manager, is sitting opposite Mala, who is the HR Manager. Isha is sitting between Navin and Mala

15. Who is sitting to the immediate left of Huma?
(a) Lakhan (b) Mala (c) Navin (d) Isha

16. Which of the following statements is definitely true?
1. Isha is sitting to the immediate right of Naveen
2. IT manager is sitting opposite to Isha
3. Huma is the Marketing Manager
(a) Only 2 (b) Only 3 (c) Both 2 and 3 (d) Both 1 and 3

17. If the Marketing Manager is sitting to the right of the Finance Manager, then which of the following statements is definitely true?
(a) The Customer Care Manager is sitting to the immediate right of Lakhan,
(b) Huma is the Marketing Manager
(c) Navin is the Customer Care Manager
(d) Both (b) and (c)

18. Who is sitting opposite to Isha?
(a) Kunal (b) IT manager (c) Marketing Manager (d) Huma

Directions for questions 19 to 22: Eight persons, comprising three females and five males, namely P1, P2, P3, P4, P5, P6, P7, and P8 are sitting around a circular table facing the centre of the table. It is also known that:
(i) No two females are sitting next to each other,
(ii) P6 is sitting between P8 and P2.
(iii) P4, who is a female, is sitting second to the left of P6.
(iv) P3, who is a female, is sitting between P5 and P2.
(v) Pl is a female.

19. Who is sitting to the immediate left of P1?
(a) P3 (b) P2 (c) P5 (d) None of these

20. Which of the following statements is definitely true?
(a) P6 is male and P7 is female. (b) P6 is female and P7 is male.
(c) Both P6 and P7 are males. (d) Both P6 and P7 are females.

21. Who is sitting to the immediate left of P4?
(a) P7 (b) P5 (c) P8 (d) None of these

22. Who is sitting opposite to P7?
(a) P3 (b) P6 (c) P2 (d) P8

Directions for questions 23 to 25: Eight delegates from eight different countries – US, UK, France, Italy, China, Australia, Nepal, and Bhutan- are sitting around a round table for a conference on global peace. It is also known that:
(a) The delegate from the US is sitting diametrically opposite to the one from the UK.
(b) There are exactly three delegates between delegates from France and Italy.
(c) The delegate from Bhutan is sitting to the immediate right of the delegate from the UK.
(d) The delegate from Nepal is not sitting adjacent to the delegate from the US.
(e) The delegate from Italy is sitting second to the left of the delegate from the US.

23. The delegate sitting to the immediate left of the French delegate is from
(a) China (b) Australia (c) UK (d) Either (a) or (b)

24. The delegates from which of the following pairs of countries are definitely not sitting opposite to each other?
(a) Italy and France (b) Australia and Nepal
(c) China and Bhutan (d)Australia and China

25. The delegate from which country is sitting second to the left of the delegate from the UK?
(a) Bhutan (b)France (c) Italy (d) None of these

MODULE 7
DATA ARRANGEMENT

Structure of Data Arrangements Questions:

Each Arrangement question usually starts with a paragraph that discusses a specific circumstance and defines a few terminologies. This introduction will offer you a sense of what you should do in response to that inquiry. This will be followed by a few short lines outlining the rules or limits that will be applied to the specific terms and circumstances.

During arrangement questions, there are three different types of clues. They are

1. **Direct hints:** The relationship between two terms will be mentioned immediately in the statements in this category.
2. **Indirect clues:** These are laws that, once all other direct clues have been recognized, can be transformed to direct clues by reasoning.
3. **Scenario hints:** Once all of the direct and indirect clues have been included in the logical framework, the rest of the problem can be reduced to two or three scenarios, each of which will lead to the correct solution after further examination.

The systematic, step-by-step approach to solving arrangement questions will involve the following steps:

1. Decide on the logical framework which should be used. This will be in the form of a diagram, through which all the terms given in the problem are plotted in a readable format using various letters, shapes, and symbols.
2. Include direct clues and indirect clues into the logical framework necessarily in that order.
3. The problem is considered to be solved, provided all the interrelationships between various terms are identified. If the information gap still persists, then the remaining problem has to be broken down into possible scenarios. Each scenario has to be checked for consistency of data. The scenario which meets all the constraints can be taken as the correct answer.
4. Guard against multiple correct answers especially when "Cannot be determined" is one of the answer choices in the questions that follow the puzzle.

PROBLEMS:

1. 'N' students, who are wearing T-shirts numbered from 1 to N, are sitting around a circular table in the given order of their T-shirt numbers, such that the distance between every pair of students sitting next to each other is the same. If the student wearing T-shirt numbered 8 is sitting diametrically opposite to the student wearing a T-shirt numbered 20. Find the value of 'N'.
   (a) 22 (b) 26 (c) 24 (d) 28

2. Four friends - Gopal, Kishan, Madhav, and Vishnu - own different cars - I-10, I-20, Ritz, and Getz - in no particular order. The cars are of different colours - Yellow, Blue, Green, and Red. It is also known that:
   (i) 1-20 is either a red or a green coloured car
   (ii) Kishan owns either Ritz or Getz
   (iii) Gopal owns I-10 and Vishnu owns a yellow-coloured car.
   (iv) Neither I-10 nor Getz is a blue-coloured car.

Which of the following combinations of friend and car colour is definitely correct?
(a) Kishan-Ritz-Blue (b) Vishnu-Ritz-Yellow
(c) Madhav-I-20-Red (d) Gopal-I-10-Green

3. In a cricket match, Rohit scored 16 runs on 6 balls with a different score on each ball. The maximum runs were scored on the 3rd ball and the minimum runs were scored on the 1st ball. Four runs were scored on the third ball after the one on which 2 runs were scored. It is also known that the ball on which 1 run was scored was neither the first nor the last. How many runs were scored on the last ball?
(a) 3 (b) 1 (c) 4 (d) Either (a) or (b)

Directions for questions 4 and 5: Four people A, B, C, and D work in four different companies C1, C2, C3, and C4 not necessarily in the same order. The head office of each of the four companies is located in a different city among S1, S2, S3, and S4 and belongs to a different sector among Banking, Insurance, Telecom, and IT. It is also known that

- B works in the company whose head office is located in S3.
- The head office of C4, which belongs to Insurance sector, is located in S2.
- The head office of the company that belongs to the IT sector is located in S1.
- D works in C2.
- A works in a company that belongs to the Telecom sector.

4. Which of the following statements is definitely true?
(a) B works in C1.
(b) B works in the banking sector.
(c) B works in the company whose head office is located in S4.
(d) B works in C2.

5. How many of the following statements are definitely true?
I. The head office of C2 is located in S1.
II. The head office of the company in which A works is located in S3.
III. The head office of the company that belongs to the Telecom sector is located in S2.
IV. The head office of C3 is located in S1.
(a) 0 (b) 1 (c) 2 (d) 3

Directions for questions 6 to 9: Five politicians namely Anand Tripathi, Balwant Rana, Chandu Ram, Dinkar Prajapati and Egnesh Alwin holding five different portfolios - HRD, Home, Finance, Education and Health-in a cabinet-paid visits to Chennai to meet the victims of a Tsunami on five different dates - 21st, 22nd, 23rd 24th and 25th of March, 2004 - not necessarily in the same order. It is also known that:
(i) The Home Minister paid his visit after the HRD Minister, but before the Finance Minister.
(ii) The Health Minister did not pay his visit on the 25th
(iii) Dinkar Prajapati was the Finance Minister
(iv) Balwant Rana was not the Education Minister.
(v) Both Balwant Rana and Chandu Ram paid their visits after the Finance Minister.

6. On Which date did Balwant Rana pay his visit?
(a) 23rd (b) 24th (c) 21st (d) 25th

7. If Anand Tripathi paid his visit on the 22nd, then who was the HRD Minister?
(a) Egnesh Alwin (b) Anand Tripathi (c) Balwant Rana (d) Dinkar Prajapati

8. Which of the following is a correct combination of Name – Ministry - Date of Visit?
(a) Dinkar Prajapati - Finance - 23rd (b) Anand Tripathi - HRD - 22nd
(c) Chandu Ram – Heath - 25th (d) Balwant Rana - Finance - 24th

9. Who paid his visit immediately after the Home Minister's visit?
(a) Egnesh Alwin (b) Anand Tripathi (c) Balwant Rana (d) Dinkar Prajapati

10. There are five friends Anand, Balu, Chandru, Deepak and Eswar all working in different shops viz. stationery shop, book store, grocery shop, hardware shop and sports goods shop. They like to play different games such as hockey, kabaddi, basketball, tennis and football. Anand does not like hockey. Balu has a bookstore and likes to play football. Chandru and Deepak do not like tennis. Chandru has a grocery shop whereas Deepak has a hardware shop. Eswar likes kabaddi and does not work in a stationery shop. The person who likes hockey does not work in the hardware shop. Who has a stationery shop?
(a) Anand (b) Chandru (c) Deepak (d) Balu

11. The first 12 even numbers are written from top to bottom. The letters of the word "SACRED" are written in alphabetical order against each multiple of 4 (one letter against one number). There are two letters between N and S. There are as many letters between E and N as between P and D. P is not against number 14. There are 5 letters between U and T. U is above T. I is written against the number 6. (no letter is repeated against any number)
Which is the letter against the number 14?
(a) T (b) D (c) I (d) N

Directions for questions 12 to 15: Five aircraft - AC-124, BB-47, DC-54, SF-232 and WC-130 went missing in five different years -1950, 1951, 1956, 1974 and 1976 - not necessarily in the same order. Each aircraft was operated by a different operator from among Walker, MacDill, Saeta, Clark, and USAF. It is also known that:

- BB-47 was not operated by Walker.
- DC-54, which was operated by USAF, did not go missing in 1951.
- The aircraft that was operated by MacDill went missing in 1956.
- WC-130, which was not operated by Walker, went missing in 1976.
- SF-232 went missing in 1974.
- BB-47 did not go missing in 1956.

12. Which of the following aircraft went missing in 1956?
(a) AC-124 (b) DC-54 (c) BB-47 (d) Data insufficient

13. The aircraft operated by Clark was
(a) DC-54 (b) WC-130 (c) AC-124 (d) Data insufficient

14. How many of the following statements are true?
1. The aircraft operated by USAF went missing in 1951.
2. SF-232 was operated by Walker. 3. WC-130 was operated by Clark.

(a) 1 (b) 2 (c) 3 (d) 0

15. Which of the following is a correct combination of aircraft operator - the year of missing?
(a) WC - 130 - Saeta -1976 (b) BB - 47 - Clark - 1951
(c) AC - 124 - MacDill -1974 (d) DC - 54 - USAF - 1950

Directions for questions 16 to 18: Read the following information and answer the questions.
At Bangalore University there are nine students - A, B, C, D, E, F, G, H, and I who live in a hostel that has a nine story-building. They live on different floors. The Lowest floor of the building is numbered 1, the one above that is numbered 2 and the topmost floor is numbered 9. They all have different branded mobile phones viz. Nokia, Samsung, Gionee, Oppo, Vivo, Sony, Lenovo, Asus, and Apple.

There are five floors between G and the one that has an Asus. D does not live on the top floor. The one who has Nokia lives immediately below the one who has Lenovo. The one who has Lenovo lives on one of the even-numbered floors. The one who has Gionee lives on an odd-numbered floor but below the 6th floor. B lives on the 6th floor and has a Samsung. The one who has Sony lives on the top floor. The one who has Vivo lives below the one who has Gionee. The one who has Apple lives on the 2nd floor. I live above H. Life immediately below the one who has Sony. F lives immediately above the floor from the one who has an Asus. The one who lives on an odd-numbered floor, has Vivo. There are 2 floors between D and B. The number of persons who live above E's floor is the same as that of the number of persons who live below. C lives on an even numbered floor and has Oppo.

16. Who among the following has Vivo?
(a) I (b) D (c) H (d) B

17. The one who has Lenovo, lives on which floor?
(a) 1st (b) 5th (c) 7th (d) 8th

18. Who lives on the 2nd Floor?
(a) F (b) C (c) D (d) E

19. Five different juices are kept on a table in a straight row such that Mango juice is not kept next to the Litchi juice; Orange juice and Mix fruit juice are kept next to each other; Guava juice is kept next to the Mango juice as well as the Mix fruit juice. Which of the following juices are kept at the extreme ends?
(a) Mango juice and Mix fruit juice (b) Litchi juice and Mix fruit juice
(c) Mango juice and Litchi Juice (d) Data inadequate

20. Each of the five children - R, S, T, U and V plays a different game - cricket, football, lawn tennis, snooker and chess - on a different day of a week from Monday to Friday, not necessarily in that order. It is also known that:
- V neither plays snooker nor plays on Tuesday.
- S plays chess, but neither on Monday nor on Friday.
- The person, who plays cricket, plays on Thursday.
- T, who plays on Wednesday, does not play snooker.
- The lawn tennis is played on Friday.

- R plays on Monday and U does not play lawn tennis.

Which of the following games is played on Wednesday?
(a) Cricket (b) Lawn Tennis (c) Football (d) Chess

21. Raman is making the schedule of classes for next week. Classes of four subjects - History, Humanities, Home Science and Arts - have to be scheduled from Monday to Friday such that three classes of different subjects are to be scheduled on each day. It is also known that:
(i) Arts must be scheduled on at least three days including Tuesday.
(ii) History, Humanities, and Home Science to be scheduled on Thursday.
(iii) Arts and Humanities cannot be scheduled on the same day.
(iv) Humanities and Home Science are scheduled in two consecutive slots on Monday.
On how many days is History to be scheduled?
(a) 2 (b) 4 (c) 5 (d) 3

22. A, B, C, D, E, F, and G are traveling in a train compartment with III tier A.C. berth. Each of them has a different profession - Engineer, Doctor, Architect, Pharmacist, Lawyer, Journalist, and Pathologist. They occupied two lower berths, three middle berths, and two upper berths.
- A, the Engineer is not on the upper berth.
- The Architect is the only other person who occupies the same type of berth as that of A.
- B and F are not on the middle berth and their professions are Pathologist and Lawyer respectively.
- C is a Pharmacist.
- G is neither a Journalist nor an Architect.
- E occupies the same type

What is D's profession?
(a) Architect (b) Engineer (c) Lawyer (d) Pharmacist

Directions for questions 23 to 25: Answer the questions on the basis of the information given:
Five boys - Amar, Amareesh, Akbar, Amit, and Ankur - are getting married in five different months of a year viz. January, March, June, November, and December (not necessarily in the same order). The brides are - Uma, Vinita, Anita, Rani, and Kavita. Each of these marriages is in different cities in India viz. Delhi, Lucknow, Mumbai, Jaipur, and Raipur (not necessarily in the same order).
Akbar is getting married in January. Vinita is getting married in Delhi. Rani is Amar's bride. The marriage in June was held in Mumbai. Kavita is getting married in March. Amit's marriage was in Jaipur. Vinita's marriage followed the marriage of Anita. Kavita is Ankur's bride.

23. In which city was the marriage held in December?
(a) Mumbai (b) Delhi (c) Lucknow (d) Raipur

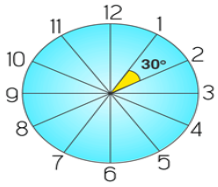
24. In which city was Amar's marriage held?
(a) Mumbai (b) Lucknow (c) Jaipur (d) Raipur

25. Whom did Vinita marry?
(a) Amit (b) Akbar (c) Amareesh (d) Amar

MODULE 8
CLOCKS

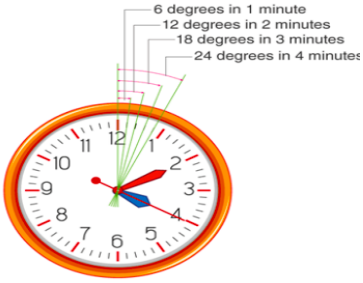
A Clock is a circular device provided with three hands viz. an hour hand, a minute, and second hand.

A clock is composed of 360 degrees and divided into 12 equal divisions. The angle between the consecutive divisions is obtained by dividing the total angle of the clock, 360° by the number of divisions i.e. 12. The angle between any two consecutive divisions = (360°)/12 = 30°



A close observation of a clock reveals that an angular space between any two consecutive divisions has five more divisions. The area between the two divisions corresponds to a value of 5 minutes. Hence, dividing the 30° by five will result in the angular value of a minute.

Angular value of a minute = (30°)/5 = 6°



- The hands of the clock are **perpendicular** in 15-minute spaces apart
- The hands of the clock are in a straight line and **opposite** to each other in **30-minute** spaces apart.
- The hands of the clock are in a straight line when they coincide or are opposite to each other.
- The hands of the clock are perpendicular to **each other 22 times in 12 hours and 44 times** in a day.
- The hands of the clock are **opposite** to each other **11 times in 12 hours and 22 times** in a day.
- The **minute hand** gain **55 minutes** over **hour hand** per hour.
  Hence x minute space to be gained by minute hand over hour hand can be calculated as x.(60/55) or x.(12/11)

Important Points to remember:

- Two right angles per hour (Right angle = 90, Straight angle=180)
- Forty-four right angles per day
- Each hour, the hands of the clock coincide with each other for one time except between 11, 12, and 12, 1. In a day they coincide 22 times.
- Each hour, they are perpendicular to each other two times except between 2, 3 and 3, 4 and 8, 9 and 9, 10. In a day they will be perpendicular to each other 44 times.
- Each hour, they will be opposite to each other one time except between 5, 6, and 6, 7. In a day they will be opposite 22 times.

Problems on angles

Before we actually start solving problems on angles, we need to get a couple of basic facts clear:

- Speed of the hour hand = 0.5 degrees per minute (dpm) {The hour hand completes a full circle or 360 degrees in 12 hours or 720 minutes}
- Speed of the minute hand = 6 dpm {The minute hand completes a full circle in 60 minutes}
- At 'n' o' clock, the angle of the hour hand from the vertical is 30n

The questions based upon these could be of the following types

Example 1: What is the angle between the hands of the clock at 7:20
At 7 o'clock, the hour hand is at 210 degrees from the vertical.
In 20 minutes,
Hour hand = 210 + 20*(0.5) = 210 + 10 = 220 {The hour hand moves at 0.5 dpm}
Minute hand = 20*(6) = 120 {The minute hand moves at 6 dpm}
Difference or angle between the hands = 220 – 120 = **100 degrees**

A) **Angle between hands of a clock**

1. When the minute hand is behind the hour hand, the angle between the two hands at M minutes past H o'clock.
   = 30 [H -(M/5)] + M/2 degree
   = 30H – (11M/2)

2. In the case where the minute hand is ahead of the hour hand, the angle between the two hands at M minutes past H 'o clock will be calculated as
   = 30 (M/5-H) -M/2 degree
   = 11/2M – 30H

B) **To calculate x minute space gain by the minute hand over the hour hand = $*\frac{60}{55} = *\frac{12}{11}$**

C) **Both the two hands of the clock will be at the right angles between H and (H+1) o'clock at (5H ± 15) minutes H<'o clock.**

D) **If the minute hand of a clock overtakes the hour hand at the interval of M minutes when the time is correct, the clock gains or loses a day by**

$= \frac{720}{11} - M[(60 \times 24)/M] minutes$

E) **Between H and H+1 o'clock, the two hands of the clock are M minutes apart at (5H ± M)12/11 minutes past H o' clock.**

PROBLEMS:

1. Find the angle between the hour hand and the minute hand of a clock when the time is 3.25.
   (a) 47.5° (b) 57.5° (c) 45.5° (d) 55.5°

2. At what time, between 3 o'clock and 4 o'clock will both the hour hand and minute hand coincide with each other?
   (a) 3:30 (b) 3:16 4/11 (c) 3:16 11/4 (d) 3:16 7/11

3. At what time between 5.30 and 6 will the hands of a clock be at right angles?
   (a) 43 5/11 min. past 5 (b) 43 7/11 min. past 5
   (c) 40 min. past 5 (d) 45 min. past 5

4. A clock gains 20 seconds for every 3 hours of time. If a clock is set at the correct time of 2 am on Friday, what would it indicate at 6:30 pm, Saturday?
   (a) 6.32.00 pm (b) 6.32.46 pm (c) 6.34.30 pm (d) 6.38.56 pm

5. An accurate clock shows 2 o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 9 o'clock in the evening?
   (a) 144 degrees (b) 210 degrees (c) 168 degrees (d)570 degrees

6. A boy saw the clock when it was 5am The clock loses 8 minutes in half a day. What will be the true time when he sees the clock at 10 p.m. on the 4th day?
   (a) 9 pm (b) 10 pm (c) 11 pm (d) 12 pm

7. The reflex angle between the hands of a clock at 10.25 is?
   (a) 180 degree (b) 192 1/2 degree (c) 195 degree (d) 197 1/2 degree

8. How many times in 24 hours, are the hands of a clock in a straight line but opposite in direction?
   (a) 20 (b) 22 (c) 24 (d) 48

9. How many times are the hands of a clock at 90 degrees in 12 hours?
   (a) 44 (b) 22 (c) 24 (d) 28

10. How many times in a day, are the hands of a clock straight in a straight line?
    (a) 44 (b) 22 (c) 24 (d) 28

11. The minute hand of a clock overtakes the hour hand at an interval of 65 minutes. How much in a day does the clock gain or lose?
    (a) 10 10/143 mins gain (b) 10 10/143 mins loss

(c) 5 mins gain (d) 5 mins loss

12. A clock loses 1% time during the first week and then gains 2% time during the next week. If the clock was set right at 12 noon on a Sunday, what will be the time that the clock will show exactly 14 days from the time it was set right?
(a) 1: 36: 48 (b) 1: 40: 48 (c) 1: 41: 24 (d) 10: 19: 12

13. At a particular point in time, the number of hours to 12:00 pm from that time is twice the number of hours to 12:00 pm after five hours from that particular time. Find the time.
(a) 2 o'clock (b) 4 o'clock (c) 5 o'clock (d) None of these

14. The clock at Hogwarts has a special way of telling the time. It does not have any hand or numbers on it, but it has a chimer. If the time is 1 o'clock, it chimes once. If the time is 2 o'clock, it chimes twice, and so forth. The time gap between any two chimes is 3 seconds. How many seconds would it take for Harry Potter to know the time after the first chime is heard if it is 3 o'clock?
(a) 6 seconds (b) 9 seconds (c) 12 seconds (d) 3 seconds

15. The clock was set at 12 PM. By 600 seconds past 5 PM, the hour hand has turned through?
(a) 145° (b) 150° (c) 155° (d) 160°

16. A watch loses 5 minutes every hour and was set right at 8 O'clock on Monday. When will it show the correct time again?
(a) 8 O'clock on Sunday (b) 8 O'clock on Tuesday
(c) 8 O'clock on Saturday (d) 8 O'clock on Wednesday

17. A digital wristwatch was set accurately at 8.30 a.m. and then lost 2 seconds every 5 minutes. What time will the watch show at 6:30 p.m. of the same day if the watch operated continuously till that time?
(a) 5: 56 pm (b) 6:00 pm (c) 6:26 pm (d) 6:23 pm

18. A clock loses 5 minutes every hour and another gains 5 minutes every hour. If they are set right at 10 AM on Monday. When will they be 12 hours apart?
(a) 10 AM on Friday (b) 10 AM on Tuesday
(c) 10 AM on Thursday (d) 10 AM on Wednesday

19. The time shown by the reflection of a clock in a mirror is 4 hours 35 minutes. What is the actual time on that clock?
(a) 7 hrs 35 min (b) 8 hrs 20 min (c) 7 hrs 25 min (d) 8 hrs 25 min

20. The famous church in the city of Kumbakonam has a big clock tower and is said to be over 300 years old. Every Monday at 10:00 AM the clock is set by Antony, doing service in the church. The clock loses 6 minutes every hour. What will be the actual time when the faulty clock shows 3P.M on Friday?
(a) 1:36 AM (b) 12:06 AM (c) 1:06 AM (d) 12:06 PM

MODULE 9
CALENDARS

A Calendar is a chart or series of pages showing the days, weeks, and months of a particular year, or giving particular seasonal information.

Basic Structure of a Calendar

1. **Ordinary year:** Any year with **365 days** is called an ordinary year. Ex: 1879, 2009, 2019, etc.
2. **Leap year:** Any year which has **366 days** is called a leap year. Ex: 2012, 2016, 2020, etc.
3. The division of the number 365 by 7 gives the quotient 52 and remainder 1 which indicates that an ordinary year has 52 weeks and one extra day. This extra day is referred to as an "**odd day**" throughout the calendar concepts.
4. A leap year has 366 days, the division of the number 366 by 7 gives the quotient 52 and the remainder 2. This indicates that a leap year has 52 weeks and 2 extra days. These two extra days are also referred to as "**odd days**".

An ordinary year has one odd day, whereas a leap year has two odd days.

Concept of an Odd Day

Number of odd days in a month

January has 31 days, irrespective of whether it's an ordinary year or leap year. The division of the number 31 by 7 provides the remainder of 3 hence January has 3 odd days. In generalizing, any month which has 31 days has 3 odd days and any month which has 30 days has 2 odd days.

The only exception happens in the case of February. The February month of an ordinary year has 28 days, a division of 28 by 7 provides zero as the remainder. Hence, the number of odd days in February of an ordinary year will have 0 odd days and that of leap years will have 1 odd day as February in a leap year has 29 days.

