SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

ENGLISH

SAINIK SCHOOL IMPHAL
WINTER VACATION ASSIGNMENT
SESSION: 2025-26
ENGLISH CORE (301)
CLASS: XI

BOOK REVIEW

A book review is written after you have read a book, and you feel that you cannot stop yourself from sharing your thoughts on the book. A book review is a great way of letting fellow readers know about the book — let your readers know if the book is exciting or boring. Whether writing on social media or on your personal blog, while reviewing the book, try to make it informative and helpful to the readers. Therefore, to help you write a good book review, I have provided a few tips. Read the tips given below and write a book review of your own.

Write a book review on the following novel:

"THE DARK ROOM" by R. K. NARAYAN

- What to Include in the Book Review?
  - Topic or Book
  - Essential Information of the novelist
  - Information about the novel
  - Important characters in the novel
  - Basic Summary
  - Development of the Plot
  - Conclusion
  - Your Criticism or views of the novel
  - Morale or the message given by the novel
  - Recommendations
  - Ratings

IMPORTANT NOTES:

(i) The assignment should be done on A4 size sheets and compiled in a hard bound file/folder. And design an attractive cover for your file/folder indicating Name, Class, Section, Adm. No. and Subject clearly.
(ii) All the answers should be neatly presented in your own handwriting.
(iii) Remember, a well-presented 'Holiday Homework' fetches you appreciations of the teachers and the classmates.

BE WITH YOUR PARENTS; STAY SAFE, STAY HAPPY.

MR. M A HAQUE
PGT (ENGLISH)

SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

COMPUTER

SAINIK SCHOOL IMPHAL

WINTER VACATION ASSIGNMENT (2025-26)

SUBJECT-COMPUTER

CLASS-11

Perform the following Python Programming with output

● Input a welcome message and display it.

● Input two numbers and display the larger / smaller number.

● Input three numbers and display the largest / smallest number. Pattern-2 Pattern-3

● Generate the following patterns using nested loops:

Pattern-1	Pattern-2	Pattern-3
* ** *** **** *****	12345 1234 123 12 1	A AB ABC ABCD ABCDE

● Write a program to input the value of x and n and print the sum of the following series:

- $1 + x + x^2 + x^3 + x^4 + \cdots x^n$
- $1 - x + x^2 - x^3 + x^4 - \cdots x^n$
- $x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \cdots \frac{x^n}{n}$
- $x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots \frac{x^n}{n!}$

● Determine whether a number is a perfect number, an Armstrong number or a palindrome.

● Input a number and check if the number is a prime or composite number.

● Display the terms of a Fibonacci series.

● Compute the greatest common divisor and least common multiple of two integers.

● Count and display the number of vowels, consonants, uppercase, lowercase characters in string.

● Input a string and determine whether it is a palindrome or not; convert the case of characters in a string.

● Find the largest/smallest number in a list/tuple

● Input a list of numbers and swap elements at the even location with the elements at the odd location.

● Input a list/tuple of elements, search for a given element in the list/tuple.

● Create a dictionary with the roll number, name and marks of n students in a class and display the names of students who have marks above 75.

SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

CHEMISTRY

XI Chemistry Winter Vacation Home Work

Unit I: Redox reaction

1. With a suitable example explain a redox reaction and its consequences.

2. Balance the following ionic equation in acid medium.

(i) $Cr_2O_7^{2-} + S^{2-} \rightarrow Cr^{3+} + S$

(ii) $MnO_4^- + Cl^- \rightarrow Mn^{2+} + Cl_2$

(iii) $SO_4^{2-} + Cu \rightarrow Cu^{2+} + SO_2$

(iv) $Cr_2O_7^{2-} + Br^- \rightarrow Cr^{3+} + Br_2$

(v) $NO_3^- + Zn \rightarrow NO_2 + Zn^{2+}$

(vi) $NO_3^- + Zn \rightarrow NO + Zn^{2+}$

(vi) $SO_4^{2-} + I^- \rightarrow SO_2 + I_2$

(vii) $SO_4^{2-} + Br^- \rightarrow SO_2 + Br_2$

(viii) $MnO_4^- + SO_2 \rightarrow Mn^{2+} + HSO_4^-$

(ix) $H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + H_2O$

(x) $Cr_2O_7^{2-} + SO_2 \rightarrow Cr^{3+} + SO_4^{2-}$

3. Balance the following ionic equation in basic medium.

(i) $MnO_4^- + I^- \rightarrow MnO_2 + IO_3^-$

(ii) $MnO_4^- + S_2O_3^{2-} \rightarrow MnO_2 + SO_4^{2-}$

(iii) $P_4 + OH^- \rightarrow PH_3 + H_2PO_2$

(iv) $Cl_2O_7 + H_2O_2 \rightarrow ClO_2^- + O_2 + H^+$

(v) $N_2H_4 + ClO_3^- \rightarrow NO + Cl^-$

4. Define electrode potential. What is the importance of electrode potential?

Unit: Organic chemistry

1. What is a carbocation? Explain the stability of different carbocation.

2. Explain structural isomerism in organic compounds.

3. Define conformational isomerism in ethane.

4. With suitable example define and explain positive and negative mesomeric effect.

5. Draw resonating structures of phenol and explain how electrophilic substitution reaction takes place in phenol.

6. How can you prepare benzene. Explain hybrid orbital strtucture of benzene.

END

SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

MATHEMATICS

Sainik School Imphal
Winter vacation H/W
Class -11
Chapter-1: SETS

Section-1 MCQ Type(each question is of 1 mark)

1. Let A and B be two non empty sets in the same universal set. Then A−B is equal to
   (a) A∩B (b)A'∩B (c) A∩B' (d) none of these
2. If A={1,2,3,4,5}, then the number of proper subsets of A is
   (a) 120 (b) 30 (c) 31 (d) 32
3. If A={2,3}, B={4,5}, C={5,6}, then what is the number of elements in A x (B ∩ C)?**(2010-II)**

   (a) 2 (b) 4 (c) 6 (d) 8

4. If set A and B are defined as $A = \{(x, y) \mid y = e^x, x \in R\}, B = \{(x, y) \mid y = x,\ x \in R\}$, then

   (a)$B \subset A$ (b) $A \subset B$ (c)$A \cap B = \emptyset$ (d) $A \cup B = A$

5. Let N be the set of natural numbers and $A = \{n^2 | n \in N\}$ and $B = \{n^3 | n \in N\}$. Which of the following is correct?(2010-II)

   (a)$A \cup B = N$ (b) $A \cap B$must be a finite set.

   (c) The complement of $A \cup B$is an infinite set.

   (d) $A \cap B$must be a proper subset of $\{m^6 | m \in N\}$.

6.If A, B, C are three sets, then what is $A - (B - C)$ equal to?(2008-II)

   (a)$A - (B \cap C)$ (b) $(A - B) \cup C$

   (c) $(A - B) \cup (A \cap C)$ (d) (A-B)∪ $(A - C)$

7. If $A = \{a, b, c, d\}$then what is number of proper subset of A?**(2010-I)**

   (a) 16 (b) 15 (c) 14 (d) 12

8. If $n(A) = 115,\ n(B) = 326,\ \ n(A - B) = 47,$ then what is $n(A \cup B)$?

   (a) 373 (b) 165 (c) 370 (d) 394

9. If $A \& B$ are two subset of a set X, then what is $A \cap (A \cup B)'$?**(2008-II)**

   (a) A (b) B (c) $\emptyset$ (d) A'

10. If $X \ \& \ Y$ are any two non – empty sets then what is $(X - Y)'$ equals to?**(2009-I)**
    (a) $X' - Y'$ (b) $X' \cap Y'$ (c) $X' \cup Y$ (c) $X - Y'$

11. If a set A contains 4 elements, then what is the number of elements in $A \times p(A)$?**(2008-II)**

    (a) 16 (b) 32 (c) 64 (d) 128

12. If $A \ \& \ B$ are two sets, then $A \cap (A \cup B)$ is equal to
    (a) A (b) B (c) $\emptyset$ (d) none of these

13. Let X be the universal set for sets $A \& B$. If $n(A) = 200, n(B) = 300 \& n(A \cap B) = 100$, then $n(A' \cap B')$ is equal to 300 provided $n(X)$ is equal to

(a) 600 (b) 700 (c) 800 (d) 900

14. If $n(A) = 4$ and, $n(B) = 7$ then the min^m and max^m value of $n(A \cup B)$respectively.

(a) 4, 11 (b) 4, 7 (c) 7, 11 (d) none of these

15. If *A, B, C* are three sets and U is the universal set such that $n(U) = 700$, $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$ then what is the value of $n(A' \cap B')$?

(a) 100 (b) 200 (c) 300 (d) 400

16. If *A*&*B* are two sets, then $(A - B) \cup (B - A) \cup (A \cap B)$is equal to

(a) $A \cup B$ (b) $A \cap B$ (c) *A* (d) B'

17. If A and B are two sets satisfying A-B = B-A, then which one of the following is correct? **(2007-II)**

(a) $A = \varphi$ (b) $A \cap B = \varphi$ (c) $A = B$ (d) none of these

18. If A and B are two subsets of set X, then what is the value of $A \cap (A \cup B)'$?

(a) A (b) B (c) ϕ (d) A'

19. If A & B are subsets of X, then what is $[A \cap (X - B)] \cup B$ equal to ?**(2009-I)**

(a) A ∪ B (b) A ∩ B (c) A (d) B

20. If A, B, C are three finite sets, then what is $[(A \cap B) \cap C]'$ equal to?

(a) $A' \cup B' \cap C'$ (b) $A' \cap B' \cap C'$ (c) $A' \cap B' \cup C'$ (d) $A \cap B \cap C$

21. If $A = \{0,1\}$ and $B = \{1,0\}$, then what is A x B equal to?

(a) $\{(0,1),(1,0)\}$ (b) $\{(0,0),(1,1)\}$ (c) $\{(0,1),(1,0),(1,1)\}$ (d) A x A

22. If $n(A) = 43$, $n(B) = 51$ & $n(A \cup B) = 75$, then $n[(A - B) \cup (B - A)]$ is

(a) 53 (b) 45 (c) 56 (d) 66

23. If A & B are non-empty sets such that B ⊂ A, then

(a) $B' - A' = A - B$ (b) $B' - A' = B - A$ (c) $A' \cap B' = B - A$ (d) $A' \cup B' = A' - B'$

24. The set $A = \{x | x + 4 = 4\}$ can also be represented by**(2012-I)**

(a) 0 (b) ∅ (c) {∅} (d) {0}

25. If X and Y are two sets, then $X \cap (Y \cup X)'$ is equal to

(a) X (b) Y (c) ∅ (d) none

26. If $n(A) = 115, n(B) = 326, n(A - B) = 47$ then $n(A \cup B)$ is

(a) 373 (b) 165 (c) 370 (d) none

27. If $A \subseteq B$, then $B' - A'$ is equal to

(a) A' (b) B' (c) A–B (d) ϕ

28. If A={$(x, y)/ x^2 + y^2 = 25$} & B={$(x, y)/ x^2+9y^2=144$}, then A∩B contains

(a) one point (b) three points (c) two points (d) four points

29. Consider the following relations:-

1. A–B = A – (A∩B)
2. A = (A∩B)∪(A–B)

3. A – (B∪C)=(A–B) ∪(A–C)
Which of these is/are correct?
(a) (1) & (3) (b) (2) only (c)(2) & (3) (d) (1) & (2)

30. If A⊆B, then A △ B is equal to
(a) (A–B) ∩(B–A) (b)A–B (c)B–A (d) None

31. If ∅ denotes the empty set, then which one of the following is correct?
(a) ∅ ∈ ∅ (b) ∅ ∈ {∅} (c) {∅} ∈ {∅} (d) 0∈ ∅

32. In a group of 500 students, there are 475 students who can speak Hindi & 200 can speak Bengali. What is the number of students who can speak Hindi only?
(a) 275 (b) 300 (c) 325 (d) 350

33. If A and B are two sets, then A∩(A∪B) equals
(a) A (b) B (c) ∅ (d) none

34. Two finite sets have *m* and *n* elements. The total number of subsets of the first set is 56 more than total number of subsets of second set. The values of *m* and *n* are**(2009-I)**

(a) 7,6 (b) 6,3 (c) 5,1 (d) 8,7

35. If X & Y are two sets, then $X \cap (Y \cup X)'$ equal to :

(a) X (b) Y (c) ∅ (d) None

36. If $n(A) = 4, n(B) = 3, n(A \times B \times C) = 24$, then $n(c)$ is

(a) 288 (b) 12 (c) 17 (d) 2

37. If A & B are non-empty sets such that $A \supset B$, then

(a) $B' - A' = A - B$ (b) $B' - A' = B - A$ (c) $A' - B' = A - B$ (d) $A' \cap B' = B - A$

38. In a class of 60 students, 45 students like music, 50 students like dancing, 5 students like neither. Then the number of students in the class who like both music and dancing is**(2015-I)**

(a) 35 (b) 40 (c) 50 (d) 55

39. Let S be the set of all distinct numbers of the form $\frac{p}{q}$, where p,qϵ{1,2,3,4,5,6,}. What is the cardinality of the set S?**(2016-II)**

(a) 21 (b) 23 (c) 32 (d) 36

40. If $A = \{(x, y)/x^2 + y^2 \leq 1, x, y \epsilon R\}$& B = $\{(x, y)/x^2 + y^2 \geq 4, x, y \epsilon R\}$ then

(a) $A - B = \emptyset$ (b) $B - A = \emptyset$ (c) $A \cap B \neq \emptyset$ (d)$A \cap B = \emptyset$

ASSERTION-REASON BASED QUESTIONS(1 mark each)

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

1.Assertion: $Let\ n(U) = 200$,$n(A) = 120$ and $n(A \cap B) = 30$ then $n(A \cap B') = 90$

Reason: $n(A - B) = n(A) - n(A \cap B)$

2. Assertion: If $A = \{x: x = 4n, n \in N\}$ and $B = \{x: x = 6n, n \in N\}$ then $A \cap B = \{24,48,72,96, \ldots.\}$

Reason: $A \cap B = \{ln: n \in N\ and\ l = LCM\ of\ (4,6)\}$

3. Assertion: If $A \cup B = A \cup C$ and $A \cap B = A \cap C$,then $B = C$

Reason: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

4.Let $A = \{0,1,\{0,1\},2,3\}$ and $B = \{0,1\}$

Assertion:B is a subset of A.

Reason: B is an element of A

5. Assertion: $Let\ n(U) = 1000, n(S) = 720, n(T) = 450,$ then least value of $n(S \cap T)$ is 170

Reason:$n(S \cup T)$ is maximum when $n(S \cap T)$ is least.

SECTION-II(2 mark each)

1. Using properties of set ,show that $(A - B) \cap B = \emptyset$

2. For any two sets Prove that P(A∩B) = P(A)∩P(B).

3. For any two sets A and B, Prove that P(A) = P(B)⇒ A = B.

4. For any three sets A, B and C, Prove that A – (B – C) = (A – B)∪(A∩C).

5.Show that if $A \subset B, then\ C - B \subset C - A$.

6. In a group of 400 people in USA, 250 can speak Spanish and 200 can speak English. How many people can speak both Spanish and English?

SECTION-III(3 mark each)

1.If A and B are two sets such that n(A)=17, n(B)=23 and n(A∪ B)=38 ,find the number of elements in exactly one of A and B.

SECTION-IV(4 mark each)

1. Out of 100 students, 15 passed in English, 12 passed in Mathematics, 8 in Science, 6 in English & Mathematics, 7 in Mathematics & Science, 4 in English & Science, 4 in all the three. Find how many passed in

   (a) English & Mathematics but not in Science

   (b) Mathematics only

   (c) more than one subject

2. There are 200 individuals with a skin disorder,120 had been exposed to chemical C_1,50 to chemical C_2 and 30 to both the chemicals C_1 and C_2 . Find the number of individuals exposed to

(i) chemical C_1 but not chemical C_2

(ii) chemical C_2 but not chemical C_1

(iii) chemical C_1 or chemical C_2

3. A college awarded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports.

4. A market research group conducted a survey of 1000 consumers and reported that 720 consumers like product A and 450 consumers like product B, what is the least number that must have liked both products?

CHAPTER-2 :Relations and Functions

SECTION -I MCQType (each question of 1 mark)

1. If A={1,2,3}, B={1,4,6,9} and R is a relation from A to B defined by 'x is greater than y', then the range of R is
(a) {1,4,6,9} (b) {4,6,9} (c) {1} (d) none of these

2. Let $f: R \to R$ defined by $f(x) = \frac{|x|}{x}, x \neq 0, f(0) = 2$. what is the range of f?(2009-II)

(a){1,2} (b) {-1,1) (c) {-1,1,2} (d) {1}

3.If $f(x) = (a - x^n)^{\frac{1}{n}}$, then $f\big(f(x)\big)$ is equal to

(a)x (b) $a - x$ (c)x^n (d) $x^{\frac{-1}{n}}$

4. Let $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}, x \in R - \{0\}$, then $f(x)$ is equal to

(a) x^2 (b) $x^2 - 1$ (c) $x^2 - 2$, when $|x| \geq 2$ (d) none

5. Let R be a relation in N defined by R={$(x, y)/x$+$2y$=8}. The range of R is
(a) {2,4,6} (b) {1,2,3} (c) {1,2,3,4,6} (d) none

For the next three (03) items that follow:-**(2014-II)**
Consider the function $f(x)$= $\frac{x-1}{x+1}$

6. What is $\frac{f(x)+1}{f(x)-1}$+ x equal to?
(a) 0 (b) 1 (c) 2 x (d) 4 x

7. What is $f(2x)$ equal to?
(a) $\frac{f(x)+1}{f(x)+3}$ (b) $\frac{f(x)+1}{3f(x)+1}$ (c) $\frac{3f(x)+1}{f(x)+3}$ (d) $\frac{f(x)+3}{3f(x)+1}$

8. What is $f\big(f(x)\big)$ equal to?
(a) x (b)$-x$ (c) $-\frac{1}{x}$ (d) none

9. If $R = \{(x, y)/x, y \in Z, x^2 + y^2 \leq 4\}$ is a relation in Z, then domain of R is:
(a) {0,1,2} (b) {0,-1,-2} (c) {-2,-1,0,1,2} (d) None

10. The range of the function $f(x) = \frac{1+x^2}{x^2}$ is equal to
(a)[0,1) (b) $(0, 1)$ (c) $(1, \alpha)$ (d) $[\,1, \alpha\,)$

11. If $f(x) = x^2 - x^{-2}$, $x \in R - \{0\}$, then $f\left(\frac{1}{x}\right)$ is equal to

(a) $f(x)$ (b) $-f(x)$ (c) $\frac{1}{f(x)}$ (d) $(f(x))^2$

12. Let R be a relation in N defined by $R = \{(x,y)/2x + y = 8\}$, then, range of *R* is
(a) {1,2,3} (b) {2,4,6} (c) {1,2,3,4,6} (d) none

13. If A={2,3}, B={4,5}, C={5,6}, then what is the number of elements in A x (B ∩ C)?**(2010-II)**

(a) 2 (b) 4 (c) 6 (d) 8

14 .If $A = \{1,2,3\}$& $B = \{3,8\}$ then $(A \cup B) \times (A \cap B)$ is

(a){(8,1), (3,2), (3,3), (3,8)} (b) {(1,3), (2,3), (3,3),(8,3)}

(c) {(1,2), (2,2), (3,3), (8,8)} (d) {(8,3), (8,2), (8,1), (8,8)}

15. The domain of the function $f = \frac{1}{\sqrt{9-x^2}}$ is

(a) $-3 \le x \le 3$ (b) $-3 < x < 3$(c) $-9 \le x \le 9$ (d) $-9 < x < 9$

16. Expansion of $\sqrt{9-x^2}$ is valid if

(a) $-3 < x < 3$ (b) $|x| > 3$ (c) $|x| \le 3$ (d) $-1 < x < 1$

17. If $A = \{0,1\}$ and $B = \{1,0\}$, then what is A x B equal to?

(a) $\{(0,1),(1,0)\}$ (b) $\{(0,0),(1,1)\}$ (c) $\{(0,1),(1,0),(1,1)\}$ (d) A x A

18. The set $A = \{x|x + 4 = 4\}$ can also be represented by**(2012-I)**

(b) 0 (b) ∅ (c) $\{\emptyset\}$ (d) $\{0\}$

19. The range of the function $f(x) = \frac{x-2}{2-x}, x \neq 2$ is

(a) R (b) R – {1} (c) { - 1 } (d) R – { - 1 }

20. Let $f(x) = \frac{x-1}{x+1}$, then $f[f(x)]$ is

(a) $\frac{1}{x}$ (b) $-\frac{1}{x}$ (c) $\frac{1}{x+1}$ (d) $\frac{1}{x-1}$

21. The range of function $f(x) = |x|$ is
(a) (0,α) (b) (−α,0) (c) [0,α) (d) none

22. A and B are two sets having 3 elements in common. If $n(A) = 5$ & $n(B) = 4$, then what is $n(A \times B)$ equal to ?**(2014-II)**

(a) 0 (b) 9 (c) 15 (d) 20

23. If $f : R \to R$ is defined by $f(x) = \frac{x}{x^2+1}, find\ f(f(2))$.
(a) $\frac{10}{29}$ (b) 29 (c) $\frac{1}{29}$ (d) $\frac{29}{10}$

24. If R is a relation on a finite set having n elements, then the number of relations on A is

(a) 2^n (b)2^n (c) n^2 (d) n^n

25. The range of the function $f(x) = \frac{1+x^2}{x^2}$ is equal to
(a) $[0\ ,1]$ (b) $(0,1)$ (c) $(1\ ,\alpha)$ (d) $[\ 1,\alpha\ )$

26. Let R be a relation in N defined by $R = \{(x,y)/2x + y = 8\}$, then, range of *R* is
(a) {1,2,3} (b) {2,4,6} (c) {1,2,3,4,6} (d) none

27. The domain & range of the function $f\ (x) = 2 - |x - 5|$ is

(a) Domain =R^+, Range =$(-\infty, 1]$ (b) Domain = R, Range =$(-\infty, 2]$
(c) Domain =R, Range =$(-\infty, 2)$ (d) Domain =R^+, Range =$(-\infty, 2]$

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

1 .Assertion: Number of relations from the set $A = \{1,3\}$ to the set $B = \{-1,0,1\}$ is 32.
Reason : Number of relation from a set A to another set B is $2^{n(A\times B)}$
2. Assertion: If $(x + y, 3) = (5, x - y)$ then $x = 4, y = 1$

Reason :Two ordered pairs are equal if and only if their corresponding elements are equal.

3.Let $A = \{2,3,4,5\}$ and a relation R on A is defined as $R = \{(a, b): a\ is\ divisible\ b\ and\ a, b \in A\}$

Assertion: R in roster form is $\{(2,2), (2,4), (3,3), (4,4), (5,5)\}$

Reason : Domain and range of R is A.

4. Assertion: A relation $R = \{(1,3), (2,2), (3,1)\}$ defined on the set $A = \{1,2,3\}$ is a function

Reason : A relation from a set A to another set B is said to be a function if every elements of A is related to a unique element of B.

5. Assertion: For two sets A and B with $n(A) = 2$ and $n(B) = 2$,if$(a, 1), (b, 1), (a, 2) \in A \times B$,

then $A = \{a, b, c\}$ and $B = \{1,2\}$

Reason :For two non-empty sets A and B $A \times B = \{(x, y): x \in A\ and\ y \in B\}$

SECTION-II(2 mark each)

1.Let $f = \{(1,1), (2,3), (0, -1), (-1, -3)\}$ be a linear function from Z to Z .Find $f(x)$.

2.Let f be the subset of Z× Z defined by $f = \{(ab, a + b)/a, b \in Z\}$Is f a function from Z to Z ? Justify your answer.

3. If P=$\{x / x < 3, x \in N\}, Q = \{x / x \leq 2, x \in W\}$ then find $(P \cup Q) \times (P \cap Q)$

4. If 'f' is a real function defined by f(x) = $\frac{x-1}{x+1}$, then Prove that f(2x) = $\frac{3f(x)+1}{f(x)+3}$.

5. If y = f(x) = $\frac{ab-ax}{a-bx}$, Show that x = f(y).

6. Find the domain of the function: $f(x) = \frac{x^2+2x+1}{x^2-8x+12}$

7. Let R be a relation on N defined by $R = \{(1+x, 1+x^2) / \ x \leqslant 4, x \in N\}$

Find domain & range of R.

SECTION-III(3 mark each)

1. Let R be a relation from Q to Q defined by

$R = \{(a,b) / \ a,\ b \in Q \text{ and } a-b \in z\}$ show that

(i) (a, a) $\in$ R for all a $\in$ Q

(ii) (a, b) $\in$ R implies that (b, a) $\in$ R

(iii) (a, b) $\in$ R and (b, c) $\in$ R implies that (a, c) $\in$ R.

2. Let 'R' be the relation in the set Z of all integers defined by (a,b) ∈ R ⇒(a-b) is divisible by 2.

Prove that

(i) (a,a) ∈ R for all a ∈ Z

(ii) (a,b) ∈ R ⟹(b,a) ∈ R for all a,b∈ Z

(iii) (a,b) ∈ R and (b,c) ∈ R ⇒(a,c) ∈ R for all a,b,c ∈ Z

3. Find the domain and range of the real function $f(x) = \sqrt{9-x^2}$

4. Let R={(x,y)|x,y∈R, y=2x+8}, if (a-2) and (4,b^2) ∈ R, find values of a and b.

5. Find the relation R on Z defined by {(a,b)|a,b∈Z and |x| = |y|}. Also write its domain and range.

6. Let $X = \{2,3,4,5\}$ and $Y = \{7,9,11,13,15,17\}$. $Define\ a\ relation\ f\ from\ X\ to\ Y\ by$:

$f = \{(x,y) : x \in X, y \in Y \text{ and } y = 2x + 3\}$.

(i)Write f in roster form.

(ii)Find domain of f and range of f

(iii)Show that f is a function from $X\ to\ Y$.

Chaptre -3: Trigonometric Functions

SECTION-I MCQ Type(1 mark each)

1. If α, β are positive angels such that $\alpha + \beta = \frac{\pi}{4}$, then what is $(1+tan\,\alpha)(1+tan\,\beta)$?(**2010-II**)

(a) 0 (b) 1 (c) 2 (d) 3

2. If $y = sec^2\theta + cos^2\theta$, where $0 < \theta < \frac{\pi}{2}$, then which one of the following is correct? (**2010-II**)

(a) $y = 0$ (b) $0 \leq y \leq 2$ (c)$y \geq 2$ (d) none

3. What is the value of $\frac{cosec(\pi+\theta)\cot\left(\frac{9\pi}{2}-\theta\right)\text{cosec}^2(2\pi-\theta)}{cot(2\pi-\theta)sec^2(\pi-\theta)sec\left(\frac{3\pi}{2}+\theta\right)}$? **(2007-I)**

(a) -1 (b) ∞ (c) 0 (d) 1

4.What is the value of $\sin 15^0 \sin 75^0$?(2010-II)

$\frac{1}{4}$ (b) $\frac{1}{8}$ (c)$\frac{1}{16}$ (d) 1

5.What is the value of$\cos\frac{\pi}{9} + \cos\frac{\pi}{3} + \cos 5\frac{\pi}{9} + \cos 7\frac{\pi}{9}$?(2010-II)

(a)1 (b) -1 (c) - $\frac{1}{2}$ (d) $\frac{1}{2}$

6.If $\sin\theta + sin^2\theta = 1$, then the value of $cos^{12}\theta + 3cos^{10}\theta + 3cos^8\theta + cos^6\theta - 1$ is

(a) 2 (b)1 (c) 0 (d) -1

7. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$, then $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$is

(a) 3 (b) 2 (c) 1 (d) 0

8. The minimum value of $9tan^2\theta + 4cot^2\theta$ is

(a) 13 (b) 9 (c) 6 (d) 12

9. If $A = \frac{41}{12}\pi$, then what is the value of $\frac{1-3tan^2A}{3tanA-tan^3A}$?

(a) – 1 (b) 1 (c) 1/3 (d) 3

10. What is the value of $\sin(1110°)$?(**2008-II)**

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

11. The value of $\frac{1-tan^2 15^0}{1+tan^2 15^0}$ is**(AIEEE-2002)**

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

12. If $\theta + \emptyset = \frac{\pi}{6}$, then what is the value of $(\sqrt{3} + \tan\theta)(\sqrt{3} + \tan\emptyset)$?

(a) 1 (b) -1 (c) 4 (d) -4

13. If $\alpha = \frac{\pi}{8}$, what is $\cos\alpha\cos 2\alpha\cos 4\alpha$? (**2007-II)**

(a) 0 (b) ¼ (c) 8 (d) 4

14. If $\cot(\alpha + \beta) = 0$ when α, β are acute angle then $\sin(\alpha + 2\beta)$ is

(a) $\sin\beta$ (b) $\cos\beta$ (c) $\sin\beta$ (d) $\sin 2\beta$

15. The value of $\sin A\sin(60^0 + A)\sin(60^0 - A)$ is

(a) $\frac{1}{4}\sin 3A$ (b) $\frac{1}{4}\sin 3A$ (c) $\sin 3A$ (d) none of these

16. The value of expression $\frac{1-4\sin 10^0 \sin 70^0}{2\sin 10^0}$ is

(a) ½ (b) 1 (c) 2 (d) none

17. If $\sin\theta + \cos ec\theta = 2$, then $\sin^n\theta + \cos ec^n\theta$ is

(a) 2 (b) 2^n (c) 2^{n-1} (d) none of these

18. The value of cot (–870°) is (**2007-II)**

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$ (c) $-\sqrt{3}$ (d) $-\frac{1}{\sqrt{3}}$

19. The radius of the circle whose arc of length 15cm makes an angle of $\frac{3}{4}$ radian at the centre is

(a) 10cm (b) 20cm (c) $11\frac{1}{4}cm$ (d) $22\frac{1}{2}cm$

20. If $\cos x + \sin x = \sqrt{2}\left(0 < x < \frac{\pi}{2}\right)$, then the value of cos3*x* is

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $-\frac{1}{\sqrt{2}}$

21. The value of $\sin 12^0 \sin 48^0 \sin 54^0$ is

(a) ½ (b) ¼ (c) 1/6 (d) 1/8

22. The value of $\cos\frac{\pi}{8}\cos\frac{3\pi}{8}\cos\frac{5\pi}{8}\cos\frac{7\pi}{8}$ is

(a) 1 (b) 1/8 (c) -1/8 (d) none of these

23. The value of x for the maximum value of $\sqrt{3}cosx + sinx$ is

(a) $30°$ (b) $45°$ (c)$60°$ (d) $90°$

24. What is the value of $sin18°cos36°$? (**2012-I)**

(a) 4 (b) 2 (c) 1 (d) $\frac{1}{4}$

25. Consider the following statements:- (**2012-I,2012-II)**

1. The value of $cos46° - sin46°$ is positive.
2. The value of $cos44° - sin44°$ is positive.

Which of the above statements is/are correct?

(a) 1 only (b) 2 only (c) both 1 & 2 (d) neither 1 nor 2

26. What is $sin^2 66\frac{1}{2}° - sin^2 23\frac{1}{2}°$ equal to ? (**2014-II)**

(a) $sin47°$ (b) $cos47°$ (c) $2sin47°$ (d) $2cos47°$

27. If $sinAsin(60° - A)\sin(60° + A) = Ksin3A$, then what is K ? (**2014-II)**

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) 1 (d) 4

28. The value of $2(cos^6\theta + sin^6\theta) - 3(cos^4\theta + sin^4\theta) + 1$ is

(a) 2 (b) 0 (c) 4 (d) 6

29. What is the value of $cos36°$? **(2014-I)**

(a) $\frac{\sqrt{5}-1}{4}$ (b) $\frac{\sqrt{5}+1}{4}$ (c) $\frac{\sqrt{10+2\sqrt{5}}}{4}$ (d) $\frac{\sqrt{10-2\sqrt{5}}}{4}$

31. $\frac{2}{\sqrt{2+\sqrt{2+\sqrt{2+2\cos 4x}}}}$ is equal to

(a) $\sec\frac{x}{2}$ (b) $\sec x$ (c) $cosec\ x$ (d) 1

ASSERTION-REASON BASED QUESTIONS (1 mark each)

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

1. **Assertion (A) :** The value of $\theta = \frac{\pi}{3}\ or\ \frac{2\pi}{3}$,when θ lies between $(0,2\pi)$ and $\sin^2\theta = \frac{3}{4}$.

Reason (R): $\sin\theta$ is positive in the first and second quadrant .

SECTION-II (2 mark each)

1. Solve : $2\cos^2 x + 3\sin x = 0$
2. Prove that: $\frac{sin5x-2sin3x+sinx}{cos5x-cosx} = tanx$
3. Prove that: $\sin x + \sin 3x + \sin 5x + \sin 7x = 4\cos x \cos 2x \sin 4x.$
4. If tan 35° = p, then show that $\frac{1+\tan 45°\tan 125°}{\tan 145°-\tan 125°} = \frac{2p}{1-P^2}$
5. The minute hand of a watch is 1.5 cm long. How far does its tip move in 40 minutes? (Use π=3.14)
6. Find the value of: $2\sin^2\frac{\pi}{6} + \text{cosec}^2\frac{7\pi}{6}\cos^2\frac{\pi}{3}.$
7. If $\tan A = \frac{1}{2}, \tan B = \frac{1}{3}$ what is the value of $\tan(2A + B)$.
8. Prove that : $\frac{\sin\theta-\sqrt{1+\sin 2\theta}}{\cos\theta-\sqrt{1+\sin 2\theta}} = \cot\theta$
9. Prove that : $\cos^2 2x - \cos^2 6x = \sin 4x \sin 8x$

SECTION-III(3mark each)

1. Prove that : $\cos^2 x + \cos^2\left(x+\frac{\pi}{3}\right) + \cos^2\left(x-\frac{\pi}{3}\right) = \frac{3}{2}.$
2. Prove that: $\tan 4x = \frac{4\tan x(1-\tan^2 x)}{1-6\tan^2 x+\tan^4 x}$
3. Prove that: $\cos 10°\cos 50°\cos 60°\cos 70° = \frac{\sqrt{3}}{16}$
4. Prove that $cos5\theta = 16cos^5\theta - 20cos^3\theta + 5cos\theta$
5. If $sin\theta = \alpha(\theta + 2\emptyset)$. Prove that $\tan(\theta + \emptyset) = \frac{1+\alpha}{1-\alpha}tan\emptyset$
6. Prove that $\sqrt{2+\sqrt{2+\sqrt{2}}} = 2cos\frac{\pi}{16}$
7. Solve: $sin2x - sin4x + sin6x = 0$

8. If $tanx + \tan\left(\frac{\pi}{3}+x\right) + \tan\left(\frac{2\pi}{3}+x\right) = 3$. Prove that $tan\,3x = 1$

9. Write the value of the expression $\dfrac{1-4\sin 10^0 \sin 70^0}{2\sin 10^0}$

10. Prove that : tan 6° tan 42° tan 66° tan 78° = 1.

11. $If\ A+B-C = 180°$,prove that

$$\sin^2 A + \sin^2 B - \sin^2 C = \sin A \sin B \cos C$$

12.Prove that: $\cos^6 A - \sin^6 A = \cos 2A(1-\frac{1}{4}\sin^2 2A)$

13. Prove that $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$

14. Solve for general values of x: $\cos 3x + \cos x - \cos 2x = 0$

SECTION-IV(4 mark each)

1. If $\tan x = \dfrac{3}{4}$ where $\pi \langle x \langle \dfrac{3\pi}{2}$, then

(i) $\frac{x}{2}$ lies in

(a) I quadrant (b) II quadrant (c) IIIquadrant (d) IV quadrant.

(ii) The value of $\sin\frac{x}{2}$ is

(a) $-\frac{3}{\sqrt{5}}$ (b) $\frac{3}{\sqrt{5}}$ (c)$\pm\ \frac{3}{\sqrt{10}}$ (d) $\frac{3}{\sqrt{10}}$.

(iii) The value of $\cos\frac{x}{2}$ is

(a) $-\frac{1}{\sqrt{5}}$ (b) $\pm\frac{1}{\sqrt{5}}$ (c) $-\frac{1}{\sqrt{10}}$ (d) $\pm\frac{1}{\sqrt{10}}$

(iv) The value of $\tan\frac{x}{2}$ is

(a) -3 (b) 3 (c)$\pm$ 3 (d) $\frac{3}{2}$

(v) The value of $\sin 2x$ is

(a) $\frac{24}{25}$ (b) $\frac{9}{16}$ (c)$-\ \frac{24}{25}$ (d) $none\ of\ these$

SECTION-V(5 mark each)

1. Prove that $\cos\theta\cos 2\theta\cos 2^2\theta\cos 2^3\theta.....\cos 2^{n-1}\theta = \dfrac{\sin 2^n\theta}{2^n\sin\theta}$

Hence show that if $\theta = \dfrac{\pi}{2^n+1}$

$2^n \cos\theta \cos 2\theta \cos 2^2\theta \ldots\ldots \cos 2^{n-1}\theta = 1$

2. Prove that $(1+\cos\frac{\pi}{10})(1+\cos\frac{3\pi}{10})(1+\cos\frac{7\pi}{10})(1+\cos\frac{9\pi}{10}) = 1$.

3. Using the result $cos\theta cos2\theta cos2^2\theta \ldots\ldots\ldots cos2^{n-1}\theta = \frac{sin2^n\theta}{2^n sin\theta}$

Prove that $(1+sec2\theta)(1+sec2^2\theta)(1+sec2^3\theta)\ldots\ldots(1+sec2^n\theta) = \frac{tan2^n\theta}{tan\theta}$

4. If $cosx = \frac{-1}{3}$, $\pi < x < \frac{3\pi}{2}$, find $sin\frac{x}{2}, cos\frac{x}{2}, tan\frac{x}{2}$

5 . Prove that :$\tan 9° - \tan 27° - \tan 63° + \tan 81° = 4$

6. Prove that $\cos 2x \cos\frac{x}{2} - \cos 3x \cos\frac{9x}{2} = \sin 5x \sin\frac{5x}{2}$.

SOURCE BASED/CASE BASED/PASSAGE BASED (4 MARKS)

1 If $\sin A = \frac{3}{5}$ and $\cos B = -\frac{5}{13}$;$0 < A < \frac{\pi}{2}$ and $\pi < B < 3\frac{\pi}{2}$

(i) Find the value of $\cos A + \sin B$

(a) $-\frac{16}{65}$ (b) $-\frac{8}{65}$ (c) $\frac{8}{65}$ (d) $\frac{12}{65}$

(ii) Find the value of $\sin(A+B)$

(a) $-\frac{63}{65}$ (b) $-\frac{33}{65}$ (c) $-\frac{65}{33}$ (d) $\frac{33}{65}$

(iii) Find the value of $\cos(A+B)$

(a) $\frac{12}{65}$ (b) $-\frac{12}{65}$ (c) $-\frac{16}{65}$ (d) $\frac{16}{65}$

(iv) Find the value of $\sin 2A$

(a) $\frac{14}{25}$ (b) $\frac{24}{25}$ (c) $-\frac{14}{25}$ (d) $-\frac{24}{25}$

(v) Find the value of $\tan(A+B)$

(a) $\frac{16}{63}$ (b) $\frac{63}{16}$ (c) $-\frac{63}{16}$ (d) $\frac{73}{65}$

2. In a class test of class XI , a teacher asked to students to consider $A + B = \frac{\pi}{4}$,where A and B are acute angles .Based on the above information ,answer the following questions :

(i) Find the value of $(1+\tan A)(1+\tan B)$

(ii) Find the value of $(\cot A - 1)(\cot B - 1)$

(iii) Find the value of $\sin(A+B) - \cos(A+B) + \tan(A+B)$

(iv) Find the value of $\sin 2A \sec 2B$

Chapter -5: Complex Numbers and Quadratic Equations

SECTION-I MCQ Type(1 mark each)

1. $(\sqrt{-2})(\sqrt{-3})$ is equal to

(a) $\sqrt{6}$ (b) $-\sqrt{6}$ (c) $i\sqrt{6}$ (d) none of these

2. The amplitude of $\frac{1}{i}$ is equal to

(a) 0 (b) $\frac{\pi}{2}$ (c) $-\frac{\pi}{2}$ (d) π

3. IfZ_1, Z_2 are two non-zero complex numbers such that $|Z_1+Z_2|=|Z_1|+|Z_2|$, then $argZ_1-argZ_2$ is

(a) $\frac{\pi}{2}$ (b)$-\pi$ (c) 0 (d)$-\frac{\pi}{2}$

4. What is the argument of the complex number $(-1-i)$ where $i=\sqrt{-1}$?**(2013-I)**

(a) $\frac{5\pi}{4}$ (b) $-\frac{5\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) None

5. If $\frac{(a+i)^2}{2a-1}=p+iq, then\ p^2+q^2$ is

(a) $\frac{(a^2+1)^2}{2a^2+1}$ (b) $\frac{(a^2+1)^2}{2a^2-1}$ (c) $\frac{(a^2+1)^2}{(2a^2-1)^2}$(d) None

6. If $|Z+4|\leq 3$, then $|Z+1|\leq$?

(a) 5 (b) 8 (c) 6 (d) none

7. The smallest positive integer n for which $(1+i)^{2n}=(1-i)^{2n}$ is

(a) 4 (b) 8 (c) 2 (d) 16

8.What is the value of $1+i^2+i^4+i^6+\cdots+i^{100}$ where$i=\sqrt{-1}$

0 (b) 1 (c) -1 (d) none

9. For all complex nos. $Z_1\&Z_2$ satisfying $|Z_1|$ =12 $\&|Z_2-3-4i|=5$, the minimum value of $|Z_1-Z_2|$ is

(a) 0 (b) 2 (c) 7 (d) 17

10. Let $Z=i^3(1+i)$ be a complex number. What is arg Z?(**2006-II**)

(a) π (b) $\frac{\pi}{4}$ (c) $-\frac{\pi}{4}$ (d) $5\frac{\pi}{4}$

11. Square root of $-i$ is

(a) $\frac{1-i}{\sqrt{2}}$ (b) $\frac{2+i}{2}$ (c) $\frac{1+i}{\sqrt{2}}$ (d) None

12. The value of sum $\sum_{n=1}^{13}\left(i^n+i^{n+1}\right)$ when $i=\sqrt{-1}$ is (**2012-II**)

(a) i (b) $-i$ (c) 0 (d) $i-1$

Ans (d)

13. If $|z|=1$ then $\frac{1+z}{1+\bar{z}}$ is equal to

(a) z (b) $\bar{z}$ (c) $z+\bar{z}$ (d) none

14. Let $z_1\&z_2$ be two non zero complex numbers such that $|z_1|=|z_2|=|\frac{1}{z1}+\frac{1}{z2}|=2$, then what is the value of $|z_1+z_2|$? (**2006-II**)

(a) 8 (b) 4 (c) 2 (d) 1

15. If $|z+\bar{z}|=|z-\bar{z}|$, then the locus of Z is**(2014-I)**

(a) A pair of straight line (b) A line
(c) A set of four straight lines (d)A circle

16. What is $\frac{(1+i)^{4n+5}}{(1-i)^{4n+3}}$ equal to, where n is a natural number and $i = \sqrt{-1}$ (**2014-II**)

(a) 2 (b) 2 i (c) $-2\,i$ (d) i

17. If a,b,c are in G.P. and $z = \frac{a+ib}{c-ib}$, then z is

(a) $\frac{ib}{c}$ (b) $\frac{ic}{b}$ (c) $\frac{ia}{c}$ (d) 0

18. If $Z = \frac{\left(\sqrt{3}+i\right)^3(3i+4)^2}{(8+6i)^2}$, then $|Z|$ is equal to

(a) 1 (b) 3 (c) 0 (d) 2

19. What is the argument of the complex number $(-1-i)$ where $i = \sqrt{-1}$? **(2013-I)**

(a) $\frac{5\pi}{4}$ (b) $-\frac{5\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) None

20. If $\frac{z_2}{z_1}$ is purely imaginary, then $\left|\frac{2z_1+3z_2}{2z_1-3z_2}\right|$ is

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) 1 (d) $\sqrt{13}$

21. If $\alpha \& \beta$ are different complex numbers with $|\beta|=1$ then $\left|\frac{\beta-\alpha}{1-\bar{\alpha}.\beta}\right|$ is

(a) 2 (b) ½ (c) 1 (d) $^1/_3$

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true

1.Assertion (A): Simplest form of $\frac{5+i\sqrt{2}}{1-i\sqrt{2}}$ is $1-2i\sqrt{2}$

Reason (R) : The value of $(1+i)^5(1-i)^5$ is 32.

Ans: (d)

2. Assertion (A): If $(1+i)^5 = a+ib$, then $b=-8$

Reason (R) : $(1-i)^3 = a+ib$, then $\frac{a}{b}=1$

Ans: (b)

3. Assertion (A): If $z = \frac{1+i2}{1-i3}$,then $|z| = \frac{1}{\sqrt{2}}$

Reason (R) : If $z = a+ib$, then $|z| = \sqrt{a^2+b^2}$

Ans: (a)

4. Assertion (A): Multiplicative inverse of $2-3i$ is $2+3i$

Reason (R) : If $z=3+4i$, then $\bar{z}=3-4i$

Ans: (d)

SECTION-II(2 mark each)

1 .Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$

2. If $x-iy=\sqrt{\frac{a-ib}{c-id}}$, prove that $(x^2+y^2)^2=\frac{a^2+b^2}{c^2+d^2}$

Proof: $x-iy=\sqrt{\frac{a-ib}{c-id}}$

=> $(x-iy)^2=\frac{a-ib}{c-id}$

=>$|(x-iy)^2|=\left|\frac{a-ib}{c-id}\right|$ 1 mark

=> $|(x-iy)|^2=\frac{|a-ib|}{|c-id|}$

=> $\left(\sqrt{x^2+y^2}\right)^2=\frac{\sqrt{a^2+b^2}}{\sqrt{c^2+d^2}}$

=> $x^2+y^2=\frac{\sqrt{a^2+b^2}}{\sqrt{c^2+d^2}}$

=> $(x^2+y^2)^2=\frac{a^2+b^2}{c^2+d^2}$ 1 mark

3. Write the complex number $\frac{1}{1+Cos\,\theta+iSin\theta}$ in a+ib form.

4. Find real values of x and y for which the complex numbers

$(-3+ix^2y) and\ (x^2+y+4i)$are conjugate of each other.

5. If $x+iy=\frac{a+ib}{a-ib}$, prove that $x^2+y^2=1$

Proof: $x+iy=\frac{a+ib}{a-ib}$

$\Rightarrow |x+iy|=\left|\frac{a+ib}{a-ib}\right|$

$\Rightarrow \sqrt{x^2+y^2}=\frac{|a+ib|}{|a-ib|}$

$\Rightarrow \sqrt{x^2+y^2}=\frac{\sqrt{a^2+b^2}}{\sqrt{a^2+b^2}}=1$

$\Rightarrow x^2+y^2=1$

6.Find the modulus of the complex number $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$.