Decoded day of the week

Always begins with Monday and hence Saturday and Sunday are referred to as weekends.

Evaluation of Leap Year

The leap year occurs every four years, most of the time, but there are scenarios where the gap between two leap years was 8 years instead of the regular 4 years.

Ex: The year 1896 is a leap year. The next leap year comes in 1904 (1900 is not a leap year).

In order to make the investigation easier and faster, any non-century year which is divisible by the number 4 completely (the remainder becomes zero) is considered a leap year.

Ex: 1888, 2012, and 2016 are leap years as it's completely divisible by 4. Years like 2009, 2019, etc. are not divisible by 4 completely hence they normal years.

An exception to note:

Year 700 is completely divisible by 4, but it is not considered a leap year. This is because, for a century year to be called a leap year, it should always be divisible by 400 not by 4. Even though the year 700 is divisible by 4 but not by 400. Hence, the year 700 cannot be considered a leap year.

Ex: 400, 800, 1200, etc. are leap years as they are divisible by 400, and years 300, 700, 100, etc. are not leap years as they are not divisible by 400.

Evaluation of Odd Days of a Century
This concept helps students in answering the question about calendars in less than 30 seconds.

Example: What day of the week was year 100 A.D. December 31st?
Solution: Let's consider the first 100 years i.e. Year 1. A.D to year 100 A.D
Dividing the first 100 by 4 we get that the first 100 years had 76 ordinary years and 24 ordinary years. (The quotient when 100 is divided by 4 gives 25 but the year 100 itself is not a leap year as it is not divisible by 400 hence 24 is considered instead of 25)

Step 1: 100 years = 76 ordinary years + 24 leap years
We know that an ordinary year has 1 odd day and a leap year has 2 odd days. Hence, 76 ordinary years will have 76 odd days and 24 leap years will have 24*2 = 48 odd days. Adding both results we get 76+48 = 124 odd days in total.

Step 2: 100 years = (76 x 1 + 24 x 2) odd days = 124 odd days.
Dividing the total odd days 124 by 7 gives the quotient of 17 and the remainder as 5. This indicates that 124 days had 17 weeks and 5 odd days.

Step 3: 100 years = (17 weeks + days) 5 odd days.
The number of odd days in 100 years = 5.
Hence, the last day (December 31st) of the year 100 A.D. was Friday.

Extension of the logic
Similarly, one can find the last day of the other century years by extending the same logic.
If 100 years had 5 odd days, then logically 200 years should have 10 odd days. Since 10 is greater than 7, the division of 10 by 7 gives the remainder 3. Hence, the 200 years had 3 odd days, which means the last day of the year 200 was Wednesday.
Number of odd days in 200 years = (5 x 2) = 10 = (7+3) = 3 odd days.

If 100 years had 5 odd days and 200 years 10 odd days logically 300 years should have 15 odd days. The division of 15 by 7 indicates it has 1 odd day from the remainder which indicates it is Monday. Hence, the last day of the year 300 was Monday.
Number of odd days in 300 years = (5 x 3) = 15 = (14+1) = 1 odd day.

Logically, 400 years should have 20 odd days since the 400th year is a leap year as it is divisible by 400. This year will have 20+1 = 21 odd days, which when divided by 7 gives zero (0) as the remainder. Hence, 400 years had 0 odd days and that was Sunday.

Century	Number of odd days	Day of the week
100	5	Friday
200	3	Wednesday
300	1	Monday
400	0	Sunday
500 = (100 + 400)	(5 + 0) = 5	Friday
600 = (200 + 400)	(3 + 0) = 3	Wednesday
700 = (300 + 400)	(1 + 0) = 1	Monday
800 = (400 + 400)	(0 + 0) = 0	Sunday
900 = (400 + 500)	(0 + 5) = 5	Friday
1000 = (500 + 500)	(5 + 5) = (7 + 3) = 3	Wednesday

Observations from the table:

1. The cycle of a number of days repeats after every four centuries and also hence the days at which it ends. The order will always be Friday, Wednesday, Monday, and Sunday.
2. A century will always end on either Friday, Wednesday, Monday, or Sunday (Decoded values of these days are 5, 3, 1, and 0 respectively).
3. A century will never end on Tuesday, Thursday and Saturday (Decoded values of these days are 2, 4, and 6 respectively).

The leap years in the 20th and 21st centuries;

1904, 1908, 1912, 1916, 1920, 1924, 1928, 1932, 1936, 1940,
1944, 1948, 1952, 1956, 1960, 1964, 1968, 1972, 1976, 1980,
1984, 1988, 1992, 1996, 2000, 2004, 2008, 2012, 2016, 2020,
2024, 2028, 2032, 2036, 2040, 2044, 2048, 2052, 2056, 2060,
2064, 2068, 2072, 2076, 2080, 2084, 2088, 2092, 2096

PROBLEMS:

1. The calendar for the year 2007 will be the same for the year:
   (a) 2014 (b) 2017 (c) 2016 (d) 2018

2. On what dates of May 2001 did Thursday fall?
   (a) 1st, 8th, 15th, 22nd, 29th (b) 2nd, 9th, 16th, 23rd, 30th
   (c) 3rd, 10th, 17th, 24th, 31st (d) 4th, 11th, 18th, 25th

3. The last day of a century cannot be:
   (a) Tuesday (b) Monday (c) Friday (d) Sunday

4. If the date April 12, 2007, is a Tuesday, then which one of the following will the date March 11, 2008, be?
   (a) Tuesday (b) Wednesday (c) Monday (d) Sunday

5. What was the day of the week on 28th May 2006?
   (a) Sunday (b) Saturday (c) Friday (d) Thursday

6. In 2007, what was the date of the last Saturday in May?
   (a) 22nd May (b) 24th May (c) 26th May (d) 28th May

7. Second Saturday and every Sunday are holidays. How many working days will be there in a month of 30 days beginning on a Saturday?
   (a) 21 (b) 24 (c) 23 (d) 22

8. How many times does the 29th day of the month occur in 400 consecutive years?
   (a) 4487 times (b) 4457 times (c) 4497 times (d) 4447 times

9. In 2016, Mohan celebrated his birthday on Friday. Which will be the first year after 2016 when Mohan will celebrate his birthday on a Wednesday? (He was not born in January or February)
   (a) 2021 (b) 2023 (c) 2020 (d) 2025

10. John was born on Feb 29th of 2012 which happened to be a Wednesday. If he lives to be 101 years old, how many birthdays would he celebrate on a Wednesday?
(a) 3 (b) 5 (c) 4 (d) 1

11. How many of the following statements have to be true?
i. No year can have 5 Sundays in the month of May and 5 Thursdays in the month of June.
ii. If Feb 14th of a certain year is a Friday, May 14th of the same year cannot be a Thursday
iii. If a year has 53 Sundays, it can have 5 Mondays in the month of May.
(a) 0 (b) 1 (c) 2 (d) 3

12. The starting and ending days of the 10th century were:
(a) Monday & Friday (b) Tuesday & Sunday
(c) Thursday & Monday (d) Saturday & Wednesday

13. In a particular year the month of January had exactly 4 Thursdays and 4 Sundays, on which day of the week, does January 1 occur?
(a) Monday (b) Tuesday (c) Thursday (d) Wednesday

14. What is the chance that a leap year selected at random contains 53 Fridays?
(a) 2/7 (b) 2/7 (c) 3/7 (d) 1/7

15. How many odd days are there in 1000 years?
(a) 4 (b) 3 (c) 5 (d) 2

16. If 15 March 1816 was Friday, what day of the week would 15th April 1916 be?
(a) Monday (b) Wednesday (c) Thursday (d) Saturday

17. The nonleap year 1895 has the same calendar as that of the year X. Which of the following is a possible value of X.
(a) 1900 (b) 1901 (c) 1902 (d) 1903

18. I was born in a century in which the last year of the previous century was a leap year. I was born in the first year after the first leap year of the century. I was born after 1200 A.D. and before 2000 A.D. What is the year of my birth?
(a) 1405 (b) 1505 (c) 1605 (d) 1705

19. 1st January of Year 19XY and 1st January of year 19PQ are the same day. It is also given that no other year before 19PQ has its 1st January on the same day as that of 1st January of 19XY. What is the minimum possible value of | PQ-XY |, where PQ and XY are the last two digits of the year?
(a) 5 (b) 6 (c) 11 (d) 13

20. Let us express the date in the DD/MM/YYYY format, where DD represents the day of the month, MM represents the month, and YYYY represents the year. If the last possible date in the 20th century with all the eight digits (in the date as expressed in the above format) being odd is a Sunday, then what day of the week will the first date of the 21st century with all the eight digits even be?
(a) Monday (b) Saturday (c) Friday (d) Tuesday

MODULE 10
SYLLOGISMS

The word syllogism is derived from the Greek word 'syllogismos' which means 'conclusion, inference'. Syllogisms are logical arguments of statements using deductive reasoning to arrive at a conclusion.

Statements of syllogisms

The questions of syllogisms consists of three main parts.

1. Major premise
2. Minor premise
3. Conclusion

The major premise is a statement in general, believed to be true by the author.
Example: All women are smart.

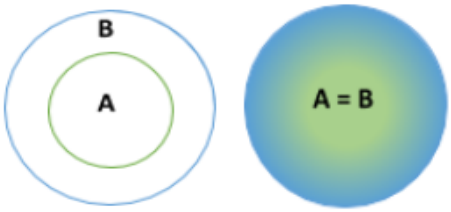
The minor premise is a specific example of the major premise.
Example: Amanda is a woman.

The conclusion is a specific statement that logically follows both major and minor statements.
Example: Amanda is smart.

Now let us take 4 statements
1. All people are kind.
2. No people are kind.
3. Some people are kind
4. Some people are not kind.

1. **Universal Positive Statement:** First of all universal means something which is applicable to all and positive means, this is of 'yes' format. A universal positive statement indicates something positive applicable to all the items in that category. This is **represented by the letter 'A'**. These statements begin with All, Each, and Every.
Examples: All boys are sharp, All girls are cute, All Indians are kind.
All these are 'A' type of statements, because they all convey universal positive meanings.

   For example, All A are B.
   So the above universal positive statement can be depicted using the Venn diagrams in the following ways.



   So, figure 1 is the basic diagram, and figure 2 is another possible representation of the statements.

2. **Universal Negative Statement:** Again, in this case, the only difference from the last category is that, in this case, the statement conveys a negative meaning. It implies that it refers to those

kinds of statements, which are universal and give a negative impression. These types of statements begin with No, None of the, Not a single etc., and are **represented by the letter 'E'**.
Examples: No S is P, No person is intelligent, No boy is smart, Not a single person is sleeping.

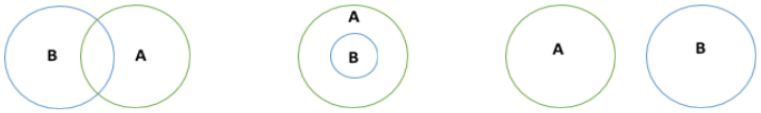
For example, No A are B.
The statement clearly says no element of A present is included in B, so there is only one possible diagrammatic representation of the statement.

This is the only representation of a universal negative statement.

3. **Particular Positive Statement:** In this case, the statement given gives a positive impression but it covers only some items and not all. These types of statements begin with some, any, or a few and are **represented by the letter 'I'**.
Examples: Some lawyers are actors, Some fruits are apples, Few books are keys.

4. **Particular Negative Statement:** Here, the statement again covers only some items, but it gives a negative impression. These kinds of statements are **represented by the letter 'O'**.
Examples: Some girls are not crazy, Some files are not pencils, Few vegetables are not green.

For example, Some A are not B.
The given statement infers that some part of A is not B. so we can represent the given statement as



These are the three ways to graphically represent a particular negative proposition.

The definitions of the A, E, I, and O statement are very important and the student must be able to immediately recognize the statement.

With these things in mind, given below is a list of all the four types of statement:

Sl. No.	Type of Statement	Represented by the letter
1	Universal Positive	A
2	Universal Negative	E
3	Particular Positive	I
4	Particular Negative	O

Syllogism Tricks and Rules:

1. With two particular statements, no universal conclusion is possible.
2. With two positive statements, no negative conclusion is possible.
3. With two negative statements, no positive conclusion is possible.
4. With two particular statements, no conclusion is possible, except when an 'I' type of statement is given and then by reversing it an 'I' type of conclusion is possible.

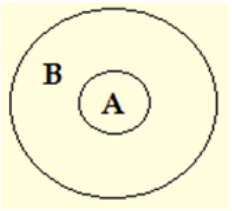
There are certain universal rules that should be followed while solving the questions:

- Any "All" and "All" sentences will always imply an "All" conclusion.
- Any "All' and "No" sentences will always imply a "No" conclusion.
- Any 'All" and "Some" sentences will always imply a "No" conclusion.
- Any "Some" and "All" sentences will always imply a "Some" conclusion.
- Any "Some" and "No" sentences will always imply a "Some not' conclusion.
- Any "Some" and "Some" sentences will always imply a "No" conclusion.

Types of Syllogism Questions

1. **All A are B**

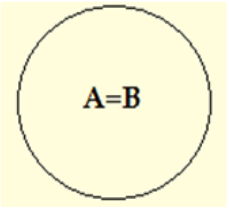
This phrase means that A is contained in B but not necessarily vice versa. This means A is a subset of B, but B may not be a subset of A. The Venn diagram for this is:



In this diagram, it is visible that circle A is inside the circle B, which means that B contains the entire A, i.e. All A are B.

2. **A = B**

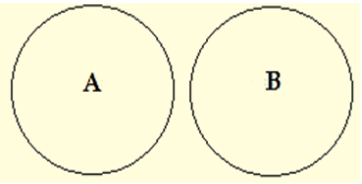
In this case, the conclusion is similar to the first type, i.e. "All A are B". Here not only "All A are B", but also "All B are A". This means A is a subset of B and B is also a subset of A. The Venn diagram is:



Here A is contained in B and so is B contained in A. So, here A contains all B and again B also contains all A.

3. **No A are B**

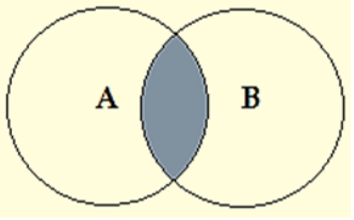
It is simply understandable that B does not contain any of A and so A is not contained in B. This means that A and B are disjoint sets. The Venn diagram for this case is:



Here no part of A is present inside of B and similarly, no part of A is present in A. So neither A nor B contain any part of B or A respectively.

4. **Some A are B**

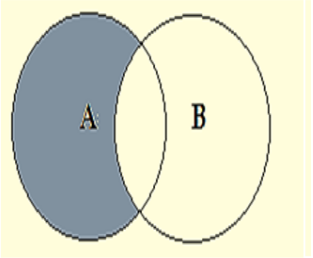
This is the case when some of A is in B that is A and B are intersecting, and thus some B are A will also be true. The Venn diagram depiction is as:



Here, the shaded portion indicates that some portion of A is contained in B while the unshaded portion is an uncertain portion and does not indicate anything whether A is contained in B or not.

5. Some A are not B

This means that some portion of A is not included in B for sure while the other part of A is uncertain whether it is included in B or not. The Venn diagram is;



In this, some portion of A is surely not included in B while there is no surety whether the shaded region is included in B or not.

PROBLEMS:

1. There are two statements, which are followed by four conclusions. Choose the conclusion which logically follows from the given statements.

Statements:

All men are vertebrates.

Some mammals are vertebrates.

Conclusions:

i) All men are mammals.

ii) All mammals are men.

iii) Some vertebrates are mammals.

iv) All vertebrates are men.

(a) Only (i) (b) Only (ii) (c) Only (iii) (d) Only (iv)

2. There are two statements, which are followed by two conclusions. Choose the conclusion which logically follows from the given statements.

Statements:

Some papers are pens.

All the pencils are pens.

Conclusions:

i) Some pens are pencils.

ii) Some pens are papers.

(a) Only conclusion (i) follows (b) Only conclusion (ii) follows

(c) Both (i) and (ii) follow (d) Either (i) or (ii) follows

3. There are two statements and some conclusions. Choose the conclusion that logically follows:

Statements:

All girls are crazy

Some girls are intelligent

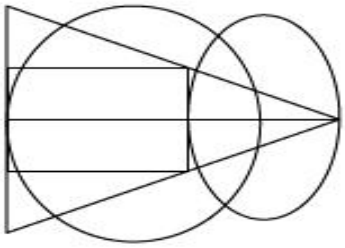
(a) Some girls are crazy (b) Some intelligent are crazy

(c) Both A & B (d) None of the options

4. In the question below are given two statements followed by two conclusions numbered (i) and (ii), you have to take the two given statements to be true even if they seem to be at variance from commonly known facts and decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts:

Statements:
Some players are singers.
All singers are tall.
Conclusions:
i) Some players are tall.
ii) All players are tall.
(a) If only conclusion I follows
(b) If only conclusion II follows
(c) If either I nor II follows
(d) If neither I nor II follows

5. The figure represents a set of people:
i) The triangle represents educated persons
ii) The rectangle represents policemen
iii) The circle represents road tax payers
iv) The ellipse represents shopkeepers



According to the figure we can say that:
(a) Policemen do not pay road tax
(b) Shopkeepers do not pay road tax
(c) Some shopkeepers are educated
(d) some policemen are shopkeepers

6. Taken "All boys are wicked, all wicked (boys) are traitors" for granted, which of the following conclusions can be logically derived?
(a) All boys are traitors
(b) No boy is a traitor
(c) Some wicked are not boys
(d) Some traitors are not boys

Directions for questions Q7 to Q10: In each of the following questions there are three statements which are followed by three or four conclusions. Choose the conclusions which logically follow from the given statements.

7. **Statements:**
All Indians are patriotic.
Some Indians are army men.
Some army men are diabetic.
Conclusions:
i) Some army men are patriotic.
ii) Some Indians may be diabetic.
(a) Neither I nor II follows
(b) Either I or II follows
(c) Only conclusion II follows
(d) Both conclusions I and II follow

8. **Statements:**
All Europeans are scientists.

Some Christians are scientists.
All Scientists are Vegans.
Some Engineers are Europeans.
Conclusions:

i) All Europeans are Christians.
ii) Some Christians are Europeans.
iii) All Vegans are Scientists.
iv) Some Engineers are Scientists.

(a) I, II and IV (b) I, II and III (c) II and III (d) Only IV

9. **Statements:**
No terriers are bulldogs.
All bulldogs are poodles.
Some collies are terriers.
All terriers are spaniels.
Conclusions:

i) All collies are spaniels.
ii) Some collies may be bulldogs.
iii) Some terriers may be poodles.
iv) No spaniels are bulldogs.

(a) I, II and III (b) II and IV (c) I and IV (d) II and III

10. **Statements:**
Some cherries are oranges.
All berries are cherries.
Some apples are berries.
Conclusions:

i) Some cherries are apples.
ii) Some oranges are not apples.
iii) Some oranges are apples.

(a) Only III follows
(b) I and either II or III follows
(c) I and III follows
(d) None follows

Directions for questions Q11 to Q15: Each question contains six statements followed by four options of combinations of any three of the given statements. Choose the option in which the combinations are logically related.

11. (A) All tigers lay eggs.
(B) All cats lay eggs.
(C) Some cats can fly.
(D) All tigers cannot fly.
(E) All tigers are cats.
(F) All tigers cannot swim.
(a) BEA (b) ABE (c) DEC (d) ECB

12. (A) Some curtains are cloth.
(B) All cloth is wood.
(C) All that is wood is cloth.
(D) All cloth are curtains.
(E) All curtains are wood.
(F) Some curtains are wood.
(a) BED (b) BDF (c) FAB (d) FBA

13. (A) All balls are tolls.
(B) Some tolls are dolls.
(C) Some dolls are balls.
(D) Some tolls are not balls.
(E) All tolls are dolls.
(F) No tolls are dolls.
(a) EAC (b) BCD (c) ABC (d) EDC

14. (A) No brother is a pro.
(B) Some pros like to work.
(C) No Indian is rude.
(D) Some rude are pros.
(E) Some pro are Indians.
(F) All Indians like to work.
(a) ABE (b) CED (c) FEB (d) BEF

15. (A) All bows are arrows.
(B) No arrow is a casket.
(C) No bow is a casket.
(D) Some caskets are arrows.
(E) Some bows are caskets.
(F) No casket is a bow.
(a) BDE (b) ACB (c) CDF (d) ABF

Directions for questions Q16 to Q20: In each of the questions below are given two or three statements followed by some conclusions. You have to take the given statements as true even if they seem to be at variance with commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follow(s) from the given statements, disregarding commonly known facts.

16. **Statements:**
(A) All cats are dogs.
(B) All dogs are brown.
Conclusions:
i) All cats are brown.
ii) All brown are dogs.
(a) If only conclusion I follows.
(b) if only conclusion II follows.
(c) if both follows.
(d) if neither I nor II follows.

17. **Statements:**
(A) All Computers are Pentiums.
(B) Some Pentiums are Machines.
Conclusions:
i) Some Computers are Machines.
ii) Some Machines are Computers.
(a) If only conclusion I follows.
(b) if only conclusion II follows.
(c) if both follows.
(d) if neither I nor II follows

18. **Statements:**
(A) Some rats are cats. (B) Some cats are dogs. (C) No dog is cow.
Conclusions:
I. No cow is cat.
II. No dog is rat.
III. Some cats are rats.
IV. No cats are cows.
(a) Only I follows.
(b) Only I and II follow.
(c) Only I and III follow.
(d) Only III follows.

19. **Statements:**
(A) All the books are papers.
(B) Some papers are journals.
(C) Some journals are calendars.

Conclusions:

I. Some journals are books.
II. Some calendars are papers.
III. Some books are journals.
IV. Some books are calendars.
(a) Only I follows.
(b) Only II follows.
(c) Only III follows.
(d) None of these follow.

20. **Statements:**
(A) All the bottles are boxes.
(B) All the boxes are bags.
(C) Some bags are trays.
Conclusions:
I. Some bottles are trays.
II. Some trays are boxes.
III. All the bottles are bags.
IV. Some trays are bags.
(a) Only III and IV follow.
(b) Only I and II follow.
(c) Only II and III follow.
(d) Only I and IV follow.

21. **Conclusions:**
Some words are excel.
All notepads are windows.
No excel is notepad.
Statements:
I. All excels are word. Some words are notepad. No window is notepad.
II. Some notepads are excel. Some windows are word. No excel is word.
III. No notepad is excel. Some excels are word. All notepads are windows.
IV. All windows are word. Some words are notepad. No notepad is excel.
V. Some notepads are excel. All words are windows. Some excels are windows.
Which of the following statements given above is/are true?
(a) Only Statement I follows
(b) Only Statement II follows
(c) Only Statement III follows
(d) Only Statement IV follows

22. In each question given below, there are statements followed by conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts and then decide which of the conclusion(s) logically follow(s) from the given statements.
Statements:
No crow is a pigeon.
All pigeons are doves.
Conclusions:
I. Some pigeons are crows.
II. Some doves may be crows.
(a) Only conclusion II follows.
(b) Both conclusions I and II follow.
(c) Neither conclusion follows.
(d) Only conclusion I follows.

23. In each question given below, there are statements followed by conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance with commonly known facts and then decide which of the conclusion(s) logically follow(s) from the given statements.

Statements:

Some blankets are soft. Some soft are cute.

Conclusions:

I. Some cute maybe blankets. II. Some soft are blankets.

(a) Only conclusion II follows.
(b) Both conclusions I and II follow.
(c) Neither conclusion follows.
(d) Either conclusion I or conclusion II follows.

24. **Statements:**

Some SRKs are actors. All actresses are actors. No actor is musician.

Conclusions:

I. Some SRKs are actresses.
II. All musicians being actresses is a possibility.
III. No SRK is an actress.
IV. Some actors not being SRK is a possibility.

(a) Only II follows (b) Only II and IV follow
(c) Only III (d) None of these

25. **Conclusions:**

I. Some Fans are Mobile.
II. Some tables are Fan.

Which of the following statements given below is true for the above conclusions?

(a) Some Fans are Paper. All papers are Tables. All Table is Mobile
(b) All fans are Paper. Some papers are Tables. No Table is Mobile.
(c) Some Fans are Paper. All Papers are Tables. No Table is Mobile.
(d) All Fans are Paper. No Paper is Table. All Tables are Mobile.

MODULE 11
DATA SUFFICIENCY

What is Data Sufficiency?

Data sufficiency means checking and testing a given set of information to see if it is enough to answer a given question. These are designed to test the candidate's ability to correlate every provided question to reach a conclusion. Above all, data sufficiency comes with broader attributes for testing the candidate's knowledge and ability.

Tips to solve questions based on Data Sufficiency:

- Firstly, it is crucial to understand the overall pattern suggested in the analogy. Since it is difficult, it might appear complicated in the first go.
- If the candidate fails to understand the given pattern, they may fail to judge the options rightly.
- Reading the questions carefully and eliminating options that are a definite no from the candidates' perspective is the most crucial step.
- Scoring marks in questions based on the analogy is easy as they are non-complicated and, mostly, direct.
- To solve these questions, understanding basic static GK is crucial.

PROBLEMS:

Directions for Questions 1 to 4: Each question is followed by two statements, A and B. Answer each question using the following instructions:
Choose 1 if the question can be answered by using one of the statements alone but not by using the other statement alone.
Choose 2 if the question can be answered by using either of the statements alone.
Choose 3 if the question can be answered by using both statements together but not by either statement alone.
Choose 4 if the question cannot be answered on the basis of the two statements.

1. Tarak is standing 2 steps to the left of a red mark and 3 steps to the right of a blue mark. He tosses a coin. If it comes up heads, he moves one step to the right; otherwise, he moves one step to the left. He keeps doing this until he reaches at one of the two marks, and then he stops.
   At which mark does he stop?
   i) He stops after 21-coin tosses.
   ii) He obtains three more tails than heads.
   (a) 1 (b) 2 (c) 3 (d) 4

2. Four candidates for an award obtain distinct scores in a test. Each of the four casts a vote to choose the winner of the award. The candidate who gets the largest number of votes wins the award. In case of a tie in the voting process, the candidate with the highest score wins the award. Who wins the award?
   i) The candidates with top three scores each vote for the top scorer amongst the other three.
   ii) The candidate with the lowest score votes for the player with the second highest score.

(a) 1 (b) 2 (c) 3 (d) 4

3. Nandini paid for an article using currency notes of denominations Rupees 1, 2, 5, and 10 using at least one note of each denomination. The total number of five and ten rupee notes used was one more than the total number of one and two rupee notes used. What was the price of the article?
i) Nandini used a total of 13 currency notes.
ii) The price of the article was a multiple of Rs. 10.
(a) 1 (b) 2 (c) 3 (d) 4

4. In a class of 30 students, Rashmi secured third rank among the girls, while her brother Kumar studying in the same class secured sixth rank in the whole class. Between the two, who had a better overall rank?
i) Kumar was among the top 25% of the boys merit list in the class in which 60% were boys.
ii) There were three boys among the top five rank holders, and three girls among the top ten rank holders.
(a) 1 (b) 2 (c) 3 (d) 4

Directions for Questions 5 to 15: Each question is followed by two statements, I and II. Answer each question using the following instructions:
Mark 1 if data in statement I alone is sufficient to answer the question
Mark 2 if data in statement II alone is sufficient to answer the question
Mark 3 if data in both statements I and II are needed to answer the question
Mark 4 if data in either statement I alone or statement II alone is sufficient to answer the question
Mark 5 if data in both statement I and II together are not sufficient to answer the question

5. Among five friends Ajay, Binoy, Chirag, Dhanush and Eswar, who is the tallest?
I. Dhanush is taller than Ajay and Chirag.
II. Binoy is shorter than Eswar but taller than Dhanush.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

6. How many sons does D have?
I. A's father has three children.
II. B is A's brother and son of D.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

7. Who is sitting to the immediate right of Manisha among five friends sitting around a circle facing the centre?
I. Shreya is sitting exactly between Kajal and Sneha. Raj is sitting to the immediate right of Sneha.
II. Manisha is sitting exactly between Kajal and Raj. Shreya is sitting to the immediate right of Kajal.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

8. What is the minimum passing percentage in a test?
I. Raman scored 25% marks in the test and Sunil scored 288 marks which is 128 more than Raman.

II. Raman scored 64 marks less than the minimum passing marks.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

9. What is the distance between A and G?
I. Point A is 3 m north of point B. Point E is 8 m east of point D. Point G is 3 m west of point F. Point D is 5 m north of point C. Point F is 7 m south of point E. Point B is 2 m west of point C.
II. Point A is 6 m west of point B. Point D is 9 m north of point E. Point G is 5m north of point F. Point C is 7 m north of point B and is also 3 m west of point D.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

10. What is the position of A from the left end of row?
I: In a row having 15 people, A is sitting second to the right of B who is sitting at twelfth position from the right end of row.
II: In a row of 20 people, C will take the eighth position from the right end of row if C and A interchange their respective positions.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

11. What is the average speed of a car?
I. Average speed of the car is double the average speed of a truck whereas the average speed of a bus is 30 km/hr.
II. Average speed of the truck is thrice the average speed of the bus whose speed is 30 km/hr.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

12. Is x even?
I. $3x - 12 = 12$
II. $2x + 16 = 24$
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

13. How is 'home' written in a given language?
I. 'go to home' is written as 'sa la da' and 'on the way' is written as 'ni da ka'
II. 'way for market' is written as 'sh da pi' and way to home is written as 'da pi ma'
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

14. Jindal Singh, Bhanu Singh and Pratap Singh together have ten cows. If each has at least one cow, how many cows does each person have?
I. Jindal Singh has 5 more than Pratap Singh.
II. Bhanu Singh has half as many as Jindal Singh.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

15. In a school election, if each of the 900 voters voted for either A or B (but not both), what percent of the female voters in this election voted for B?
I. Eighty percent of the female voters voted for A.
II. Sixty percent of the male voters voted for B.
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

Directions for Questions 16 to 20: Each question is followed by three statements, I, II and III. You have to decide whether the data given in the statements is sufficient to answer the question. Read all the statements carefully and find which of the statements is/are sufficient to answer the given question. Choose the correct alternative accordingly.

16. In which year was Sanjay born?
    I. Sanjay is six years older than Gopal.
    II. Gopal's brother was born in 1982.
    III. Sanjay's brother is two years younger than Gopal's brother who was eight years younger than Gopal.
    (a) Only I and II
    (b) Only II and III
    (c) Only I and III
    (d) All I, II and III

17. Four subjects - Physics, Chemistry, Mathematics and Biology - were taught in four consecutive periods of one hour each starting from 8.00 a.m. At what time was the Chemistry period scheduled?
    I. Mathematics period ended at 10.00 a.m., which was preceded by Biology.
    II. Physics was scheduled in the last period.
    III. Mathematics period was immediately followed by Chemistry.
    (a) Only I
    (b) Either I only or II only
    (c) Only II and III
    (d) Only I and either II or III

18. Who is the tallest among six boys P, T, N, D, Q and R?
    I. P is taller than D and N but not-as tall as T.
    II. R is taller than Q but not as tall as T.
    III. Q is not taller than T and R.
    (a) Only I and II
    (b) Only II and III
    (c) Only I and III
    (d) All I, II and III

19. What is the total monthly salary of Vasu?
    I. Vasu's basic salary is Rs. 100 more than Rajan's salary who also serves in Vasu's company.
    II. Other allowances drawn by Rajan besides his basic salary are Rs. 2000 per month which is Rs. 50 less than Vasu's salary.
    III. Rajan's basic salary is Rs. 1550 per month.
    (a) Only II and III
    (b) Only I and II
    (c) Only I and III
    (d) All I, II and III

20. What does 'come' represent in a code language?
    I. 'pit na tac' means 'come and go' in that code language.
    II. 'ja ta da' means 'you are good' in that code language.
    III. 'na da rac' means 'you can come' in that code language.
    (a) Only I and II
    (b) Only II and III
    (c) Only I and III
    (d) All I, II and III

THE APTITUDE TRIAD

SECTION C
VERBAL ABILITY

MODULE 1
ARTICLES AND PREPOSITIONS

Articles are the words that are used before a noun to determine whether it is specific or unspecific.

Consider the following examples:

- On the cold day, the bowl of soup was particularly welcoming.
  By using the article the, we've shown that it was one specific day and one specific bowl of soup that was welcoming.
- On a cold day, a bowl of hot soup is particularly welcoming.
  By using the article a, we've created a general statement, implying that any bowl of hot soup would taste good on any cold day.

The Definite Article:

- The definite article is the word the. It limits the meaning of a noun to one particular thing. For example, your friend might ask, "Are you attending the wedding this weekend?"
- The definite article tells you that your friend is referring to a specific wedding that both of you know about.

The definite article can be used with singular, plural, or uncountable nouns. Below are some examples of the definite article 'the' used in different contexts:

- Please take the cup.
- Please take the yellow; the green one is too small.
- Please hand me the spoon.
- Please hand me the big spoon; the small one will fall into the saucepan.
- Please take the sandwich and the cake.

The Indefinite Article:

- The indefinite article takes two forms – A and An
  A precedes a consonant and an precedes a vowel.

- The indefinite article indicates that a noun refers to a general idea rather than a particular thing. For example, you might ask your friend, "Should I send a car to pick you up?"
  Your friend will understand that you are not asking about a specific type of gift or a specific item.
  "I am going to buy an ice cream," your friend tells you.
  Again, the indefinite article indicates that she is not talking about a specific ice cream. Your friend probably doesn't even have any ice cream yet.

- The indefinite article only appears with singular, countable nouns. Consider the following examples of indefinite articles used in different contexts:
  Please pass me a pen; any pen will do.
  Please give me an umbrella; any umbrella will do.

Exceptions: Choosing A or An:
There are a few exceptions to the general rule of using a before words that start with consonants and an before words that begin with vowels.
The words honour, hour etc. are spelt with a consonant, but pronounced with the sound of the vowel -o. Therefore, we use 'an' before such words.

Similarly, when the first letter of a word is a letter from any of the vowel sounds (a, e, i, o, u) but produces a consonant sound, use a, as in the sample sentence below:
Incorrect: The actor turned out to be an one-film wonder.
Correct: The actor turned out to be a one-film wonder.

This holds true with acronyms and initialisms, too: an MBA degree, a UK-based company, an HR department, a URL.

Article Before an Adjective:
An article is usually placed before a noun, but in some cases, if there is an adjective to describe the noun, the article is placed before the adjective. In such cases, a or an is used according to the adjective that it is placed before.
Example: Sophie has planted a red rose in her garden.
Tim told me an intriguing tale.

Indefinite Articles with Uncountable Nouns:
Uncountable nouns are nouns that are either difficult or impossible to count. Uncountable nouns include intangible things (e.g., information, air), liquids (e.g., milk, wine), and things that are too large or numerous to count (e.g., equipment, sand, wood). As these things can't be counted, you should never use a or an with them—remember, the indefinite article is only for singular, countable nouns.

Uncountable nouns can be modified by words like some, however. Consider the examples below for reference:

- I need to buy a petrol.
  Petrol is an uncountable noun and should not be used with the indefinite article.

- I need to buy some petrol.
  However, if you describe the petrol in terms of countable units (such as litres, cans etc.), you can use the indefinite article.

- I bought two litres of petrol.
  I put a can of petrol in the boot of the car.

Note that depending on the context, some nouns can be countable or uncountable (e.g., hair, noise, time):

- I hear a noise outside.
- Keep the noise down; people are sleeping.

Omission of Articles:

Articles are omitted altogether before Proper nouns: the names (except when it is used as an adjective eg: He is the Shakespeare of our class) the names of meals, the names of sports, nationalities, languages, academic subjects, or words such as a church, hospital, school, etc.

Example:

- Let's have breakfast; I'm hungry.
- He plays football.
- I go to church every Sunday.

Exception: When words such as church, school, or hospital are used for any other purpose than their primary one, they do take an article before them.

Example:

- I volunteer at the hospital every Friday.
- He went to the school to interview the Principal.

Articles and Idiomatic usage:

Articles form a very important part of idioms and phrases and certain fixed usages in English.

Example: a few and few; a little and little

There is a definite difference in the expressions.

- Incorrect: I need a few moments.
- Correct: I need a few moments.

The articles in idioms are also fixed. One cannot change them at will.

- Incorrect: He let the cat out of the bag.
- Incorrect: He let a cat out of a bag.
- Correct: He let the cat out of the bag.

PREPOSITIONS:

A preposition is a word or group of words used before a noun, pronoun, or noun phrase to show direction, time, place, location, or spatial relationships, or to introduce an object. Some examples of prepositions are words like "in," "at," "on," "of," and "to."

Prepositions in English are highly idiomatic. Although there are some rules for usage, much preposition usage is dictated by fixed expressions. In these cases, it is best to memorize the phrase instead of the individual preposition.

A Few Rules

1. **Prepositions of Direction**

   To refer to a direction, use the prepositions "to," "in," "into," "on," and "onto."

   She drove to the store.

   Don't ring the doorbell. Come right in(to) the house.

   Drive on(to) the grass and park the car there.

2. **Prepositions of Time**

   To refer to one point in time, use the prepositions "in," "at," and "on."

- Use "in" with parts of the day (not specific times), months, years, and seasons.

He reads **in** the evening.
The weather is cold **in** December.
She was born **in** 1996.
We rake leaves **in** the fall.

- Use "at" with the time of day. Also use "at" with noon, night, and midnight.
  I go to work **at** 8:00.
  He eats lunch **at** noon.
  She often goes for a walk **at** night.
  They go to bed **at** midnight.
- Use "on" with days.
  I work **on** Saturdays.
  He does laundry **on** Wednesdays.

To refer to extended time, use the prepositions "since," "for," "by," "during," "from…to," "from…until," "with," and "within."

I have lived in Minneapolis since 2005. (I moved there in 2005 and still live there.)
He will be in Toronto for 3 weeks. (He will spend 3 weeks in Toronto.)
She will finish her homework by 6:00. (She will finish her homework sometime between now and 6:00.)
He works part-time during the summer. (For the period of time throughout the summer.)
I will collect data from January to June. (Starting in January and ending in June.)
They are in school from August until May. (Starting in August and ending in May.)
She will graduate within 2 years. (Not longer than 2 years.)

3. **Prepositions of Place**
   To refer to a place, use the prepositions "in" (the point itself), "at" (the general vicinity), "on" (the surface), and "inside" (something contained).
   They will meet in the lunchroom.
   She was waiting at the corner.
   He left his phone on the bed.
   Place the pen inside the drawer.
   To refer to an object higher than a point, use the prepositions "over" and "above." To refer to an object lower than a point, use the prepositions "below," "beneath," "under," and "underneath."

   The bird flew over the house.
   The plates were on the shelf above the cups.
   Basements are dug below ground.
   There is hardwood beneath the carpet.
   The squirrel hid the nuts under a pile of leaves.
   The cat is hiding underneath the box.
   To refer to an object close to a point, use the prepositions "by," "near," "next to," "between," "among," and "opposite."

   The gas station is by the grocery store.
   The park is near her house.

Park your bike next to the garage.
There is a deer between the two trees.
There is a purple flower among the weeds.
The garage is opposite the house.

4. **Prepositions of Location**
To refer to a location, use the prepositions "in" (an area or volume), "at" (a point), and "on" (a surface).

They live in the country. (an area)
She will find him at the library. (a point)
There is a lot of dirt on the window. (a surface)

Prepositions of Spatial Relationships
To refer to a spatial relationship, use the prepositions "above," "across," "against," "ahead of," "along," "among," "around," "behind," "below,"
"beneath," "beside," "between," "from," "in front of," "inside," "near," "off," "out of," "through," "toward," "under," and "within."

The post office is across the street from the grocery store.
We will stop at many attractions along the way.
The kids are hiding behind the tree.
His shirt is off.
Walk toward the garage and then turn left.
Place a checkmark within the box.

Error Detection – Articles and Prepositions:

Directions: The sentences given below are divided into three parts (A), (B) and (C). One of these parts may contain an error. You have to indicate that part as your answer. If there is no error, mark (D) as your answer.

1. (A)However, one of most famous researchers, (B)Jane Wills, had received worldwide acclaim (C)from an early age. (D)No error.
(a) A (b) B (c) C (d) D

2. (A)The most interesting aspect was (B)how data communication via internet (C)changed a way they did their research. (D)No error.
(a) A (b) B (c) C (d) D

3. (A)In order to write a thesis, (B)one must engage in research that focuses (C)at a specific topic relevant to one's field of study. (D)No error.
(a) A (b) B (c) C (d) D

4. (A)This academic program offers (B)opportunities of studies which can lead to careers in the (C)increasingly important field of international business. (D)No error.
(a) A (b) B (c) C (d) D

5. (A)In his talk, Edmondson didn't reveal (B)whether the device was ever practically put on the test, (C)or what became of his friend's informant. (D)No error.
(a) A (b) B (c) C (d) D

6. (A)There is renewed (B)sense of urgency in (C)completing the project. (D)No error.
(a) A (b) B (c) C (d) D

7. (A)Contrary from their expectations, many people find (B)themselves wanting to go back (C)to work within months of their retirement. (D)No error.
(a) A (b) B (c) C (d) D

8. (A)Mary Cassatt, American Impressionist painter born in 1844, (B)became famous mainly for her portraits of women and their children, unlike (C)other Impressionists of her time who were known for their landscapes. (D)No error.
(a) A (b) B (c) C (d) D

9. (A)President Calvin Coolidge presided (B)over 1927 ceremony that officially commenced (C) the carving of Mount Rushmore. (D)No error.
(a) A (b) B (c) C (d) D

10. (A)Children are naturally drawn by the art of Keith Haring, (B)whose vibrant, simplistic paintings and drawings tell sophisticated stories (C)and embody rich emotions in vivid colors and shapes. (D)No error.
(a) A (b) B (c) C (d) D

11. (A)While German printer Johannes Gutenberg is often (B)credited for the invention of the first printing press to use movable type, (C)Chinese printers used movable block prints and type made of clay as early as 1040. (D)No error.
(a) A (b) B (c) C (d) D

12. (A)Seated high in the amphitheatre, the audience members could (B)see a facial expressions of (C)the ancient Greek actors, who wore masks. (D)No error.
(a) A (b) B (c) C (d) D

13. (A)At her great relief, Jennifer found (B)that wearing sunglasses in bright sunlight (C)helped to mitigate her headaches. (D)No error.
(a) A (b) B (c) C (d) D

14. (A)The library housed all the literature of Greece, plus the(B)literature of other cultures, most of which, as a (C)result of the burning of the library, was lost for later generations. (D)No error.
(a) A (b) B (c) C (d) D

15. (A)In last Thursday night's performance, Allison (B)was the strongest of the singers who entertain (C)for the children's ward of hospital. (D)No error.
(a) A (b) B (c) C (d) D

MODULE 2
SUBJECT VERB AGREEMENT

A noun (name of a person, place, animal, or thing - E.g.: cat, table, Ram, India, bunch, agreement, industrialization, poverty, etc.) or a pronoun (he, she, they, we, I, etc.) acts as the 'subject' in a sentence.

The 'subject' is the one that does the action conveyed by the verb, so there has to be an agreement between the subject and the verb on the basis of number - singular or plural - and person -1st person, 2nd person or 3rd person for the sentence to be correct.
E.g.: A cat sleeps. (singular subject-singular verb). | Cats sleep. (plural subject-plural verb)
Note - A verb in singular ends with an 's'. A verb in the plural doesn't end in 's'.

There are different ways of forming a subject:

1) Two nouns or pronouns are joined by 'and' to form a plural subject.
E.g.: Gold and silver are precious metals.
He and she have studied together.
Exception: When the two nouns form an idiomatic unit, they form a singular subject.
E.g.: Bread and butter is a favourite snack.
Time and tide waits for none. Subject-'time and tide'

2) When two nouns or pronouns are joined by 'or', 'neither-nor', 'either-or', the verb agrees with whichever noun or pronoun is closer to it.
E.g.: No nook or cranny was left unexplored.
Either the cat or the dog has been here.
Neither praise nor blame seems to affect him.
Either he or I am mistaken.
Neither the chairman nor the directors are present.

3) When two nouns or pronouns are joined by certain phrases such as - along with, as well as, together with, in addition to and including – the verb agrees with the primary subject.
The other noun/pronoun becomes the secondary subject because it is preceded by the expressions mentioned above, which has the effect of putting the noun/pronoun into a bracket.
E.g.: The house, with its contents, was insured.
Silver, as well as cotton, has fallen in price.
Accompanied by his councillors, the mayor is to be present.

4) Phrases that are made up of a noun/pronoun + preposition + noun/pronoun can also be used as subjects. In such a case, the verb agrees with the first noun/pronoun.
E.g.: The quality of the mangoes was quite good.
Subject - 'The quality', so the verb should be 'was' and not 'were'.
His knowledge of the Indian vernaculars is beyond the common. **Subject - 'Knowledge'**

Exception: When such phrases contain words such as some, any, none, all, most, majority, and fractions, the verb agrees with the second noun/pronoun.
E.g.: All of the books have been put away.
All of the money is in the wallet.

5) Rule - Expressions such as 'every', 'each' either', 'neither', 'many a', 'everyone', 'everybody', 'someone', 'somebody' etc. are all singular.
E.g.: Everyone in the class was absent. **Subject - 'everyone'**

6) i) Sometimes, verbs are separated from the subjects by a descriptive phrase or clause.
E.g.: The painter, whose works are displayed at the gallery, is working on creating the biggest painting ever made.
The bag of oranges lying on the ground belongs to me.

ii) The verb within the descriptive clause agrees with whichever noun or pronoun the clause describes.
E.g.: The house, which stands at the corner of the street, is haunted.

7) Some words are always considered singular even though they end with an 's', so they are followed by singular verbs.
E.g.: The news is true. | Politics is a game. | Economics is a difficult subject.

8) Some words always end with an 's' and are always plural., so they are followed by a verb in the plural.
E.g.: All possible means have been tried.
The nuptials have been fixed for tomorrow.

9) Units of 'time', 'money' and 'distance' are always singular and are followed by a singular verb.
E.g.: Fifteen kilometers is a long way to walk.
Ten minutes is allotted to each speaker.
Fifty thousand rupees is a large sum.

Directions: The sentences given below are divided into three parts (A), (B) and (C). One of these parts may contain an error. You have to indicate that part as your answer. If there is no error, mark (D) as your answer.

1. (A)The information on a standard CD is contained on the (B)polycarbonate layer, as a single spiral track of pits, starting at (C)the inside of the disk and circling its way to the outside. (D)No error.
(a) A (b) B (c) C (d) D

2. (A)Made from 1.2 mm of polycarbonate plastic, (B)the disc is coated with a much thinner (C)aluminium layer that are then protected with a film of lacquer. (D)No error.
(a) A (b) B (c) C (d) D

3. (A)The beginning of the twenty-first century have been called the end (B)of the supermodel era by fashion magazines, trend watchers, (C)and news organizations around the world. (D)No error.
(a) A (b) B (c) C (d) D

4. (A)It is on the wish list of the Computer Museum of America, (B)in San Diego, California, which (C)hopes you will donate it to their holdings. (D)No error.
(a) A (b) B (c) C (d) D

5. (A)The Life and Casualty Company hopes that by increasing its environmental fund revenues to $1.2 billion, (B) they have set aside enough to pay for environmental claims and (C)will no longer have to use its profits and capital to pay those claims bit by bit, year by year. (D)No error.

(a) A (b) B (c) C (d) D

6. (A)A major pharmaceutical company, in cooperation with an international public health organization and (B)the medical research departments of two large universities, are expected to announce tomorrow (C)that it will transfer the rights to a manufacture a number of tuberculosis drugs to several smaller companies. (D)No error.
(a) A (b) B (c) C (d) D

7. (A)The purpose of these sites, (B)as with the shopping mall, (C)are both economic and social. (D)No error
(a) A (b) B (c) C (d) D

8. (A)Palaeontologists believes that fragments of a primate jawbone unearthed in Burma and (B)estimated to be 40 to 44 million years old provide evidence of a crucial (C)step along the evolutionary path that led to human beings. (D)No error.
(a) A (b) B (c) C (d) D

9. (A)Since the suburbs typically have no centralized marketplace, (B)shopping centres or malls was designed to fill the needs of the changing community, (C)providing retail stores and services to an increasing suburban population. (D)No error.
(a) A (b) B (c) C (d) D

10. (A)Works of art, fountains, tropical plants, (B)flowers and decorative lighting was placed (C)throughout the mall. (D)No error.
(a) A (b) B (c) C (d) D

11. (A)Though tiny, blind, and translucent, a recently discovered species (B)of catfish has thickened bones and (C) armour plates on its sides that lessen its vulnerability. (D)No error.
(a) A (b) B (c) C (d) D

12. (A)This incredible growth in availability and consumption point to the fact (B)that Americans have decided that sushi isn't just good for them, or (C)just convenient, but that this once-scorned food is truly delicious. (D)No error.
(a) A (b) B (c) C (d) D

13. (A)Using meticulous research gathered over a 10-year period, a group (B)of climate scientists have determined that methane (C)is accumulating in the atmosphere much faster than previously believed.
(a) A (b) B (c) C (d) D

14. (A)Even those who doesn't win the big prize (B)get national television exposure, and have a (B)better chance of becoming famous than (C)they did before the show.(D)No error.
(a) A (b) B (c) C (d) D

15. (A)In a crowded, acquisitive world, the disappearance of lifestyles such as those once (B)followed by southern Africa's Bushman and Australia's aborigines, life-styles requiring (C)vast wild spaces and permitting little accumulation of goods, seem inevitable. (D)No error.
(a) A (b) B (c) C (d) D

MODULE 3
CHANGE OF SPEECH

Direct Speech: A sentence is said to be in Direct Speech if it is conveyed exactly as a person says it. This is used in informal conversations and novels and stories to make dialogues interesting and convey emotions as a person would convey them in spoken communication. A sentence in direct speech is enclosed within inverted commas.

Example:

- The manager said to the team, "You have to work hard to ensure that the project is completed on time.
- The witch said, "I want your firstborn to be named after me."
- She said, "Who is at the door?"
- The boy said, "Hey! The ball is rolling into the ditch."