7. Solve: $ix^2+4x-5i=0$.

SECTION-III(3 mark each)

1.If $(x+iy)^3=u+iv$,then show that $\frac{u}{x}+\frac{v}{y}=4(x^2-y^2)$

ANS: $(x+iy)^3 = u+iv$

$=> x^3+3x^2iy+3x(iy)^2+(iy)^3 = u+iv$

$=> (x^3-3x\,y^2)+i(3x^2y-y^3) = u+iv$ 1mark

Equating real and imaginary parts

u=$x^3-3x\,y^2$, v=3 x^2y-y^3

$\frac{u}{x} = x^2-3y^2$, $\frac{v}{y}=3x^2-y^2$ 1mark

$\therefore \frac{u}{x}+\frac{v}{y} = (x^2-3y^2)+(3x^2-y^2) = 4(x^2-y^2)$ 1mark

2.Find the modulus and argument of the complex number $\frac{1+2i}{1-3i}$

Sol: Here $Z=\frac{1+2i}{1-3i}$

$=\frac{(1+2i)(1+3i)}{(1-3i)(1+3i)}$ [1]

$=-\frac{1}{2}+\frac{1}{2}i$

$\therefore |Z| = \sqrt{(-\frac{1}{2})^2+(\frac{1}{2})^2}$

$=\sqrt{\frac{1}{4}+\frac{1}{4}}$

$=\frac{1}{\sqrt{2}}$ [1]

$Let\ \theta\ be\ the\ argument\ of\ Z$

$\therefore \tan\theta = \frac{1/2}{-1/2} = -1$ [1]

$\Rightarrow \tan\theta = -\tan\frac{\pi}{4}$

$\Rightarrow \theta = n\pi-\frac{\pi}{4}$

$When\ n=0 \Rightarrow \theta = -\frac{\pi}{4}$

$n=1 \Rightarrow \theta = 3\frac{\pi}{4}$

$But\ the\ given\ complex\ no\ lies\ in\ II\ quadrant.$

$$\therefore \theta = 3\frac{\pi}{4}$$

3..If $(x+iy)^3$ = a+ib, when x,y,a,b$\in R$, Show that $\frac{x}{a}-\frac{y}{b}=-2(a^2+b^2)$.

4.Solve the equation $z^2 = \bar{z}$

5. Convert the complex number $\frac{-16}{1+i\sqrt{3}}$ into polar form.

6. If z is a complex number such that |z|=1 ,Prove that $\frac{z-1}{z+1}$ is purely imaginary.

7. If $\alpha \; and \; \beta$ are different complex numbers with $|\beta| = 1$, then find $\left|\frac{\beta-\alpha}{1-\bar{\alpha}\beta}\right|$.

8. Express $(-2-\frac{1}{3}i)^3$ in the form a+ib.

9.Represent the complex number $z = 1 + i\sqrt{3}$ in the polar form .

10. Reduce $\left(\frac{1}{1-4i}-\frac{2}{1+i}\right)\left(\frac{3-4i}{5+i}\right)$ to the standard form.

Sol: $\left(\frac{1}{1-4i}-\frac{2}{1+i}\right)\left(\frac{3-4i}{5+i}\right)$

$$= \frac{1+i-2+8i}{(1-4i)(1+i)} \times \frac{(3-4i)}{(5+i)}$$

$$= \frac{(-1+9i)}{(1+i-4i+4)} \times \frac{(3-4i)}{(5+i)}$$

$$= \frac{-3+4i+27i+36}{(5-3i)(5+i)}$$

$$= \frac{33+31i}{25+5i-15i+3}$$

$$= \frac{33+31i}{28-10i}$$

$$= \frac{33+31i}{2(14-5i)}$$

$$= \frac{(33+31i)(14+5i)}{2\times(196+25)}$$

$$= \frac{462+165i+434i-155}{442}$$

$$= \frac{307+599i}{442}$$

$$= \frac{307}{442} + i\frac{599}{442}$$

11. Convert the complex number $z = \frac{i-1}{cos\frac{\pi}{3}+sin\frac{\pi}{3}}$ in the polar form.

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED

1. Consider two complex numbers $z_1 = 1 + i$ and $z_2 = 2 - i$.

Based on the above information answer the following questions:

(i) Find the value of ${z_1}^6 + (\overline{z_1})^6$

(ii) Find real part of $(z_1)^{-1}$

(iii) Find the conjugate of $\frac{z_2}{z_1}$

OR

(iii) Find the modulus of $z_1 z_2$.

Chaptre -6: Linear Inequalities of one variable

SECTION-I MCQ Type(1 mark each)

1. If $\frac{5-2x}{3} \leq \frac{x}{6} - 5$,then x belongs to

(a) $[2, \infty)$ (b) $[-8,8]$ (c) $[4, \infty)$ (d) $[8, \infty)$

Ans: (d)

2. Given that x, y and b are real numbers and x< $y, b < 0$ then

(a) $\frac{x}{b} < \frac{y}{b}$ (b) $\frac{x}{b} \leq \frac{y}{b}$ (c) $\frac{x}{b} > \frac{y}{b}$ (d) $\frac{x}{b} \geq \frac{y}{b}$

Ans: (c)

3.If $-8 \leq 5x - 3 < 7$, then x belongs to

(a) $(-1,2)$ (b) $[-1,2)$ (c) $[-2, \infty)$ (d) $[-2,0)$

Ans: (b)

SECTION-II(2 mark each)

1. Solve: |x - 2 | > 5
2. Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.
3. Solve $\frac{x-3}{x-5} > 0$

3.Sol: $\frac{(x-3)(x-5)}{(x-5)^2} > 0$

$\Rightarrow (x-3)(x-5) > 0$

$\Rightarrow x < 3 \ or \ x > 5$

The required solution is $(-\infty, 3) \cup (5, \infty)$

4. Solve: $\frac{x}{2} \geq \frac{(5x-2)}{3} - \frac{(7x-3)}{5}$

SECTION-III(3 mark each)

SECTION-IV(4 mark each)

1. Solve the following system of inequalities graphically:

$x + 2y \leq 8$,$2x + y \leq 8$, $x \geq 0$, $y \geq 0$.

2. A manufacturer has 600 litres of a 12% solution of acid. How many litres of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%.

2.Sol: $Let\ x\ litres\ of\ 30\%\ acid\ solution\ is\ to\ be\ added.$

Then total volume of mixture $V_1 = (600 + x) litres.$

Total volume of acid $V_2 = 12\% of\ 600 + 30\% of\ x = \frac{12}{100} \times 600 + \frac{30}{100}\ x$

$$= \frac{7200 + 30x}{100}$$

Percentage of acid = $\frac{V2}{V_1} \times 100 = \frac{7200+30x}{100\,(600+x)} \times 100 = \frac{7200+30x}{600+x}$

B/Q $15 < \frac{7200+30x}{600+x} < 18$

$15(600 + x) < 7200 + 30x < 18(600 + x)$

$9000 + 15x < 7200 + 30x < 10800 + 18x$

$\Rightarrow \quad 9000 + 15x < 7200 + 30x \quad and \quad 7200 + 30x < 10800 + 18x$

$\Rightarrow \quad 15x - 30x < 7200 - 9000 \quad and \quad 30x - 18x < 10800 - 7200$

$\Rightarrow \quad -15x < -1800\ and\ 12x < 3600$

$\Rightarrow \quad x > 120\ and\ x < 300$

$$\therefore The\ amount\ of\ 30\%\ acid\ solution\ to\ be\ mixed\ is \quad 120\ litre < x < 300\ litres$$

3. How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content ?

Sol: $Let\ x\ litres\ of\ water\ is\ to\ be\ added.$

Then total volume of mixture $V_1 = (1125 + x) litres.$

Total volume of acid $V_2 = 45\%\ of\ 1125 + 0\%\ of acid\ in\ x\ litres\ of\ water = \frac{45}{100} \times 1125 + 0$

$$= \frac{50625}{100}$$

Percentage of acid = $\frac{V2}{V_1} \times 100 = \frac{50625}{1125+x} \times 100 = \frac{50625}{1125+x} \times 100$

B/Q $25 < \frac{50625}{1125+x} \times 100 < 30$

$\Rightarrow 25(1125 + x) < 50625 < 30(1125 + x)$

$\Rightarrow 25 \times 1125 + 25x < 50625 < 30 \times 1125 + 30x$

$\Rightarrow \quad 25 \times 1125 + 25x < 50625 \quad and \quad 50625 < 30 \times 1125 + 30x$

$\Rightarrow \quad 25x < 50625 - 25 \times 1125 \quad and \quad 50625 - 30 \times 1125 < 30x$

$\Rightarrow \quad 25x < 50625 - 28125 \; and \; 50625 - 33750 < 30x$

$\Rightarrow \quad 25\,x < 22500 \; and \; 16875 < 30x$

$\Rightarrow x < 900 \; and \; 562.5 < x$

$$\therefore The\ amount\ of\ water\ \ to\ be\ mixed\ is \quad 562.5\ litre < x < 900\ litres$$

4. Solve the following system of inequalities graphically: -

$5x + 4y \leqslant 40, x \geqslant 2, y \geqslant 3$

5. Solve the system of linear inequalities graphically: $x - 2y \leq 3, 3x + 4y \geq 12, x \geq 0, y \geq 1.$

6. Solve the system of inequalities graphically: 3x + 2y ≤ 150, x + 4y ≤ 80, x ≤ 15, y ≥ 0, x ≥ 0.

7. Solve the following system of inequalities graphically : $4x + 3y \leq 60\,,\ y \geq 2x,\ \ x \geq 3,\quad x, y \geq 0$

SOURCE BASED/CASE BASED/PASSAGE BASED (4 MARKS)

Chapter -7: Permutations and Combinations

SECTION-I MCQ Type(1 mark each)

1. In how many ways can a committee consisting of 3 men and 2 women be formed from 7 men and 5 women?

(a) 45 (b) 350 (c) 700 (d) 4200

2.What is the number of signals that can be sent by 6 flags of different colours taking one or more at a time?

(a)21 (b) 63 (c) 720 (d) 1956

3.What is the number of the words that can be formed from the letter of the word UNIVERSAL, the vowels remaining always together?

(a)720 (b) 1440 (c) 17280 (d) 21540

4.If the letter of the word RANDOM are arranged in dictionary order. What is the rank of RANDOM?

(a)614 (b) 600 (c) 613 (d) 616

5. The number of words which can be formed from the letter of the word MAXIMUM, if two consonants cannot occur together is

(a) $\lfloor 4$ (b) $\lfloor 3 \times \lfloor 4$ (c) $\lfloor 7$ (d) none

6. If $n_{C_r} = n_{C_{r-1}}$ &$n_{P_r} = n_{P_{r+1}}$, then n is

(a) 3 (b) 2 (c) 4 (d) 5

7. A man has 7 friends. In how many ways he can invite one or more of them for a tea party?

(a) 128 (b) 256 (c) 127 (d) 130

8. $n_{C_r} + 2\, n_{C_{r-1}} + n_{C_{r-2}}$ is equal to

(a) $n + 1_{C_r}$ (b) $n + 1_{C_{r+1}}$ (c) $n + 2_{C_r}$ (d) $n + 2_{C_{r+1}}$

9. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together is

(a) $\lfloor 6 \times \lfloor 5$ (b) 30 (c) $\lfloor 5 \times \lfloor 4$ (d) $\lfloor 7 \times \lfloor 5$

10. How many 3 digits numbers, each less than 600 can be formed from {1, 2, 3, 4, 7, 9} if repetition of digits is allowed?

(a) 216 (b) 180 (c) 144 (d) 120

11. If a polygon has 20 diagonals, then what is the numbers of sides?

(a) 6 (b) 10 (c) 12 (d) 8

12. What is $\frac{(n+2)! + (n+1)(n-1)!}{(n+1)(n-1)!}$ equals to? (**2007-I**)

(a) 1 (b) always an odd integer (c) a perfect square (d) none of these

13. If the letters of words BAZAR are arranged in dictionary order, then what is 50th words?

(a) ZAABR (b) ZBAAR (c) ZBRAA (d) ZAARB

14. A man has 7 friends. In how many ways he can invite one or more of them for a tea party?

(a)128 (b) 256 (c) 127 (d) 130

15. $n_{C_r} + 2\, n_{C_{r-1}} + n_{C_{r-2}}$ is equal to

$(a)\ n + 1_{C_r}$ (b) $n + 1_{C_{r+1}}$ (c) $n + 2_{C_r}$ (d) $n + 2_{C_{r+1}}$

16. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together is

(a)$\lfloor 6 \times \lfloor 5$ (b) 30 (c) $\lfloor 5 \times \lfloor 4$ (d) $\lfloor 7 \times \lfloor 5$

17. How many 3 digits numbers, each less than 600 can be formed from {1, 2, 3, 4, 7, 9} if repetition of digits is allowed?

(a) 216 (b) 180 (c) 144 (d) 120

18. If a polygon has 20 diagonals, then what is the numbers of sides?

(a) 6 (b) 10 (c) 12 (d) 8

19. What is $\frac{(n+2)! + (n+1)(n-1)!}{(n+1)(n-1)!}$ equals to? (**2007-I**)

(a) 1 (b) always an odd integer (c) a perfect square (d) none of these

20. If the letters of words BAZAR are arranged in dictionary order, then what is 50th words?

(a) ZAABR (b) ZBAAR (c) ZBRAA (d) ZAARB

21. The no. of ways in which 7 people can be arranged at a round table so that two particular person may be together is

(a) 132 (b) 148 (c) 240 (d) none of these.

22. If $n - 1_{C_3} + n - 1_{C_4} > n_{C_3}$, then the least value of n is

(a) 3 (b) 4 (c) 7 (d) 8

23. How many ways are there to arrange the letters in the word GARDEN with the vowels in alphabetical order?

(a) 120 (b) 240 (c) 360 (d) 480

24. The value of $50_{C_4} + \sum_{r=1}^{6} 56 - r_{C_3}$ is

(a) 55_{C_4} (b) 55_{C_3} (c) 56_{C_3} (d) 56_{C_4}

25. There are 4 candidates for the post of a lecturer in Maths and one is to be selected by votes of 5 men. What is the number of ways in which the votes can be given?
(**2011-II**)

(a) 1048 (b) 1072 (c) 1024 (d) 625

26. The no of ways in which the letters of the word VOWEL can be arranged so that the letters O, E occupy only even places is

(a) 12 (b) 18 (c) 24 (d)none of these

27. In how many ways can 3 books on Hindi and 3 books on English can be arranged in a row on a shelf, so that not all the Hindi books are together?

(a) 144 (b) 360 (c) 576 (d) 720

28. What is value of *r*if $p(5, r) = p(6, r-1)$?

(a) 9 (b) 5 (c) 4 (d) 2

29. A student is to answer 10 out of 13 questions in an examination such that he must choose at least 4 from the first five questions. The no. of choice available to him is

(a) 140 (b) 196 (c) 280 (d) 346

30. If $m + n_{P_2=90}$ and $m - n_{P_2=30}$ then (m,n)are given by (m and n are positive integer)

(a) (8,2) (b) (5,6) (c) (3,7) (d) (8,3)

31. The number of ways in which the letters of the word COMBINE can be arranged so that the words begin and end with a vowel is

(a) 30 (b) 504 (c) 360 (d) 720

32. How many ways are there to arrange the letters in the word GARDEN with the vowels in alphabetical order? (**AIEEE-2004**)

(a) 360 (b) 240 (c) 120 (d) 480

33. A vehicle registration number consists of 2 letters of English alphabet followed by 4 digits, where the first digit is not zero. Then the total number of vehicles with distinct registration number is

(a) $26^2 \times 10^4$ (b) $26_{p_2} \times 10_{p_4}$ (c) $26_{p_2} \times 9 \times 10_{p_3}$ (d) $26^2 \times 9 \times 10^3$

34. On a railway route there are 20 stations. What is the number of different tickets required in order that it may be possible to travel from every station to every other stations ?
(**2007-II**)

(a) 40 (b) 380 (c) 400 (d) 420

35. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together is (**AIEEE-2003**)
(a) $\underline{|6}$ x $\underline{|5}$ (b) 30 (c) $\underline{|5}$ x $\underline{|4}$ (d) $\underline{|7}$ x $\underline{|5}$

36. If a polygon has 20 diagonals, then what is the number of sides?(**2008-II**)
(a) 6 (b) 10 (c) 12 (d) 8

37. Using the digits 1, 2, 3, 4 & 5 only once, how many numbers greater than 41000 can be formed? (**2011-II**)
(a) 41 (b) 48 (c) 50 (d)55

38. Five digit number divisible by 3 is formed using using 0,1,3,4,6,7 without repetition. Total number of such numbers are:-
(a) 312 (b) 3125 (c) 120 (d) 7216

39. If the letters of word KUBER are written in all possible orders and arranged as in a dictionary, then rank of the word KUBER will be
(a) 67 (b) 68 (c) 65 (d) 69

40. If P(77,31)= x& C(77,31)=y, then which of the following is correct?(**2013-I**)
(a) $x = y$ (b) 2 x= y (c) 77 x=31 y (d) $x > y$

41. The number of triangles which can be formed by using the vertices of a regular polygon of (n+3) sides is 220, then n is
(a) 8 (b)9 (c) 10 (d) 11

42. At an election, a voter may vote for any number of candidates, not greater than the number to be elected. There are 10 candidates and 4 are to be elected. If a voter votes for at least one candidate, thenthe number of ways in which he can vote is
(a) 5040 (b) 6210 (c) 385 (d) 1110

43. Let T_n denote the number of triangles which can be formed by using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 36,$ then n is equal to :
(a) 2 (b) 5 (c) 6 (d) 9

44. The number of diagonals that can be drawn by joining the vertices of an octagon is
(a) 28 (b) 48 (c) 20 (d) none

45. The number of 3 digit even numbers that can be formed from the digits 0,1,2,3,4& 5, repetition of digits being not allowed is (**2015-II**)
(a) 60 (b) 56 (c) 52 (d) 48

46. How many words can be formed using all the letters of the word 'NATION' so that all the three vowels should never come together ?(**2015-I**)
(a) 354 (b) 348 (c) 288 (d) None

47. The numbering of ways of dividing 15 men and 15 women into 15 couples, each consisting of a man & a woman is
(a) 1240 (b) 1840 (c) 1820 (d) 2005

48. The number of ways in which 7 people can be arranged at a round table so that 2 particular persons may be together is

(a) 132 (b) 148 (c) 240 (d) None

49. Nisha has 5 coins each of the different denomination. The number of different sums of money she can form is

(a) 32 (b) 25 (c) 31 (d) None

50. The number of words which can be formed out of the letters of the word ARTICLE, so that vowels occupy the even place is

(a) 1440 (b) 144 (c) $\llcorner 7$ (d) $4_{c_4} \times 3_{c_3}$

51.The value of $\frac{n!}{r!(n-r)!}$ When $n = 5, r = 2$ is

(a) 10 (b) 12 (c)14 (d) 16

Ans: (a)

52.The number of six digit numbers ,whose all digits are odd (i.e., 1,3,5,7,9) is

(a) 6^5 (b) 5^6 (c)$\frac{6!}{2!}$ (d) $none\ of\ these$

Ans: (b)

53. If $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$,then x is

(a) 90 (b) 100 (c) 80 (d) 95

Ans: (b)

54. If $n_{C_9} = n_{C_8}$,then $n_{C_{17}}$ is

(a) 1 (b) 2 (c)0 (d) 3

Ans: (a)

55. A polygon has 35 diagonals ,then the number of sides of the polygon is

(a) 15 (b) 20 (c) 10 (d)none of these

Ans: (c)

56. If ${}^8c_r - {}^7c_3 = {}^7c_2$, then value of r is

(a) 3 or 5 (b) 3 or 2 (c) 2 or 5 (d) 3

Ans: (a)

57. If $8!\left[\frac{1}{3!} + \frac{5}{4!}\right] = 9_{P_r}$, then the value of r is

(a) 4 (b) 5 (c)3 (d) 2

Ans: (b)

58. What is $\frac{(n+2)! + (n+1)(n-1)!}{(n+1)(n-1)!}$ equals to?

(a) 1 (b) always an odd integer (c) a perfect square (d) none of these

Ans: (c)

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

Consider the following statement :

In a shop there are five types of ice -creams available and a child buys the six ice-creams.

1. **Assertion (A) :** The number of different ways the child can buy the six ice-creams is 10_{C_5}. .

Reason (R): The number of different ways the child can buy the six ice − creams is equal to the number of different ways of arranging 6 A's and 4 B's in a row.

Ans:(d)

SECTION-II(2 mark each)

1. If $C^{13}_6+2\,C^{13}_5+ C^{13}_4= C^{15}_r$ find the value of r.

ANS. $C^{13}_6+2\,C^{13}_5+ C^{13}_4= C^{15}_r$

$\Rightarrow C^{13}_6+ (C^{13}_5+ C^{13}_5)+ C^{13}_4= C^{15}_r$

$\Rightarrow (C^{13}_6+ C^{13}_5)+ (C^{13}_5+ C^{13}_4)= C^{15}_r$ 1mark

$\Rightarrow C^{14}_6+ C^{14}_5= C^{15}_r$

$\Rightarrow C^{15}_6= C^{15}_r$

$\Rightarrow$ r=6 or r+6=15

r=6 or 9 1mark

2. If ${}^nP_5=42\,{}^nP_3$,where n>4 then find n.

3. Find the number of permutations of the letters of the word ALLAHABAD.
4. Find r if ${}^nP_r=720$ and ${}^nC_r=120$.
5. A Polygon has 90 diagonals. Find the number of sides.
6. Find 'n' if ${}^{2n+1}P_{n-1} : {}^{2n-1}P_n = 3:5$

SoL: $^{2n+1}P_{n-1} : {}^{2n-1}P_n = 3:5$

$\Rightarrow \frac{(2n+1)!}{(2n+1-n+1)!} : \frac{(2n-1)!}{(2n-1-n)!} = \frac{3}{5}$

$\Rightarrow \frac{(2n+1)!}{(n+2)!} \div \frac{(2n-1)!}{(n-1)!} = \frac{3}{5}$

$\Rightarrow \frac{(2n+1)!}{(n+2)!} \times \frac{(n-1)!}{(2n-1)!} = \frac{3}{5}$

$\Rightarrow \frac{(2n+1)2n(2n-1)!}{(n+2)(n+1)n(n-1)!} \times \frac{(n-1)!}{(2n-1)!} = \frac{3}{5}$

$\Rightarrow \frac{(2n+1)2}{(n+2)(n+1)} = \frac{3}{5}$

$\Rightarrow 20n + 10 = 3(n^2 + 3n + 2)$

$\Rightarrow 3n^2 - 11n - 4 = 0$

$\Rightarrow 3n^2 - 12n + n - 4 = 0$

$\Rightarrow 3n(n-4) + (n-4) = 0$

$\Rightarrow (n-4)(3n+1) = 0$

$\Rightarrow n = 4, -\frac{1}{3}$

$\Rightarrow n = 4 \qquad (since\ n\ can\ not\ be\ negative)$

7 Find the value of 'r' if P (5, r) = P (6, r-1).

8. Find n, if $3^nP_4 = 5^{n-1}P_4$, n>4

Sol: $3^nP_4 = 5^{n-1}P_4$

$\Rightarrow 3n \times (n-1)(n-2)(n-3) = 5(n-1)(n-2)(n-3)(n-4)$

$\Rightarrow 3n = 5(n-4)$

$\Rightarrow 2n = 20 \Rightarrow n = 10$

9.Find $^{15}C_8 + {}^{15}C_9 - {}^{15}C_6 - {}^{15}C_7$

Sol: $(^{15}C_8 + {}^{15}C_9) - (^{15}C_6 + {}^{15}C_7)$

$= {}^{16}C_9 - {}^{16}C_7$

$= {}^{16}C_7 - {}^{16}C_7$

=0

10.Prove that: $^nC_r + 2\,{}^nC_{r-1} + {}^nC_{r-2} = {}^{n+2}C_r$

11.If $\frac{1}{4_{C_n}} = \frac{1}{5_{C_n}} + \frac{1}{5_{C_n}}$ find n.

Sol: $\frac{1}{4_{C_n}} = \frac{1}{5_{C_n}} + \frac{1}{5_{C_n}}$

=> $\frac{(4-n)!n!}{4!} = \frac{(5-n)!n!}{5!} + \frac{(6-n)!n!}{6!}$

=> 1=$\frac{5-n}{5} + \frac{(6-n)(5-n)}{6\times5}$

=>1=$\frac{5-n}{5}\left(1 + \frac{6-n}{6}\right)$

=>3× $10 = (5-n)(12-n)$

=>$5 - n = 3$ =>n=2

12.If n_{C_4}, n_{C_5} ,n_{C_6} are in AP ,find n.

13. If $28_{C_{2r}}$: $24_{C_{2r-4}}$=225: 11 ,find r.

14. If $^{9}P_5$+5 $^{9}P_4$= $^{10}P_r$ find r.

Sol: $^{9}P_5$+5 $^{9}P_4$= $^{10}P_r$

=>$\frac{9!}{4!} + 5\frac{9!}{5!} = \frac{10!}{(10-r)!}$

=>$\frac{1}{4!} + \frac{1}{4!} = \frac{10}{(10-r)!}$

=>$\frac{1}{12} = \frac{10}{(10-r)!}$

=>$(10-r)!$=120=5!