Indirect/Reported Speech: A sentence is said to be in Indirect or Reported speech if it is reported by someone. In such sentences, there are changes in tense, pronoun, etc. This is used for formal conversations and written communication.
Example:

- The manager told the team that they had to work hard to ensure that the project was completed on time.
- The witch said that she wanted my firstborn to be named after her.
- She asked who was at the door.
- The boy exclaimed that the ball was rolling into the ditch.

There are some rules to be observed while changing a sentence from Direct to Indirect speech or vice versa:

1. The inverted commas are removed and the relative pronoun 'that' takes its place.
   Example: Vijay said, "The train will leave at ten p.m."
   Vijay said that the train would leave at ten p.m.

2. The verb outside the inverted commas is called the reporting verb. The reporting verb conveys the kind of sentence that is being reported – statement, question, exclamation, etc.

   Example 1: Martin said, "It is a sunny day.
   Martin said that it was a sunny day. (statement)

   Example 2: The captain said, "Hurrah! We have won!
   The captain exclaimed joyfully that they had won. (exclamation)

   Example 3: My sister said to me, "We must hurry."
   My sister told me that we must hurry. (the verb 'told' is used when the object is known)

3. The tense of the verb within inverted commas is changed.
   simple present – simple past
   Example: The patient said, "I have a headache."
   The patient said that he had a headache.

Note: The tense does not change from the simple present to the simple past when the statement is a general or universal truth or a habitual action.
Example: Rob said, "I exercise every day
Rob said that he exercises every day.

simple past – past perfect
Example: She said to her brother, "I finished my work early."
She told her brother that she had finished her work early.

present continuous – past continuous
Example: The doctor said, "I am going on my rounds now."
The doctor said that she was going on her rounds then.

present perfect – past perfect
Example: He said, "I have sent the letter.
He said that he had sent the letter.

will – would
Example: He said, "I will apply for leave tomorrow."
He said that he would apply for leave the next day.

The same rule of moving the tenses one step back also applies to modal verbs. For example:

DIRECT SPEECH	INDIRECT SPEECH
She said, "I **can** swim."	She said she **could** swim.
She said, "I **must** go."	She said she **had** to go.
She said, "I **may** drive there."	She said she **might** drive there.
She said, "**Shall** we start."	She asked if we **should** start.
She said, "**I'll** call you."	She said she **would** call me.

4. The pronouns change form to make sure the meaning of the sentence is conveyed in a logical manner.
   Example:
   "We are the best students," he said. - He said they were the best students.
   "They called us," he said. - He said they had called them.
   "I like your jeans," she said. - She said she liked my jeans.
   "I can lend you my car," he said. - He said he could lend me his car.

- In some cases, the pronoun has to be replaced by a noun to make sure that the sentence is logical.
  "He killed them," Kevin said. - Kevin said that the man had killed them.
  If we only make mechanical changes (Kevin said he had killed them), the new sentence can convey a different meaning - Kevin himself killed them.

- This and these are usually substituted.

"They will finish it this year," he said. - He said they would finish it that year.
"We want these flowers," they said. - They said they wanted those flowers.

5. The adverbs that convey time and place are also changed –
here – there, today – that day, tomorrow – the next day, now – then, yesterday – the previous day, etc.

6. A word conveying the emotion implied by an interjection is added.
Example:
They said, "Alas! The king is no more!
They exclaimed sorrowfully that the king was no more.

7. While changing questions from Direct to Indirect speech, the order of words within the inverted commas is changed from verb + subject + verb in direct speech to Subject + verb + verb in indirect speech.
Example:
She said, "What will you do now?"
She asked what I would do then.

In 'yes' or 'no' questions, i.e., questions that start with a verb, the word 'if' or 'whether' is used instead of 'that'.
Example:
"Will you come?" she asked me. - She asked me if/whether I would come.
"Did he marry Sue?" she said. - She wondered if/whether he had married Sue.
She said, "Do you know my name?"- She asked if/whether I knew her name.

Directions for questions 1 to 5: Rewrite the following sentences by changing the speech.

1. John said, "I love this town."
2. "Do you like soccer?" He asked me.
3. "What have you decided to do?" she asked him.
4. John's father reminded him to take his umbrella.
5. John asked, "How long will it take to travel from Germany to South Africa?"

Directions for questions 6 to 10: A sentence has been given in Direct Speech. Out of the four alternatives suggested, select the one which best expresses the same sentence in Indirect Speech.

6. His father says "Honesty is the best policy."
   (a) His father called honesty is the best policy.
   (b) His father asked if honesty is the best policy.
   (c) His father exclaimed that honesty is the best policy.
   (d) His father says that honesty is the best policy.

7. Rama said, 'I am very busy now.'
   (a) Rama said that he was very busy then.
   (b) Rama said that he would be very busy now.

(c) Rama said that he is very busy then.
(d) Rama said that he is very busy now.

8. He said to him,' Is not your name Khalid?
   (a) He said that his name was Khalid.
   (b) He inquired whether his name was not Khalid.
   (c) He asked if his name was not Khalid.
   (d) He asked why his name was Khalid.

9. Ram remarked "What a wonderful day!"
   (a) Ram exclaimed that it was a wonderful day.
   (b) Ram asked if it was a wonderful day.
   (c) Ram said what a wonderful day.
   (d) Ram asked what a wonderful day.

10. Ali said to the beggar, 'I know you very well'
   (a) Ali recognized the beggar.
   (b) Ali told the beggar that he knew him very well.
   (c) Beggar knew Ali too.
   (d) Beggar was recognized by Ali.

Directions for questions 11 to 15: A sentence has been given in Indirect Speech. Out of the four alternatives suggested select the one which best expresses the same sentence in Direct Speech.

11. His father ordered him to go to his room and study.
   (a) His father said, "Go to your room and study."
   (b) His father said to him, "Go and study in your room."
   (c) His father shouted, "Go right now to your study room."
   (d) His father said firmly, "Go and study in your room."

12. He assured them that he would soon return.
   (a) He assures them, "I will soon return."
   (b) He assured them, "I will soon return."
   (c) He assured them, "I may soon return."
   (d) He assured them, "I might soon return."

13. He said he was very sorry for the fault he had committed.
   (a) He said, "I am very sorry for the fault I have committed."
   (b) He said, "I was very sorry for the fault I have committed."
   (c) He said, "I have been very sorry for the fault I have committed."
   (d) He said, "I am very sorry for the fault I had committed."

14. She ordered her servant to bring her a cup of tea.
   (a) She said to her servant, "Bring me a cup of tea."
   (b) She told her servant, "Bring a cup of tea."

(c) She said, "Please bring a cup of tea."
(d) She told her servant, "Bring her that cup of tea."

15. Ram said his sister was getting married.
(a) Ram said, "His sister is getting married."
(b) Ram told, "His sister is getting married."
(c) Ram said, "My sister is getting married."
(d) Ram said, "My sister was getting married."

Directions for questions 16 to 20: Change the speech in the following sentences appropriately as per the given choices. (Mixed speech exercise)

16. The priest said, 'Be quiet and listen to my words.'
(a) The priest said them to be quiet and listen to his words.
(b) The priest told them that they should be quiet and listen to his words.
(c) The priest urged them to be quiet and to listen to his words.
(d) The priest said they should be quiet and listen to him.

17. "Please bring your own plates and spoons," she told us.
(a) She suggested us to bring her own plates and spoons.
(b) She suggested us to bring their own plates and spoons.
(c) She suggested that we bring our own plates and spoons.
(d) She suggested us to bring my own plates and spoons.

18. "Don't touch it! Leave it alone!" I said.
(a) I told him not to touch it but to leave it alone.
(b) I told him not to touch it but to have left it alone.
(c) I will tell him not to touch it but to leave it alone.
(d) I told him to touch it but to leave it alone.

19. The father warned his son that he should beware of him.
(a) The father warned his son, "beware of him!"
(b) The father warned his son, "Watch that chap!
(c) The father warned his son, "Be careful about him."
(d) The father warned his son, "Don't fall into the trap."

20. Bhim asked his mother to cheer up because he would go and get work somewhere.
(a) 'Don't worry, mother, I'll go and get work somewhere,' said Bhim.
(b) 'Cheer up, mother, I'll go and get work somewhere,' said Bhim.
(c) 'Cheer up, mother, I am going now to get work somewhere,' said Bhim.
(d) 'Smile mother, I shall go and get work somewhere,' said Bhim.

MODULE 4
CHANGE OF VOICE

The voice of the sentence relates to the structure of the sentence. The voice of the sentence is decided by the form of the verb and the role of the subject and object.

Active Voice: If the subject is active and does the action conveyed by the verb, the sentence is said to be in the Active voice.
Example: The dog chased the man.
The subject 'dog' is active and does the action conveyed by the verb 'chases'.

The Active voice is used in most situations because it is shorter and to the point. The active voice has a direct, clear tone. Use it when you want the reader to focus on the subject of your sentence and the action it is doing rather than on the action's target.

Passive voice: In the passive voice, the subject is the person or thing acted on or affected by the verb's action.
Example: The man was chased by the dog.
The subject 'man' is affected by the verb 'chase'.
The passive voice is typically formed with a form of the verb be—such as is, was, or has been—and the past participle of the verb – chased, thrown, struck, etc.

The passive voice has a subtler tone than the active voice has. Sometimes your writing needs this tone, like when you want your reader to focus on the action being described or the action's target rather than on who or what is performing the action. This is why the passive voice is used in lab reports—it conveys scientific objectivity by minimizing the focus on the doer of the action.
Example: The sugar levels are elevated.

It is also used in professional communication to be diplomatic and not point fingers at anyone.
Example: A mistake was made.

It is also used when the doer of the action is unknown.
Example: The dog was abandoned in a crowded area.
Only a sentence that has a subject + verb + object can be changed to the Passive Voice.

There are specific rules to change a sentence from the Active voice to the Passive voice:

1. The subject in the Active voice becomes the object of the preposition 'by' in the Passive voice.
   Example: She kicked the stool
   The stool was kicked by her.

2. The object in the Active voice becomes the subject in the Passive voice.
   Example: The cat ate the fish.
   The fish was eaten by the cat.

3. The form of the verb is changed to the Passive form – Be (is, am, are, was, were, been, being) + Past participle form of the verb.

Tense Table in the Active Voice

	Past	Present	Future
Simple	I took the test.	He takes the test. They take the test.	I will take the test.
Continuous	He was taking the test. They were taking the test.	I am taking the test. He is taking the test. They are taking test.	He will be taking the test.
Perfect	He had taken the test.	He has taken the test. They have taken test.	He will have taken the test by evening.
Perfect Continuous	He had been taking the test every year before he got admission.	He has been taking the test since 2000. They have been taking the test since 2000.	He will have been taking the test every year for 5 years by next year.

Tense table in the Passive Voice

	Past	Present	Future
Simple	The test was taken by me.	The test is taken by me.	The test will be taken by me.
Continuous	The test was being taken by me.	The test is being taken by me.	
Perfect	The test had been taken by me.	The test has been taken by me.	The test will have been taken by me.

The Future continuous and the Perfect Continuous tenses cannot be changed to the Passive voice.

4. When the sentence is an order, the sentence in the Passive voice begins with the verb 'let' and contains the base form – be.
   Example: Do the dishes.
   Let the dishes be done.

Directions for questions 1 to 5: Rewrite the following sentences by changing the Voice.

1. John's mother raised him in a small town.
2. Some students study grammar on the Internet.
3. A strange man was watching us.
4. We are working on the report right now.
5. My manager has told him to arrive early.

Directions for questions 6 to 10: A sentence has been given in Active voice. Out of the four alternatives suggested, select the one which best expresses the same sentence in Passive Voice.

6. His selection in the team surprised me.
   (a) I was surprised at his selection in the team.
   (b) I was surprised at the selection of the team.
   (c) His selection was a surprise.
   (d) His selection in the team was a big surprise.

7. People bless him for his goodness.
   (a) He is blessed for his goodness by the people.
   (b) He has been blessed for his goodness by people.
   (c) The people have been blessing him for his goodness.
   (d) People have blessed him for his goodness.

8. You can play with these kittens quite safely.
   (a) These kittens can played with quite safely.
   (b) These kittens can be played with quite safely.
   (c) These kittens can play with you quite safely.
   (d) These kittens can be played with you quite safely.

9. A child could not have done this mischief.
   (a) This mischief a child could not have been done.
   (b) This mischief could not have been done by a child.
   (c) This mischief could not be done by a child.
   (d) This mischief could not been done by a child.

10. James Watt discovered the energy of steam.
   (a) The energy of steam was discovered by James Watt.
   (b) The energy of steam discovered James Watt.
   (c) James Watt was discovered by the energy of steam.
   (d) James Watt had discovered energy by the steam.

Directions for questions 11 to 15: A sentence has been given in Passive Voice. Out of the four alternatives suggested, select the one which best expresses the same sentence in Active Voice.

11. Champagne is drunk on New Year's Eve.
   (a) People drink champagne on New Year's Eve.
   (b) Let us drink champagne on New Year's Eve.
   (c) They will drink champagne on New Year's Eve.
   (d) People always drink champagne on New Year's Eve.

12. My bicycle has been sold.
   (a) I had sold my bicycle.
   (b) I have sold my bicycle.
   (c) They sold my bicycle.
   (d) My bicycle will sell.

13. Hundreds of students were rescued by the police.
   (a) The police has rescued hundreds of students.
   (b) The police had rescued hundreds of students.

(c) The police rescued hundreds of students.
(d) The police have rescued hundreds of students.

14. The most useful lessons of my life were given to me by my guru.
(a) My guru gives the most useful lessons.
(b) My guru is giving me the most useful lessons.
(c) My guru gave me the most useful lessons of my life.
(d) My guru has been giving me the most useful lessons of my life.

15. He was arrested on the charge of theft, but was released for lack of evidence.
(a) He was arrested on a charge of theft, but was released for lack of evidence.
(b) The police arrested him on a charge of theft, but for lack of evidence he was released.
(c) The police arrested him on a charge of theft, but released him for lack of evidence.
(d) None of these.

Directions for questions 16 to 20: A sentence has been given in Active/Passive Voice. Out of the four alternatives suggested, select the one which best changes the voice of the sentence appropriately. (Mixed voice exercise).

16. The government has launched a massive tribal welfare program in Jharkhand.
(a) A massive tribal welfare program is launched by the government in Jharkhand.
(b) A massive tribal welfare program has been launched by the government in Jharkhand.
(c) Jharkhand government has launched a massive tribal welfare program.
(d) The government in Jharkhand has launched a massive tribal welfare program.

17. Cricket was being played by the boys.
(a) Cricket had been played by the boys.
(b) Cricket has been played by the boys.
(c) Cricket was played by the boys.
(d) The boys were playing cricket.

18. Has anybody answered your question?
(a) Your question has been answered?
(b) Anybody has answered your question?
(c) Has your question been answered?
(d) Have you answered your question?

19. The burglar destroyed several items in the room. He tore the carpet too.
(a) Several items destroyed in the room by the burglar. Even the carpet he has torn.
(b) Several items in the room were destroyed by the burglar. Even the carpet was torn.
(c) Including the carpet, several items in the room have been torn by the burglar.
(d) The burglar, being destroyed several items in the room, also the carpet has torn.

20. He was given the details of his uncle's will by the lawyer.
(a) The lawyer gives him the details of his uncle's will.
(b) The lawyer has to give him the details of his uncle's will.
(c) The lawyer will be giving him the details of his uncle's will.
(d) The lawyer gave him the details of his uncle's will.

MODULE 5
SENTENCE CORRECTION

Sentence correction is the one of the most important topic in the verbal ability section. Generally, two or three questions are asked of this type in every test. A sentence is given with a part of it underlined, followed by four options: one has to pick the right option which grammatically rectifies the error present in the underlined or highlighted part of the sentence. If there is no correction required then choose the option which is the same as the underlined part.

Types of error with an example is given below:

1. **Subject–Verb agreement:** In any sentence, the verb should agree with the subject in person as well as in number. In other words, if the subject is singular then the verb should also be singular and if the subject is plural then the verb should also be plural.
   For example, 'he plays' and they play. There are two important tricks to correct these types of questions and these are 'F.S.R' i.e. first or farthest subject rule and the second 'N.S.R' i.e. 'nearest subject rule'.
   'Not only the principal but also the teachers (is/are) playing'. In this example, the correct form of the verb is 'are' as it is based on the nearest subject rule.
   'The Principal, as well as the teachers, (is/are) playing'. In this example, the correct form of the verb will be 'is' as the question is based on F.S.R or the first subject rule.

2. **Modifier:** It can be a word or phrase used to modify any other word or phrase.
   In this the parts of speech that are considered 'modifiers' are:
   1. 'Adjectives' as they are used to modify either nouns or pronouns.
   2. 'Adverbs' are used to modify adjectives, adverbs, and verbs.

   Example: Chic and smart, the travel agency could not help admiring the model's clothes.
   In the above sentence, chic and smart refer to Travel Agencies, though they were meant to refer to the Model's clothes.
   The correct sentence would be:
   The travel agency could not help admiring the model's chic and smart clothes.

3. 'Participles' are used to modify nouns.
   Example: Walking down the road, my hat flew off.
   In the above sentence, it seems as if the hat was walking down the road and it flew, thus we need to specify who was walking down the road.
   The correct sentence should be:
   While I was walking down the road, my hat flew off.

3. **Parallelism:** If a sentence expresses many ideas that are similar to each other, they should be presented in parallel constructions i.e., they should be in the same grammatical form.
   Example: He wanted to make a lot of money and that might earn a good reputation. In the above example, the sentence presents two same ideas but the grammatical form is different. Therefore, the correct sentence should be: He wanted to make a lot of money and earn a good reputation.

4. **Pronoun reference error:** A pronoun is a word used to stand for (or take the place of) a noun. A pronoun should refer clearly to one, clear, unmistakable noun coming before the pronoun. This noun is called the pronoun's antecedent.
   Unfortunately, it is very easy to create a sentence that uses a pronoun WITHOUT a clear,

unmistakable noun antecedent.
Example: The minister met the manager and he recognized him.
In this sentence "he" is neither referring to the minister nor the manager, hence the sentence can be corrected in two ways:
In this sentence,
The minister met the manager who recognized him.
The minister met the manager and recognized him.

5. **Diction:** An incorrect choice of words makes the sentence erroneous. The mistakes could be in the usage of simple words - later and later, its and it's, lies and lay, and the likes. There can be confusion in words that sound alike - adapt and adept, principal and principle, affront and confront, etc. The only way to tackle these is to know the meanings of these words.

6. **Redundancy:** Avoid needless repetition of a fact or an idea
Example: We shall combine the three departments into one.
In this sentence, it has been written to combine the three departments into one, but whenever things are combined, we always get one thing only.
Thus, the correct sentence is: We shall combine the three departments.

EASY:
Directions: Look at the underlined part of each sentence. Below each sentence is given possible substitutions for the underlined part. Choose the one that is better than the underlined part.

1. He was very tired as he is working since 6 O' clock in the morning
(a) he was working (b) he had been working
(c) he has been working (d) he will be working

2. The girl to who I sold my car was very honest
(a) to who I sell (b) to whom I sold (c) to who I sold (d) to whom I sell

3. The small girl does whatever her mother was done.
(a) has did (b) do (c) had done (d) does

4. The population of China is higher than that of all other country in the world.
(a) higher than all other countries (b) greater than all other countries
(c) greatest than that of any country (d) higher than that of any other country

5. The singer stood quietly for few moments before the performance.
(a) for moments (b) for few times
(c) for a few moments (d) No correction required

MEDIUM:
Directions: Look at the underlined part of each sentence. Below each sentence are given possible substitutions for the underlined part. Choose the one that is better than the underlined part.

1. The lead actor had food poisoning and couldn't continue after the first act, but his understudy rose upon the occasion and was rewarded by an enthusiastic response from the audience.

(a) rose above the occasion
(b) rose against the situation
(c) rose to the occasion
(d) rose over the situation

2. After Robert was elected president, he forgot his friends and tried to lord on them all the time.
(a) no correction required
(b) lord it around
(c) lord above
(d) lord it over

3. His outburst today ate crow between heated protest and outright insult.
(a) crossed the line
(b) brought to light
(c) put to rest
(d) struck a balance

4. I know you find lectures on philosophy tedious but please bear on me this one time.
(a) bear down on
(b) bear with
(c) bear out
(d) bear up with

5. If I would have realized the nature of the job earlier, I would not have accepted it.
(a) If I have had
(b) In case I would have
(c) Had I been
(d) Had I

Directions: Look at the underlined part of each sentence. Below each sentence are given possible substitutions for the underlined part. Choose the one that is correct. The first option is the same as the underlined part. Hence choose option A if you think no change is required.

1. The people of the ancient Assyrian Empire were renowned warriors, although they also crafted some of the best-preserved ancient art.
(a) were renowned warriors, although they also crafted
(b) had been renowned warriors, although they also crafted
(c) were renowned warriors, and also crafted
(d) was renowned warriors, although they also crafted

2. Among the litany of threats that many Israelis face, the potential for a nuclear-armed Iran is perhaps the more scary, as this scenario could engulf the region in a violent war. This would likely result in historically unseen amounts of destruction, even for a region whose history is marred by perennial violence.
(a) perhaps the more
(b) perhaps the most
(c) possibly, perhaps the most
(d) possibly the greatest

3. Despite being thousands of years old, the writing of Augustine of Hippo has inspired and captivated countless individuals, fundamentally because they convey the moving inner-journey of man searching for the divine in a lucid and compelling fashion.
(a) because they convey the moving inner-journey
(b) because of the fact conveying the moving inner-journey
(c) because of its conveyance of the moving inner-journey
(d) because it conveys the moving inner-journey

4. On the Discovery channel last night, they showed an informative program about new innovations in medical imaging, which you would have found interesting.

(a) they showed an informative program about new innovations in medical imaging, which you would have found interesting.
(b) it showed an informative program about innovations in medical imaging, which you would have found interesting.
(c) one was shown an informative program about innovations in medical imaging, that you would have found interesting.
(d) there was an informative program about innovations in medical imaging, a program you would have found interesting.

5. World War II, which resulted in the death of over 70 million individuals, proved to be the deadliest conflict in human history, claiming nearly twice as many lives than would be killed in World War I.
(a) lives than would be killed in World War I
(b) lives as would World War I
(c) lives than those who were killed in World War I
(d) lives as World War I

HARD:
Directions: Look at the underlined part of each sentence. Below each sentence are given possible substitutions for the underlined part. Choose the one that is correct. The first option is the same as the underlined part. Hence choose option A if you think no change is required.

1. During the worst years of the Great Depression, America faced tremendous challenges as unemployment topped 25%. Many historians credit the New Deal and the World War II industrial complex for propelling America out of the depression and into a then-unparalleled time of economic prosperity
(a) for propelling
(b) with having propelled
(c) as propelling
(d) with propelling

2. If the gardener would sow the seeds in the greenhouse rather than the garden, he might get a better display of flowers.
(a) If the gardener would sow the seeds in the greenhouse rather than the garden
(b) If the gardener sowed the seeds in the greenhouse rather than the garden
(c) If the gardener would sow the seeds in the greenhouse rather than in the garden
(d) If the gardener were to sow the seeds in the greenhouse rather than in the garden

3. Twenty-two feet long and 10 feet in diameter, the AM-1 is one of the many new satellites that are a part of 15 years effort of subjecting the interactions of Earth's atmosphere, oceans, and land surfaces to detailed scrutiny from space.
(a) is one of the many new satellites that are a part of 15 years effort of subjecting the interactions of Earth's atmosphere, oceans, and land surfaces to
(b) are one of the many new satellites that is a part of 15 years effort of subjecting the interactions of Earth's atmosphere, oceans, and land surfaces to
(c) are one of the many new satellites that is a part of 15 years effort of subjecting the interactions of Earth's atmosphere, oceans, and land surfaces for

(d) is one of the many new satellites that are a part of 15 years effort of subjecting the interactions of Earth's atmosphere, oceans, and land surfaces on

4. Floating in the waters of the equatorial Pacific, data is collected and transmitted by an array of buoys on long-term interactions between the ocean and the atmosphere, interactions that affect global climate.
   (a) Floating in the waters of the equatorial Pacific, data is collected and transmitted by an array of buoys
   (b) Floating in the waters of the equatorial Pacific, an array of buoys collect and transmit data
   (c) Floating in the waters of the equatorial Pacific, data are collected and transmitted by an array of buoys
   (d) Floating in the waters of the equatorial Pacific, an array of buoys collects and transmits data

5. New hardy varieties of rice show promise of producing high yields without the costly irrigation and application of commercial fertilizer that were required by earlier high yielding varieties.
   (a) of producing high yields without the costly irrigation and application of commercial fertilizer that were required by earlier high yielding varieties
   (b) to produce high yields without the costly requirements of irrigation and application of commercial fertilizer of earlier high yielding varieties
   (c) to produce high yields without the costly irrigation and application of commercial fertilizer that was required by earlier high yielding varieties
   (d) of producing high yields without the costly requirements of irrigation and application of commercial fertilizer for earlier high yielding varieties

HOMEWORK:

Directions: Look at the underlined part of each sentence. Below each sentence are given possible substitutions for the underlined part. Choose the one that is correct.