=>10-r=5 =>r=5.

15. If $^{20}P_r$=13× $^{20}P_{r-1}$ find r.

Sol: $^{20}P_r$=13× $^{20}P_{r-1}$

=>$\frac{20!}{(20-r)!} = 13\frac{20!}{(21-r)!}$

=> $(21-r)! = 13(20-r)!$

7. Find 'n' if $^{2n+1}P_{n-1}$: $^{2n-1}P_n$ = 3:5

SoL: $^{2n+1}P_{n-1}$: $^{2n-1}P_n$ = 3:5

=>$\frac{(2n+1)!}{(2n+1-n+1)!}$: $\frac{(2n-1)!}{(2n-1-n)!} = \frac{3}{5}$

=> $\frac{(2n+1)!}{(n+2)!} \div \frac{(2n-1)!}{(n-1)!} = \frac{3}{5}$

=> $\frac{(2n+1)!}{(n+2)!} \times \frac{(n-1)!}{(2n-1)!} = \frac{3}{5}$

$$\Rightarrow \frac{(2n+1)2n(2n-1)!}{(n+2)(n+1)n(n-1)!} \times \frac{(n-1)!}{(2n-1)!} = \frac{3}{5}$$

$$\Rightarrow \frac{(2n+1)2}{(n+2)(n+1)} = \frac{3}{5}$$

$$\Rightarrow 20n + 10 = 3(n^2 + 3n + 2)$$

$$\Rightarrow 3n^2 - 11n - 4 = 0$$

$$\Rightarrow 3n^2 - 12n + n - 4 = 0$$

$$\Rightarrow 3n(n-4) + (n-4) = 0$$

$$\Rightarrow (n-4)(3n+1) = 0$$

$$\Rightarrow n = 4, -\frac{1}{3}$$

$$\Rightarrow n = 4 \qquad (since\ n\ can\ not\ be\ negative)$$

7 Find the value of 'r' if P (5, r) = P (6, r-1).

8. Find n, if $3^nP_4 = 5^{n-1}P_4$, n>4

Sol: $3^nP_4 = 5^{n-1}P_4$

$$\Rightarrow 3\,n \times (n-1)(n-2)(n-3) = 5(n-1)(n-2)(n-3)(n-4)$$

$$\Rightarrow 3n = 5(n-4)$$

$$\Rightarrow 2n = 20 \Rightarrow n = 10$$

14. If $^9P_5 + 5\,^9P_4 = {}^{10}P_r$ find r.

Sol: $^9P_5 + 5\,^9P_4 = {}^{10}P_r$

$$\Rightarrow \frac{9!}{4!} + 5\frac{9!}{5!} = \frac{10!}{(10-r)!}$$

$$\Rightarrow \frac{1}{4!} + \frac{1}{4!} = \frac{10}{(10-r)!}$$

$$\Rightarrow \frac{1}{12} = \frac{10}{(10-r)!}$$

$\Rightarrow (10-r)! = 120 = 5!$

$\Rightarrow 10-r=5 \Rightarrow r=5.$

15. If $^{20}P_r = 13 \times {}^{20}P_{r-1}$ find r.

Sol: $^{20}P_r = 13 \times {}^{20}P_{r-1}$

$$\Rightarrow \frac{20!}{(20-r)!} = 13\frac{20!}{(21-r)!}$$

$=> (21-r)! = 13(20-r)!$

$=> 21-r = 13 \quad => r = 8$

16. Prove that $C_r^n + C_{r-1}^n = C_r^{n+1}$

LHS= $C_r^n + C_{r-1}^n$

$$= \frac{n!}{r!\,(n-r)!} + \frac{n!}{(r-1)!\,(n-r+1)!}$$

$$= \frac{n!}{r(r-1)!\,(n-r)!} + \frac{n!}{(r-1)!\,(n-r+1)(n-r)!}$$

$$= \frac{n!}{(r-1)!\,(n-r)!}\left(\frac{1}{r} + \frac{1}{n-r+1}\right)$$

$$= \frac{n!}{(r-1)!\,(n-r)!}\left(\frac{n-r+1+r}{r(n-r+1)}\right)$$

$$= \frac{n!}{(r-1)!\,(n-r)!} \times \frac{(n+1)}{r(n-r+1)}$$

$$= \frac{(n+1)!}{r!\,(n+1-r)!}$$

$= C_r^{n+1} = RHS$

17. Find r if ${}^5\mathrm{P}r = 2\ {}^6\mathrm{P}r - 1$

Sol: ${}^5\mathrm{P}r = 2\ {}^6\mathrm{P}r - 1$

$$\Rightarrow \frac{5!}{(5-r)!} = 2\frac{6!}{(7-r)!}$$

$$\Rightarrow \frac{5!}{(5-r)!} = 2\frac{6 \times 5!}{(7-r)(6-r)(5-r)!}$$

$$\Rightarrow 1 = 2\frac{6}{(7-r)(6-r)}$$

$\Rightarrow (7-r)(6-r) = 12$

$\Rightarrow (7-r)(6-r) = 4 \times 3$

$\Rightarrow 6-r = 3$

$\Rightarrow r = 3$

SECTION-III(3 mark each)

1. How many words with or without meaning ,each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE?

.Sol: Total number of letters in INVOLUTE $= 8$

Numbers of vowels$= 4$

Numbers of consonants $= 4$

3 vowels can be selected out of 4 vowels in ${}^4C_3$ ways .

2 consonants can be selected out of 4 consonants in ${}^4C_2$ ways .

By Fundamental Principle of product rule,

total numbers of ways to select 3 vowels and 2 consonants $={}^4C_3 \times {}^4C_2 = 4 \times 6 = 24$

Again in each of 24 selections ,these 5 letters can be arrange among themselves in $5!$ ways.

Hence total numbers of words $= 24 \times 5! = 24 \times 120 = 2880$

2. How many words with or without meaning each of 2 vowels and 3 consonants can be formed from the letters of the word DAUGHTER ?

Sol: Total number of letters in **DAUGHTER** $= 8$

Numbers of vowels$= 3$

Numbers of consonants $= 5$

2 vowels can be selected out of 3vowels in ${}^3C_2$ ways .

3 consonants can be selected out of 5 consonants in ${}^5C_3$ ways .

By Fundamental Principle of product rule,

total numbers of ways to select 2 vowels and 3 consonants $={}^3C_2$ x ${}^5C_3$ = 3x10 =30

Again in each of 30 selections ,these 5 letters can be arrange among themselves in $5!$ ways.

Hence total numbers of words $= 30 \times 5! = 30 \times 120 = 3600$

3. From 4 officers and 8 jawans in how many ways can 6 be chosen to include at least one officer ?

4. If ${}^{n+1}C_{r+1} : {}^nC_r : {}^{n-1}C_{r-1} = 11:6:3$, find the value of n and r.

5. How many different numbers each of six digits can be formed by using the digits 1, 2, 1,2,0,2?

VI	V	IV	III	II	I

Sol:

Case-I: Six digits number begins with 1$= \frac{5!}{3!} = 20$ as digit 2 repeating 3 times.

Case-II: Six digits number begins with 2= $\frac{5!}{2!2!} = 30$ as digits 1 and 2 each repeating 2 times .

Total no of 6 digits nos =20+30=50

6. How many numbers greater than 1000000 can be formed by using the digits 1,2,0,2,4,2,4?

Sol: Here numbers greater than 1000000 are to be of all 7 digits number as 7 digits are available with us.

VII	VI	V	IV	III	II	I

Case I: Seven digits number begins with 1 $= \frac{6!}{3!2!} = 60$ as digit 2 repeating 3 times and digit 4 repeating 2 times.

Case II: Seven digits number begins with 2 $= \frac{6!}{2!2!} = 180$ as digits 2 and 4 each repeating 2 times .

Case III: Seven digits number begins with 4 $= \frac{6!}{3!} = 120$ as digit 2 repeating 3 times

Total number of 7digits numbers $= 60 + 180 + 120 = 360$

7.Using 1,2,3,4 how many four digits numbers can be formed such that at least one digit is repeated?

Sol: No of ways for at least 1digit repeated=(total no of four digits number without restriction)$-$ (no of four digits number with the restriction of no digit repeating)

=$(4\times 4 \times 4 \times 4)-(4 \times 3 \times 2 \times 1)$=256$-$24=232

8. If all the permutations of the letters of the word **SAINIK** are arranged as in dictionary order, find the rank of SAINIK.

Sol: No of words begin with A=$\frac{5!}{2!} = 60$

No of words begin with I= $5! = 120$

No of words begin with K=$\frac{5!}{2!} = 60$

No of words begin with N =$\frac{5!}{2!} = 60$

No of words begin with SAII=$2! = 2$

No of words begin with SAIK=$2! = 2$

Total no of words obtained so far=60+120+60+60+2+2=304

Next word as in dictionary begins SAIN is SAINIK

Rank of SAINIK is 305.

9. If all the permutations of the letters of the word **IMPHAL** are arranged as in dictionary order, find the rank of IMPHAL.

Sol: No of words begin with A= $5! = 120$

No of words begin with H= $5! = 120$

No of words begin with IA= $4! = 24$

No of words begin with IH= $4! = 24$

No of words begin with IL= $4! = 24$

No of words begin with IMA= $3! = 6$

No of words begin with IMH= $3! = 6$

No of words begin with IML= $3! = 6$

No of words begin with IMPA= $2! = 2$

Total no of words obtained so far=120+120+24+24+24+6+6+6+2=332

Next word as in dictionary begins IMPH is IMPHAL

Rank of IMPHAL is 333.

10.Five balls of different colours are to be placed in three boxes of different sizes. In how many ways can we place the balls so that no box remains empty?

11. In how many ways a team of 7 can be made out of 10 boys and 10 girls such that

(i) team has no boy

(ii) team has exactly 4 boys

(iii) at least 5 boys

(iv) at least 1boy

(v) at least one boy and one girl

(vi) at most 2 boys

Sol: (i) No of ways to select a team of 7 having no boy

= No of selection of 7 girls out of 10 girls

= $^{10}C_7 = {}^{10}C_3 = 120$

(ii) No of ways to select 4boys out of 10 boys = $^{10}C_4 = 210$

No of ways to select 3 girlsout of 10 girls = $^{10}C_3 = 120$

Total no of ways=210×120 =25200

(iii) Since there should be at least 5 boys in the team of7, the possible selections are

Case I: 5 boys and 2 girls

Case II: 6 boys and 1girls

Case III: 7 boys and no girl

No of ways for Case I= $^{10}C_5 \times {}^{10}C_2 = 252 \times 45 = 11340$

No of ways for Case II= $^{10}C_6 \times {}^{10}C_1 = 210 \times 10 = 2100$

No of ways for Case III= $^{10}C_7 \times {}^{10}C_0 = 120 \times 1 = 120$

Total no of ways=11340+2100+120= 13560

(iv) No of ways for at least 1 boy=(No of ways of team of 7 out of 20 without restriction of no of boys and girls)−

(No of ways of team of 7 with the restriction of no boy)

$={}^{20}C_7-{}^{10}C_7$

(v) Since there should be at least 1 boy and 1 girl in the team of 7, the possible selections are

Case I: 1 boy and6 girl

Case II: 2 boy and 5 girl

Case III: 3 boy and 4 girl

Case IV: 4 boy and 3girl

Case V: 5 boy and 2girl

Case VI: 6 boy and 1girl

Case VI: 7 boy and no girl

No of ways for Case I=${}^{10}C_1\times{}^{10}C_6=10\times 210=2100$

No of ways for Case II=${}^{10}C_2\times{}^{10}C_5=45\times 252=11340$

No of ways for Case III=${}^{10}C_3\times{}^{10}C_4=120\times 210=25200$

No of ways for Case IV=${}^{10}C_4\times{}^{10}C_3=210\times 120=25200$

No of ways for Case V=${}^{10}C_5\times{}^{10}C_2=252\times 45=11340$

No of ways for CaseVI=${}^{10}C_6\times{}^{10}C_1=210\times 10=2100$

No of ways for CaseVI=${}^{10}C_7\times{}^{10}C_0=120\times 1=120$

Total no of ways=2100+11340+25200+25200+11340+2100+120=77400

(vi) Since there should be at most 2boys in the team of 7, the possible selections are

Case I: 2 boy and 5 girls

Case II: 1 boy and 6 girls

Case III: no boy and 7girls

No of ways for Case I=${}^{10}C_2\times{}^{10}C_5=45\times 252=11340$

No of ways for Case II=${}^{10}C_1\times{}^{10}C_6=10\times 210=2100$

No of ways for Case IV=${}^{10}C_0\times{}^{10}C_7=1\times 120=120$

Total no of ways=11340+2100+120= 13560

12.A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has

(i) no girl ?

(ii) at least one boy and one girl?

(iii) at least 3 girls?

(iv) at least one girl ?

(v) exactly 2 girl?

(vi) at most 3 girls?

Sol: (i) No of ways to select a team of 5 having no girl

=No of selection of 5 boys out of 7 boys

= ${}^7C_5={}^7C_2 = \frac{7\times6}{2} = 21$

(ii)Since there should be at least 1 boy and 1 girl in the team of 5, the possible selections are

Case I: 1 boy and 4 girl

Case II: 2 boy and 3 girl

Case III: 3 boy and 2 girl

Case IV: 4 boy and 1girl

No of ways for Case I=${}^7C_1\times{}^4C_4=7\times 1=7$

No of ways for Case II=${}^7C_2\times{}^4C_3=21\times 4=84$

No of ways for Case III=${}^7C_3\times{}^4C_2=35\times 6=210$

No of ways for Case IV=${}^7C_4\times{}^4C_1=35\times 4=140$

Total no of ways=7+84+210+140=441

(iii) Since there should be at least 3 girls in the team of 5, the possible selections are

Case I: 3girls and 2 boys

Case II: 4 girls and 1 boy

No of ways for Case I=${}^4C_3\times{}^7C_2=4\times 21=84$

No of ways for Case II=${}^4C_4\times{}^7C_1=1\times 7=7$

Total no of ways=84+7=91

(iv) Since there should be at least 1 girl in the team of 5, the possible selections are

Case I: 1 girl and 4 boys

Case II: 2 girls and 3 boys

Case III: 3 girls and 2 boys

Case IV: 4 girls and 1 boy

No of ways for Case I=${}^4C_1\times{}^7C_4=4\times 35=140$

No of ways for Case II=${}^4C_2\times{}^7C_3=6\times 35=210$

No of ways for Case III=${}^4C_3\times{}^7C_2=4\times 21=84$

No of ways for Case IV=${}^4C_4\times{}^7C_1=1\times 7 = 7$

Total no of ways=140+210+84+7=441

Alternative method:

No of ways for at least 1 girl=(No of ways of team of 5 without restriction of no of boys and girls)−

(No of ways of team of 5 with the restriction of no girls)

$={}^{11}C_5-{}^7C_5={}^{11}C_5-{}^7C_2 = \frac{11\times10\times9\times8\times7}{5\times4\times3\times2\times1}-\frac{7\times6}{2}=462-21=441$

(v) No of ways to select 2 girls out of 4 girls = ${}^4C_2=6$

No of ways to select 3 boys out of 7 boys = ${}^7C_3=35$

Total no of ways=$6\times 35=210$

(vi) Since there should be at most 3 girls in the team of 5, the possible selections are

Case I: 3 girls and2 boys

Case II: 2 girls and 3 boys

Case III: 1 girl and 4 boys

Case IV: 0 girls and 5 boys

No of ways for Case I=$^4C_3 \times ^7C_2 = 4 \times 21 = 84$

No of ways for Case II=$^4C_2 \times ^7C_3 = 6 \times 35 = 210$

No of ways for Case III=$^4C_1 \times ^7C_4 = 4 \times 35 = 140$

No of ways for Case IV=$^4C_0 \times ^7C_5 = 1 \times 21 = 21$

Total no of ways=84+210+140+21=455

13. If the letters of the word 'SACHIN' are arranged in dictionary order, find the rank of word SACHIN.

14. Prove that $C_r^n + C_{r-1}^n = C_r^{n+1}$.

15. In an examination ,a question paper consists of 12 questions divided into two parts i.e., part-I and part-II, containing 5 and 7 questions respectively. A student is required to attempt 8 questions in all ,selecting at least 3 from each part . In how many ways can a student select the questions?

16. How many odd numbers of 6 digits can be formed with the digits 0,1,2,3,4,5, no digits being repeated ?

Sol: Here box VI can be filled up in 3 ways as out of 1,3,5 any one can be placed to get odd number.

And box I can be filled up in 4 ways ,as 0 can't be placed there.

I	II	III	IV	V	VI

Remaining 4 boxes can be filled up with remaining 4 digits in $4 \times 3 \times 2 \times 1 = 24\ ways$

Total no of ways=$3 \times 4 \times 24 = 288$

Required no of 6 digits odd no=288

17.How many ways 4 boys and 3 girls can be arrange in a row when

(i) no restriction is there

(ii) 3 girls are together

(iii) 3 girls not together

(iv) no 2 girls together(ie there may be any nos of boys between 2 girls).

Sol: (i)No of ways to arrange 7 persons in a row without restriction =$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 7 \times 720 = 5040$

(ii)Considering 3 girls as one ,we have 5 persons and the number of ways to arrange them in a row

$=5\times4\times3\times2\times1=120.$

Now in each of 120 arrangement 3 girls can interchange among themselves in $3\times2\times1$=6ways.

Hence total number of arrangement 3 girls together =120$\times6=720$

(iii)No of arrangement with restriction of 3 girls not together

=(No of arrangement without restriction of 3girls together)$-$ (No of arrangement with restriction of 3 girls together)

= 5040$-$720 =4320

(iv)Arrangement of boys in a row =$4\times3\times2\times1=24$

As no two girls are be together , so they are to occupy 5 gaps.

Arrangement of 3 girls in 5 gaps =$5\times4\times3=60$

Hence total number of arrangement when no 2 girls together =$24\times60=1440$

18. How many ways 3 boys and 3 girls can be arrange in a row so as to sit alternate?

Sol: No of ways to arrange 3 boys in a row without restriction= 3! =3$\times2\times1=6$

As boys and girls to sit alternate , so 3 girls are to occupy 3 blank places .

No of ways for girls to occupy 3 blank places = 3! =6 $\begin{bmatrix} \text{case}-\text{I}: & -\text{B}-\text{B}-\text{B} \\ \text{case}-\text{II}: & \text{B}-\text{B}-\text{B}- \\ \text{case}-\text{III}: & -\text{gB}-\text{B}-\text{gBg}- \text{ wrong} \end{bmatrix}$

Total no of arrangement=$(3!\times3!)\times2$=72

19. How many ways 4 boys and 3 girls can be arrange in a row so as to sit alternate?

Sol: No of ways to arrange 4 boys in a row without restriction= 4! =4×3$\times2\times1=24$

As boys and girls to sit alternate , so 3 girls are to occupy 3 blank places

No of ways for girls to occupy 3 blank places = 3! =6

. $\begin{bmatrix} \text{case}-\text{I}: & \text{B}-\text{B}-\text{B}-\text{B} \\ \text{case}-\text{II}: & -\text{G}-\text{G}-\text{G}- \\ \text{case}-\text{III}: & \text{gBgBgB}-\text{B wrong} \\ \text{case}-\text{IV}: & \text{B}-\text{BgBgBg wrong} \end{bmatrix}$

Total no of arrangement=$(4!\times3!)$=24$\times6=144$

Note: For alternate arrangement no of boys and girl should be either same or difference of them should be one.

20. In how many ways can 5 girls and 3 boys be seated in a row so that no two boys are together ?

Sol: No of arrangement of 5 girls in a row =$5\times4\times3\times2\times1=120$

As no two boys are be together , so they are to occupy 6 gaps

No of arrangement of 3 boys in 6 gaps $=6 \times 5 \times 4 = 120$

Total no of arrangement=$120 \times 120 = 14400$

21. How many 7 letters words that can be formed using the letters of the word **SUCCESS** so that the two **C** are together but no two **S** are together?

Sol: Considering (2C) as one letter ,the no of words that can be formed using the letters U ,E (2C)= 3! =6

As no two S are be together , so they are to occupy 4 gaps.

Arrangement of three S in 4 gaps $=4 \times 3 \times 2 = 24$

Total no of words=$6 \times 24 = 144$

22.From 5 men and 4 women in how many ways can a committee of 4 is to be formed such that it contains

(i)exactly one woman. **Ans:** ${}^4C_1 \times {}^5C_3$

(ii) no woman. **Ans:** ${}^4C_0 \times {}^5C_4$

(iii)all woman. **Ans:** ${}^4C_4 \times {}^5C_0$

(iv)at most one women. **Ans:** ${}^4C_1 \times {}^5C_3 + {}^4C_0 \times {}^5C_4$

(v)at least one women. **Ans:** ${}^9C_4 - {}^5C_4$

(vi) having same sex. **Ans:** ${}^5C_4 + {}^4C_4$

(vii) 3 women and 1 man. **Ans:** ${}^4C_3 \times {}^5C_1$

23.How many 4 digits numbers greater than 5000 and divisible by 5 can be formed using the digits 0,1,3,5,7 when repetition of digits not allowed ?

Sol: Case I: When digit 5 in box -I

IV	III	II	I

Box –IV can be filled up by digit 7 and the middle two boxes II and III can be filled up with the remaining 3 digits in 3and 2 ways respectively.

Total no of ways =$1 \times 1 \times 3 \times 2$=6

Case II: When digit 5 is not in box- I i.e. when digit 0 in box- I

Box –IV can be filled up by digit 5 or7 i.e. 2 ways and the middle two boxes II and III can be filled up with the remaining 3 digits in 3and 2 ways respectively.

Total no of ways =$1 \times 2 \times 3 \times 2$=12

Total no of ways =6+12=18

Hence total no of 4 digits nos greater than 5000 and divisible by 5=18.

24.How many odd nos lying between 4000 and 7000 can be formed with the digits 0,1,2,3,4,5,6,7 when repetition not allowed ?

Sol: Case I: When digit 5 in box -I

IV	III	II	I

Box –IV can be filled up by digit 4or 6 i.e. 2 ways and the middle two boxes II and III can be filled up with the remaining 6digits in 6and 5 ways respectively.

Total no of ways =1× 2 ×6× 5=60

Case II: When digit 5 is not in box- I , it can be filled up by digit 1or 3 or7 i.e. 3 ways

Box –IV can be filled up by digit 4or 5or 6 i.e. 3ways and the middle two boxes II and III can be filled up with the remaining 6 digits in 6 and 5ways respectively.

Total no of ways =3× 3 ×6× 5=270

Total no of ways =60+270=330

Hence total no of 4 digits odd nos lying between 4000 and 7000 =330.

Note (i) when there is a condition/ restriction for any boxes ,then those boxes are to be filled up first.

(ii)When a digit has more than one place to occupy ,divide the sum into cases.

25.How many nos less than 1000 can be formed by using the digits 0,1,2,3,4,5,6 ,repetition of digits being allowed?

Sol: Case I: No of 1 digit nos less than 1000 =7

Case II: No of 2 digit nos less than 1000 =6× $\mathbf{7} = \mathbf{42}$

Case III: No of 3 digit nos less than 1000 =6× $\mathbf{7} \times \mathbf{7} = \mathbf{294}$

Hence total no of nos less than 1000 =7+42+294=343.

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED (4 MARKS)

1.A state cricket authority has to choose a team of 11 members ,to do it so, the authority asks 2 coaches of a government academy to select the team members that have experience as well as the best performers in last 15 matches. They can make up a team of 11 cricketers amongst 15 possible candidates. In how many ways can the final eleven be selected from 15 cricket players if:

(i) there is no restriction.

(a) 1365 (b) 2365 (c) 1465 (d) 1375

Ans (a)

(ii) one of them must be included

(a) 1002 (b) 1003 (c) 1001 (d) 1004

Ans (c)

(iii) one of them who is in bad form ,must always be excluded

(a) 480 (b) 364 (c) 1365 (d) 640

Ans (b)

(iv) two of them being leg spinners ,one and only one leg spinner must be included

(a) $^{2}C_{1} \times ^{13}C_{10}$ (b) $^{2}C_{1} \times ^{10}C_{13}$ (c) $^{1}C_{2} \times ^{13}C_{10}$ (d) $^{2}C_{10} \times ^{13}C_{10}$

Ans (a)

(v) if there are 6 bowlers,3 wicket keepers and and 11 batsmen in all, the number of ways in which a team of 4 bowlers ,2 wicket keepers and 5 batsmen can be chosen.

(a) $^{6}C_{2} \times ^{3}C_{4} \times ^{11}C_{5}$ (b) $^{6}C_{2} \times ^{4}C_{3} \times ^{11}C_{5}$ (c) $^{6}C_{2} \times ^{3}C_{5} \times ^{11}C_{4}$ (d) $^{6}C_{4} \times ^{3}C_{2} \times ^{11}C_{5}$

Ans (d)

2. Sainik School is to select 3 cadets for the appointment of School captain ,Mess captain and Discipline captain out of 10 boys and 5 girls of class XII.One cadet can't hold more than one appointment.

Based on the above information answer the following question.

(i) number of ways to select when school captain is from girls and both discipline and mess captain from boys.

Ans: $^{5}C_{1} \times ^{10}C_{1} \times ^{9}C_{1}$ = 5x10x9 =450

(ii) when particular 2 boys are unwilling to hold any appointment ,number of ways to select the 3 appointments from boys only.

Ans: $^{8}C_{1} \times ^{7}C_{1} \times ^{6}C_{1}$ =8x7x6 =336

(iii) number of ways to select the 3 appointments from girls only.

Ans: $^{5}C_{1} \times ^{4}C_{1} \times ^{3}C_{1}$=5x4x3= 60

(iv) number of ways to select the 3 appointments either all from girls or all from boys.

Ans: $^{5}C_{1} \times ^{4}C_{1} \times ^{3}C_{1} + ^{8}C_{1} \times ^{7}C_{1} \times ^{6}C_{1}$=60+336 =396.

3. Imochha a class XI students had been anxiously waiting for having a get together with his class mates as he could not be with them for a stretch of two months due to his exam preparation .He invited four of his best friends Alex ,Aakash ,Anthony and Abinash to his birthday party. After cutting cake they want to take a group photograph of all of them sitting in a single raw.

Based on the above information answer the following question.

(i) How many different photograph can be clicked ?

(a) 120 (b) 240 (c) 60 (d) 30

4	3	Alex	2	1

Sol: No of ways to arrange 5 persons in a raw without any restriction $= 5 \times 4 \times 3 \times 2 \times 1 = 120$

Ans: (a)

(ii) In how many of these photograph Alex be sitting in middle ?

(a) 12 (b) 24 (c) 36 (d) 60

Sol: No of ways to arrange 5 persons in a raw with a restriction of Alex in the middle

$= 4 \times 3 \times 1 \times 2 \times 1 = 24$

Ans: (b)

(iii) In how many of these photograph would Aakash and Anthony be sitting next to each other ?

(a) 120 (b) 24 (c) 48 (d) 60

Sol: Considering Aakash and Anthony as one person ,we have altogether 4 persons and them can be arrange in a raw in $4 \times 3 \times 2 \times 1 = 24$ ways .

But in each of these 24 arrangement Aakash and Anthony can interchange their position in 2 ways .

So total number of ways $= 24 \times 2 = 48$

Ans: (c)

(iv) In how many of these photograph would Aakash and Anthony be not sitting together ?

(a) 48 (b) 96 (c) 120 (d) 72

Sol: Number of ways for Aakash and Anthony be not sitting together

$= (No\ of\ ways\ to\ arrange\ 5\ persons\ in\ a\ raw\ without\ any\ restriction) -$
$(no\ of\ ways\ to\ arrange\ 5\ person\ with\ a\ restriction\ of\ Aakash\ and\ Anthony\ sitting\ togather)$

$= 120 - 48 = 72$

Ans: (d)

(v) In how many of these photograph would Alex be not sitting in middle ?

(a) 24 (b) 48 (c) 96 (d) 120

Sol: Number of ways for Alex be not sitting in middle

$= (No\ of\ ways\ to\ arrange\ 5\ persons\ in\ a\ raw\ without\ any\ restriction)$
$- (no\ of\ ways\ to\ arrange\ 5\ person\ with\ a\ restriction\ of\ Alex\ sitting\ in\ middle)$

$= 120 - 24 = 96$

Ans: (c)

4.Two friends Sohan and Iqbal have just learnt the concept of Permutations and Combinations. They started playing games on the same and are asking each other some questions.

Help them to find the answer:

(i) If all the letters in the word GAME are arranged as in a dictionary ,then what would be the rank of the word MEGA ?

Sol: **Sol:** No of words begin with A= $3! = 6$

No of words begin with E= $3! = 6$

No of words begin with G=$3! = 6$

No of words begin with MA=$2! = 2$

Total no of words obtained so far=6+6+6+2=20

21st word as in dictionary begins ME is MEAG

22nd word as in dictionary is MEGA

Rank of MEGA is 22.

(ii) If all the letters of word SUCCESS are arranged as in dictionary, what would be the word at 361th rank ?

Sol: No of words begin with C= $\frac{6!}{3!} = \frac{720}{6} = 120$

No of words begin with E= $\frac{6!}{2!\,3!} = \frac{720}{12} = 60$

No of words begin with S=$\frac{6!}{2!\,2!} = \frac{720}{4} = 180$

Total no of words obtained so far=120+60+180=360

361th word as in dictionary is UCCESSS.

5. A school is planning to take a group 60 students to visit an Art Gallery. Students are being asked for consent of their parents .In class XI-B there are 15 boys and 20 girls and 20 students can join from their class to the trip.

Answer the following questions:

(i) A group of 4 girls decided that either all will go or no one will go. What will be the possible number of selection from this class ?

Sol: Case I: When 4 girls will go

No of ways to select 16 students from remaining 31 students $= {}^{31}C_{16}$

Case II: When 4 girls will not go

No of ways to select 20 students from remaining 31students $= {}^{31}C_{20}$

Hence total no of selection $= {}^{31}C_{16} + {}^{31}C_{20}$

(ii) Together with this group of 4 girls one more group of 5 boys also decided the same i.e. either all of them will go or no one will go. What will be the possible number of selection from this class?

Sol: Case I: When 4 girls and 5 boys will go

No of ways to select 11 students from remaining 26 students $={}^{26}C_{11}$

Case II: When 4 girls and 5 boys will not go.

No of ways to select 20 students from remaining 26 students $={}^{26}C_{20}$

Case III: When 4 girls will go and 5 boys will not go.

No of ways to select 16 students from remaining 26 students $={}^{26}C_{16}$

Case IV: When 4 girls will not go and 5 boys will go.

No of ways to select 15 students from remaining 26 students $={}^{26}C_{15}$

Hence total no of selection $={}^{26}C_{11}+{}^{26}C_{20}+{}^{26}C_{16}+{}^{26}C_{15}$

Chapter -8: Binomial Theorem

SECTION-I MCQ Type(1 mark each)

1. What is the sum of all the coefficients in the expansion of $(1+x)^n$?

   (a)2^n (b) $2^n - 1$ (c)2^{n-1} (d) $2(n-1)$

2. If A and B are coefficient of x^n in the expansion of $(1+x)^{2n}$ and $(1+x)^{2n-1}$respectively, then

   (a) $A = B$ (b) $2A = B$ (c)$A = 2B$ (d) $A = -B$

3.What is the coefficient of x^{17} in the expansion of $(3x - \frac{x^3}{6})^9$?

   (a) $\frac{189}{8}$ (b) $\frac{567}{2}$ (c)$\frac{21}{16}$ (d) none

4.If the coefficient of x^7 and x^8 in $(2+\frac{x}{3})^n$ are equal, then n is equal to

   (a)56 (b) 55 (c) 45 (d) 15

5. The coefficient of x^{20} in the expansion of $(1+3x+3x^2+x^3)^2$ is

   (a) $60_{C_{40}}$ (b) $30_{C_{20}}$ (c) 15_{C_2} (d) none of the above

6. If the 4^{th} term in the expansion of $\left(\frac{2}{3}x - \frac{3}{2x}\right)^n$ is independent of$x$, then n is equal to

   (a) 5 (b) 6 (c) 9 (d) none

7. If x^4 occurs in r^{th} term of $\left(x^4 + \frac{1}{x^3}\right)^{15}$, what is the value of r?

   (a) 4 (b) 8 (c) 9 (d) none

8. How many terms are there in $(4x+7y)^{10} + (4x-7y)^{10}$?

   (a) 5 (b) 6 (c) 11 (d) 22

9. The co-efficient of the middle term in expansion of $(2+3x)^4$ is

   (a) 6 (b) 5! (c) 8! (d) 216

10. In the expansion of $(1+x)^{50}$ the sum of the coefficient of odd powers of *x* is

(a) 0 (b) 2^{49} (c) 2^{50} (d) $2^{49}-1$

11. The term independent of *x* in the expansion of $\left(2x+\frac{1}{3x}\right)^6$ is

(a) $\frac{160}{9}$ (b) $\frac{80}{9}$ (c) $\frac{160}{27}$ (d) $\frac{80}{3}$

12. The middle term in $\left(x^2+\frac{1}{x^2}+2\right)^n$ is

(a) $\frac{n!}{\left(\frac{n}{2}!\right)^2}$ (b) $\frac{(2n)!}{\left(\frac{n}{2}!\right)^2}$

(c) $\frac{(2n)!}{(n!)^2}$ (d) $\frac{1.3.5.....(2n+1)2^n}{n!}$

13. No. of terms in the expansion of $\left[(a+4b)^3(a-4b)^3\right]^6$ is

(a) 7 (b) 17 (c) 18 (d) 19

14. The sum of coefficients in the expansion of $\left(1+3x-3x^2\right)^{1143}$ is equal to

(a) –1 (b) 0 (c) 1 (d) 2^{1143}

15. The term independent of x in $(1+x)^m\,(1+\frac{1}{x})^n$ is

(a) $^{m+n}C_m$ (b) $^{m+n}C_n$ (c) $^{m+n}C_{m-n}$ (d) none

16. How many terms are there in the expansion of $\left(\frac{a^2}{b^2}+\frac{b^2}{a^2}+2\right)^{21}$

where $\neq 0, b \neq 0$? **(2021-II)**

(a) 21 (b) 22 (c) 42 (d) 43

17. In the expansion of $\left(x+\frac{1}{x}\right)^{2n}$, what is the $(n+1)th$ term from the end (when arranged in descending power of x) ? **(2022-I)**

(a) $C(2n,n)x$ (b) $C(2n,n-1)x$ (c) $C(2n,n)$ (d) $C(2n,n-1)$

18.How many terms are there in the expansion of $\left(1+\frac{2}{x}\right)^9\left(1-\frac{2}{x}\right)^9$? **(2022-I)**

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

SECTION-II(2 mark each)

24. Find the 13th term in the expansion of $\left(9x-\frac{1}{3\sqrt{x}}\right)^{18}, x \neq 0.$

Sol: $T_{13} = T_{12+1} = {}^{18}C_{12}\ (9x)^{18-12}\left(-\frac{1}{3\sqrt{x}}\right)^{12}$

$= {}^{18}C_{12}\ (9x)^{6}(-1)^{12}\ \frac{1}{3^{12}x^{6}}$

$= {}^{18}C_{12}\ 9^{6}x^{6}\frac{1}{3^{12}x^{6}}$

$= {}^{18}C_{12}\ 3^{12}\frac{1}{3^{12}}$

$= {}^{18}C_{12}$=18564.

SECTION-III(3 mark each)

1. Find the team independent of *x* in the expansion of $\left(\frac{3}{2}x^{2}-\frac{1}{3x}\right)^{6}$.

2. Find the term independent of x in the expansion of $\left(\sqrt[3]{x}+\frac{1}{2\sqrt[3]{x}}\right)^{18}, x>0$.

SECTION-IV(4 MARK EACH)

SOURCE BASED/CASE BASED/PASSAGE BASED (4 marks)

SECTION-V(5 mark each)

1.If the co-efficient of x^{7} in $(ax^{2}+\frac{1}{bx})^{11}$ and x^{-7} in $(ax-\frac{1}{bx^{2}})^{11}$ are equal, find the relation between a & b.

2. If the coefficients of a^{r-1}, a^{r} and a^{r+1} in the expansion of $(1+a)^{n}$ are in A.P. Prove that $n^{2}-n(4r+1)+4r^{2}-2=0$

3. The 3rd, 4th & 5th terms in the expansion of $(x+a)^{n}$ in descending powers of x are 84, 280, 560 respectively. Find x, a & n

4.The second ,third and fourth terms in the binomial expansion $(x+a)^{n}\ are$ 240,720 and 1080 respectively. Find $x, a\ and\ n$.

5. The co-efficients of the (r-1)th, rth and (r+1)th terms in the expansion of $(x+1)^{n}$ are in the ratio 1∶ $3:5$ .Find the values of n and r.

6 .Find n,if the ratio of the fifth term from the beginning to the fifth term from the end in the expansion of $\left(\sqrt[4]{2}+\frac{1}{\sqrt[4]{3}}\right)^{n}\ is\ \sqrt{6}:1$

Sol: Fifth term from beginning

$= T_{5}$

$= T_{4+1}$

$= {}^{n}C_4\left(\sqrt[4]{2}\right)^{n-4}\left(\frac{1}{\sqrt[4]{3}}\right)^{4}$

$= {}^{n}C_4 2^{\frac{n-4}{4}} . \frac{1}{3}$ [2]

Fifth term from the end

$= T_{n-3}$ [1]

$= T_{(n-4)+1}$

$= {}^{n}C_{n-4}\left(\sqrt[4]{2}\right)^{n-(n-4)}\left(\frac{1}{\sqrt[4]{3}}\right)^{n-4}$

$= C_{n-4} 2 . \frac{1}{3^{\frac{n-4}{4}}}$

$= {}^{n}C_4 \frac{2}{3^{\frac{n-4}{4}}}$ [1]

B/Q $ {}^{n}C_4 2^{\frac{n-4}{4}} . \frac{1}{3} : {}^{n}C_4 \frac{2}{3^{\frac{n-4}{4}}} = \sqrt{6} : 1$

$\Rightarrow \frac{2^{\frac{n-4}{4}} . 3^{\frac{n-4}{4}}}{6} = \sqrt{6}$

$\Rightarrow 6^{\frac{n-4}{4}} = 6\sqrt{6} = 6^{\frac{3}{2}}$

$\Rightarrow \frac{n-4}{4} = \frac{3}{2}$

$\Rightarrow n - 4 = 6$

$\Rightarrow n = 10$

Chapter -9: Sequence and Series

SECTION-I MCQ Type(1 mark each)

1. If a, b, c are in G.P then $\frac{1}{a^2-b^2} + \frac{1}{b^2}$ is

   (a) $\frac{1}{c^2-b^2}$ (b) $\frac{1}{b^2-c^2}$ (c) $\frac{1}{c^2-a^2}$ (d) $\frac{1}{b^2-a^2}$

2. The sum of an infinity G.P is 6. If the sum of the first two terms is $\frac{9}{2}$, then what is the first term?

   (a) 1 (b) $\frac{5}{2}$ (c) 3 or $\frac{3}{2}$ (d) 9 or 3

3. If x, y, z are in G.P, then log x, log y, log zare in

   (a) A.P (b) G.P (c) H.P (d) none

4. If the first term of an infinite G.P is 1 and each term is twice the sum of the succeeding terms, then the common ratio is

(a) $\frac{1}{3}$ (b) $\frac{2}{5}$ (c) $\frac{3}{4}$ (d) none

5. If x, y, z are in A.P., then $\frac{1}{yz}, \frac{1}{zx}, \frac{1}{xy}$ are in

(a) G.P. (b) H.P. (c) A.P. (d) none

6. If p^{th} term of an A.P be q and q^{th} term be p, then its r^{th} term will be

(a) $p + q + r$ (b) $p + q - r$ (c) $p + r - q$ (d) $p - q - r$

7. If $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$ & a, b, c are in G.P, then x, y, z will be in

(a) A.P (b) G.P (c) H.P (d) none of these

8. If the A.M of a & b is $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$, the value of n is

(a) -1 (b) 0 (c) 1 (d) none of these

9. The m^{th} term of an A.P is $\frac{1}{n}$ and n^{th} term is $\frac{1}{m}$, then what is $(mn)^{th}$ term?

(a) $\frac{1}{mn}$ (b) $\frac{m}{n}$ (c) $\frac{n}{m}$ (d) 1

10. Fifth term of a G.P is 2, then the product of its first 9 term is **(AIEEE-2002)**

(a) 256 (b) 512 (c) 1024 (d) none

11. If n^{th} term of an A.P is 2n – 1, then what is the sum upto n term?

(a) n^2 (b) $n^2 - 1$ (c) $n^2 + 1$ (d) ½ n(n+1)

12. If $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in H.P, then a, b, c are in

(a) A.P (b) G.P (c) H.P (d) none

13. What is the value of $7^{\frac{6}{7}} \cdot 7^{\frac{6}{7^2}} \cdot 7^{\frac{6}{7^3}} \ldots\ldots\ldots\ldots \propto$

(a) $\log_7\left(\frac{6}{7}\right)$ (b) $\propto$ (c) $\frac{6}{7}$ (d) 7

14. The product of 6 geometric means inserted between 81 and 1/27 is

(a) 243 (b) 27 (c) 3 (d) 9

15. If no. of terms of A.P is $(2n + 1)$, what is the ratio of sum of odd terms to the sum of even terms? **(2008-II)**

(a) $\frac{n}{n+1}$ (b) $\frac{n^2}{n+1}$ (c) $\frac{n+1}{n}$ (d) $\frac{n+1}{2n}$

16. If the 2nd term of a G.P is 2 and the sum of its infinite terms is 8, then its first term is

(a) ½ (b) ¼ (c) 2 (d) 4

17. If the sum of *p* terms of an *A.P* is *q* and that of *q* terms is *p*, then the sum of *p*+*q* terms is

(a) O (b) $p - q$ (c) $p + q$ (d) $-(p + q)$

18. The value of $\frac{1}{\log_{xy} xyz} + \frac{1}{\log_{yz} xyz} + \frac{1}{\log_{zx} xyz}$ is

(a) 1 (b) 2 (c) 3 (d) 4

19. If a, b, c are in H.P, then $\frac{a}{b+c},\frac{b}{c+a},\frac{c}{a+b}$ are in

(a) A.P. (b) G.P. (c) H.P. (d) none of these

20. If 1, *x, y, z*, 2 are in G.P, then *xyz* is

(a) 4 (b) 2 (c) 8 (d) none of these

21. The sum of $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+.....+\frac{1}{n(n+1)}$ is

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

22. If a, b, c, d, e, f are in A.P then (e – c) is equal to which one of the following?(**2011-II**)

(a) 2 (c – a) (b) 2 (d – c) (c) 2 (f – d) (d) (d – c)

23. Let T_r be the r^{th} term of an $A.P$ whose first term in a and common difference is d. If for some positive integers $m,n,\ m\neq n, Tm=\frac{1}{n}\&\ Tn=\frac{1}{m}$ then $a-d$ is (**AIEEE-2004**)

(a) 0 (b) l (c) $\frac{1}{mn}$ (d) $\frac{1}{m}+\frac{1}{n}$

24. If $\frac{1}{b-a}+\frac{1}{b-c}=\frac{1}{a}+\frac{1}{c}$, then a,b,c are in (**2011-I**)

(a) A.P (b) G.P (c) H.P (d) none

25. $2^{\frac{1}{4}}.4^{\frac{1}{8}}.8^{\frac{1}{16}}.16^{\frac{1}{32}}$ ... ... is equal to

(a)1 (b) 2 (c) $\frac{3}{2}$ (d) $\frac{5}{2}$

26. If H.M. and G.M. of two positive numbers a & b are in the ration 4 : 5, then a : b is

(a) 1:2 (b) 2:3 (c) 3: 4 (d) 4:1

27. If x>1, y>1, z>1 are in G.P., then $\frac{1}{1+logx}$, $\frac{1}{1+logy}$, $\frac{1}{1+logz}$ are in

(a) $A.P.$ (b) $G.P.$ (c) $H.P.$ (d) none

28. If the numbers $n-3,\ 4n-2,\ 5n+1$ are in A.P what is the value of n ?(**2013-I**)

(a) 1 (b) 2 (c) 3 (d) 4

29 . What is the sum of the series 0.5+0.55+0.555+…… to n terms (**2015-I**)

(a) $\frac{5}{9}[n-\frac{2}{9}(1-\frac{1}{10^n})]$ (b) $\frac{1}{9}[5-\frac{2}{9}(1-\frac{1}{10^n})]$

(c) $\frac{1}{9}[n-\frac{5}{9}(1-\frac{1}{10^n})]$ (d) $\frac{5}{9}[n-\frac{1}{9}(1-\frac{1}{10^n})]$

30. If $\frac{1}{ab+ac}$, $\frac{1}{bc+ba}$, $\frac{1}{ca+cb}$ are in H.P, then a,b,c are in (**2016-II**)

(a) A.P (b) G.P (c) H.P (d) none

1.The third term of a GP is 42,then the product of its first five terms is

(a) 42 (b) $(42)^5$ (c) 98 (d) $(25)^5$

Ans: (b)

2.which term of the sequence 4, 9, 14, 19 ,…….is 124 ?

(a) 25th (b) 20th (c) 26th (d) 21st

Ans: (a)

3. the value of $3^{\frac{1}{2}}.\ 3^{\frac{1}{4}}.3^{\frac{1}{8}}.3^{\frac{1}{16}}\ldots\ldots\ldots\infty$ is

(a) 3 (b) ∞ (c) 3^{∞} (d) $none\ of\ these$

Ans: (a)

4. The minimum value of $4^x + 4^{1-x}, x \in R$ is

(a) 2 (b) 4 (c) 1 (d) 0

Ans: (b)

5.The third term of a GP is 42,then the product of its first five terms is

(a) 42 (b) $(42)^5$ (c) 98 (d) $(25)^5$

Ans: (b)

6.If the sum of n terms of an AP is given by $S_n = 3n + 2n^2$,then the common difference of the AP is

(a) 3 (b) 2 (c) 6 (d) 4

Ans: (d)

7. The value of $3^{\frac{1}{2}}.\ 3^{\frac{1}{4}}.3^{\frac{1}{8}}.3^{\frac{1}{16}}\ldots\ldots\ldots\infty$ is

(a) 3 (b) ∞ (c) 3^{∞} (d) $none\ of\ these$

Ans: (a)

8. If in an AP ,$S_n = n^2p$ and $S_m = m^2p$, where S_r denotes the sum of the r terms of the AP ,then S_p is equal to

(a) $\frac{1}{2}p^3$ (b) mnp (c) p^3 (d) $(m+n)p^2$

Ans: (c)

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

1. Assertion (A) : If the sum of first two terms of an infinite GP is 5 and each term is three times the sum of the succeeding terms, then the common ratio is $\frac{1}{4}$.

Reason(R): In an AP of 3 ,6 , 9 ,12 ,…. the 10th term is equal to 30.

Ans: (b) Hint : $a = 3\frac{ar}{1-r} \Rightarrow 1 - r = 3r \Rightarrow r = \frac{1}{4}$

2. Assertion (A) :The sum of first n terms of the series $0.6 + 0.66 + 0.666 + \cdots ..$ is $\frac{2}{3}\left[n - \frac{1}{9}\left\{1 - \left(\frac{1}{10}\right)^n\right\}\right]$

Reason(R):General term of a GP is $t_n = ar^{n-1}$, where a= first term and r=common difference.

Ans: (b)

SECTION-II(2 mark each)

1 .If AM and GM of two positive numbers a and b are 10 and 8 respectively, find the numbers.

2 .If a,b,c are in GP and $a^{1/x} = b^{1/y} = c^{1/z}$,prove that $x, y, z \; are \; in$ AP.

3. If f is a function satisfying $f(x+y) = f(x).f(y)$ for all $x, y \in N$ such that $f(1)$=3 and $\sum_{x=1}^{n} f(x)$=120, find the value of n.