1. In addition to enhanced their reputations through strategic use of philanthropy, companies are sponsoring social initiatives to open new markets.
   (a) of enhancing their reputation (b) to having enhance their reputation
   (c) to enhancing their reputation (d) to have their reputation enhancing

2. Can you tell me why did you not speak the truth?
   (a) why did not you speak (b) that why did you not speak
   (c) why you did not speak (d) why did you not spoke

3. They continued to work in the field despite of the heavy rains.
   (a) even though there is heavy rain (b) although heavily rains
   (c) in spite the heavy rains (d) even though it rained heavily

4. As there was no time, the remaining items were deferred into the next meeting.
   (a) are deferred till (b) were deferred till
   (c) were deferred to (d) had deferred with

5. What kind of a car do you want?
   (a) What kinds of car do you want? (b) What kind of car do you want?

(c) What kind of a car are you wanting? (d) What are the kinds of car you want?

6. According to a recent study, financial problems, together with their serious ramifications, ranks as one of the high causes of marital stress in America.
   (a) ranks as one of the high causes of marital stress in America
   (b) rank as one of the leading causes of marital stress in America
   (c) rank as one of the most high causes of marital stress in America
   (d) ranks as one of the leading causes of marital stress in America

7. Sheila took the bright, red hat and put it on her head, which had been given to her by her friend.
   (a) Sheila took the bright, red hat and put it on her head, which had been given to her by her friend.
   (b) Which had been given to her by her friend. Sheila took the bright, red hat and put it on her head.
   (c) Sheila took the bright, red hat, which had been given to her by her friend, and put it on her head.
   (d) Sheila, which had been given to her by her friend, took the bright, red hat and put it on her head.

8. The problem he presented to the students was not only interesting and complicated.
   (a) was not only interesting and complicated
   (b) was not only interesting but also complicated
   (c) was only interesting and complicated
   (d) was interesting but complicated

9. Whoever is chosen as the new chief, they will not be able to fill the shoes of the present one.
   (a) Whoever is chosen as the new chief, they will
   (b) Whomever is chosen as the new chief, he will
   (c) Whoever is chosen as the new chief, it is likely that them will
   (d) Whoever is chosen as the new chief will

10. One of the many problems of running a business are to find trustworthy people who undertake their jobs with sincerity.
    (a) of running a business are to find trustworthy people who undertake
    (b) of running a business is finding trustworthy people who undertakes
    (c) of running a business is finding trustworthy people who undertake
    (d) of running a business would be to find trustworthy people undertaking

11. Found only in the Western Hemisphere and surviving through extremes of climate, hummingbirds' range extends from Alaska to Tierra del Fuego, from sea-level rain forests to the edges of Andean snowfields and ice fields at altitudes of 15,000 feet.
    (a) Found only in the Western Hemisphere and surviving through extremes of climate, hummingbirds' range extends
    (b) Found only in the Western Hemisphere, the hummingbird survives extreme climates, its range extending
    (c) Found only in the Western Hemisphere and surviving through extremes of climate, hummingbirds' range extend

(d) Found only in the Western Hemisphere and surviving through extremes of climate, the hummingbird survives through extreme climates, their range extending

12. Especially in the early years, new entrepreneurs may need to find resourceful ways, like renting temporary office space or using answering services, that make their company seem large and more firmly established than they may actually be.
    (a) that make their company seem large and more firmly established than they may actually be
    (b) to make their companies seem larger and more firmly established than they may actually be
    (c) to make their company seem large and more firmly established than they may actually be
    (d) that make their company seem larger and more firmly established than they may actually be

13. As a baby emerges from the darkness of the womb with a rudimentary sense of vision, they would be rated about 20/500, or legally blind if they were an adult with such vision.
    (a) As a baby emerges from the darkness of the womb with a rudimentary sense of vision, they would be rated about 20/500, or legally blind if they were an adult with such vision.
    (b) A baby emerges from the darkness of the womb with a rudimentary sense of vision that would be rated about 20/500; an adult with such vision would be deemed legally blind.
    (c) As a baby emerges from the darkness of the womb with a rudimentary sense of vision, the vision would be rated about 20/500, or legally blind if it were an adult with such vision.
    (d) A baby emerge from the darkness of the womb with a rudimentary sense of vision that would be rated about 20/500; such visions would be deemed legally blind in an adult.

14. One view of the economy contend that a large drop in oil prices should eventually lead to a lowering of interest rates and of fears about inflation, a rally in stocks and bonds, and a weakening of the dollar.
    (a) One view of the economy contend that a large drop in oil prices should eventually lead to a lowering of interest rates
    (b) One view of the economy contend that a large drop in oil prices should eventually lead to lowering of interest rates
    (c) One view of the economy contends that a large drop in oil prices should eventually led to lowering of interest rates
    (d) One view of the economy contends that a large drop in oil prices should eventually lead to a lowering of interest rates

15. The computer company announced that it will purchase the color-printing division of a rival company for $950 million as part of a deal that will make it the largest manufacturer in the office color-printing market.
    (a) The computer company announced that it will purchase the color-printing division of a rival company for $950 million
    (b) The computer company had announced that it will purchase the color-printing division of a rival company at $950 million
    (c) The computer company has announced that it will purchase the color-printing division of a rival company for $950 million
    (d) The computer company have announced that they will purchase the color-printing division of a rival company for $950 million

MODULE 6
SENTENCE COMPLETION

Sentence Completion is a common test in most of the competitive exams and the verbal section of the aptitude round. A sentence contains one or two blanks (usually), to be filled in using the choices. These questions test your knowledge of grammar, vocabulary, idiomatic (fixed) usage, and the ability to make finer distinctions among words. Sentences are composed of a number of words and ideas that are connected to one another in various ways. You are to figure out how the parts of the sentence are connected. A good vocabulary can be of great help here, but you can use many strategies for these questions, even without knowing all the choices.

Two types of questions expected in this section are - **Sentences with single blank and sentences with double blanks.** Let's understand the strategies for both types.

Types of Sentence completion questions:

1. **Grammar-based:** This is one of the simplest types of fill-in-the-blank questions and is used to test students on basic concepts of grammar such as articles and determiners, prepositions, tenses, usage of transition words, and subject-verb agreement.

   Example 1: Joan is a rich _____ discontented person.
   Explanation: The words rich and discontented are the clues. They don't match as "rich" which seems to indicate that she has no reason to be discontented. So, the word in the blank has to be the transition "but", which indicates a contradiction of the first part of the sentence.

   Example 2: The winter festival will start _____ December.
   Explanation: The blank needs a preposition, which connects two words in terms of position, placement, and time. A month is a period of time within which something takes place. So, the word in the blank must be "in".

2. **Idiomatic usage-based:** There are some fixed or idiomatic usage in English.
   An idiom is a fixed group of words that also has a fixed meaning.
   Example: to let the cat out of the bag means to let out a secret; to cry foul means to complain that something that someone has done is not fair.

   There are also phrasal verbs, which are fixed combinations of verbs and prepositions that have a fixed meaning.
   Example: To walk away from is to leave something or someone willingly; to give way is to retreat.

   There are also certain nouns or verbs or adjectives that must be followed by certain prepositions as these combinations are fixed.
   Example: The verb "agree" is followed by "to" when one talks about agreeing to a proposal or proposition, but the same verb is followed by "with" when one talks about agreeing with a person.

   Example 1:
   The problem should be _____, or else we will no longer be in a position to handle it.

(a) play truant (b) held water (c) at daggers drawn (d) nipped in the bud
Explanation: The clues in the sentence are "problem" and "no longer handle it". So, the idea is that the problem should be controlled or taken care of before it becomes unmanageable. To nip something in the bud means to take care of a problem before it becomes worse.
To play truant means to take leave or be absent without an explanation; to hold water means to be or appear valid; to be at daggers drawn means to be in a state of constant enmity.

Example 2:
One should _____ unexpected delays when one draws up a plan.
(a) allow for (b) back out (c) bring up (d) cast aside
Explanation: The clue is "unexpected delays when one draws up a plan". The words indicate that there may be some unexpected delays which we must take into account while drawing up a plan. So, allow for, which means to consider, fits best into the blank.
To back out is to withdraw from something; to bring up is to bring it to the attention; to cast aside is to stop thinking about something.

3. **Word usage-based:** Such questions are the ones that test you on your knowledge of vocabulary and the ability to differentiate between the subtle differences in the usage of words. These may be single or double-blank questions.

Example 1: I admire the actor because he _____ the conventions and always tries something new.
(a) flouts (b) flaunts (c) reprises (d) pre-empts
Explanation: The clue in the sentence is "conventions and always tries something new". If the actor always tries something new, he does not repeat the conventions. So, "reprises" is wrong. Flaunting the conventions would also imply that he follows the conventions because "flaunt" means to show off. To pre-empt is to take some action in order to prevent some other things from happening.
So, flouts, which means to scornfully disregard or go against something is the best choice for the blank.

Example 2: When people are happy, they tend to give _____ interpretations of events they witness: the eye of the beholder is _____ by the emotions of the beholder.
a. conscientious……sharpened b. vague…….disquieted
c. charitable…..coloured d. joyful……manipulated

Explanation: The colon in the sentence indicates that one part of the sentence is an explanation or an elaboration of the other part. The use of the word "eye" is metaphorical. It refers to perspective. So, the sentence conveys the meaning that when people are happy, they tend to interpret events they witness in a positive manner because the perspective is influenced by the emotions of the person who has witnessed the event.
Conscientious means careful or meticulous, which may fit into the first blank, but sharpened cannot be used to describe emotions. When people are happy, they are unlikely to give vague interpretations of events they witness and disquieted means made anxious, which doesn't fit into the context of the sentence at all.

Joyful fits into the first blank but manipulated gives the sentence a negative meaning. So, charitable, which means kind or generous, and coloured, which means influenced, fit best into the blanks.

Strategies for Sentence Completion

1. **Use sentence clues**

Two things make a question difficult: difficult words and sentence structure. Hence, we need to use the sentence clues by reading the sentence thoroughly.

Example 1: Crestfallen at having done poorly on the exam, Priya began to question her abilities. Her self-confidence was.....

(a) boosted (b) destroyed (c) placated (d) elevated

Explanation: If somebody is crestfallen (despairing) and has begun to question herself, then her self-confidence would be destroyed. Here the clue word is crestfallen, which is negative. Hence the effect will also be negative. **Hence, the answer is (B).**

Example 2: Neem has _____qualities and in many clinical trials, doctors have saved countless lives by using raw neem leaves on serious wounds.

(a) remedial (b) flavouring (c) inferior (d) doubtful

Explanation: Clue words here are, clinical trials, doctors, saving lives, wound. Hence, we need a positive word with a "life-saving"-like meaning. The obvious choice is A as the word remedy fits into the context.

2. **Contrast indicators**

In this type of sentence, one part of the sentence expresses an idea that is opposite to the idea in the other part of the sentence.

Following are some of the most common contrast indicators:

- But
- Yet
- Despite
- Although
- However
- Nevertheless
- Still
- While

Example 1: Zahid looks like a noble person but he always becomes _____ in the path of good deeds.

(a) a supporter (b) an obstacle (c) a proponent (d) a promoter

Explanation: Here in this example, the signal word "but" indicates a contrast in the 2nd part of the sentence. Apparently, a noble looking person should do wrong in the 2nd part of the sentence. Hence, the right choice is "obstacle".

Example 2: The much-hated bill sparked off a wave of public _____which could not be _____ by the concessions the British announced.

(a) enthusiasm…dampened (b) clamour…misled

(c) curiosity…complemented (d) discontent…abated

Explanation: Much-hated indicates a negative choice for the first blank, indicating anger or protest here. Hence, we can safely eliminate options A & C as the word choices in these options are positive and they don't fit. Between the remaining choices - B & D, D is the right choice. When there is discontent or dissatisfaction and concessions are made to decrease the discontent, then it should abate (D). The word misled (B) doesn't fit logically in the context.

3. **Support indicators**

In this type of sentence, one part of the sentence expresses an idea, and the other part gives the explanation, elaboration or an example of that idea.

Indicators for Support

- Not only...but also
- In the same way
- Like
- Similarly
- For example
- For instance
- Such as
- Specifically
- And
- Also
- Furthermore
- In addition to

Example 1: The Lahore city council representative promised that he would consider all the suggestions from downtown residents and that he was willing not only to discuss the proposal, but also to _____ it.

(a) change (b) vanish (c) implement (d) disapprove

Explanation: The structural construction of the sentence "not only ... but also" indicates that a similar idea or maybe even an extension of the idea should follow the first part. Hence, the right choice is option C.

4. **Cause & Effect indicators**

In this type of sentence, one part of the sentence describes something that causes something in the other part of the sentence.

Indicators for Cause and Effect

- because
- so
- so that
- causes
- accordingly
- thus
- consequently
- hence
- therefore
- in order to

Example 1: Rizwana always wins the debate competition because she works _____ and prepares as well as she can.

(a) lazily (b) hard (c) continually (d) spontaneously

Explanation: The first part of this sentence describes something - always wins the debate competition - that is caused or influenced by what's described in the second part. Ask the question - "What causes Rizwana to win the competition?" and the answer could only be that she works "hard".

The two parts of the sentence are connected by the word "because" that indicates the cause and effect composition of the sentence.

5. **Positive & Negative words**

When you read the sentence, look out for adjectives/adverbs and find out if the idea of the sentence is positive/negative. Mark all the words in the sentence with +/-. Then, compare the +/- signs on both parts/ blanks of the sentence and make your choice accordingly. In simple words, if the flow of the first part of the sentence is positive and the second part is negative (maybe because there is a contrast indicator in between), the blank must be negative. . This would help one solve the sentence completion question without even understanding the question.

Example 1: Can public opinion be influenced so that it _____ rather than encourages the increase the sale of firearms?

(a) advances (b) changes (c) discourages (d) amplifies

Explanation: The best choice is C discourages. The clue here is rather than encourages. You need a verb that means the opposite of encourages. The best choice is "discourages".

QUESTIONS - IDIOMATIC USAGE-BASED:

1. I want someone who is willing to dedicate himself to the job and will not _____.
   (a) jump the gun (b) cut corners
   (c) cross the bridge when one gets there (d) get bent out of shape

2. The machinery in the factory is old and _____ It is always _____.
   (a) worn out – breaking down (b) fallen apart – coming out
   (c) broken up – tearing down (d) worn away – giving away

3. I can't wait till I get to the climax of the book to _____ who the killer is.
   (a) make up (b) go along with (c) think over (d) find out

4. In this day and age of social media, it is extremely easy to _____ someone based entirely on appearances.
   (a) look up to (b) look over (c) look at (d) look into

5. She could have gone places and achieved great things but her ego and her inability to get along with people _____
   (a) held her up (b) broke her down (c) held her back (d) held her down

6. He's got a sharp _____. He might just get into trouble if he isn't careful.
   (a) tongue (b) mouth (c) intellect (d) vision

7. His interest in the study of Forensic pathology is indeed very _____.
   (a) strong (b) large (c) deep (d) vast

8. Every week, in the office, one hour is _____ to games and sports.
   (a) conferred (b) dedicated (c) conceded (d) devoted

9. A committee has been _____ to _____ the transformation of the city into an International finance centre.

(a) constituted....convert
(b) appointed....oversee
(c) converged....evaluate
(d) inaugurated….determine

10. If you plan to go trekking, you must get yourself a sturdy pair of shoes that will give you good _____ on slippery surfaces.
(a) tread (b) cover (c) purchase (d) tramp

QUESTIONS - GRAMMAR-BASED:

1. The students _____ French next year.
(a) is learning (b) must be learning (c) will have learnt (d) will be learning

2. I _____ on the presentation for two hours before I went to sleep.
(a) have worked (b) had worked (c) will work (d) was working

3. The club has changed its administration and brought about some changes, but unfortunately _____ changes do not seem to include fair practices.
(a) a (b) an (c) No article (d) the

4. The project is not due _____ a week, so I can afford to take it easy.
(a) in (b) during (c) over (d) for

5. I had a lot of material on test preparation _____ I didn't know where to start.
(a) but (b) and (c) moreover (d) so

QUESTIONS - WORD-BASED:

1. The bus met with an accident and was _____ the traffic, so he had a hard time driving through the downtown.
(a) obstructing (b) obviating (c) hiding (d) disturbing

2. Some people _____ themselves into believing that, they are the only honest and hardworking employees in the company.
(a) keep (b) fool (c) delude (d) force

3. Apurva made some _____ remarks to the Indian Prime Minister. She was soundly chastised by his co-reporters.
(a) irreverent (b) reverent (c) flattering (d) complimentary

4. James Hadley Chase was a _____ writer who intrigued readers with his plots that took unexpected twists.
(a) profuse (b) copious (c) prolific (d) abundant

5. Saurav had the _____ experience of being seated next to a garrulous passenger on his recent train journey.
(a) pleasant (b) quiet (c) nice (d) galling

6. My father did not approve of some of my friends and he said that I was _____ in choosing them.
(a) choosy (b) selective (c) particular (d) indiscriminate

7. With his _____ eyesight, Raghav spotted the military jet streaking in the sky.
(a) inferior (b) poor (c) keen (d) myopic

8. The government exhorted citizens to report any crime witnessed by them as otherwise it could be construed as being _____ in that crime.
(a) disinterested (b) complicit (c) adept (d) absorbed

9. Moyna is _____ writing stories because she was well honed by her job as a reporter in a leading newspaper.
(a) proficient in (b) incapable of (c) incompetent at (d) slovenly in

10. If you will not do your work on your own _____, I have no choice but to penalize you if it is not done on time.
(a) preference (b) coercion (c) excursion (d) volition

QUESTIONS - TWO BLANKS:

1. Challenges must be _____ to realize the _____ of a greater regional economic integration.
(a) overcome....potential (b) suppressed....power
(c) ignored....benefits (d) sustained....advantages

2. For silent movies to succeed, the quality of acting has to be___ as there are no _____ dialogues or music for support.
(a) mediocre....engaging (b) sublime....intimate
(c) realistic....melodramatic (d) extraordinary....mesmerizing

3. Sports for the visually challenged, _____ their confidence and help them to mingle with the _____ of society.
(a) plummet....elite (b) boost....mainstream
(c) abate....cream (d) curb....best

4. Although he puts in _____ of overtime and takes only a few holidays, he _____ cannot support his family.
(a) sufficient....however (b) lot....besides
(c) much....thus (d) plenty....still

5. I have never _____ such a problem and therefore confess I have no_____ to it.
(a) left alone....inhibitions (b) chickened at....solution
(c) dreaded....panacea (d) come across....ready-made answer

6. The Maruti has become so _____, that snobbish customers, who believe their tastes are superior to others, are _____ buy this car of the masses.
(a) reputed....shirking from (b) sought after....queuing to
(c) ubiquitous....disinclined to (d) affordable....waiting to

7. Technology may have changed the way alliances are fixed in India (now at the click of a button) but the_____ still is arranged marriages with even most youngsters _____ the practice.
(a) preference....loathing (b) norm....endorsing
(c) practice....customizing (d) tradition.....avoiding

8. The city remained _____ for years after the hurricane's destruction. Efforts to rebuild were largely _____.
(a) blighted....successful (b) underwater....effective
(c) barren....isolated (d) desolate….abortive

9. _____ clearly when giving a speech. You will be misunderstood if you slur your speech or _____.
(a) pontificate....whisper (b) enunciate ... mumble
(c) speak ... articulate (d) murmur ... drawl

10. The famous pop singer tragically died at age fifty. This was an _____ loss for his _____ fans.
(a) awful....healthy (b) amazing....dubious
(c) irreparable....devoted (d) emotional....heavy

HOMEWORK:

1. I ran back to the cafe in which I had had lunch and_____, but nobody had seen my phone.
(a) asked around (b) asked to (c) asked over (d) asked aside

2. The show, which began very well and had some interesting twists and turns, has now _____to a run-of-the-mill family melodrama.
(a) set up (b) struck down (c) given up (d) boiled down

3. She hadn't eaten all day, and by the time she got home she was _____.
(a) impaired (b) exhausted (c) ravenous (d) pallid

4. Mustaq unwittingly _____ the burglar by giving him way and ensuring his escape.
(a) blocked (b) abetted (c) coerced (d) halted

5. The manager would _____ her subordinates into a discussion by asking a few searching questions.
(a) hound (b) subdue (c) prejudice (d) provoke

6. While grizzly bears have long, flat, and somewhat blunt claws, black bears have short, curved, _____claws.
(a) obtuse (b) abominable (c) barren (d) acute

7. The kenjogo or humble language used in Japanese to refer to oneself and the sonkiego or honorific language used to describe the interlocutor are often toned down in English translation, as more accurate renderings might sound _____ to an ear accustomed to more egalitarian phrasings.
(a) servile (b) loquacious (c) hostile (d) circumspect

8. The doctor takes note of any _____ blemishes on the patient's skin; such abnormalities are often _____ of skin cancer.
(a) irregular....symptoms (b) typical....clues
(c) small....indications (d) common....causes

9. While other corporations have _____ as a result of the economic depression, ours has _____.
(a) decreased....declined (b) improved....spread
(c) suffered....grown (d) disappeared...retreated

10. Due to Blake's _____ attitude, many were _____ to trust him as camp counsellor.
(a) good....unwilling (b) apathetic....compelled
(c) positive....hesitant (d) uncaring....reluctant

11. It is clear that there is a _____ in their midst. Yet, the _____ soldiers hesitate to accuse one of their own.
(a) traitor....loyal (b) weapon....dangerous
(c) general....disrespectful (d) enemy....cunning

12. Attendance is not _____; employees are _____ to arrive at the meeting at 8:00 sharp.
(a) expected....demanded (b) practical....needed
(c) optional....required (d) necessary....challenged

13. The _____ mountain peaks soared up into the clouds, while the cool riverbed lay low in the _____.
(a) compact....apex (b) bottomless....pinnacle
(c) distant....point (d) towering....valley

14. The audience at the performance was _____. Dancers were repeatedly _____.
(a) gracious....criticized (b) disrespectful....praised
(c) supportive....applauded (d) helpful….ostracized

15. Though we may not always agree with the politicians in power, living in a democracy is a _____. People in many parts of the world don't enjoy similar _____.
(a) burden....expectations (b) right....oppression
(c) privilege....liberties (d) advantage....dangers

16. The practice of purchasing books was primarily a _____ of the well-to-do until the early 1900s, when the increased popularity of dime novels, an expansion of the number of bookstores, and the introduction of the paperback made books _____ the average man.
(a) tragedy……dislikeable to (b) prerogative……attainable to
(c) plight…….excitable to (d) privilege……achievable by

17. As Molly was practising Spanish with her friends before their trip to Chile, she discovered that although she could comprehend her friends, she could not_____ her thoughts in the _____ language.
(a) acknowledge……..inherent
(b) articulate……unfamiliar
(c) disencumber……..objective
(d) enunciate……..familiar

18. There are as yet no vegetation types or ecosystems whose study has been _____ to the extent that they no longer _____ ecologists.
(a) exhausted…….interest
(b) prevented……hinder
(c) delayed……..require
(d) undertaken……..involve

19. Since 1813, reaction to Jane Austen's novels has oscillated between _____ and condescension; but in general later writers have esteemed her works more highly than did most of her literary _____.
(a) dismissal…….admirers
(b) adoration…….contemporaries
(c) disapproval…….precursors
(d) reverence……critics

20. Whereas the art critic Vasari saw the painting entitled the Mona Lisa as an original and wonderful_____ feat, the reproduction of a natural object, the aesthetes saw it as _____that required deciphering.
(a) collaborative……..an aberration
(b) technical…….a hieroglyph
(c) historical……an illusion
(d) archaic……a puzzle

MODULE 7
CLOZE TEST

Cloze Test Rules and Tips

1. **Read the entire passage carefully:**
   Keep in mind that the questions related to Cloze Test Passage are quite tricky. Each comprehension or paragraph contains its own uniformity as well as theme. Hence, your primary cloze test answering approach must always be to go through the whole text or comprehension carefully, at least for one time. As soon as you gather a general idea, you can find the best choice appropriate for every fill-in-the-blank.

2. **Read the options thoroughly:**
   There are 4-5 options or choices available for the given blanks that helps you to choose a suitable answer for the blanks. It is very important to read through the options with care. Options might seem to be similar or alike and so choosing the right one takes time and patience.

3. **Choose the most appropriate word:**
   Thoroughly read the passage and make up your mind about which word could be possibly missing to fill the blank space. Think with the appropriate word that can fit into the context while reading slowly, grasping the meaning of each sentence. The answer could be from any of the components of speech – noun, pronoun, verb, preposition, conjunction, adjective, article.

   To solve Cloze Test, read the rules for the following: Preposition & Conjunction, Articles and Tenses

4. **Maintain Readability:**
   The main thing that you have to remember or understand while answering cloze test paragraph questions is keeping the original reliability as well as the tone of the text. Choose an answer that fits perfectly with the passage and also doesn't change the tone or meaning of the passage.

5. **Consider the tone of the passage:**
   The cloze test passage is connected with a combination of nouns, articles, pronouns, adjectives and more. Find out the basic tone of the passage and pattern of the entire comprehension. Some of the common tones are: narrative, descriptive, humorous, critical…..etc.