Sol: Here $f(x+y) = f(x)f(y)$ & $f(1) = 3$
$\therefore\ f(2) = f(1+1) = f(1)\,f(1) = 3.3 = 3^2$
$f(3) = f(2+1) = f(2).f(1) = 3^2.3 = 3^3$
$f(4) = f(3+1) = f(3).f(1) = 3^3.3 = 3^4$
⋮
Similarly $f(n) = 3^n$
Now $\sum_{x=1}^{n} f(x) = 120$
$\Rightarrow f(1) + f(2) + f(3) + \ldots\ldots + f(n) = 120$
$\Rightarrow 3+3^2+3^3+ \ldots\ldots\ldots\ldots +3^n = 120$
$\Rightarrow 3.\frac{3^n-1}{3-1} = 120$
$\Rightarrow 3^n - 1 = \frac{120\times 2}{3} = 80$
$\Rightarrow 3^n = 81 = 3^4$
$\therefore\ n = 4$

4. In an A.P.if pth term is $\frac{1}{q}\ and$ qth term is $\frac{1}{p}$, prove that sum of first pq terms is $\frac{1}{2}(pq+1)$,where $p \neq q$.

Sol: Let first term $= a$ and common difference $= d$

B/Q $t_p = \frac{1}{q} \Rightarrow a + (p-1)d = \frac{1}{q} \longrightarrow (1)$

$t_q = \frac{1}{p} \Rightarrow a + (q-1)d = \frac{1}{p} \longrightarrow (2)$

$(1) - (2)$ gives

$$(p-1)d-(q-1)d=\frac{1}{q}-\frac{1}{p}$$

$$\Rightarrow (p-q)d=\frac{p-q}{pq}$$

$$\Rightarrow d=\frac{1}{pq}$$

$From\ (1)\quad a+(p-1)\frac{1}{pq}=\frac{1}{q}$

$$\Rightarrow a+\frac{1}{q}-\frac{1}{pq}=\frac{1}{q}$$

$$\Rightarrow a=\frac{1}{pq}$$

Now $S_{pq}=\frac{pq}{2}[2a+(pq-1)d]$

$$=\frac{pq}{2}\left[2\frac{1}{pq}+(pq-1)\frac{1}{pq}\right]$$

$$=1+\frac{pq-1}{2}$$

$$=\frac{pq+1}{2}$$

SECTION-III(3 mark each)

1. Find the sum of all natural numbers lying between 100 and 1000, which are multiples of 5

2. How many terms of the G.P. 3, $\frac{3}{2},\frac{3}{4}$,....., , ,... are needed to give the sum $\frac{3069}{512}$?

3. If $a\left(\frac{1}{b}+\frac{1}{c}\right), b\left(\frac{1}{c}+\frac{1}{a}\right), c\left(\frac{1}{a}+\frac{1}{b}\right)$ are in A.P., Prove that a, b, c are in A.P.

4. If the sum of n terms of an A.P is $3n^2+5n$ and its m^{th} term is 164, find the value of m.

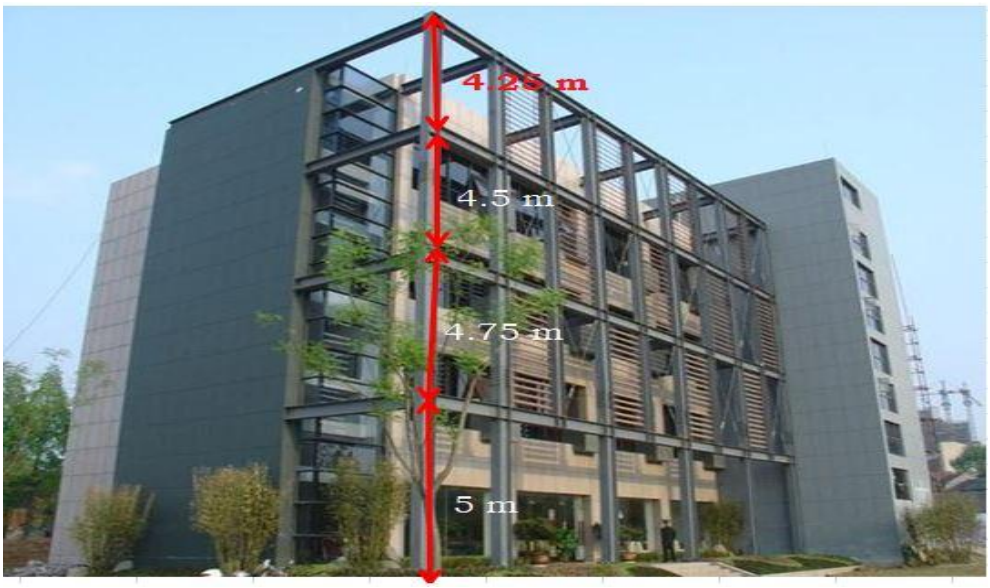
5.Find the sum of the following series up to n terms : 5+55+555+5555+····

SECTION-IV(4 MARK EACH)

SOURCE BASED/CASE BASED/PASSAGE BASED (4 marks)

1.Read the Case study 2 given below and attempt any 4 sub parts:

Father of Ashok is a builder, He planned a 12 story building in Gurgaon sector 5. For this, he bought a plot of 500 square yards at the rate of Rs 1000 /yard². The builder planned ground floor of 5 m height, first floor of 4.75 m and so on each floor is 0.25 m less than its previous floor.



Now Answer the following questions:

i. What is the height of the last floor?
   a. 2.5 m
   b. 2.75 m
   c. 2.25 m
   d. 3 m

ii. Which floor no is of 3 m height?

   a. 5
   b. 7
   c. 10
   d. 9

iii. What is the total height of the building?

   a. 40 m
   b. 43.5
   c. 40.5 m
   d. 44 m

iv. Up to which floor the height is 33 m?

   a. 8
   b. 7
   c. 10
   d. 9

v. Which floor no. is half in height of ground floor?

   a. 10
   b. 9
   c. 12
   d. 11

2.A manufacturer produces 600 laptops in third year and 700 laptops in seventh year .Assuming that the production increases uniformly by a constant number every year,

(i) find the value of the fixed number by which production is increasing every year .

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

Ans (b)

(ii) find the production in first year

(a) 400 (b) 350 (c) 500 (d) 550

Ans (d)

(iii) find thetotal production in 6 years

(a) 3600 (b) 3650 (c) 3675 (d) 3725

Ans (c)

(iv) find the number of laptops manufactured in 10^{th} year.

(a) 775 (b) 770 (c) 800 (d) 850

Ans (a)

SECTION-V(5 mark each)

1. If p, q, r are in G.P. and the equations, $px^2 + 2qx + r = 0$ and $dx^2 + 2ex + f = 0$ have a common root, then show that $\frac{d}{p}, \frac{e}{q}, \frac{f}{r}$ are in A.P.

Proof: Since p, q, r are in G.P.

$\therefore q^2 = pr$

Now $px^2 + 2qx + r = 0$

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-2q \pm \sqrt{4q^2 - 4pr}}{2p}$$

$$= \frac{-2q \pm \sqrt{4q^2 - 4q^2}}{2p} \qquad [\because q^2 = pr]$$

$$= \frac{-2q}{2p} = -\frac{q}{p}$$

Since $x = -\frac{q}{p}$ $is\ also\ a\ root\ of\ equation$ $dx^2 + 2ex + f = 0$

$\therefore d\left(-\frac{q}{p}\right)^2 + 2e\left(-\frac{q}{p}\right) + f = 0$

$\Rightarrow d\frac{q^2}{p^2} - 2e\frac{q}{p} + f = 0$

$\Rightarrow dq^2 - 2epq + fp^2 = 0$

$\Rightarrow dq^2 + fp^2 = 2epq$

$\Rightarrow \frac{dq^2+fp^2}{pq^2} = \frac{2epq}{pq^2}$ $\quad [dividing\ both\ sides\ by\ pq^2]$

$\Rightarrow \frac{dq^2}{pq^2} + \frac{fp^2}{pq^2} = \frac{2e}{q}$

$\Rightarrow \frac{d}{p} + \frac{fp}{q^2} = 2\frac{e}{q}$

$\Rightarrow \frac{d}{p} + \frac{fp}{pr} = 2\frac{e}{q}$ $\quad [\because q^2 = pr]$

$\Rightarrow \frac{d}{p} + \frac{f}{r} = 2\frac{e}{q}$

Hence $\frac{d}{p}, \frac{e}{q}, \frac{f}{r}$ are in A.P

2 .Find the sum to n terms the series: 5+11+19+29+41+.....

3.Find the sum of the first n term of the series 3+7+13+21+31+……..

4. In the arithmetic series 2,5,8,11…… upto 50 terms and 3,5,7,9…….. upto 60 terms, find how many terms are identical.

5. If S be the sum ,P the product and R the sum of reciprocals of n terms in a G.P. prove that $P^2 = \left(\frac{S}{R}\right)^n$

Proof: Let first term= a and common ratio= r

B/Q $S = a + ar + ar^2 + ar^3 + \cdots \ldots + ar^{n-1}$

$= \frac{a(1-r^n)}{1-r}$

$P = a.ar.ar^2.ar^3 \ldots\ldots\ldots ar^{n-1}$

$= a^n r^{1+2+3+\cdots\ldots\ldots+(n-1)}$

$= a^n r^{\frac{n(n-1)}{2}}$

$R = \frac{1}{a} + \frac{1}{ar} + \frac{1}{ar^2} + \frac{1}{ar^3} + \cdots \ldots\ldots + \frac{1}{ar^{n-1}}$

$$= \frac{\frac{1}{a}\left(1-\frac{1}{r^n}\right)}{1-\frac{1}{r}}$$

$$= \frac{r(r^n-1)}{a(r-1)r^n}$$

$$= \frac{(1-r^n)}{a(1-r)r^{n-1}}$$

$$= \frac{a(1-r^n)}{(1-r)} \cdot \frac{1}{a^2 r^{n-1}}$$

$$= \frac{S}{a^2 r^{n-1}}$$

$$\Rightarrow \frac{S}{R} = a^2 r^{n-1}$$

$$\Rightarrow \left(\frac{S}{R}\right)^n = (a^2 r^{n-1})^n$$

$$\Rightarrow \left(\frac{S}{R}\right)^n = a^{2n} r^{n(n-1)}$$

$$\Rightarrow \left(\frac{S}{R}\right)^n = \left(a^n r^{\frac{n(n-1)}{2}}\right)^2$$

$$\Rightarrow \left(\frac{S}{R}\right)^n = P^2$$

6. The sum of n terms of two Arithmetic Progressions are in the ratio $(3n+8):(7n+15)$. Find the ratio of their 12th terms.

Sol:Let S_1= sum of n terms of first A.P.

S_2= sum of n terms of second A.P.

a_1 = first term of first A.P.

a_2 = first term of second A.P.

d_1 = C.D of first A.P.

d_2 = C.D of second A.P.

B/Q

$$\frac{S_1}{S_2} = \frac{3n+8}{7n+15}$$

$$\Rightarrow \quad \frac{\frac{n}{2}[2a_1 + (n-1)\,d_1]}{\frac{n}{2}[2a_2 + (n-1)\,d_2]} = \frac{3n+8}{7n+15}$$

$$\Rightarrow \quad \frac{[2a_1 + (n-1)\,d_1]}{[2a_2 + (n-1)\,d_2]} = \frac{3n+8}{7n+15}$$

$$\Rightarrow \quad \frac{a_1 + \frac{(n-1)}{2}\,d_1}{a_2 + \frac{(n-1)}{2}\,d_2} = \frac{3n+8}{7n+15}$$

$$\Rightarrow \quad \frac{a_1 + \frac{(23-1)}{2}\,d_1}{a_2 + \frac{(23-1)}{2}\,d_2} = \frac{3\times 23+8}{7\times 23+15} \qquad (putting\ n = 23\ both\ sides\ )$$

$$\Rightarrow \quad \frac{a_1 + 11\,d_1}{a_2 + 11\,d_2} = \frac{77}{176}$$

$\therefore$ The ratio of their 12th terms is $77:176$

7.If a, b, c are in A.P; b, c, d are in G.P. and $\frac{1}{c},\frac{1}{d},\frac{1}{e}$ are in A.P. Prove that a, c, e are in G.P.

Proof: a, b, c are in A.P

$$\Rightarrow 2b = a + c$$

$$\Rightarrow b = \frac{a+c}{2} \qquad \rightarrow (1)$$

b, c, d are in G.P

$$\Rightarrow c^2 = bd \qquad \rightarrow (2)$$

$\frac{1}{c},\frac{1}{d},\frac{1}{e}$ are in A.P.

$$\Rightarrow 2\frac{1}{d} = \frac{1}{c} + \frac{1}{e}$$

$$\Rightarrow \frac{2}{d} = \frac{c+e}{ce}$$

$$\Rightarrow d = \frac{2ce}{c+e} \qquad \rightarrow (3)$$

Using (1) and (3) in (2) we get

$$c^2 = \frac{a+c}{2}\ \frac{2ce}{c+e}$$

$$\Rightarrow 2c^2(c+e) = 2ce(a+c)$$

$$\Rightarrow c(c+e) = e(a+c)$$

$$\Rightarrow c^2 + ce = ae + ce$$

$$\Rightarrow c^2 = ae$$

$\therefore$ $a, c, e\ are\ in$ G.P

8. If a, b are the roots of $x^2 - 3x + p = 0$ and c ,d are the roots of $x^2 - 12x + q = 0$,where a,b,c,d form a G.P. Prove that $(q+p) : (q-p) = 17 : 15$

9. Find the sum of the series up to n terms: $7 + 77 + 777 + \cdots$

Sol: $\boldsymbol{S_n} = 7 + 77 + 777 + \cdots \ldots\ldots\ldots\ldots\ldots to\ n\ terms$

$$= 7(1 + 11 + 111 + \cdots \ldots \text{to nterms})$$

$$= \frac{7}{9}(9 + 99 + 999 + \cdots \ldots to\ n\ terms)$$

$$= \frac{7}{9}[(10 - 1) + (100 - 1) + (1000 - 1) + \cdots \ldots to\ n\ terms]$$

$$= \frac{7}{9}[(10 - 1) + (10^2 - 1) + (10^3 -) + \cdots . to\ n\ terms]$$

$$= \frac{7}{9}[(10 + 10^2 + 10^3 + \cdots . to\ n\ terms) - (1 + 1 + 1 + \cdots to\ n\ terms)]$$

$$= \frac{7}{9}\left[\frac{10(1 - 10^n)}{1 - 10} - n\right]$$

$$= \frac{7}{9}\left[\frac{10}{-9}(1 - 10^n) - n\right]$$

$$= \frac{7}{9}\left[\frac{10}{9}(10^n - 1) - n\right]$$

$$= \frac{70}{81}(10^n - 1) - \frac{7n}{9}$$

Chapter -10: Straight Lines

SECTION-I MCQ Type(1 mark each)

1. The distance between the lines $x + 2y + 1 = 0$ and $2x + 4y + 12 = 0$ is
(a) $\sqrt{5}$ (b) $\frac{1}{\sqrt{5}}$ (c) 5 (d) none of these

2. Intercepts of straight line on axis are 'a' and 'b' and the perpendicular from origin on the line is 1, then which is correct?

(a) $\frac{1}{a^2} + \frac{1}{b^2} = 2$ (b) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{\sqrt{2}}$ (c) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{2}$ (d) $\frac{1}{a^2} + \frac{1}{b^2} = 1$

3. If the line $(ax + by + c) + k(lx + my + n) = 0$ is parallel to Y – axis, then k is

(a)$-\frac{a}{m}$ (b) $-\frac{b}{m}$ (c) $-\frac{l}{a}$ (d) $-\frac{a}{c}$

4. What is foot of perpendicular from point (2, 3) on the line $x + y - 11 = 0$?

(a)(1,10) (b) (5, 6) (c) (6, 5) (d) (7, 4)

5. What is the equation to the straight line joining the origin to the point of intersection of the lines $\frac{x}{a} + \frac{y}{b} = 1$and $\frac{x}{b} + \frac{y}{a} = 1$? **(2010-II)**

(a) $x + y = 0$ (b) $x + y + 1 = 0$ (c)$x - y = 0$ (d) $x + y + 2 = 0$

6. If the straight lines $x - 2y = 0$ and $kx + y = 1$ intersect at the point $(1,\frac{1}{2})$ then what is the value of k?**(2010-II)**

(a) 1 (b) 2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

7. If the portion of the straight line intercepted between the co-ordinate axes is bisected at (2,2), then the equation of the line is

(a) $x + y = 4$ (b) $x + 2y = 6$ (c)$2x + y = 6$ (d) $3x - y = 4$

8. A straight line given by $22x + 8y - 18 + \lambda(11x + 3y + 12) = 0$ is parallel to x - axis if

(a) $\lambda = \frac{8}{3}$ (b) $\lambda = 2$ (c) $\lambda = -2$ (d) $\lambda = -\frac{3}{2}$

9. In what ratio does the line $y - x + 2 = 0$ cut the line joining (3, -1) and (8, 9)?**(2007-I)**

(a) 3 : -2 (b) 1 : 2 (c) 2 : 3 (d) 3:2

10. What is the slope of the line perpendicular to the line $\frac{x}{4} + \frac{y}{3} = 1$(2010-II)

(a) $\frac{3}{4}$ (b) $-\frac{3}{4}$ (c)$-\frac{4}{3}$ (d) $\frac{4}{3}$

11. If the area of a triangle with vectors (-3,0), (3, 0) and (0, k) is 9 sq. units, then what is the value of k?(2010-II)

(a) 3 (b) 6 (c) 9 (d) 12

12. The line $(p + 2q)x + (p - 3q)y = p - q$ for different value of p and q passes through the point

(a) (2/5, 3/5) (b) (3/2, 5/2) (c) (2/5, 2/5) (d) (3/5, 3/5)

13. If the lines $x + 2y + 3 = 0, 3y - 2x + 5 = 0$ and $x - 5y + a = 0$ are concurrent then

(a) $a = -2$ (b) $a = -\frac{1}{2}$ (c)$a = -8$ (d) none

14. The distance between the parallel lines $y = 2x + 4$ and $6x = 3y + 5$ is

(a) $\frac{17}{\sqrt{3}}$ (b) 1 (c) $\frac{3}{\sqrt{5}}$ (d) $\frac{17\sqrt{5}}{15}$

15. If $p(x,y)$ is equidistance from $(a + 1, b - 1)$ and $(a - 1, b + 1)$, then which of the following relation hold true?

(a)$ay = bx$ (b) $x - y = a - b$ (c)$\frac{a}{x} + \frac{b}{y} = 1$ (d) $\frac{x}{a} + \frac{y}{b} = 1$

16. The equation of the straight line cutting off an intercept 8 from x-axis and making an angle of 60^0 with the positive direction of y-axis is

(a) $x + \sqrt{3}y = 8$ (b) $x - \sqrt{3}y = 8$ (c)$x - \sqrt{3}y = 4$ (d) none

17. A straight line through the point A(3, 4) is such that its intercept between the axis is bisected at A, its equation is

(a) $3x - 4y + 7 = 0$ (b) $4x + 3y = 24$ (c) $3x + 4y = 25$ (d) $x + y = 7$

18. The distance between the parallel lines $3x - 4y + 9 = 0$ & $6x - 8y - 15 = 0$ is

(a) – 33/10 (b) 10/33 (c) 33/10 (d) 33/20

19. The area of the triangle formed by the lines x = 0, y = 0 and 3x + 4y = 12 is

(a) 3 (b) 4 (c) 6 (d) 12

20. What is foot of perpendicular from point (2, 3) on the line $x + y - 11 = 0$?

(b)(1,10) (b) (5, 6) (c) (6, 5) (d) (7, 4)

21. If the line $2x + y = k$ passes through the point which divide the line segment joining the points (1, 1) and (2, 4) in the ratio 3:2, then k equals**(AIEEE-2012)**

(a)6 (b) 11/5 (c)29/5 (d) 5

22. The points (3, 3), (h, 0) and (0, k) are collinear if

(a) 1/h + 1/k =1/3 (b) 1/h-1/k=1/3 (c) 1/k-1/h=1/3 (d) none of these

23. The equation of the st. line which is perpendicular to $y = x$ and passes through (3, 2) will be given by

(a) $x - y = 5$ (b) $x + y = 5$ (c) $x + y = 1$ (d) $x - y = 1$

24. If $A(-3,2), B(-1,4), C(4,-3)$ are three vertices of parallelogram ABCD, then co-ordinates of the 4th vertex D is

(a) (6, -1) (b) (2, -5) (c) (0, 3) (d) (-2, 5)

25. The image of the point (-8, 12) with respect to the line mirror $4x + 7y + 13 = 0$ is

(a) (16, -2) (b) (-16,2) (c) (16,2) (d) (-16, -2)

26. The equation of the line perpendicular to the line 2x + 3y + 5 =c and passing through (1,1) is
(a) 3x+2y+1=0 (b) 3x–2y–2=0 (c) 3x–2y–1=0 (d) 3x–y–1=0

27. The co-ordinates of the foot of the perpendicular drawn from the point (1,–2) on the line y = 2x + 1 is
(a) (1,1) (b) (–1, 1) (c) (1, –1) (d) (–1, –1)

28. The distance between the parallel lines $y = mx + c$ & $y = mx + d$ is
(a) $|c-d|$ (b) $\frac{1}{2}|c-d|$ (c) $\frac{|c-d|}{\sqrt{1+m^2}}$ (d) none of these

29. A line through the points (4, 3) & (2,5) cuts off intercepts of lengths λ & μ on the axes. Which of the following is correct?
(a) $\lambda > \mu$ (b) $\lambda < \mu$ (c) $\lambda < -\mu$ (d) $\lambda = \mu$

30. What is the angle between straight lines $y=\left(2-\sqrt{3}\right)x+5$ and $y=\left(2+\sqrt{3}\right)x-7$
(a) 60° (b) 45° (c) 30° (d) 15°

31. What is the foot of perpendicular from the point (2,3) on the line x + y –11=0?
(a) (1,10) (b) (5,6) (c) (6,5) (d) (7,4)

32. The line y = 0 divides the line joining the points (3, –5) and (–4, 7) in the ratio**(2012-II**)
(a) 3:4 (b) 4:5 (c) 5:7 (d) 7:9

33. The equation of straight line which makes an angle 45^0 with the x-axis with y-intercept 101 unit is**(2012-II**)
(a) $10x+101y=1$ (b) $101x+y=1$ (c) $x+y-101=0$ (d) $x-y+101=0$

34. The line $\frac{x}{a}-\frac{y}{b}=1$ cuts the x-axis at P. The equation of the line through P and perpendicular to the given line is
(a) $x+y=ab$ (b) $x+y=a+b$ (c) $ax+by=a^2$ (d) $bx+ay=b^2$

35. The area of the triangle bounded by the straight line $ax+by+c=0\ (a,b,c\neq 0)$ and the co-ordinate axes is
(a) $\frac{a^2}{2|bc|}$ (b) $\frac{c^2}{2|ab|}$ (c) $\frac{b^2}{2|ca|}$ (d) 0

36. For what value of k are the two straight lines 3x +4y=1 and4x +3y +2k=0 equidistant from the point (1,1) ?**(2013-II**)
(a)$\frac{1}{2}$ (b)2 (c) – 2 (d) $-\frac{1}{2}$

37. Two points $(a,0)$ & $(0,b)$ are joined by a straight line. Another point on this line is
(a) $(3a,-2b)$ (b) (a^2,ab) (c) $(-3a,2b)$ (d) (a,b)

38. If PM is perpendicular from P(2,3) onto the line $x+y$=3, then the co-ordinates of M are
(a) (2,1) (b) $(-1,4)$ (c) (1,2) (d)(4, -1)

39. Angle between the lines $2x-y-15=0$&$3x+y+4=0$ is
(a) 90° (b) 45° (c) 180° (d) 60°

40. If a & b are non-zero real &$a=b$, then the equation of the line passing through origin and point of intersection of $\frac{x}{a}+\frac{y}{b}=1$& $\frac{x}{b}+\frac{y}{a}=1$ is**(2015-I**)
(a) ax+by=0 (b) bx+ay=0 (c) y – x=0 (d) x+y=0

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

1. Assertion: If a,b,c are in A.P, then straight line $ax+by+c=0$ will always passes through a fixed point $(1,-2)$.

Reason :A straight line $ax + by + c = 0$ will pass through a point (x_1, y_1)

if $ax_1 + by_1 + c = 0$

2. Assertion: If $AB + BC = AC, then\ \triangle ABC$ cannot be possible .

Reason : $\triangle ABC$ will be possible only if $A, B, C\ are\ non\ collinear.$

SECTION-II(2 mark each)

1. Find the angle between the lines $y - \sqrt{3}x - 5 = 0$ and $\sqrt{3}y - x + 6 = 0$

2..Find the equation of a line perpendicular to the line $x - 2y + 3 = 0$ and passing through the point $(1, -2)$

3 . Assuming that straight lines work as the plane mirror for a point ,find the image of the point $(1,2)$ in the line $x - 3y + 4 = 0$

4. If p is the length of the perpendicular from the origin to the line whose intercepts on the axes are a and b, then show that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

Proof: Equation of line in intercept form is

$\frac{x}{a} + \frac{y}{b}$=1

=> $\frac{x}{a} + \frac{y}{b} - 1 = 0 \rightarrow (1)$ 1 mark

B/Q Perpendicular distance of line (1) from origin=p

=> $\left| \frac{-1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}} \right|$=p

=> $\frac{1}{\frac{1}{a^2} + \frac{1}{b^2}} = p^2$

=>$\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$ 1mark

5.Intercepts of a straight line on the co-ordinate axes are a and b .Find the condition for which its perpendicular distance from origin is 1.