6. **Avoid Repetition:**
   Eliminating the options that are irrelevant and do not fit in the context is important to avoid repetition. Though the options might seem to be similar and confusing, it is important to filter out the options to reach a definite answer.

7. **Find the Link:**
   You can often find blanks that can have more than one suitable answer but what can help you here is finding a link to connect the options and sentence. For this the shortcut is to try all the suitable words by putting them in the sentence and then find the most appropriate answer. Linking the before and after word with the blank in between is always helpful.

8. **Find Keywords:**
Looking for specific keywords in the passage can help you figure out the main theme. This can eventually help you to choose a more appropriate word that matches or relates with the central theme and doesn't stand in contrast to it. Keywords are verbs, descriptive words and joining words.

9. **Familiarize yourself with common jargon:**
Jargon is the term used to describe a concept that is related to a particular field. These can also be termed as 'lingo' for a particular field.
E.g.: Due diligence: A business term, "due diligence" refers to the research that should be done before making an important business decision.

10. **Re-read after completing the passage:**
Once you have finished answering the questions, it is necessary that you re-read the entire passage to see if the tone and context of the entire passage is comprehensive. Do not skip to the next question without proofreading the answer and passage.

11. **Practice as much as possible:**
Practice is the key to every problem. It is possible to get similar type of questions in your exams while practicing and solving workbooks, previous questionnaires or quizzes online and offline.

EXERCISE:
Directions: Read the following text and complete it using the words given in the options.

PASSAGE 1:
Opera refers to a (1) art form, originating in Europe, in which the emotional content is conveyed to the audience as much through music, both vocal and instrumental, as it is through the lyrics. (2) contrast, in musical theatre an actor's dramatic performance is (3), and the music plays a lesser role. The drama in opera is presented using the primary (4) of theatre such as scenery, costumes, and acting. However, the words of the opera, or libretto, are sung rather than spoken. The singers (5) by a musical ensemble ranging from a small instrumental ensemble to a full symphonic orchestra.

1.	(a) dancing	(b) musical	(c) dramatic	(d) septuagenarian
2.	(a) In	(b) By	(c) With	(d) To
3.	(a) primeval	(b) primitive	(c) secondary	(d) primary
4.	(a) elements	(b) equipment	(c) nature	(d) troops
5.	(a) is accompanied	(b) are accompanied	(c) have accompanied	(d) has accompanied

PASSAGE 2:
Naval architects never **(1)** that a ship is unsinkable, but the sinking of the passenger-and-car ferry Estonia in the Baltic surely should have never have happened. It was well designed and carefully maintained. It carried the proper number of **(2)**. It had been thoroughly inspected the day of its **(3)** voyage. Yet hours later, the Estonia rolled over and sank in a cold, stormy night. It went down so quickly that most of those on board, caught in their dark, flooding cabins, had no chance to

save themselves: of those who managed to scramble overboard, only 139 survived. The rest died of hypothermia before the rescuers could **(4)** them from the cold sea. The final death toll amounted to 912 souls. However, there were an unpleasant number of questions about why the Estonia sank and why so many survivors were men in the prime of life, **(5)** most of the dead were women, children and the elderly.

1.	(a) proclaim	(b) protest	(c) provide	(d) claim
2.	(a) crew	(b) lifeboats	(c) hulks	(d) temperaments
3.	(a) tenuous	(b) vulnerable	(c) maiden	(d) fatal
4.	(a) plunge	(b) pluck	(c) shelter	(d) hover
5.	(a) while	(b) moreover	(c) nevertheless	(d) or

PASSAGE 3:

(1) America's farmland by wind and water has been a problem since settlers first put the prairies and grasslands under the **(2)** in the nineteenth century. **(3)** the 1930s, more than 282 million acres of farmland were damaged by erosion. After 40 years of conservation efforts, soil erosion has **(4)** due to new demands placed on the land by heavy crop production. In the years ahead, soil erosion and the pollution problems **(5)** causes are likely to replace petroleum scarcity as the nation's most critical natural resource problem.

1.	(a) Erosion	(b) Debilitation	(c) Derision	(d) Evasion
2.	(a) hull	(b) sceptre	(c) plough	(d) harrow
3.	(a) Since	(b) For	(c) On	(d) By
4.	(a) diminished	(b) accelerated	(c) ravished	(d) hoarded
5.	(a) they	(b) that	(c) those	(d) it

PASSAGE 4:

A tall tree can **(1)** a hundred gallons of water a day from its roots deep underground to the treetop. Is this movement **(2)** by pulling the water from above or pushing it from below? The pull mechanism has long been favored by most scientists. First proposed in the late 1800's, the theory **(3)** on a property of water not commonly associated with fluids: its tensile strength. Instead of making a clean break, water evaporating from treetops tugs on the remaining water molecules, with that tug **(4)** from molecule to molecule all the way down to the roots. The tree itself does not actually push or pull; all the energy for **(5)** water comes from the sun's evaporative power.

1.	(a) fetch	(b) transport	(c) acquire	(d) transgress
2.	(a) projected	(b) propelled	(c) provoked	(d) propitiated
3.	(a) relies	(b) relates	(c) predicates	(d) comprises
4.	(a) repelling	(b) wafting	(c) extending	(d) slithering
5.	(a) heaving	(b) slinging	(c) sloughing	(d) lifting

PASSAGE 5:

Notable as important nineteenth-century novels by women, Mary Shelley's Frankenstein and Emily Bronte's Wuthering Heights treat women very **(1)** Shelley produced **(2)** a text in which the fates of subordinate female characters seem entirely dependent on the actions of male heroes or anti-heroes. Bronte produced a more realistic narrative, portraying a world where men battle for

the favors of apparently high-spirited, independent women. **(3)**, these two novels are alike in several crucial ways. Many readers are convinced that the **(4)** mysteries of each plot conceal elaborate structures of allusion and fierce, though shadowy, moral ambitions that seem to indicate metaphysical intentions, though efforts by critics to articulate these intentions have generated much controversy. Both novelists use a storytelling method that emphasizes ironic disjunctions between different perspectives **(5)** the same events and ironic tensions that inhere in the relationship between surface drama and concealed authorial intention, a method I call an evidentiary narrative technique.

1.	(a) discriminately	(b) indiscriminately	(c) differently	(d) indifferently
2.	(a) "masculine"	(b) "feminist"	(c) "romantic"	(d) "prosy"
3.	(a) Moreover	(b) Although	(c) So	(d) Nevertheless
4.	(a) compelling	(b) horrifying	(c) tiresome	(d) coercive
5.	(a) for	(b) in	(c) on	(d) towards

PASSAGE 6:

Eight percent of the Earth's crust **(1)** aluminium, and there are hundreds of aluminium-bearing minerals and vast quantities of the rocks that **(2)** them. The best aluminium ore is bauxite, **(3)** as aggregates of aluminous minerals, more or less impure, in which aluminium is present **(4)** hydrated oxides. Bauxite is the **(5)** of all those aluminous rocks that occur in large quantities, and **(6)** yields alumina, the intermediate product required for the production of aluminium. Alumina also **(7)** naturally as the mineral corundum, but corundum is not found in large deposits **(8)** high purity, and therefore it is an impractical source for making aluminium. Most of the many abundant non bauxite aluminous minerals are silicates, and, **(9)** all silicate minerals are refractory, resistant to analysis, and extremely difficult to process. The aluminium silicates are therefore generally unsuitable alternatives to bauxite **(10)** considerably more energy is required to extract alumina from them.

1.	(a) was	(b) is	(c) will be	(d) being
2.	(a) contain	(b) contains	(c) could contain	(d) has contained
3.	(a) defined	(b) explained	(c) hypothesized	(d) identified
4.	(a) by	(b) for	(c) as	(d) beside
5.	(a) richer	(b) rich	(c) richly	(d) richest
6.	(a) they	(b) those	(c) it	(d) its
7.	(a) occurs	(b) weakens	(c) strives	(d) transforms
8.	(a) in	(b) on	(c) of	(d) within
9.	(a) besides	(b) like	(c) about	(d) similarly
10.	(a) because	(b) although	(c) so	(d) yet

PASSAGE 7:

Solar ponds are bodies of water in which circulation is incomplete and there is a very high salt concentration that increases with depth. This **(1)** change in salinity serves to trap heat because concentrated brine in the lowest water level **(2)** as a collector and storage area for solar heat, while the less saline, lighter water at the upper levels provides insulation. Heat is thus **(3)** in the depths. An artificial pond of this type **(4)** on the western shore of the Dead Sea in Israel in order to test **(5)** suitability as a source of low-grade heat for conversion **(6)** electricity. **(7)** immediate **(8)** to the

success of the venture was the growth of algae. Water in solar ponds must be kept maximally transparent to allow **(9)** of light to the deep storage area. Therefore, any particles of matter in the water, such as algae cells, that scatter or absorb light will interfere with the collection of heat. One proposed method of controlling the algae was the application of an algicide. **(10)**, the Dead Sea is a closed body of water without any outlet and as such is very easily contaminated. Extensive use of chemicals in numerous future full-scale solar ponds would lead to such contamination of the Dead Sea, which now enjoys a lucrative tourist trade.

1.	(a) vertical	(b) profound	(c) horizontal	(d) complex
2.	(a) stands	(b) stores	(c) acts	(d) assimilates
3.	(a) eliminated	(b) protracted	(c) retracted	(d) retained
4.	(a) was constructed	(b) constructed	(c) constructs	(d) has been constructed
5.	(a) its	(b) their	(c) it's	(d) the
6.	(a) towards	(b) into	(c) for	(d) of
7.	(a) An	(b) Some	(c) Thus	(d) A
8.	(a) objective	(b) triumph	(c) threat	(d) shield
9.	(a) obtuseness	(b) penetration	(c) felicity	(d) comprehension
10.	(a) However	(b) Hence	(c) Furthermore	(d) To summarize

PASSAGE 8:

The color of animals is by no means a matter of **(1)**; it depends on many considerations, but in the majority of cases tends to protect the animal from danger by rendering it less **(2)**. Perhaps it may be said that if coloring is mainly protective, there ought to be but few brightly colored animals. There are, however, not a few cases in which **(3)** colors are themselves protective. The kingfisher itself, though so brightly colored, is by no means easy to see. The blue harmonizes with the water, and the bird as it darts along the stream looks almost like a flash of sunlight. Desert animals are generally the color of the desert. Thus, for instance, the lion, the antelope, and the wild donkey are all sand-colored. "Indeed," says Canon Tristram, "in the desert, where neither trees, brushwood, nor even undulation of the surface **(4)** the slightest protection to its foes, a modification of color **(5)** to that of the surrounding country is absolutely necessary.

Hence, without exception, the upper **(6)** of every bird, and also the fur of all the smaller mammals and the skin of all the snakes and lizards, is of one uniform sand color." The next point is the color of the mature caterpillars, some of which are brown. This probably makes the caterpillar even more conspicuous among the green leaves than would otherwise be the case. Let us see, then, whether the habits of the insect will throw any **(7)** upon the riddle. What would you do if you were a big caterpillar? Why, like most other **(8)** creatures, you would feed by night, and lie concealed by day. So do these caterpillars. When the morning light comes, they creep down the stem of the food plant, and lie concealed among the thick herbage and dry sticks and leaves, near the ground, and it is obvious that under such circumstances the brown color really becomes a **(9)**. It might indeed be argued that the caterpillars, having become brown, concealed themselves on the ground, and that we were reversing the state of things **(10)**. But this is not so, because, while we may say as a general rule that large caterpillars feed by night and lie concealed by day, it is by no means always the case that they are brown; some of them still retaining the green color. We may then conclude that the habit of concealing themselves by day came first, and that the brown color is a later

1.	(a) choice	(b) gamble	(c) chance	(d) decision
2.	(a) available	(b) conspicuous	(c) serendipitous	(d) gratuitous
3.	(a) pale	(b) felicitous	(c) vivid	(d) bland
4.	(a) affords	(b) treats	(c) severs	(d) works
5.	(a) assimilated	(b) differentiated	(c) prevaricated	(d) alleviated
6.	(a) recrudescence	(b) indigence	(c) cornucopia	(d) plumage
7.	(a) pattern	(b) praise	(c) light	(d) judgement
8.	(a) timid	(b) defenseless	(c) intrepid	(d) fierce
9.	(a) fortitude	(b) cachet	(c) protection	(d) armour
10.	(a) envelope	(b) venture	(c) affectation	(d) adaptation

PASSAGE 9:

In the 16th century, an age of great marine and terrestrial exploration, Ferdinand Magellan **(1)** the first expedition to sail around the world. As a young Portuguese noble, he **(2)** the king of Portugal, but he became involved in the quagmire of political intrigue at court and **(3)** the king's favor. After he was **(4)** from service by the king of Portugal, he offered to serve the future Emperor Charles V of Spain. A papal **(5)** of 1493 had assigned all land in the New World west of 50 degrees W longitude to Spain and all the land east of that line to Portugal. Magellan offered to prove that the East Indies **(6)** under Spanish authority. On September 20, 1519, Magellan set sail from Spain with five ships. More than a year later, one of these ships was exploring the topography of South America in search of a water route across the continent. This ship sank, but the remaining four ships searched along the southern peninsula of South America. Finally, they found the passage they **(7)** near 50 degrees S latitude. Magellan named this passage the Strait of All Saints, but today it is known as the Strait of Magellan. One ship **(8)** while in this passage and returned to Spain, so fewer sailors were privileged to gaze at that first panorama of the Pacific Ocean. Those who remained crossed the meridian now known as the International Date Line in the early spring of 1521 after 98 days on the Pacific Ocean. During those long days at sea, many of Magellan's men died of starvation and disease. Later, Magellan became involved in an insular conflict in the Philippines and was killed **(9)** a tribal battle. Only one ship and 17 sailors under the command of the Basque navigator Elcano survived to complete the westward journey to Spain and thus prove once and for all that the world is round, with no **(10)** at the edge.

1.	(a) leads	(b) lead	(c) do lead	(d) led
2.	(a) attacked	(b) served	(c) ministered	(d) touted
3.	(a) lost	(b) has lost	(c) losing	(d) had lost
4.	(a) dismissed	(b) distinguished	(c) deterred	(d) precluded
5.	(a) commission	(b) verdict	(c) decree	(d) document
6.	(a) submitted	(b) fell	(c) collapsed	(d) wrecked
7.	(a) sought	(b) searched	(c) foraged	(d) mediated
8.	(a) burgeoned	(b) wangled	(c) deserted	(d) rankled
9.	(a) on	(b) in	(c) of	(d) for
10.	(a) tenure	(b) verdure	(c) schism	(d) precipice

PASSAGE 10:

Mount Vesuvius, a volcano located between the ancient Italian cities of Pompeii and Herculaneum, **(1)** much attention because of its frequent and destructive eruptions. The most

famous of these eruptions occurred in A.D. 79.The volcano had been **(2)** for centuries. There was **(3)** warning of the coming eruption, although one account unearthed by archaeologists says that a hard rain and a strong wind had **(4)** the celestial calm during the preceding night. Early the next morning, the volcano poured a huge river of molten rock down upon Herculaneum, completely burying the city and filling the harbor with coagulated lava. Meanwhile, on the other side of the mountain, cinders, stone and ash **(5)** down on Pompeii. Sparks from the burning ash ignited the combustible rooftops quickly. Large portions of the city were destroyed in the **(6)**. Fire, however, was not the only cause of destruction. Poisonous sulfuric gases saturated the air. These heavy gases were not buoyant in the atmosphere and therefore sank toward the earth and suffocated people. Over the years, excavations of Pompeii and Herculaneum **(7)** a great deal about the behavior of the volcano. By analyzing data, much as a zoologist dissects an animal specimen, scientists have concluded that the eruption **(8)** large portions of the area's geography. For instance, it turned the Sarno River from its course and raised the level of the beach along the Bay of Naples. Meteorologists studying these events have also concluded that Vesuvius caused a huge tidal wave that affected the world's climate.In addition to making these investigations, archaeologists have been able to study the skeletons of victims by using distilled water to wash away the volcanic ash. By strengthening the brittle bones with acrylic paint, scientists have been able to examine the skeletons and draw **(9)** about the diet and habits of the residents. Finally, the excavations at both Pompeii and Herculaneum have yielded many examples of classical art, such as jewelry made of bronze, which is an alloy of copper and tin. The eruption of Mount Vesuvius and its **(10)** consequences have provided everyone with a wealth of data about the effects that volcanoes can have on the surrounding area. Today, volcanologists can locate and predict eruptions, saving lives and preventing the destruction of other cities and cultures.

1.	(a) received	(b) has received	(c) had received	(d) was receiving
2.	(a) inactive	(b) silent	(c) polemic	(d) vivacious
3.	(a) a little	(b) hardly	(c) little	(d) few
4.	(a) disturbed	(b) destroyed	(c) degraded	(d) degenerated
5.	(a) flown	(b) marooned	(c) divulged	(d) rained
6.	(a) deluge	(b) recrimination	(c) trepidation	(d) conflagration
7.	(a) has revealed	(b) have revealed	(c) were revealing	(d) was revealing
8.	(a) changed	(b) covered	(c) erased	(d) evaded
9.	(a) speculations	(b) versions	(c) conclusions	(d) supplications
10.	(a) altruistic	(b) pathetic	(c) tragic	(d) morose

MODULE 8
ORDERING OF SENTENCES

Ordering of sentences is a verbal question format that is used to arrange the given jumbled sentences in a logical order to extract a meaningful passage.

Tips and tricks for solving questions from the ordering of sentences:

1. **Spotting the opening sentence:**
   Firstly, to arrange the jumbled sentences you need to identify the opening sentence. Go step by step reading all the sentences, finding the main theme and then looking for the opening sentence.

2. **Identify the closing sentence:**
   Secondly, you need to figure out the closing sentence of the passage. This again requires you to read all the sentences mentioned in the option, read the introductory sentence and then connect it with the last one according to the given theme.

3. **Spotting the transition words or the linking words:**
   Thirdly, look for transition words. These words are basically the ones that make the movement or shift from one sentence to another smoother and without a break.
   Once you identify the opening, closing sentences, and the transitory words, it becomes easy for you to ideally connect the sentences and create a passage with the help of the given options.

QUESTIONS:

1. Arrange the below-mentioned sentences coherently:
A. Hence the morning time is best for a workout.
B. The morning workout is more beneficial, as our body has already taken full rest for the whole night.
C. Throughout the day the body is involved in some or the other physical activity.
D. People often ask why morning workout sessions are the best.
E. That's why the entire body gets tired on all accounts due to everyday tasks.
(a) DABCE (b) DBCEA (c) ADBCE (d) DEACB

2. Order the following parts in proper sequence to obtain a correct sentence
P. the sparrows are few birds
Q. sparrows first scratch a hole in the ground with their feet
R. that engage in dust bathing
S. then lie in it and fling dirt or sand over their bodies with flick of their wings.
(a) PQRS (b) RSQP (c) QRPS (d) PRQS

3. Order the following parts in proper sequence to obtain a correct sentence
P. sent into space in anticipation of man
Q. a chimpanzee is one of the great apes.
R. scientists have examined its mental capacities and
S. and the nearest in intelligence to man.
(a) SRPQ (b) PRSQ (c) RPSQ (d) QSRP

4. Arrange the sentences in correct sequence
A. But in terms of practical value they do not impress much
B. Creative work should be our watch word
C. We all do a lot of talking and theorising
D. The affluent society can contribute a lot in this respect
E. What we need today is practical work
(a) becda (b) bedac (c) cadbe (d) caebd

5. Arrange the sentences in correct sequence
A. Indian political life has been dominated by our sentiment of opposition to alien value
B. Thus social and moral atmosphere is not suitable for democracy
C. And the leaders idealised tradition
D. The constitution was not product of urge for freedom
E. Consequently democratic aspirations were relegated to the background
(a) aebcd (b) dacbe (c) aedcb (d) aecbd

6. Arrange the sentences in correct sequence
A. But there are omissions and commissions in planning
B. It is true that standard has fallen in general sector
C. In a period of expansion, it is inevitable
D. Some say that quantitative expansion is achieved by the expense of quality
E. And the number of substandard institutions has increases
(a) debca (b) dbeca (c) bedca (d) bdeca

7. Arrange the sentences in correct sequence
A. There is danger that it may become formal
B. There should also be a deep concern for national welfare
C. Democracy can save by constant renewal
D. India has been described as largest democracy
E. Moreover it should be free from corruption
(a) daebc (b) dabec (c) dbace (d) daceb

8. Arrange the sentences in correct sequence
A. The authorities must be cautious enough to prevent such misadventure
B. Internet is one of the most modern communication techniques
C. But there is danger of foreign businessmen encroaching into the field of indian technology
D. It may be regarded as milestone in the development of communication facilities in India
E. India has just started trying it nationally
(a) becda (b) bdcea (c) bedca (d) badce

9. Arrange the sentences in correct sequence
A. For most of us education is a short-cut to get employment and livelihood
B. They cannot satisfy the thirst for wealth and position
C. Many people have no idea about the correct purpose of education
D. The only means of achieving satisfaction in life is the formation of character
E. But money and position always leads us astray if we do not have good character

(a) deabc (b) cabed (c) caebd (d) caedb

10. Arrange the sentences in correct sequence
A. It leads to the conclusion that our mental setup including those of drivers and pilots is worsening day by day
B. On-travel danger is also increasing proportionately
C. The history of human transportation extends from horses to supersonic jets
D. But they cannot find remedy to human errors
E. Scientists and technocrats are trying their best to reduce on-travel dangers
(a) cbeda (b) cbdae (c) acdeb (d) cedab

11. Arrange the sentences in correct sequence
A. Now they admit that aptitude is also highly necessary
B. Most businesses fail due to lack of professional administration
C. Success in business is combined result of professional administration
D. So far people believed that honesty was the best policy
E. Aptitude helps to decide upon profitability and feasibility
(a) bdeac (b) becad (c) cdeba (d) bdeac

12. Arrange the sentences in correct sequence
A. The curious fact is that they too are not beyond charges of corruption
B. Corruption at high places is a modern trend in India
C. We have organisations like CBI to investigate charges of corruption
D. Common men have adjusted themselves to corruption thinking that it is something that is there to stay
E. People famous for their integrity are being accused of corruption and malpractice
(a) beadc (b) edbac (c) becad (d) bedac

13. Arrange the sentences in correct sequence
(i) However, it is in India that this diversity manifests clearly.
(ii) There is a complex intermingling of cultures and subcultures, and almost all the countries in this region have this diversity.
(iii) South Asia is a land of diversities, which is reflected not just in the topography, but also in the languages and cultures as well as religious beliefs.
(iv) This region with a huge ethnic diversity is home to almost one-fifth of the world's population, where people practise six major religions and speak in hundreds of different languages.
(v) Pakistan has eight languages and two major religions, Sri Lanka has three languages and four religions and Nepal has three languages and three religions.
(a) (i) (ii) (v) (iv) (iii) (b) (iii) (iv) (ii) (v) (i)
(c) (i) (ii) (iv) (iii) (v) (d)) (iii) (ii) (v) (i) (iv)

14. Arrange the sentences in correct sequence
(i) That convergence, which has been repeated over the centuries, took place again about 40 years ago, at the origins of what is sometimes called the 'Cognitive Revolution'.
(ii) I will use the term intending you to hear quotes around the phrase 'Cognitive Revolution', expressing some scepticism; it was not all that much of a revolution, in my opinion.

(iii) Language has sometimes been described as a 'mirror of mind', so that the study of language should then give unique insight into human thought.
(iv) The study of languages and mind goes back to classical antiquity - to Classical Greece and India in the pre-Christian era.
(v) It has often been assumed over these millennia that the two inquiries have some intimate relation.

(a) (ii) (iv) (i) (iii) (v)
(b) (ii) (i) (iii) (v) (iv)
(c) (iv) (v) (iii) (i) (ii)
(d) (iv) (ii) (iii) (v) (i)

15. Arrange the sentences in correct sequence

(i) The second Persian invasion of Greece was catalysed by the spectacular failure of the first, with the then Persian King Darius. I see his desire to subjugate the city-states of Athens and Eretria ended brutally at the Battle of Marathon in 490 BCE.
(ii) Indeed, despite sending over 300,000 soldiers to take down the Persian's western enemy, the majority of Greece - and certainly the mainland - remained firmly out of Persian hands, with Darius himself checked in his empire's expansion for the first time.
(iii) Well, if you were a Spartan, the most war loving, brutal and savage city-state in the entirety of Greece, then you would fight - and you would do so to the last man.
(iv) That is exactly what King Leonidas I of Sparta did in 480 BCE and, despite falling in battle, he fell a free man on his home country's soil and helped repel the Persians from mainland Greece once and for all.
(v) After receiving the news of the defeat, however, his will remained intact and he began preparations for an even larger second invasion.