6. Point R(h, k) divides a line segment between the axis in the ratio 1 : 2. Find equation of the line.

7. Reduce the equation of straight line $\sqrt{3}x + y - 8 = 0$ into normal form.

SECTION-III(3 mark each)

1.Find the distance of the line $4x - y = 0$ from the point P(4,1) measured along the line making an angle of 135° with the positive x -axis.

2. Find the equations of the lines through the point (3,2) which makes an angle of 45° with the line $x - 2y = 3$.

3. A straight line passes through the point $(-1, 2)$ and its distance from the origin is one unit. Find its equation.

4. Find the equation of the line passing through the point (2,3) so that the segment of the line intercepted between the axes is bisected at that point.
5. Prove that the product of the lengths of the perpendiculars drawn from the points $\left(\sqrt{a^2-b^2},\ 0\right)$ and $\left(-\sqrt{a^2-b^2},\ 0\right)$ $to\ the\ line\ \frac{x}{a}\cos\theta+\frac{y}{b}\sin\theta=1\ is\ \ b^2$

6. Find the equation of the line passing through the point of intersection of the lines

$4x+7y-3=0$ and $2x-3y+1=0$ that has equal intercepts on the axes.

7. Find the co-ordinates of the foot of perpendicular from the point $(-1,3)$ to the line $3x-4y-16=0$
8. Find the equation of the line passing through the point of intersection of the lines $4x+7y-3=0$ and $2x-3y+1=0$ that has equal intercepts on the axis.

9. Find equation of the line passing through the point (2, 2) and cutting off intercepts on the axis whose sum is 9.

10. If $p\ and\ q$ are the lengths of perpendiculars from the origin to the lines

$x\cos\theta-y\sin\theta=k\cos 2\theta$ and $x\sec\theta+y\,\mathrm{cosec}\,\theta=k$ respectively, prove that $p^2+4q^2=k^2$

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED ASSESSMENT

SECTION-V(5 mark each)

Chapter -11: Conic Sections

SECTION-I MCQ Type(1 mark each)

1. The equation $x^2+y^2+2x-4y+5=0$ represents

(a) a point (b) a pair of straight lines (c) a circle of non-zero radius (d) none of these

2. Co-ordinates of foci of hyperbola are (-5,3) and (7,3) and eccentricity is $\frac{3}{2}$. Then length of its latus rectum is

(a) +10 (b) -20 (c) 20 (d) none

3. If for the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, y-axis is the minor axis and the length of the latus rectum is one half of the length of its minor axis, then its eccentricity is

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{3}{4}$

4. For which value of a in equation $x^2+y^2+(a^2-4)xy+2x+2y+a=0$ represent circle?

(a) 3 (b) 2 (c) 4 (d) none

5. The other end of the diameter through the point (-1, 1) on the circle

$x^2+y^2-6x+4y-12=0$is

(a) (-7, 5) (b) (-7, -5) (c) (7, -5) (d) (7, 5)

6. If the latus rectum of an ellipse is equal to half its minor axis, then what is its eccentricity?

(2010-II)

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

7. In an ellipse minor axis is 8 and eccentricity is $\frac{\sqrt{5}}{3}$. The major axis is

(a) 6 (b) 12 (c) 10 (d) 16

8. What is radius of circle passing through$(0,0), (a, 0)\& (0, b)$?

(a)$\sqrt{a^2 - b^2}$ (b) $\sqrt{a^2 + b^2}$ (c) $\frac{1}{2}\sqrt{a^2 + b^2}$ (d) $2\sqrt{a^2 + b^2}$

9. For what value of k does the euation $9x^2 + y^2 = k(x^2 - y^2 - 2x)$ represents equation of circle?

(a)1 (b) 2 (c) -1 (d) 4

10. Which one of the following is equation of diameter of circle $x^2 + y^2 - 6x + 2y = 0$?

(a)$2x + y = 0$ (b) $x + 2y = 0$ (c) $x + 3y = 0$ (d) $3x + y = 0$

11. In an ellipse minor axis is 8 and eccentricity is $\frac{\sqrt{5}}{3}$. The major axis is

(b) 6 (b) 12 (c) 10 (d) 16

12. What is radius of circle passing through$(0,0), (a, 0)\& (0, b)$?

(b)$\sqrt{a^2 - b^2}$ (b) $\sqrt{a^2 + b^2}$ (c) $\frac{1}{2}\sqrt{a^2 + b^2}$ (d) $2\sqrt{a^2 + b^2}$

13. For what value of k does the euation $9x^2 + y^2 = k(x^2 - y^2 - 2x)$ represents equation of circle?

(b)1 (b) 2 (c) -1 (d) 4

14. Which one of the following is equation of diameter of circle $x^2 + y^2 - 6x + 2y = 0$?

(b)$2x + y = 0$ (b) $x + 2y = 0$ (c) $x + 3y = 0$ (d) $3x + y = 0$

15. If e_1, e_2 are the eccentricities of the ellipse $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ respectively, then the relation between e_1 and e_2 is

(a) $3e_1^2 + e_1^2 = 2$ (b) $e_1^2 + 2e_2^2 = 3$ (c) $2e_1^2 + e_2^2 = 3$ (d) $e_1^2 + 3e_2^2 = 2$

16. The eccentricity of the curve $x^2 - y^2 = a^2$ is

(a) 2 (b) $\sqrt{2}$ (c) 4 (d) none of these

17. The eccentricity of an ellipse with its centre at origin is ½ . If one of the directrix is x=4, then the equation of ellipse is

(a) $3x^2 + 4y^2 = 1$ (b) $3x^2 + 4y^2 = 12$ (c) $4x^2 + 3y^2 = 12$ (d) $4x^2 + 3y^2 = 1$

18. If the line $\frac{x}{a} + \frac{y}{b} = 1$ touches the circle $x^2 + y^2 = r^2$, then

(a) $a^2+b^2=r^2$ (b) $a^2-b^2=r^2$ (c) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{r^2}$ (d) $\frac{1}{a^2}-\frac{1}{b^2}=\frac{1}{r^2}$

19. The sum of focal distances of a point on the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is **(2012-II)**
(a) 4 unit (b) 6 units (c) 8 units (d) 10 units

20. The difference of focal distances of any point on a hyperbola is equal to **(2013-I)**
(a) latus rectum (b) semi-transverse axis
(c) transverse axis (d) semi-latus rectum

For the next two (02) items that follows: Consider the circles $x^2+y^2+2ax+c=0$ and $x^2+y^2+2by+c=0$ **(2014-II)**

21. What is the distance between the centres of the two circles?
(a) $\sqrt{a^2+b^2}$ (b) a^2+b^2 (c) $a+b$ (d) $2(a+b)$

22. The two circles touch each other if
(a) $c=\sqrt{a^2+b^2}$ (b) $\frac{1}{c}=\frac{1}{a^2}+\frac{1}{b^2}$ (c) $c=\frac{1}{a^2}+\frac{1}{b^2}$ (d) $c=\frac{1}{a^2+b^2}$

23. The circle $x^2+y^2-8x+4y+4=0$ touches
(a) x-axis (b) y-axis
(c) both axis (d) neither x-axis nor y-axis

24. A straight line $x=y+2$ touches the circle $4(x^2+y^2)=r^2$. The value of r is **(2015-II)**
(a)$\sqrt{2}$ (b) $2\sqrt{2}$ (c) 2 (d) 1

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

SECTION-II(2 mark each)

SECTION-III(3 mark each)

1.Find the equation of the ellipse with major axis along the x-axis and passing through the points (4,3) and $(-1,4)$.

2. Find the equation of the hyperbola whose foci are at $(0,\pm 12)$ and the length of the latus rectum is 36.

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED

SECTION-V(5 mark each)

Chapter -12: Introduction of 3D

SECTION-I MCQ Type(1 mark each)

1 xz plane divides the join of (2,3,1) and (6,7,1) in the ratio
(a) 3 : 3 (b) 2 : 7 (c) $-3 : 7$ (d) $-2 : 7$

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

SECTION-II(2 mark each)

1. A point R with x co ordinates 4 lies on the line segment joining the points P$(2,-3,4)$ and Q(8,0,10). Find the co- ordinates of R.

2. Find the ratio in which the yz- plane divides the line joining points

A(3,5,-7) and B(-2,1,8). Also find the point of division.

3. Find the ratio in which the yz plane divides the line segment formed by joining the points (-2,4,7) and (3,-5,8)

SECTION-III(3 mark each)

1. Find the co-ordinates of the point where the line through the points A(3,4,1) & B(5,1,6) crosses the xy – plane

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED ASSESSMENT (4 MARKS)

SECTION-V(5 mark each)

Chapter -13: Limits and Derivatives

SECTION-I MCQ Type(1 mark each)

1. If $\lim_{x\to\frac{\pi}{2}} \frac{Sinx}{x} = l$ & $\lim_{x\to\infty} \frac{Cos\,x}{x} = m$ then which one of the following is correct **(2017-II)**

(a) $l = 1, m = 1$ (b) $l = \frac{\pi}{2}, m = \infty$

(c) $l = \frac{2}{\pi}, m = 0$ (d) $l = 1, m = \infty$

2. If $f(x) = \sqrt{25 - x^2}$ then what is $\underset{x\to 1}{Lt}\ \frac{f(x)-f(1)}{x-1}$? **(2015-II)**

(a) $\frac{1}{5}$ (b) $\frac{1}{24}$ (c) $\sqrt{24}$ (d) $-\frac{1}{\sqrt{24}}$

3. What is $\underset{x\to 0}{Lt}\frac{log_5(1+x)}{x}$? **(2014-II)**

(a) 1 (b) log_{5^e} (c) log_{e^5} (d) 5

4. What is $\underset{x\to 0}{\text{Lt}}\ \frac{(1+x)^n-1}{x}$? **(2014-I)**

(a) 0 (b) 1 (c) n (d) $n-1$

5. What is $\underset{x\to 0}{\text{Lt}}\ \frac{x}{\sqrt{1-Cosx}}$? **(2014-I)**

(a) $\sqrt{2}$ (b) $-\sqrt{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) *Limit does not exists*

6. What is $\underset{x\to 2}{\text{Lt}}\ \frac{2-x}{x^3-8}$? **(2013-II)**

(a) $\frac{1}{8}$ (b) $-\frac{1}{8}$ (c) $\frac{1}{12}$ (d) $-\frac{1}{12}$

7. Consider the following statements: **(2013-I)**

1. $\underset{x\to 0}{\text{Lt}}\ Sin\frac{1}{x}\ DNE$
2. $\underset{x\to 0}{\text{Lt}}\ xSin\frac{1}{x}$ exists.

Which of the above statement is / are correct?

(a) 1 *only* (b) 2 *only* (c) *both* 1 & 2 (d) *neither* 1 *nor* 2

8. $\underset{x\to 0}{\text{Lt}}\ \frac{Sin\,x-tanx}{x}$? **(2013-I)**

(a) 0 (b) 1 (c) -1 (d) $\frac{1}{2}$

9. $\underset{x\to\infty}{\text{Lt}}\left(\sqrt{a^2x^2+ax+1}-\sqrt{a^2x^2+1}\right)$? **(2011-I)**

(a) $\frac{1}{2}$ (b) 1 (c) 2 (d) 0

10. What is $\underset{x\to 0}{\text{Lt}}\ \frac{Cosax-Cosbx}{x^2}$? **(2010-II)**

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

11. What is $\underset{x\to 1}{\text{Lt}}\ \frac{(x-1)^2}{|x-1|}$? **(2010 –I)**

(a) 0 (b) 1 (c) -1 (d) limit does not exists

12. What is $\underset{x\to\infty}{\text{Lt}}\left(\frac{x+6}{x+1}\right)^{x+4}$? **(2010-I)**

(a) e (b) e^2 (c) e^4 (d) e^5

13. What is $\underset{x\to\infty}{\text{Lt}}\left(\frac{x}{3+x}\right)^{3x}$? **(2009 –II)**

(a) e (b) e^3 (c) e^{-9} (d) e^9

14. What is $\underset{x\to 0}{\text{Lt}}\frac{Sin^2 ax}{bx}$? **(2009-I)**

(a) 0 (b) $\frac{a}{b}$ (c) $\frac{a^2}{b}$ (d) DNE

15. Let $f(x)=\frac{1}{1-|1-x|}$, then what is $\underset{x\to 1}{\text{Lt}} f(x)$ **(2008-II)**

(a) 0 (b) $\propto$ (c) 1 (d) -1

16. What is $\underset{x\to\propto}{\text{Lt}}\frac{\sqrt{\propto+2x}-\sqrt{3x}}{\sqrt{3\propto+x}-2\sqrt{x}}$? (08-II)

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

17. If $\underset{x\to 0}{\text{Lt}}\ \emptyset\,(x)=a^2$ where $a\neq 0, then\ what\ is\ \underset{x\to 0}{\text{Lt}}\ \emptyset\left(\frac{x}{a}\right)$? (16-I)

(a) a^2 (b) a^{-2} (c) $-a^2$ (d) $-a$

18. If$f(x)=\frac{Sin\,(e^{x-2}-1)}{\ln(x-1)}$ then $\underset{x\to 2}{\text{Lt}} f(x)$ is **(2015-II)**

(a) -2 (b) -1 (c) 0 (d) 1

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

(d) A is false but R is true .

SECTION-II(2 mark each)

1 . Evaluate :$\lim_{x\to 0}\frac{\sin ax+bx}{ax+\sin bx}$,$(a,b\ \ and\ a+b\neq 0)$

ANS. $\lim_{x\to 0}\frac{\sin ax+bx}{ax+\sin bx}$

$= \lim_{x\to 0}\frac{ax\frac{\sin ax}{ax}+bx}{ax+bx\frac{\sin bx}{bx}}$ $\frac{1}{2}$mark

$= \lim_{x\to 0}\frac{x(a\frac{\sin ax}{ax}+b)}{x\,(a+b\frac{\sin bx}{bx})}$

$= \lim_{x\to 0}\frac{(a\frac{\sin ax}{ax}+b)}{(a+b\frac{\sin bx}{bx})}$

$=\frac{a\lim_{x\to 0}\frac{\sin ax}{ax}+\lim_{x\to 0}b}{\lim_{x\to 0}a+b\lim_{x\to 0}\frac{\sin bx}{bx}}$ $\frac{1}{2}$mark

$=\frac{a\times 1+b}{a+b\times 1}$

$=\frac{a+b}{a+b}=1$ 1mark

2. Evaluate : $\lim_{x\to\frac{\pi}{4}}\ \frac{\sin x-\cos x}{x-\frac{\pi}{4}}$

3. Evaluate : $\lim_{x\to a}\frac{x\ sin\ a-a\sin x}{x-a}$

4. Evaluate: $\lim_{x\to 0}\ \frac{cos2x-1}{cosx-1}$

5. (a) Evaluate $\lim_{x\to 0}\frac{ax+x\cos x}{b\sin x}$

(b) Using first principle, find the derivative of $f(x)=\frac{1}{x+1}$

(c) Find the derivative of $f(x)=\frac{x}{1+\tan x}$

6.Using rules of differentiation find the derivative of $f(x)=\frac{x^5-\cos x}{\sin x}$

7.Evaluate$\lim_{x\to 0}\frac{\cos 2x-1}{\cos x-1}$

SECTION-III(3 mark each)

SECTION-IV(4 mark each)

1. (a) Using first principle, find the derivative of $f(x)=\frac{1}{\sqrt{x}}$

(b) Find the derivative of $x^{-4}(3-4x^{-5})$ w.r.t. x

2. (i)Using first principle find the derivative of $f(x)=\frac{1}{x^2}$

(ii)Find the derivative of $\frac{x^3-\cos x}{\sin x}$

3.(a)Using first principle, find the derivatives of $f(x)$ =$\sqrt{x+1}$

(b) Find the derivative of $f(x) = (x + \sec x)(x - \tan x)$

SOURCE BASED/CASE BASED/PASSAGE BASED(4 marks)

SECTION-V(5 mark each)

1.If $y = \sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}}$,show that $\frac{dy}{dx} = \sec x \tan x - \sec^2 x$.

ANS :$y = \sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}}$

$$y = \sqrt{\frac{(\sec x - \tan x)(\sec x - \tan x)}{(\sec x + \tan x)(\sec x - \tan x)}}$$

$$y = \sqrt{\frac{(\sec x - \tan x)^2}{\sec^2 x - \tan^2 x}}$$

$y = (\sec x - \tan x)$

$\frac{dy}{dx} = \frac{d}{dx}\sec x - \frac{d}{dx}\tan x$

$=\sec x \tan x - \sec^2 x$

2. Find the derivative of $f(x) = x + \frac{1}{x}$ using first principle.

3. Find derivative of $f(x) = \frac{2}{x+1} - \frac{x^2}{3x-1}$

4. (a) Evaluate $\lim_{x \to 0} \frac{ax + x\cos x}{b \sin x}$

(b) Using first principle, find derivative of $f(x)$=$\frac{1}{x+1}$

(c) Find derivative of $f(x) = \frac{x}{1+\tan x}$

Chapter -15: Statistics

SECTION-I MCQ Type(1 mark each)

1. If 1+2+3+…….+n=45, then 1^3+2^3+3^3+4^3+……+n^3 is

(a) $(45)^2$ (b) $(45)^3$ (c) 3x45 (d) none of these

For the next three question items which follow: (**2010-II**)

The frequency distribution of life of 90 TV tubes whose median life is 17 months is as follow:

Life of TV tubes (in months)	Nos. of TV tubes
0 – 5	3
5 – 10	12
10 – 15	X

15 – 20	35
20 – 25	Y
25 – 30	4

2. What is the lower limit of the median class?

(a) 10 (b) 15 (c) 20 (d) 25

3. What is the missing frequency y?

(a) 20 (b) 16 (d) 15 (d) 12

4. What is the cumulative frequency of the modal class?

(a) 31 (b) 35 (c) 66

(d) Can't be determined as the given data is insufficient.

5. If the variance of n observation is σ^2 and every observation is multiplied by h then new variance is

(a)$h\sigma^2$ (b)$\frac{\sigma^2}{h}$ (c)$h^2\sigma^2$ (d)$\frac{\sigma^2}{h^2}$

6. The mean income of a group of workers is $\bar{X}$ and that of another group is $\bar{Y}$. If the number of workers in the second group is 10 times the number of workers in the first group, then the men income of combined group is

(a) $\frac{\bar{X}+10\bar{Y}}{3}$ (b) $\frac{\bar{X}+10\bar{Y}}{11}$ (c)$\frac{10\bar{X}+10\bar{Y}}{Y}$ (d) $\frac{\bar{X}+10\bar{Y}}{9}$

7. If a variable takes values 0, 1, 2, 3……n and its frequencies are 1, ${}^nc_1$, ${}^nc_2$, ${}^nc_3$,……${}^nc_n$ then mean is

(a) n (b) n+1 (c)$\frac{2^n}{n}$ (d)$\frac{n}{2}$

8. The average marks of boys in class are 52 and that of girl is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is(AIEEE-2007)

(a) 80 (b) 60 (c) 40 (d) 20

9. The mean of the numbers a, b, 8.5 and 10 is 6 and the variance is 6.80. Then which one of the following gives possible values of a and b?

(a) a=0, b=7 (b) a=5, b=2 (c) a=1, b=6 (d) a=3, b=4

10. The variance of first n natural numbers is

(a) $\frac{n^2-1}{6}$ (b) $\frac{n^2+1}{12}$ (c)$\frac{n^2-1}{12}$ (d) $\frac{n^2+1}{6}$

11. The geometric mean of three numbers was computed as 6. It is subsequently found that in their computation a number 8 was wrongly read as 12. What is the correct geometric mean?(2010-I)

(a) 4 (b) $\sqrt[3]{5}$ (c) $2\sqrt[3]{18}$ (d) none

12. The mean of the values of $1, 2, 3, \ldots \ldots n$ with respective frequencies $x, 2x, 3x, \ldots nx$ is

(a) $\frac{n}{2}$ (b) $\frac{1}{3}(2n+1)$ (c) $\frac{1}{6}(2n+1)$ (d) $\frac{n}{2}$

13. In a series of $2n$ observations, half of them equal $'a'$ and remaining half equal $' -a'$. If the standard deviation of the observation is 2, then $|a|$ is

(a) $\frac{1}{n}$ (b) $\sqrt{2}$ (c) 2 (d) $\frac{\sqrt{2}}{n}$

14. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class in 72, then what is the average of the girls?

(a) 73 (b) 65 (c) 68 (d) 74

15. What is the G.M. of the ratios of corresponding terms of two series where $G_1 \& G_2$ are G.Ms of the two series?

(a) $\log G_1 - \log G_2$ (b) $\log G_1 + \log G_2$ (c) $\frac{G_1}{G_2}$ (d) $G_1 G_2$

16. The standard deviation of 7, 9, 11, 13, 15 is

(a) 2.4 (b) 2.5 (c) 2.7 (d) 2.8

17. The mean of five numbers is 0 and their variance is 2. If three of those numbers are -1, 1 and 2, then the other two numbers are

(a) -5 and 3 (b) -4 and 2 (c) -3 and 1 (d) -2 and 0

18. The variance of 6, 8, 10, 12, 14 is

(a) 1 (b) 8 (c) 12 (d) 16

19. In a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately**(AIEEE-2005**)

(a) 20.5 (b) 22.0 (c) 24.0 (d) 25.5

20. What is the arithmetic mean of the series ${}^nC_0, {}^nC_1, {}^nC_2, \ldots\ldots {}^nC_n$? (**2006-I**)

(a) $\frac{2^n}{n}$ (b) $\frac{2^n}{n+1}$ (c) $\frac{2^{n+1}}{n}$ (d) $\frac{2^{n+1}}{n+1}$

21. A set of n values $x_1, x_2 x_3 \ldots \ldots \ldots x_n$ has standard deviation σ. What is the S.D of n values $x_1 + k, x_2 + k, x_3 + k \ldots \ldots, x_n + k$? (**2010-II)**

(a) σ (b) $\sigma + k$ (c) $\sigma - k$ (d) $k\sigma$

22. In a series of 2n observations, half of them equals 'a' and remaining half equal – a. If the standard deviation of the observations is 2, then |a| equals**(AIEEE-2004**)

(a) 1/n (b) $\sqrt{2}$ (c) 2 (d) $\frac{\sqrt{2}}{n}$

23. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

(**AIEEE-2003**)

(a) is increased by 2 (b) is decreased by 2
(c) is two times the original median (d) remains the same as that of the original set

24. The S.D of 15 items is 6 and if each item is decreased by 1, the S.D will be
(a) 5 (b) 7 (c) $\frac{91}{15}$ (d) 6

25. The variance of 20 observations is 5. If each observation is multiplied by 2, then what is the new variance of the resulting observations? (**2014-II**)
(a) 5 (b) 10 (c) 20 (d) 40

26. What is the mean of the squares of the first 20 natural numbers? (**2014-I**)
(a) 151.5 (b) 143.5 (c) 65 (d) 72

27. Variance is always independent of the change of**(2013-I**)

(a) origin but not scale(b) Scale only (c) both origin and scale (d) None

28. The root mean square deviation is least when deviations are measured from

(a) mean (b) mode (c) median (d) origin

29. The standard deviation of the set of first n natural number is

(a) $\frac{\sqrt{n^2-1}}{4n}$ (b) $\frac{\sqrt{n^2+1}}{4n}$ (c) $\frac{\sqrt{n^2+1}}{2n}$ (d) $\sqrt{\frac{n^2-1}{12}}$

30. If all the natural numbers from 1 to 20 are multiplied by 3 then what is the vaiance of the resulting series ?**(2019-I**)

(a) 99.75 (b)199.75 (c) 299.25 (d) 399.25

31. The standard deviation of the numbers 31, 32, 33, …….. 46, 47 is

(a) $\sqrt{\frac{17}{12}}$ (b) $\sqrt{\frac{47^2-1}{12}}$ (c) $2\sqrt{6}$ (d) $4\sqrt{3}$

32. The standard deviation of a distribution is 30 and each item is raised by 3, then new S.D is

(a) 32 (b) 28 (c) 27 (d) $None$

33. The variance of numbers $x_1, x_2, \ldots\ldots x_n$ is V. Consider the following statements.

(1) If every x_i is increased by 2, the variance of the new set of numbers is V.