(a) (iii) (iv) (i) (ii) (v)
(b) (iii) (i) (ii) (iv) (v)
(c) (iv) (ii) (i) (iii) (v)
(d) (iv) (iii) (i) (ii) (v)

16. Arrange the sentences in correct sequence

(i) Speech and writing differ in their mechanics, of course, and that is one reason children must struggle with writing- it takes practice to reproduce the sounds of language with a pencil.
(ii) But the written word is a recent invention that has left no trace in our genome and must be laboriously acquired throughout childhood and beyond.
(iii) Man has an instinctive tendency to speak, as we see in the babble of our young children, whereas no child has an instinctive tendency to bake, brew or write.
(iv) The spoken word is more orderly than our species, and the instinct for language allows children to engage in articulate conversation years before they enter a schoolhouse.
(v) But they differ in another way, which makes the acquisition of writing a lifelong challenge, even after the mechanics have been mastered.

(a) (i) (ii) (iii) (iv) (v)
(b) (iii) (iv) (ii) (i) (v)
(c) (iv) (ii) (i) (iii) (v)
(d) (iv) (v) (iii) (ii) (i)

17. Arrange the sentences in correct sequence

(i) When a grammatical construction is associated with politicians, you can be sure that it provides a way to evade responsibility.
(ii) Zombie nouns, unlike the verbs whose bodies they snatched, can shamble around without subjects.
(iii) That is what they have in common with the passive constructions that also bog down these examples, like was affirmed and were used.

(iv) And, in a third evasive manoeuvre, many students and politicians stay away from the pronouns I,me, and you.
(v) The social psychologist Gordon Allport explained these tactics as 'Your anxiety and feeling of insecurity will tempt you to an excessive use of the passive voice'.

(a) (i) (ii) (iii) (iv) (v)
(b) (ii) (iii) (iv) (v) (i)
(c) (iv) (iii) (v) (ii) (i)
(d) (i) (iv) (ii) (iii) (v)

18. Arrange the sentences in correct sequence
(i) He was a useful and able committeeman, a ready writer and a good speaker.
(ii) In all, Bacon was elected to the House of Commons eight times and Parliamentary career covered the 30 years between 1584 and 1614.
(iii) As a member of the Lower House, Bacon combined qualities very seldom found in the same person.
(iv) The 'great year' 1588, the year of the Armada, made him a member for Liverpool and Reader at Gary's Inn.
(v) In 1584, at the age of 23, he was elected to parliament for Melcombe Regis, and in 1586, for Taunton.

(a) (i) (ii) (iii) (iv) (v)
(b) (iii) (i) (ii) (iv) (v)
(c) (iv) (i) (ii) (iii) (v)
(d) (v) (iv) (ii) (iii) (i)

19. Arrange the sentences in correct sequence
(i) In its vaguer significance, the phrase, though it contains a truth, contains also some possibilities of self-deception and error.
(ii) A giant holding up the earth and all its animal creation might still find the grasshopper a burden.
(iii) The lady may excuse herself for revealing the crumpled roseleaf by reflecting with what extraordinary dignity she would wear the crown of thorns - if she had to.
(iv) People who have both small troubles and big ones say that they find the small ones the most bitter; and it is undoubtedly true that the back which is bowed under incredible loads can feel a faint addition to those loads.
(v) But I am afraid that the maxim that the smallest worries are the worst is sometimes used or abused by people, because they have nothing but the very smallest worries.

(a) (v) (ii) (iii) (i) (iv)
(b) (iii) (ii) (iv) (v) (i)
(c) (i) (iv) (ii) (v) (iii)
(d) (iv) (i) (ii) (v) (iii)

20. Arrange the sentences in correct sequence
(i) By 1945, this incredible young woman from the coal fields of Eastern Ukraine would write her name in pencil on the wall of the Reichstag in Berlin, as Hitler's empire finally died.
(ii) As soon as war was declared, she rushed to the airfield to enlist, but it would only be in October 1941 - four months of heartbreak later- that her offer would be accepted.
(iii) Nadia was a member of a flying club since she was 15, and had completed her first solo flight and her first parachute jump aged 16.
(iv) She lost 30 comrades in action, and would be one of the 23 women of her regiment awarded the nation's highest honour along with the Order of Lenin and three Orders of the Patriotic War.
(v) She would become part of a unit - a squadron leader, no less - that flew up to 30,000 missions in the most primitive of planes and dropped an estimated 23,000 tons of bombs.

(a) (iii) (ii) (v) (iv) (i)
(b) (i) (iv) (iii) (ii) (v)

(c) (iv) (ii) (iii) (v) (i)
(d) (ii) (iii) (v) (i) (iv)

21. Arrange the sentences in correct sequence
(i) It was to be his last night alive, as at 3.00 a.m. Imperial forces stormed the mountain castle.
(ii) The age of the samurai mat had been extinguished that day, but it was done so displaying all of the central tenants that had made this warrior class so legendary - honour, courage and loyalty.
(iii) Takamori organised a sake party for his closest friends, an impressive display of bloody mindedness as he must have known what was coming.
(iv) By the time they were repelled, only 40 of the rebels were still alive and Takamori was badly injured.
(v) Being rendered unable to flight, Takamori did what honour dictated , as did the remaining samurai who charged into the bullets of the waiting Imperial army.
(a) (iii) (i) (iv) (v) (ii)
(b) (ii) (i) (iii) (iv) (v
(c) (iv) (iii) (v) (ii) (i)
(d) (i) (iii) (iv) (ii) (v)

22. Arrange the sentences in correct sequence
(i) Another positive aspect is that almost 90 per cent of Tamil Nadu's 60 million people are literate, compared to just half of Biharis.
(ii) As a result, there was much greater emphasis on educating the masses as the most obvious way of raising their social status.
(iii) Furthermore, Bihar and Uttar Pradesh are deep in India's landlocked interior, while Tamil Nadu is a coastal state, so it was always more open to foreign influences.
(iv) Other reason could be that Tamil Nadu, like neigh-bouring Kerala, had far more experience than the north of Christian missionary activity in the 18th and 19th century, which meant there were many more opportunities for the lower castes to attend schools.
(v) This owes something to the fact lower caste agitation began in Tamil Nadu long before India became a democracy, which meant lower castes leaders had to focus on other arenas to empower their followers.
(a) (i) (iv) (iii) (ii) (v)
(b) (ii) (iv) (iii) (v) (i)
(c) (ii) (i) (iii) (iv) (v)
(d) (i) (v) (ii) (iv) (iii)

23. Arrange the sentences in correct sequence
(i) Trades between the seven member countries amount to less than 5 percent of their overall trade flow, which is very feeble.
(ii) There are an estimated 10-15 million illegal Bangladeshi immigrants in India already and many more will come if Bangladesh does not achieve sustained economic growth.
(iii) India also has a history of awkward relations with Bangladesh, which, in spite of the fact that it was created by India in 1971, is both fearful and resentful of its large neighbour.
(iv) India must give Pakistani and Bangladeshi exporters more access to its huge market, in order to enhance economic development and curb Islamic fundamentalism in these countries.
(v) India must take the largest share of blame for the fact that trade is so anaemic within the SAARC.
(a) (iii) (iv) (v) (i) (ii)
(b) (iii) (ii) (v) (i) (iv)
(c) (ii) (i) (iv) (iii) (v)
(d) (ii) (iii) (iv) (v) (i)

24. Arrange the sentences in correct sequence

S1: In a recently opened laboratory just north of London, an experiment is under way to discover how the liver will respond to a new drug.

(i) Tests could also be carried out in animals, such as rats or dogs, as is required by regulations.

(ii) Normally, such a test would be carried out on liver cells cultured in rows of dishes.

(iii) It contains a miniature liver made from human cells and promises more reliable results.

(iv) But this experiment uses a small device about the size of a smartphone.

S6: It is one the first commercial versions of what bioengineers call an organ-on-a-chip.

(a) (i) (iv) (ii) (iii)
(b) (ii) (i) (iv) (iii)
(c) (i) (iv) (iii) (ii)
(d) (ii) (iv) (iii) (i)

25. Arrange the sentences in correct sequence

S1: Gone are the official weight versus height charts that some airlines used, although some physical prescription remains.

(i) That obsession with the body and grooming persists, referred to as 'labour of femininity' by some.

(ii) Maintaining the look, particularly in a heavily stylised crew uniform, with hair and makeup, can be a laborious task.

(iii) At the Emirates-Rolls Royce press conference at London, the grey-haired CEOs were flanked by an ever-smiling uniformed female crew.

(iv) But the role of glamorous attendants to project the brand is strong as ever.

S6: But the job goes beyond the glamour into the expertise and safety responsibility, particularly in the face of skyjacking history.

(a) (iv) (iii) (i) (ii)
(b) (i) (ii) (iv) (iii)
(c) (i) (iii) (ii) (iv)
(d) (iv) (ii) (i) (iii)

26. Arrange the sentences in correct sequence

S1: If you hang out with programmers, you will notice that they have a strong belief that their favoured programming language is the only correct one.

(i) Python versus Java is a popular ongoing argument as is Java versus Google, or Java versus Ruby or really Java versus any other language.

(ii) Evidence of this is present in discussion fora where questions on which programming language to use gets innumerable replies.

(iii) The discussions turn into long thoughtful debates and often turn flame wars.

(iv) Java, an old workhorse of website app development, is very poorly regarded and lots of voices suggest its time has passed.

S6: More recently , a hot topic has been Objective-C, the language in which most iPhone apps are written, versus Apple's Swift.

(a) (ii) (iii) (i) (iv)
(b) (ii) (iv) (i) (iii)
(c) (i) (iii) (ii) (iv)
(d) (i) (iv) (ii) (iii)

27. Arrange the sentences in correct sequence

S1: Sony and Panasonic may have lost billions of dollars in their TV business but they are not quitting, as that would close the door to more promising business.

(i) Staying relevant in the TV market ensures top-of -mind recall when customers shop for other electronic products.

(ii) But in spite of this shift, TVs remain among their best-known products.

(iii) TV business now accounts for a small portion of Sony's income, after it restructured its business focusing on gaming and image sensors.
(iv) Panasonic, too, restructured its business and now focuses on the emerging business of electric car batteries.
S6: That makes it worth remaining in a TV market, dominated by cheaper Asian rivals such as Samsung, by focusing on high-margin 4K models.

(a) (iv) (ii) (i) (iii) (b) (iii) (iv) (ii) (i)
(c) (iv) (i) (iii) (ii) (d) (iii) (i) (iv) (ii)

28. Arrange the sentences in correct sequence
S1: I was struck by the variety of cultures in the room that day.
(i) They would take off their shoes and bow down to Guruji's feet before taking their seat.
(ii) Outside the door, Guruji's host, the American Yoga teacher Freeman, greeted visitors.
(iii) Eager American Hatha Yoga practitioners were sitting in a room with a Brahmin, who himself was sitting in front of a Buddhist painting.
(iv) They say cross-legged on velvet cushions with their spines in perfect posture.
S6: Although students fled through the room all afternoon, Guruji's attention was unwavering.

(a) (ii) (iii) (i) (iv) (b) (iii) (iv) (ii) (i)
(c) (iii) (ii) (i) (iv) (d) (ii) (iv) (i) (iii)

29. Order the following parts in proper sequence to obtain a correct sentence
P. The potential exchanges between the officials of IBBF and the Maharashtra Body-Building Association has all the trappings of a drama we are accustomed to.
Q. In the case of sports persons, there is room for some sympathy, but the apathy of the administrators, which has even led to sanctions from international bodies, is unpardonable.
R. A case in the point is the hefty penalty of US $10,000 slapped on the Indian Body-Building Federation for not fulfilling its commitment for holding the Asian Championships in Mumbai in October.
S. It is a matter of deep regret and concern that the sports administrators often cause more harm to the image of the country than sportsmen and sportswomen do through their dismal performances.

(a) RPQS (b) SQRP (c) SPQR (d) RSQP

30. Order the following parts in proper sequence to obtain a correct sentence
P. Over the years, I have had the opportunities to observe and understand the thought processes behind the ads that have been flooding both the print and the TV media.
Q. Although there is a huge shift in the quality of ads that we come across on a daily basis-- thanks essentially to improvement in technology--I somehow can't help but feel that the quality of communication of the message has become diluted.
R. One reason is that there is an increasing attempt by most companies to be seen as cool and funky.
S. Another reason could be the burgeoning number of companies, which means an exponential increase in the number of ads that are being made.

(a) SRPQ (b) SRQP (c) PQRS (d) QPSR

MODULE 9
READING COMPREHENSION

What is reading comprehension?

Reading comprehension is the ability to read, process and understand a text. It's an active part that takes place before, during, and after you read something. Being able to comprehend what you are reading, can help you extract meaning from the text and realise what the author is trying to convey. RC is an integral part of all the verbal tests and competitive exams.

7 simple strategies to improve reading comprehension:

1. **Improve your vocabulary**

   Knowing what the words you are reading mean can improve your ability to comprehend the text better. To improve your vocabulary, you can:

- Take an online vocabulary quiz to assess your current level of vocabulary understanding
- Use flashcards to quiz yourself on words you don't know once or twice a week
- Make a point to use newly learned words in verbal and written communication
- Read as much as possible to improve your ability to guess what a word means in a certain context
- Make a list of unfamiliar words as you read and look them up in the dictionary

2. **Come up with questions about the text you are reading**

   Asking questions about what you are reading can help improve your understanding of the text better. It enables you to explore themes and other components of the text that you otherwise wouldn't inquire about. The following are examples of questions you could pose as you read:

- Why did the author begin the book at that location?
- What kind of relationship do these two characters share?
- What do we know about the main character up to this point in the book?
- Are there any themes that have consistently come up throughout the book? If so, what do they mean?

  The more specific your questions, the more likely you will gain further insight into the text and its meaning.

3. **Use context clues**

   Using context clues is a great way to understand what you are reading even if you don't know the vocabulary being used. Context clues can be found in the words and sentences surrounding the word that you aren't familiar with. To use context clues, you can focus on the key phrases or ideas in a sentence and deduce the main idea of a sentence or paragraph based on this information. You can also look for nearby words that are synonyms or antonyms of the word you don't know.

4. **Look for the main idea**

   Identifying the main idea of a paragraph or article can help you determine the importance of the article. Understanding why and what you're reading is important can give you a better comprehension of what the author is trying to convey. When reading, pause every few paragraphs and see if you can decipher what the main idea is. Then, try to put the main idea in your own words for even further understanding.

5. **Write a summary of what you read**
   A great way to increase your knowledge of what you have read is to write a summary. Summarizing requires you to decide what is important in the text and then put it in your own words. It can be simple note making. Summarizing the passage into simple words allows you to determine if you truly understand what you have read and better remember what you have read in the long term.

6. **Break up the text into smaller sections**
   If you are reading longer or more challenging text, consider breaking it up into smaller sections. For example, you could read two paragraphs at a time and then pause to quickly summarize what you just read in your mind. Breaking up what you are reading can help you feel less overwhelmed and give you a better chance of truly comprehending the information in the text.

7. **Eliminate distractions**
   When you are distracted, your ability to comprehend what you are reading is negatively impacted. When reading—even if it's a simple email—eliminate distractions and focus solely on the text. If you finish a sentence or paragraph and realize that you don't understand what it was trying to convey, take the time to re-read it until you do. Try to read slower the second time. This will help you learn to hold your attention to what you read and enable you to know whether you understand what you are reading.

QUESTIONS:

Directions - Questions 1 to 5: Read the passage and answer the given questions.

Political education has many connotations. It may be defined as the preparation of a citizen to take well informed, responsible and sustained action for participation in the national struggle in order to achieve the socio-economic objectives of the country. The predominant socio- economic objectives in India are the abolition of poverty and the creation of a modern democratic, secular and socialist society in place of the present traditional, feudal, hierarchical and in egalitarian one.

Under colonial rule, the Congress leaders argued that political education was an important part of education and refused to accept the official view that education and politics should not be mixed with one another. But when they came to power in 1947 they almost adopted the British policy and began to talk of education being defiled by politics. 'Hands off education' was the call to political parties. But in spite of it, political infiltration into the educational system has greatly increased in the sense that different political parties vie with each other to capture the minds of teachers and students. The wise academicians wanted political support, without political interference. What we have actually received is infinite political interference with little genuine political support. This interference with the educational system by political parties for their own ulterior motives is no political education at all and with the all round growth of elitism, it is hardly a matter for surprise that real political education within the school system (which really means the creation of a commitment to social transformation) has been even weaker than in the pre-independence period.

During that time only, the struggle for freedom came to an end and the major non- formal agency of political education disappeared. The press played a major role by providing some political education.

But it did not utilize the opportunity to the full and the stranglehold of vested interests continued to dominate it. The same can be said of political parties as well as of other institutions and agencies outside the school system which can be expected to provide political education. After analyzing all these things , it appears that we have made no progress in genuine political education in the post-education period and have even slided back in some respects. For instance, the education system has become even more elite-oriented. Patriotism has become the first casualty. The father of the nation gave us the courage to oppose the government when it was wrong, in a disciplined fashion and on basic principles. Today, we have even lost the courage to fight on basic issues in a disciplined manner because agitational and anarchic politics for individual, group or party aggrandizement has become common. In recent times the education system continues to support domination of the privileged groups and domestication of the under- privileged ones. The situation will not change unless we take vigorous steps to provide genuine political education on an adequate scale. This is one of the major educational reforms we need, and if it is not carried out, mere linear expansion of the existing system of formal education will only support the status quo and hamper radical social transformation.

1. Which word is nearly opposite in meaning as "defile" as used in the passage?
   (a) Disparage (b) forgery (c) degenerate (d) sanctify

2. According to the passage, what should be the main purpose of political education?
   (a) To champion the cause of elitism
   (b) To bring qualitative change in the entire education system
   (c) To create an egalitarian society
   (d) To prepare the young generation with high intellectual acumen.

3. How has politics been related to educational institutions after independence?
   (a) Although they got political support, there was no interference in politics.
   (b) It is clear that they got almost no political support as well as political interference.
   (c) They got political support at the cost of political interference.
   (d) There was substantial interference without political support.

4. Based on the passage, which is the major drawback of the present education system?
   (a) The education system mainly represents the oppressed sections of the society.
   (b) The present education system promotes the domination of the privileged few.
   (c) It is based on the British model of education.
   (d) It is highly hierarchical and egalitarian in nature.

5. Which is the most opposite in meaning to the word 'hamper' as used in the passage?
   (a) Accelerate (b) envision (c) foster (d) initiate

Directions - Questions 6 to 10: Read the passage and answer the given questions.

A fact that draws our attention is that, according to his position in life, an extravagant man is either admired or loathed. A successful business man does nothing to increase his popularity by being prudent with his money. A person who is wealthy is expected to lead a luxurious life and to be lavish with his hospitality. If he is not so, he is considered mean, and his reputation in business may even suffer in

consequence. The paradox remains that he had not been careful with his money in the first place; he would never have achieved his present wealth.

Among the low income group, a different set of values exists. The young clerk, who makes his wife a present of a new dress when he has not paid his house rent, is condemned as extravagant. Carefulness with money to the point of meanness is applauded as a virtue. Nothing in his life is considered more worthy than paying his bills. The ideal wife for such a man separates her housekeeping money into joyless little piles – so much for rent, for food, for the children's shoes, she is able to face the milkman with equanimity every, month satisfied with her economising ways , and never knows the guilt of buying something she can't really afford.

As for myself, I fall into neither of these categories. If I have money to spare I can be extravagant, but when, as is usually the case, I am hard up and then I am the meanest man imaginable.

6. Which of the following would be the most appropriate title for the passage:
   (a) Being extravagant is always condemnable.
   (b) The cause of poverty is extravagance.
   (c) Extravagance is a part of the rich as well as of the poor.
   (d) Stingy habits of the poor.

7. According to the passage the person, who is a successful businessman and wealthy
   (a) Is expected to have a lavish lifestyle.
   (b) Should not bother about popularity.
   (c) Is more popular if he appears to be wasting his time.
   (d) Must be extravagant before achieving success.

8. The phrase 'lavish with his hospitality' in the third sentence of the first paragraph means
   (a) Thoughtful in spending only on guests and strangers.
   (b) Unconcerned in treating his friends and relatives.
   (c) Stinginess in dealing with his relatives.
   (d) Extravagance in entertaining guests.

9. The word 'paradox' in the last sentence of the first paragraph means
   (a) Statement based on the popular opinion
   (b) a statement that seems self-contradictory but in reality expresses a possible truth.
   (c) Statement based on facts
   (d) A word that brings out the hidden meaning

10. What is the meaning of the word "equanimity"?
   (a) Calmness (b) Discomposure (c) Equivocal (d) Dubious

Directions - Questions 11 to 15: Read the passage and answer the given questions.

If a person suddenly encounters any terrible danger, the change of nature one undergoes is equally great. Sometimes fear numbs our senses. Like animals, one stands still, powerless to move a step in fright or to lift a hand in defense of our lives, and sometimes one is seized with panic, and again, acts

more like the inferior animals than rational beings. On the other hand, frequently in cases of sudden extreme peril, which cannot be escaped by flight, and must be instantly faced, even the most timid men at once as if by miracle, become possessed of the necessary courage, sharp quick apprehension and swift decision. This is a miracle very common in nature. Man and the inferior animals alike, when confronted with almost certain death 'gather resolution from despair' but there can really be no trace of such debilitating a feeling in the person fighting, or prepared to fight for dear life. At such times the mind is clearer than it has ever been; the nerves are steel, there is nothing felt but a wonderful strength and daring. Looking back at certain perilous moments in my own life, I remember them with a kind of joy, not that there was any joyful excitement then, but because they broadened my horizon, lifted me for a time above myself.

11. The title that best suits the passage would be:
    (a) The Will to Fight
    (b) The Miracle of Confronting Danger
    (c) The Change of Nature
    (d) Courage and Panic

12. A man may react to sudden danger in three different ways. What are they?
    (a) He may flee in panic, or fight back or stand still.
    (b) He may be paralyzed with fear, seized with panic or act like an inferior animal.
    (c) He may be paralyzed with fear, or seized with panic, or as if by miracle, become possessed of the necessary courage, and face the danger.
    (d) He may be paralyzed with fear, run away or fight.

13. What is the meaning of the word debilitating?
    (a) enfeeble (b) strengthen (c) debase (d) thriving

14. Explain the phrase 'gather resolution from danger'.
    (a) Find peace in times of difficulty.
    (b) A state of utter hopelessness makes one determined to face the difficulty.
    (c) To remain calm and not to lose hope.
    (d) To be enthusiastic and brave the odds.

15. The author feels happy in the recollection of dangers faced and overcome because
    (a) They brought him a new experience.
    (b) They added a new perspective and lifted him above himself for a time.
    (c) These experiences boosted his confidence.
    (d) He felt elated as he was alive.

16. In cities throughout the country, there is a new direction in local campaign coverage. Frequently in local elections, journalists are not giving voters enough information to understand the issues and evaluate the candidates. The local news media devotes too much time to scandal and not enough time to policy.
    Q: This paragraph best supports the statement that the local news media
    (a) is not doing an adequate job when it comes to covering local campaigns.
    (b) does not understand either campaign issues or politics.
    (c) should learn how to cover politics by watching the national news media.
    (d) has no interest in covering stories about local political events.

17. The use of desktop computer equipment and software to create high quality documents such as newsletters, business cards, letterhead, and brochures is called Desktop Publishing, or DTP. The most important part of any DTP project is planning. Before you begin, you should know your intended audience, the message you want to communicate, and what form your message will take.
Q: The paragraph best supports the statement that
(a) Desktop Publishing is one way to become acquainted with a new business audience.
(b) Computer software is continually being refined to produce high quality printing.
(c) The first stage of any proposed DTP project should be organization and design.
(d) The planning stage of any DTP project should include talking with the intended audience.

18. More and more office workers telecommute from offices in their own homes. The upside of telecommuting is both greater productivity and greater flexibility. Telecommuters produce, on average, 20% more than if they were to work in an office, and their flexible schedule allows them to balance both their family and work responsibilities.
Q: The paragraph best supports the statement that telecommuters
(a) get more work done in a given time period than workers who travel to the office.
(b) produce a better-quality work product than workers who travel to the office.
(c) are more flexible in their ideas than workers who travel to the office.
(d) would do 20% more work if they were to work in an office.

19. Sushi, the thousand-year-old Japanese delicacy, started small in the United States, in a handful of restaurants in big cities. Today, sushi consumption in America is 50% greater than it was ten years ago and not just in restaurants. Sushi is also sold at concession stands in sports stadiums, university dining halls, and in supermarkets throughout the country
Q: This paragraph best supports the statement that
(a) sushi is now a fast food as popular as hot dogs, burgers, and fries
(b) more sushi is sold in restaurants than in supermarkets.
(c) Americans are more adventurous eaters than they were in the past
(d) sushi wasn't always widely available in the United States.

20. Many animals hibernate during parts of the year, entering a state that is similar to a very deep sleep. But hibernation is more than simply a deep sleep. The animal's body temperature drops well below its normal range, the animal does not wake up for a long period of time, and its metabolism slows to the point that the animal does not need to eat or relieve itself during that period. In order to prepare for hibernation, the animal must build up its body weight and increase its body fat. This is important, since the animal will be living off its own body fat during the months of hibernation. Of course, once the period of hibernation is over, the animal "wakes up" to find itself slim and trim once again!
Q: How does an animal prepare for hibernation?
(a) It exercises for two months.
(b) It gradually increases its sleeping habits.
(c) It grows extra fur
(d) It eats more food than usual.

Directions - Questions 21 to 25: Read the passage and answer the given questions.

The walnut tree produces wood that is used for countless purposes, and is considered the finest wood in the world. The wood is easy to work with, yet it is very hard and durable—and when it is polished, it produces a rich, dark luster. It also shrinks and swells less than any other wood, which makes it especially desirable for fine furniture, flooring, and even gun stocks. In fact, just about every part of the walnut is unusually hard and strong. The nut of the tree is encased inside a very hard shell, which itself is enclosed in a leathery outer covering called a husk. It requires real effort to break through those layers to get at the tasty meat inside. Yet every part of the walnut is useful to people. The outer husk produces a dark reddish stain that is hard to remove from the hands of the person who opens the nut, and this pigment is widely used in dyes and wood stains. The inner shell is used as an abrasive to clean jet engines. And the meat of the nut is extensively used in cooking, ice cream, flavourings - and just eaten raw. Walnut trees exude a chemical into the soil near their roots which can be poisonous to some trees and shrubs. Fruit trees, for example, will not survive if planted too close to a walnut. Many other plants, such as maple trees or ivy, are not affected by the walnut's presence, and are well-suited to grow in its vicinity.

21. What is the topic of this passage?
    (a) the use of walnut wood in furniture
    (b) walnut trees
    (c) where to plant walnut trees
    (d) trees of North America

22. What is the main idea of the passage?
    (a) Trees are used for many things.
    (b) Maple trees grow well with walnuts.
    (c) Walnuts can kill other trees.
    (d) Walnut trees are valuable when planted correctly

23. As used in the passage, the word <u>abrasive</u> most nearly means
    (a) rough (b) disagreeable (c) soft (d) fragrant

24. The author of the passage probably believes that
    (a) walnut trees are endangered.
    (b) people should recycle more
    (c) people should grow walnut trees if possible.
    (d) maple trees are not good for furniture making.

25. As used in the passage, the word exude most nearly means
    (a) give off. (b) naked. (c) smell bad. (d) leave the area.

Directions: Questions 26 to 30: Read the passage and answer the given questions.

Today, bicycles are elegantly simple machines that are common around the world. Many people ride bicycles for recreation, whereas others use them as a means of transportation. The first bicycle, called a draisienne, was invented in Germany in 1818 by Baron Karl de Drais de Sauerbrun. Because it was made of wood, the draisienne wasn't very durable nor did it have pedals. Riders moved it by pushing their feet against the ground.

In 1839, Kirkpatrick Macmillan, a Scottish blacksmith, invented a much better bicycle. Macmillan's machine had tires with iron rims to keep them from getting worn down. He also used foot-operated cranks, similar to pedals, so his bicycle could be ridden at a quick pace. It didn't look much like the modern bicycle, though, because its back wheel was substantially larger than its front wheel. Although Macmillan's bicycles could be ridden easily, they were never produced in large numbers.

In 1861, Frenchman Pierre Michaux and his brother Ernest invented a bicycle with an improved crank mechanism. They called their bicycle a vélocipède, but most people called it a "bone shaker" because of the jarring effect of the wood and iron frame. Despite the unflattering nickname, the vélocipède was a hit. After a few years, the Michaux family was making hundreds of the machines annually, mostly for fun-seeking young people.

Ten years later, James Starley, an English inventor, made several innovations that revolutionised bicycle design. He made the front wheel many times larger than the back wheel, put a gear on the pedals to make the bicycle more efficient, and lightened the wheels by using wire spokes. Although this bicycle was much lighter and less tiring to ride, it was still clumsy, extremely top-heavy, and ridden mostly for entertainment.

It wasn't until 1874 that the first truly modern bicycle appeared on the scene. Invented by another Englishman, H. J. Lawson, the safety bicycle would look familiar to today's cyclists. The safety bicycle had equal-sized wheels, which made it much less prone to toppling over. Lawson also attached a chain to the pedals to drive the rear wheel. By 1893, the safety bicycle had been further improved with air-filled rubber tires, a diamond-shaped frame, and easy braking. With the improvements provided by Lawson, bicycles became extremely popular and useful for transportation. Today, they are built, used, and enjoyed all over the world.

26. There is enough information in this passage to show that
    (a) several people contributed to the development of the modern bicycle.
    (b) only a few vélocipèdes built by the Michaux family are still in existence.
    (c) for most of the nineteenth century, few people rode bicycles just for fun.
    (d) bicycles with wheels of different sizes cannot be ridden easily

27. The first person to use a gear system on bicycles was
    (a) H. J. Lawson.
    (b) Kirkpatrick Macmillan.
    (c) Pierre Michaux.
    (d) James Starley

28. This passage was most likely written in order to
    (a) persuade readers to use bicycles for transportation.
    (b) describe the problems that bicycle manufacturers encounter.
    (c) compare bicycles used for fun with bicycles used for transportation.
    (d) tell readers a little about the history of the bicycle

29. Macmillan added iron rims to the tires of his bicycle to
    (a) add weight to the bicycle.
    (b) make the tires last longer.
    (c) make the ride less bumpy.
    (d) make the ride less tiring.

30. Which of the following statements from the passage represents the writer's opinion?
    (a) The safety bicycle would look familiar to today's cyclists.
    (b) Two hundred years ago, bicycles didn't even exist.
    (c) The Michaux brothers called their bicycle a vélocipède.
    (d) Macmillan's machine had tires with iron rims.

Directions - Questions 31 to 35: Read the passage and answer the given questions.

One of the most hazardous conditions a firefighter will ever encounter is a backdraft (also known as a smoke explosion). A backdraft can occur in the hot-smoldering phase of a fire when burning is incomplete and there is not enough oxygen to sustain the fire. Unburned Carbon particles and other flammable products, combined with the intense heat, may cause instantaneous combustion if more oxygen reaches the fire. Firefighters should be aware of the conditions that indicate the possibility for a backdraft to occur. When there is a lack of oxygen during a fire, the smoke becomes filled with carbon dioxide or carbon monoxide and turns dense grey or black. Other warning signs of a potential backdraft are little or no visible flame, excessive heat, smoke leaving the building in puffs, muffled sounds, and smoke-stained windows. Proper ventilation will make a backdraft less likely. Opening a room or building at the highest point allows heated gases and smoke to be released gradually. However, suddenly breaking a window or Opening a door is a mistake, because it allows oxygen to rush in, causing an explosion.

31. A backdraft is a dangerous condition for firefighters mainly because
    (a) there is not enough oxygen for breathing.
    (b) the heat is extremely intense.
    (c) the smoke is dangerously thick.
    (d) an explosion occurs

32. Which of the following is not mentioned as a potential backdraft warning sign?
    (a) windows stained with smoke
    (b) flames shooting up from the building
    (c) puffs of smoke leaving the building
    (d) more intense heat than usual

33. To prevent the possibility of a backdraft, a firefighter should
    (a) carry an oxygen tank.
    (b) open a door to allow gases to escape.
    (c) make an opening at the top of the building.
    (d) break a window to release carbon particles

34. When compared with a hot, smoldering fire, a fire with visible, high-reaching flames
    (a) has more oxygen available for combustion.
    (b) has more carbon dioxide available for consumption.
    (c) produces more dense grey smoke.
    (d) is more likely to cause a backdraft.

35. Choose the word which is most nearly the same in meaning to the word given in bold as used in the passage. **AGGRAVATION**
    (a) Compression
    (b) Improvement
    (c) Reduction
    (d) Augmentation

Directions - Questions 36 to 40: Read the passage and answer the given questions.

The human body can tolerate only a small range of temperature, especially when the person is engaged in vigorous activity. Heat reactions usually occur when large amounts of water and/or salt are lost through excessive sweating following strenuous exercise. When the body becomes overheated and cannot eliminate this excess heat, heat exhaustion and heat stroke are possible. Heat exhaustion is generally characterised by clammy skin, fatigue, nausea, dizziness, profuse perspiration, and sometimes fainting, resulting from an inadequate intake of water and the loss of fluids. First aid treatment for this condition includes having the victim lie down, raising the feet 8 to 12 inches, applying cool, wet cloths to the skin, and giving the victim sips of salt water (1 teaspoon per glass, half a glass every 15 minutes) over a 1-hour period. Heat stroke is much more serious; it is an immediate life-threatening situation. The characteristics of heat stroke are a high body temperature (which may reach 106° F or more); a rapid pulse; hot, dry skin; and a blocked sweating mechanism. Victims of this condition may be unconscious, and first-aid measures should be directed at quickly cooling the body. The victim should be placed in a tub of cold water or repeatedly sponged with cool water until his or her temperature is sufficiently lowered. Fans or air conditioners will also help with the cooling process. Care should be taken, however, not to over-chill the victim once the temperature is below 102° F.

36. The most immediate concern of a person tending to a victim of heat stroke should be to?
    (a) get salt into the victim's body.
    (b) raise the victim's feet.
    (c) lower the victim's pulse.
    (d) lower the victim's temperature.

37. Which of the following is not mentioned as a potential backdraft warning sign?
    (a) windows stained with smoke
    (b) flames shooting up from the building
    (c) puffs of smoke leaving the building
    (d) more intense heat than usual

38. To prevent the possibility of a backdraft, a firefighter should?
    (a) carry an oxygen tank.
    (b) open a door to allow gases to escape.
    (c) make an opening at the top of the building.
    (d) break a window to release carbon particles.

39. When compared with a hot, smoldering fire, a fire with visible, high-reaching flames:
    (a) has more oxygen available for combustion.
    (b) has more carbon dioxide available for consumption.
    (c) produces more dense gray smoke.
    (d) is more likely to cause a backdraft.

40. Which of the following is a symptom of heat exhaustion?
    (b) Unconsciousness
    (b) Profuse sweating
    (c) Hot, dry skin
    (d) A weak pulse

MODULE 10
CRITICAL REASONING

The typical structure of Critical Reasoning questions is that of a short passage (mostly consisting of a single paragraph) followed by a question on the basis of the paragraph.

However, classifying them as short Reading Comprehension (RC) questions is not correct. They differ from RC in both structuring of the passage and the types and variety of questions. The typical CR passage is anything between 50 to 200 words long and necessarily contains an **argument**. An argument will always have a claim, supported by **reasons / evidences**.

QUESTIONS:

1. One of the most important and constructive reforms in National Politics has been the abolition of the post of State Ministers in the various departments.
Each of the following, if true, would strengthen the above argument, except
(A) There are few, if any, specific duties or responsibilities assigned to the state minister in any department.
(B) A historian claimed that the post was "superfluous."
(C) People of Cabinet minister caliber normally refuse the post if offered a minister ship in the guise of a state minister.
(D) The office is used as a means of appeasing regional parties, by giving their MPs ministerial status and perks without giving them, any significant responsibilities.

2. In the past, to run for one's country in the Asiad was the ultimate achievement of any athlete. Nowadays, an athlete's motives are more and more influenced by financial gain, and consequently, we do not see our best athletes in the Asiad, which is still only for amateurs.
Which of the following will most weaken the above conclusion?
(A) The publicity and fame that can be achieved by competing in the Asiad makes the athletes who do so, more "marketable" by agents and potential sponsors. Thus, they can earn a lot of money even while retaining their amateur status.
(B) The spirit of the Asiad places emphasis on participation rather than on the winning of the race.
(C) A leading columnist recently argued on the basis of concrete evidence that our best Asiad athletes already receive enough in terms of promotions and sponsorships.
(D) It has been suggested that professional athletes should be allowed to compete in the games.

3. In accordance with their powers, many zilla panchayats are introducing chlorination of the drinking water provided to families through the water supply system. This follows the conclusion of 10 years of research that the process ensures that children and adults receive the required intake of fluoride that will strengthen teeth. The maximum level has been set at one part per million. However, there are many who object, claiming that chlorination removes freedom of choice.
Which of the following will weaken the claim of the proponents of chlorination?
(A) Chlorination over a certain prescribed level has been shown to lead to a general weakening of teeth.

(B) There is no record of the long-term effects of drinking chlorinated water on dental and general health.
(C) In a study done at the grassroots level, it was found that some people to be affected by chlorination claim that they have not had sufficient opportunity to voice their views about the issue.
(D) Water already contains natural chlorine.

4. In response to the criticism about the methods used by his poll predicting agency, a leading psephologist Mannoy Toy, replied: "I realize there are some shortcomings to the questionnaire method that we have applied to do the survey. However, since we have ensured that we send a copy of the questionnaire to every home in each of the constituency where we have carried out our survey, we believe the results to be quite representative. We think the numbers received are so large that it overcomes the lack of a scientific approach that might have crept into our survey.
The writer of the above statement makes which of the following assumptions?
(A) A high proportion of the respondents who have received the questionnaire have replied to the same.
(B) A majority of the voters in the constituency live in homes.
(C) The method of data collection used by the agency is unscientific.
(D) A large, absolute number of replies automatically guarantees the accuracy of the results.

5. If you are interested in getting a good donation, you need to realize that Donors are almost never disturbed by being asked for too much. In fact, the result is the opposite-they are flattered. Besides, if you ask for too much, the donor can always suggest a smaller amount. On the other hand, if you ask for too little, the donor is usually offended. A common reaction to being asked too little is "so that's all he thinks I'm worth."
The above statement assumes that:
(A) Donors are usually never asked for enough.
(B) A good fund raiser will value the worth of the donor.
(C) It is worth the gamble to ask for large donations.
(D) None of these

6. New age problems require new age solutions. Further new age problems arise with new age populations and new age technologies. In order to find solutions to these problems we need to build new age institutions as well as new age political, economic, and social mechanisms. Yet, institutions and political and economic mechanisms grow slowly and die slowly. Hence, new age institutions should be given every chance of trying to achieve success in their objectives.
The argument above rests on which of the following assumptions:
(A) New age institutions are needed because old institutions are inefficient.
(B) New age institutions are created in order to solve existing problems.
(C) Over a course of time, as an institution grows, it has chances of succeeding in its objectives.
(D) None of these

7. In its quest to go global, once an Indian company has established an extensive sales network in a foreign market and therefore, has achieved substantial sales, it seems that these markets should be treated in a very similar fashion to those in India. It is therefore only in those countries where only

initial sales networks have been developed, where marketing methods will have to differ from the methods applied in India.
The above statement assumes that:
(A) Sales networks can be the same in both foreign countries and in India.
(B) Extensive sales networks are preferable to less developed ones.
(C) The markets of some countries will develop faster than others.
(D) None of these.

8. The reason that is most commonly quoted for nationalisation of foreign companies is a change in governance. Nationalisation tends to cover a wide range of industries and is not selective to the country of ownership of the foreign company.
The above statement assumes that:
(A) Some critical industries are more likely to be nationalised than others which might not be so critical.
(B) The process of nationalisation is not limited to any particular industry or country.
(C) Nationalisation of businesses is so widespread as to cause concern at the international level.
(D) Sharing ownership with local nationals will forestall takeovers by foreign governments.

9. About 40 percent of urban Indian husbands think it is a good idea for wives with school age children to work outside the home. Only about ten percent of rural Indian husbands approve of the same. Every second urban Indian wife, and one in four rural Indian wives with school age children has a job outside her home.
If the information above is correct, which of the following can be inferred?
(A) Rural Indian families have more children than urban Indian families.
(B) Employment opportunities for urban Indian wives are greater than for rural Indian wives.
(C) Urban Indian husbands have a less conservative attitude than rural Indian husbands.
(D) Rural Indian husbands would seem to be less satisfied about working wives who have school age children than urban Indian husbands.

10. An advertisement for a leading racquet manufacturer made the following claim:
The last five Wimbledon men's single champions have all changed to Head's new tennis rackets- the only racket that uses genuine nano technology in its frame. In that case, isn't now the time to add power to your tennis strokes and to trade in your old racket for a Head?
Which of the following claims is not made and cannot be inferred from the above ad?
(A) Frames strengthened by nano-technology are used only in Head's new rackets.
(B) Nano technology strengthened frames make tennis rackets stronger and allow the player to make more powerful strokes.
(C) Former Wimbledon champions know a great deal about tennis and their equipment.
(D) Head tennis rackets helped the last five Wimbledon men's' singles champions achieve their status.

11. In order to boost sales of toys at times other than the peak sale time, toy-manufacturers take recourse to the use of several techniques. Some of these include promoting character toys from Bollywood and Hollywood movies or TV series. All these sets are marketed as "collectibles" for the young consumers. The collections within a family of Collectibles, however, never appear to be complete (especially to the parents). As soon as all the characters are acquired, the child then requires the associated gadgets and gizmos that are bundled into the collectible set. Thus, parents

go shopping for the "car," the "home," the "mobile home," and even the "airplane" to ensure a happy homely environment for the toys. Ultimately, just as the elusive final piece of the series is attained, the manufacturer and promoter release the next series of "collectibles."

The prime aim of the manufacturer and promoter is to ensure that:

(A) all children should be happy, and no child can be happy without a complete series of toys.
(B) as soon as one set is complete or almost complete, then the next one arrives on the scene.
(C) children should be encouraged to complete their collections of toys.
(D) sales need to be artificially bolstered throughout the year.

12. Federer's fifth grand slam win prompted a reporter to ask whether he was the best ever. Federer is certainly not lacking in confidence, but he wasn't about to proclaim himself the best ever. "The best player of this generation, yes" he said, "But nowhere close to ever. Just look at the records that some guys have. I'm a minnow." _____

(A) His win against Agassi, a genius of the previous generation, contradicts that.
(B) Sampras, the king of an earlier generation, was as humble.
(C) He is more than a minnow to his contemporaries.
(D) The difference between 'the best of this generation' and 'the best ever' is a matter of perception.

13. Most firms consider expert individuals to be too elitist, temperamental, egocentric, and difficult to work with. Force such people to collaborate on a high stakes project and they just might come to fisticuffs. Even the very notion of managing such a group seems unimaginable. So, most organizations will fall into default mode, setting up project teams of people who get along nicely. _____

(A) The result however is disastrous.
(B) The result is mediocrity.
(C) A The result is the creation of experts who then become elitists.
(D) Naturally, they drive innovations.

14. The audiences for crosswords and sudoku, understand- ably, overlap greatly, but there are differences, too. A crossword attracts a more literary person, while sudoku appeals to a keenly logical mind. Some crossword enthusiasts turn up their noses at sudoku because they feel it lacks depth. A good crossword requires vocabulary, knowledge, mental flexibility and sometimes even a sense of humor to complete it. It touches numerous areas of life and provides an 'Aha!' or two along the way. _____

(A) Sudoku, on the other hand, is just a logical exercise, each one similar to the last.
(B) Sudoku, incidentally, is growing faster in popularity than crosswords even among the literate.
(C) Sudoku, on the other hand, can be attempted and enjoyed even by children.
(D) Sudoku, however, is not exciting in any sense of the term.

15. Jaya and Devika are both successful women who are also members of a socially disadvantaged section of the society. Jaya has a firm belief in positive discrimination. By positive discrimination she believes that the negative discrimination that society has subjected her section of the society to can only be offset through reverse discrimination. She believes that if positions of economic, social and political eminence, power and honor are offered principally to historically disadvantaged sections of society, then these groups will begin to play a more significant role in society today.

Devika, on the other hand, feels that she has succeeded in her chosen field of work on her hard work and on her own merits. She thinks that the principle of positive discrimination is flawed since it will result in the lowering of standards and decreases competition between similarly qualified personnel who will expect to achieve positions because of their factors other than rather than their suitability for the particular position.

Which of the following best sums up Jaya's argument?

(A) Positive discrimination will encourage more people to apply for jobs, previously unavailable to them.
(B) Positive discrimination will give extra opportunities to socially disadvantaged sections of the society.
(C) Quality and professionalism will improve because of the greater number of positions held by members of minority groups.
(D) Positive discrimination will remove deep rooted prejudices against the weaker sections of society from the work arena.

16. In India in 1990, there were, on an average 14 deaths at birth (infant mortality) per 1,00,000 population. By 2000 there were 11, and by 2001, 8. Today, there are 5 deaths at birth per 1,00,000 population, and it is anticipated that the downward trend will continue.

Each of the following, if true, would help account for this trend except:

(A) Medical care is more widespread and available.
(B) More effective birth control methods have been implemented.
(C) The number of pediatricians per 10,000 population has increased.
(D) Midwifery has declined in favor of doctors.

17. Oligopoly is the state where there are many competitors within a single market. The Pepsi Company realizes that its operations are in competitive industries.

Which of the following conclusions may be inferred from the above?

(A) Pepsi's market is not oligopolistic.
(B) Monopoly is defined as one seller in a market.
(C) The Pepsi Company has a lot of domestic competition.
(D) The Pepsi Company is operating in an oligopolistic market.

18. People in a South African tribe have observed that heavy rains are usually preceded by claps of thunder. They are convinced that the heavy rains are some- how caused by the claps of thunder.

Which of the following, if true, would weaken the tribals, conviction?

(A) The temperature must fall below 20 degrees Celsius for both heavy rains and claps of thunder to occur.
(B) The presence of rain bearing clouds is the reason for the heavy rains as well as the claps of thunder.
(C) The tribals of the particular tribe are unscientific people prone to superstitions.
(D) It is as yet to be proved that claps of thunder precede and hence, cause heavy rains.

19. "If the islanders are doomed to have local self-governance and it is the islanders who have determined this-then they should be ready to bear the negative consequences of local self-governance." said a British colonist as he left the shores of the island he was governing.

Which of the following, if true, would weaken his argument?

(A) Local rulers are always more interested in the development of their country than foreign colonists.

(B) Local self-governance is not child's play.
(C) The islanders are equally qualified and competent, if not more than the colonists, to run their own government.
(D) A group of islanders were against the transfer of power.

20. Stock market analyst Dhirubhai Mehta: "We believe that company's stock will appreciate at 35% a year for the next 10-12 years. The company just became the leader in its industry and we expect its sales to continue to grow at 8% a year over this period." Investor: "But how can the stock's price be expected to grow more quickly than the company's underlying sales?"
Which of the following facts would best support the stock analyst?
(A) The company's expenses will be declining over the next 5 to 10 years.
(B) The company just won a patent on a new product.
(C) Company A's stock is currently overvalued by a significant amount.
(D) The company's industry peer group is expected to experience stock appreciation rates of 30% over the same time horizon.

21. A car magazine report: 'The average mileage in the small car market was found to be 18 kilometers per litre. The average mileage was calculated by taking cars of all manufacturers in the segment, filling them with 10 litres of fuel and driving them along the Mumbai-Pune expressway. However, for the Karuti, the mileage was 22 kilometers per litre. Clearly, if you want to buy a new car, you should buy the Karuti.'
Which of the following assumptions does the magazine make?
(A) The reader is interested in buying a car.
(B) Mileage is the sole consideration for the readers of the magazine who intend to buy a car.
(C) No other car in the segment had a mileage better than the Karuti's mileage.
(D) None of these.

22. The head of the NCAER was quoted as saying that the Consumer Price Index (CL) will go down next month because of a recent drop in the price of petrol and steel.
Which of the following cannot be inferred from the statement?
(A) The cost of petrol and steel has gone down sharply.
(B) Consumption of petrol and steel has gone up.
(C) Petrol and steel are major items in the CPI.
(D) The changes in the cost of petrol is reflected quickly in the CPI.

23. The Incandescent brand fruit juice claims to be the most original fruit juice available on the market today. To prove this claim, the company marketing Incandescent called 10 people and asked them about their thoughts on fruit juices available on the market today. Nine of them stated that they unequivocally drink Incandescent brand fruit juices on a regular basis because it is closest to the taste of real fruits.
Which of the following would most weaken this argument?
(A) The Incandescent brand fruit juice is highly addictive.
(B) The 10 people called were related closely to top executives of the company.
(C) Most people prefer cola drinks to fruit juices. Here, Incandescent is a poor third to Coke and Pepsi.
(D) The 10 people were selected at random.

24. Many of the junk foods on the market today, doughnuts, burgers and pizza, have less nutrients than natural foods, which were dominant a decade or two ago. Many nutritionists claim that pizza and doughnuts give less nourishment than natural foods. A spokesman of a leading junk food Company - Pizza House - stated recently that an examination of grade-school students shows less nutritional deficiency than in their parents' time. Hence, junk foods are not as bad as made out to be.

Which of the following, if true, would tend to strengthen the view of the spokesman?

(A) Grade school children reported eating no break- fast at all.
(B) Fewer junk foods were available to the parents.
(C) Adults claim to eat junk foods as well as natural foods.
(D) Both (b) and (c).

25. The argument for liberalization which answers the worries of the left parties about the possible trade deficits created by the opening up of the Indian economy goes thus: 'In today's economic scenario, where there are many trading countries, the trade between two specific countries need not be balanced. The differing demands of goods and services and the differing productive capabilities of the same among different countries will cause a country like India to have trade deficits with some countries and surpluses with other countries. On the whole, the trade deficits and surpluses will balance out in order to give a trade balance'.

Which of the following conclusions best summarizes the argument presented in the passage above?

(A) Left parties need not worry about trade deficits in India since its trade will always be in balance even though it runs a deficit with a single country.
(B) India's trade deficits and surpluses with other countries always balance out.
(C) The left parties in India should not be concerned about India's trade deficits with specific countries because they will balance out in the long run.
(D) None of these.