(2) If the numbers x_i is squared, the variance of the new set is V^2.

Which of the following statements is / are correct?(**2014-I**)

(a) 1 only (b)2 only (c)both 1 & 2 (d)Neither 1 nor 2

34. If the variance of the data 2, 4, 5, 6, 17 is V, then what is the variance of the data 4, 8, 10, 12, 34? (**2011-II**)
(a) V (b) 4V (c) V^2 (d) 2V

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

SECTION-II(2 mark each)

SECTION-III(3 mark each)

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED

SECTION-V(5 mark each)

1. Calculate mean, variance and standard deviation for the following distribution:-

Classes	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

2. The mean and standard deviation of 100 observations were calculated as 40 and 5.1 respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct mean and standard deviation?

3. Calculate the mean and variance for the following frequency distribution:

Class interval	0 – 30	30 – 60	60 – 90	90 – 120	120 – 150	150 – 180	180 - 210
frequency	2	3	5	10	3	5	2

Chapter -16: Probability

SECTION-I(1 MARK EACH)

MCQ Type

1. Two balls are selected from a box containing 2 blue and 7 red balls. What is the probability that at least one ball is blue? **(2010-I)**

(a) 2/9 (b) 7/9 (c) 5/12 (d) 7/12

2.What is the probability of having 53 Sundays or 53 Mondays in a leap year? (2010-II)

(a) $\frac{2}{7}$ (b) $\frac{3}{7}$ (c) $\frac{4}{7}$ (d) $\frac{5}{7}$

3.A die is thrown. Let A be the event that the number obtained is greater than 3. Let B be the event that the number obtained is less than 5. Then $P(A \cup B)$ is (AIEEE-2008)

(a) $\frac{3}{5}$ (b) 1 (c) 0 (d) $\frac{2}{5}$

4.A bag contains 3 red, 4 white and 5 blue balls. All balls are different. Two balls are drawn at random. The probability that they are different colour is

(a) $\frac{47}{66}$ (b) $\frac{10}{33}$ (c) $\frac{5}{22}$ (d) none

5. The probability that in the toss of two dice, we obtain the sum 7 or 11 is

(a) $\frac{1}{6}$ (b) $\frac{1}{18}$ (c) $\frac{2}{9}$ (d) $\frac{23}{108}$

6. From a pack of 52 cards two cards are drawn in succession one by one without replacement. The probability that both are aces is

(a) $\frac{2}{13}$ (b) $\frac{1}{51}$ (c) $\frac{1}{221}$ (d) $\frac{2}{21}$

7. If $P(A \cup B) = 0.8 \quad \& P(A \cap B) = 0.3, \quad$ then $P(A') + P(B')$ is

(a) 0.3 (b) 0.5 (c) 0.7 (d) 0.9

8. If A and B are events such that $P(A \cup B) = \frac{3}{4}, \quad P(A \cap B) = \frac{1}{4}$, $P(\bar{A}) = \frac{2}{3} then P(\bar{A} \cap B)$ is**(AIEEE-2002)**

(a) 5/12 (b) 3/8 (c) 5/8 (d) 1/4

9. If $P(A) = P(B) = x$ and $P(A \cap B) = P(A' \cap B') = \frac{1}{3}$ then x is

(a)½ (b) ¼ (c) 1/3 (d) 1/6

10. Three identical dice are rolled. The probability that the same number will appear on each of them is

(a)1/6 (b) 1/36 (c) 1/18 (d) 3/28

11. A card is drawn at random from a well shuffled pack of 52 cards. The probability of getting a heart or a diamond is

(a)1/26 (b) 1/2 (c) 3/13 (d) 1

12. If $A \& B$ are two events such that $P(A \cup B) = \frac{3}{4}, P(A \cap B) = \frac{1}{4}, \& P(A') = \frac{2}{3}$ then what is $P(B)$?

(a)1/3 (b) 2/3 (c) 1/9 (d) 2/9

13. Two uniform dice marked 1 to 6 are tossed together. The probability of the total 7 in a single through is

(a) 5/36 (b) 1/12 (c) 1/8 (d) 1/6

14. The probability of having a king and a queen when the two cards are drawn at random from a pack of 52 cards is

(a) 16/663 (b) 8/663 (c) 4/663 (d) 2/663

15. What is the probability that in a family of 4 children there will be at least one boy?

(a) $\frac{15}{16}$ (b) $\frac{3}{8}$ (c) $\frac{1}{6}$ (d) $\frac{7}{8}$

16. In tossing three coins at a time, what is the probability of getting at most one head?

(a) $\frac{3}{8}$ (b) $\frac{7}{8}$ (c) $\frac{1}{2}$ (d) $\frac{1}{8}$

17. If A & B are two events such that $P(A \cup B) = \frac{5}{6}$, $P(A \cap B) = \frac{1}{3}$, $P(\overline{B}) = \frac{1}{2}$

then what is $P(\overline{A})$?

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{1}{2}$

18. If A and B are mutually exclusive events such that P(A) = 0.25, P(B) = 0.4, then P ($A^c \cap B^c$) is

(a) 0.45 (b) 0.55 (c) 0.9 (d) 0.35

19. If *A*&*B* are two mutually exclusive and exhaustive events with *P*(*B*)=3*P*(*A*), then what is the value of $P(\overline{B})$? (**2009-I**)

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$

20. What is the probability that a non-leap year has 53 Sundays is

(a) 1/7 (b) 2/7 (c) 3/7 (d) 4/7

21. A bag contains 6 white & 4 black balls. Two balls are drawn at random. The probability that they are of same colour is

(a) $\frac{1}{15}$ (b) $\frac{2}{15}$ (c) $\frac{4}{15}$ (d) $\frac{7}{15}$

22. What is the probability of two persons being born on the same day (ignoring date) ?(**2008-I**)

(a) $\frac{1}{49}$ (b) $\frac{1}{365}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

23. What is the number of outcomes when a coin is tossed and then a die is rolled only in case a head is shown on the coin? (**2013-II**)

(a) 6 (b) 7 (c) 8 (d) none

24. What is the number of outcomes when a coin is tossed and then a die is rolled only in case a head is shown on the coin ?(**2013-II**)
(a) 6 (b) 7 (c) 8 (d) none

25. Two dices are thrown simultaneously. What is the probability of obtaining a total score less than 11?
(a) $\frac{1}{12}$ (b) $\frac{11}{12}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

ASSERTION-REASON BASED QUESTIONS

In the following questions ,a statement of assertion (A) is followed by a statement of Reason (R) . Choose the correct answer out of the following choices .

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false .

SECTION-II(2 mark each)

1. If E and F are events such that P(E)=¼, P(F) = ½ and P(E and F)=$\frac{1}{8}$, find

(i) P(E or F) (ii) P(not E and not F)

ANS.(i) P(E or F)
= P(EUF)
= P(E) + P(F) – P(E∩F)
= $\frac{1}{4}+\frac{1}{2}-\frac{1}{8}$
= $\frac{2+4-1}{8}=\frac{5}{8}$ 1 mark
(ii) P (not E and not F)
=P(E'∩F')
=P(EUF)'
= 1-P(EUF)
= 1-$\frac{5}{8}$
= $\frac{3}{8}$ 1 mark

2. 4 cards are drawn from a well-shuffled deck of 52 cards. What is the probability of obtaining 3 diamonds and one spade ?

3. An experiment consists of rolling a die and then tossing a coin once if the number on the die is even. If the number on the die is odd, the coin is tossed twice. Write the sample space for this experiment.

4. A couple decided to have only two children and no more

(a) Find the probability that out of the two children, one will be a boy and the other will be a girl.

(b) Find the probability that both the children will be girls.

5.A and B are two events such that P(A∪ B)= $\frac{3}{4}$, $P(A \cap B) = \frac{1}{4}$

$and\ \ P(\overline{A}) = \frac{2}{3}\ \ find\ P(B).$

6. Given P(A) = $\frac{3}{5}$ and P(B) = $\frac{1}{5}$. Find P(A or B), if A and B are mutually exclusive events.

7. A and B are events such that P(A) = 0.42, P(B) = 0.48 and P(A and B) = 0.16. Determine (i) P(not A), (ii) P(not B).

SECTION-III(3 mark each)

1. The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1 If the probability of passing the English examination is 0.75,what is the probability of passing the Hindi examination?

2. A box contains 10 red marbles, 20 blue marbles and 30 green marbles. 5 marbles are drawn from the box. Find the probability for at least one green
3. Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains at least 3 kings.
4. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that
   (a) Both Anil and Ashima will not qualify the exam.
   (b) At least one of them will not qualify the exam.
   (c) Only one of them will qualify the exam.

SECTION-IV(4 mark each)

SOURCE BASED/CASE BASED/PASSAGE BASED

1.Mr X joined a gambling with a fair coin .The coin to be tossed four times and there will be a gain of Re1 for each head and lose of Rs1.50 for each tail turn up.

(i) What is the total number of possible outcomes?

(a) 16 (b)8 (c) 4 (d) infinite.

(ii) What is the probability of four tail to turn up?

(a) $\frac{1}{4}$ (b)$\frac{1}{8}$ (c)$\frac{1}{16}$ (d)1

(iii) The probability of getting at least one heads is

(a)0 (b)$\frac{15}{16}$ (c)$\frac{1}{16}$ (d)$\frac{1}{4}$

(iv)The probability that MrX wins Rs4 is

(a)1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d)$\frac{1}{16}$

(v) The probability that MrX loses Rs6 is

(a)$\frac{1}{16}$ (b)0 (c)1 (d)$\frac{1}{4}$

ANS .1.(i) (a) (ii) (c) (iii)(b) (iv) (d) (v)(a) 4 mark

2. On her vacations Veena visits four cities (A, B, C and D) in a random order. What is the probability that she visits

(i) A before B?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

(ii) A before B and B before C?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

(iii) A first and B last ?

(a) $\frac{1}{2}$ (b) $\frac{1}{12}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

(iv) A either first or second ?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

(v) A just before B?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

ANS .2. (i) (a) (ii) (d) (iii) (b) (iv) (a) (v) (c) 4 mark

3.Two friends Salam and Rohan are appearing for a competitive examination .The probability that Salam will qualify the examination is 0.2, Rohan will qualify the examination is 0.1 and the probability that will qualify the examination is 0.05.

Answer the following questions ,based on this data :

(i) Find the probability that at least one of them will qualify the examination.

Ans: 0.25

(ii) Find the probability that both will qualify the examination.

Ans: 0.75

(iii) Find the probability that only one of them will qualify the examination.

Ans: 0.2

4. Sneha is a Human Resource Manager in a multi -national company. For post of two data analyst ,she has applications of 3 men and 2 women.

Answer the following questions ,based on this data :

(i) What will be the probability that only one man will be selected ?

Ans: $\frac{3}{5}$

(ii) What will be the probability that no man will be selected ?

Ans: $\frac{1}{10}$

(iii) What will be the probability that both man will be selected ?

Ans: $\frac{3}{10}$

SECTION-V(5 mark each)

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SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

PHYSICS

SAINIK SCHOOL IMPHAL
WINTER BREAK ASSIGNMENT
CLASS: XI
SUBJECT: PHYSICS

There are 248 questions in this assignment. Solve all the questions in A4 size paper.

1. The weight of a body is 9.8 $kgms^{-2}$. Its mass is
(a) zero (b) 9.8 kg (c) 10 kg (d) 1 kg

2. Consider two hollow glass spheres, one containing water and the other containing mercury. Each liquid fills about one-tenth of the volume of the sphere. In zero gravity environment
(a) water and mercury float freely inside the sphere
(b) water forms a layer on the glass, while mercury floats
(c) mercury forms a layer on the glass, while water floats
(d) water and mercury both form a layer on the glass

3. Consider the following statements:
A body weighs less at the equator than at the poles because
1. earth rotates about its axis.
2. the ice cap at the poles increases gravitational pull.
3. equatorial diameter is greater than the polar diameter.
4. of some unknown facts.

Which of the statements given above is/are correct?
(a) 1 and 2 (b) 3 only (c) 1 and 3 (d) 4 only

4. Consider the following statements with reference to observation made by an astronaut on the surface of moon :
1. The astronaut finds that a simple pendulum continues to oscillate for a much longer time than that on the earth.
2. No atmosphere exists there.

Which of the statements given above is/are correct?
(a) Only 1 (b) Only 2 (c) Both 1 and 2 (d) Neither 1 nor 2

5. How does the weight of body vary while moving from earth to the moon?
(a) It gradually decreases till it reaches the moon surface.
(b) It gradually increases till it reaches the moon surface.
(c) First it gradually decreases to zero value and then increases till it reaches the moon surface.
(d) First it gradually increases to zero value and then decreases till it reaches the moon surface.

6. Consider the following statements?
1. The gravitational force exerted by the sun on the moon is greater than the gravitational force exerted by the earth on the moon.
2. A heavy body tails at a faster rate than a light body in vacuum.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only (c) Both 1 and 2 (d) Neither 1 nor 2

7. A body attached to a spring balance weighs 10 kg on the Earth. The body attached to the same spring balance is taken to a planet where gravity is half that of the Earth. The balance will read
(a) 20kg (b) 10 kg (c) 5 kg (d) 2-5 kg

8. Which one of the following statements is true for the relation $= \frac{Gm_1m_2}{r^2}$?
(All symbols have their usual meanings)

(a) The quantity G depends on the local value of g, acceleration due to gravity.
(b) The quantity G is greatest at the surface of the earth.
(c) The quantity G is used only when earth is one of the two masses
(d) The quantity G is a universal constant

9. Which one of the following statements about a satellite orbiting around the Earth is correct ?
(a) Satellite is kept in orbit by remote control from ground station.
(b) Satellite is kept in orbit by retro-rocket and solar energy keeps it moving around the Earth.
(c) Satellite requires energy from solar panels and solid fuels for orbiting.
(d) Satellite does not require any energy for orbiting.

10. Which one of the following is an example of the force of gravity of the earth acting on a vibrating pendulum bob?
(a) Applied force (b) Frictional force (c) Restoring force (d) Virtual force.

11. Which one of the following is about gravitational force is NOT correct?
(a) It is experienced by all bodies in the universe.
(b) It is a dominant force between celestial bodies.
(c) It is negligible force for atoms.
(d) It is same for all pairs of bodies in our universe.

12. Which one of the following statements about the mass of a body is correct?
(a) It changes from one place to another. (b) It is same everywhere
(c) it depends on its shape (d) It does not depend on its temperature

13. This question consists of two statements, Statement I and Statement II. You are to examine these items using the code given below:
Code:
(a) Both the statements are individually true and Statement II is correct explanation of Statement I.
(b) Both the statements are individually true but Statement II is not the correct explanation of Statement I.
(c) Statement I is true but Statement II is false.
(d) Statement I is false but Statement II is true.
Statement I:
The acceleration due to gravity decreases with increases in height from the surface of Earth.
Statement II:
The acceleration due to gravity is inversely proportional to the square of the distance from the centre of Earth.

14. Planet A has double the radius than that of planet B. If the mass of the planet A is 4 times heavier than the mass of planet B, which of the following statements regarding weight of an object is correct?
(a) Heavier on planet A than on planet B (b) Heavier on planet B than on planet A
(c) Same on both the planets (d) Cannot be measured on planet B.

15. The free fall acceleration g increases as one proceeds, at sea level, from the equator towards pole. The reason is
(a) Earth is sphere with same density everywhere
(b) Earth is sphere with different density at the polar regions than in the equatorial regions.
(c) Earth is approximately ellipsoid having its equatorial radius greater than its polar radius by 21 km
(d) Earth is approximately ellipsoid having its equatorial radius smaller than its polar radius by 21 km.

16. Which one of the following statements is correct?
(a) The measurement of mass taken by a spring weighing balance is correct at the place where the spring balance is calibrated for
(b) The measurement of mass taken by a spring weighing balance is correct at all places

(c) The measurement of mass taken by a spring weighing balance is correct at places where the acceleration due to gravity is same with the place where the spring balance is calibrated for
(d) A spring balance cannot be used for measure of mass at any place.

17. A planet has a mass M_1, and radius R_1. The value of acceleration due to gravity on its surface is g_1. There is another planet 2, whose mass and radius both are two times that of the first planet. Which one of the following is the acceleration due to gravity on the surface of planet 2?
(a) g_1 (b) $2g_1$ (c) $\frac{g_1}{2}$ (d) $\frac{g_1}{4}$

18. 'Black hole' is a
(A) huge black star which has zero acceleration due to gravity on its surface
(B) star which has moderate acceleration due to gravity on its surface
(C) star which has collapsed into itself and has large acceleration due to gravity on its surface
(D) star which has collapsed into itself and has zero acceleration due to gravity on its surface

19. LIGO stands for
(A) Laser interferometer Gravitational wave observatory
(B) Light interferometer Gravitation wave observatory
(C) Light induced Gravity observatory
(D) Laser induced Gaseous optics

20. Suppose there are two planets, 1 and 2, having the same density but their radii arerR_1 and R_2 respectively, where $R_1 > R_2$. The accelerations due to gravity on the surface of these planet are related as (A) $g_1 > g_2$ (B) $g_1 < g_2$ (C $g_1 = g_2$ (D) Can't say anything

21. Inhabitants are unaware of the speed of rotation of the planet Earth because
1.The angular velocity is constant for each place on the Earth's surface
2.The atmosphere rotates with the Earth
3.There are no nearby objects, either stationary or moving at a rate different from that of the earth
Which of the above is/are the correct explanation(s)?
(a) 1 only (b) 1 and 2 only (c) 2 and 3 only (d) 1, 2 and 3

22. An astronaut whose weight on the Earth is 600 N experiences weightless ness on International Space Station orbiting around the Earth. It means that
(a) acceleration of the astronaut is Zero
(b) normal reaction of the space station floor on the astronaut is Zero
(c) gravitational pull of earth on the astronaut is zero
(d) space station applies a centrifugal force on the astronaut

75. The masses of two planets are in the ratio of 1:7. The ratio between their diameters is 2:1. The ratio of forces which they exert on each other is
(a) 1:7 (b) 7:1 (c) 1:1 (d) 2:1

76. When oil floats on water, the surface tension of water
(a) vanishes immediately (b) decreases considerably
(c) increases considerably (d) remains unaffected

77. The density of cast iron having specific gravity 7.20 is
(a) 7.20 kg/m^3 (b) 720 kg/m^3 (c) 72 kg/m^3 (d) 7200 kg/m^3

78. A vessel contains oil of density 0.8 gm/cm3 over mercury of density 13.6 gm/cm3. A homogeneous sphere floats with half of its volume immersed in mercury and the other half in oil. The density of the material of the sphere in CGS unit is
(a) 3.3 (b) 6.4 (c) 7.2 (d) 12.8

79. A vessel contains oil density ρ_1 over a liquid of density ρ_2;a homogeneous sphere of volume V floats with half of its volume immersed in the liquid and the other half m oil. The weight of the sphere is
(a) V(ρ_2 - ρ_1)/2 (b) V(ρ_2 + ρ_1)g/2 (c) V(ρ_2 + ρ_1) (d) V(ρ_2 + ρ_1)/2

80. What is the mass of one litre of cottonseed oil of density 926 kg/m3?
(a) 926 kg (b) 92.6 kg (c) 0.926 kg (d) 9260 kg

81. Let us assume that air density (0.0013 gm/cm3) remains constant as we go up in the atmosphere. In such a hypothetical case, what is the approximate height of atmosphere to have 1 atmospheric pressure?
(a) 4 km (b) 8 km (c) 40 km (d) 80 km

82. Consider the following statements:
An external pressure Po is applied to the surface of a liquid in a container. Then,
1. the pressure on all side-walls increases by Po.
2. the pressure on the bottom wall increases by Po.
3. the pressure at all points inside the liquid increases by Po.

Which of the statements given above are correct?
(a) 1, 2 and 3 (b) I and 2 only (c) 1 and 3 only (d) 2 and 3 only

83. Consider the following statements:
The fraction of a ball floating inside the liquid depends upon -
1. density of the liquid.
2. mass of the ball.
3. density of the ball.

Which of the statements given above are correct?
(a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2 and 3

84. When water is heated from O°C to 20°C, how does its volume change?
(a) It shall increase (b) It shall decrease
(c) It shall first increase and then decrease (d) It shall first decrease and then increase

95. A cylinder of mass m and radius R floats vertically in a liquid of density d. What is the height of the submerged region?
(a) $\frac{m}{\pi R^2 d}$ (b) $\sqrt{\frac{m}{\pi R^2 d}}$ (c) $\frac{m}{\pi R^2 d}$ (d) $\frac{R}{2}$

96. A block of ice is floating in a beaker containing liquid of specific gravity greater than one. When ice melts completely, what happens to the level of liquid in the beaker?
(a) It will remain the same as before (b) It will go down
(c) It will rise up (d) It may or may not change depending upon size of beaker

97. A solid cube of iron (specific gravity=8) is melted into sheets. The side of the cube is I m. The sheets are used to make a hollow cube. This cube floats such that its whole volume is inside water. What should be the minimum length of side of such a cube?
(a) 2.0 m (b) 2.5 m (c) 2.75 m (d) 3.0 m

98. Consider the following statements:
If there were no capillarity.
1. it would be impossible to use a kerosene 1amp
2. one would not be able to use a straw to consume a soft drink.
3. the blotting paper would fail to function.
4. there would have been no plants on the earth. Which of the statements given above are correct?

(a) 1, 2 and 4 only (b) 1, 3 and 4 only (c) 2 and 3 only (d) 1, 2, 3 and 4

99. The specific gravity of a substance is measured by a hydrometer at the sea level. If the measurement is done at the top of a mountain, what would be the specific gravity?
(a) Zero (b) More than that measured at the sea level
(c) Less than that measured at the sea level (d) Same as that measured at the sea level.

Codes : (for 100 & 101)
(a) Both A and R are individually true and R is the correct explanation of A.
(b) Both A and R are individually true but R is not the correct explanation of A.
(c) A is true but r is false
(d) A is false but R is true.

100. Assertion (A) : Diameter of one 0f the limbs of a U-tube manometer is twice that of its other limb. The limbs are open to atmosphere at their free ends. If mercury is added to the manometer, the level of mercury in the wider limb will be half of that in the narrower limb.
Reason (R) : Liquid always maintain the same level under same pressure.

101. Assertion (A) : If barometer caries water instead of mercury, the height of the column for pressure equivalent to76 cm of mercury increases.
Reason (R) : Specific heat of water is greater than that of mercury.

102. Why doesn't Archimedes' principle hold for a vessel under a free fall?
(a) The effective value of g increases
(b) The effective value of g decreases
(c) The body immersed in the vessel will become weightless
(d) The density of air increases

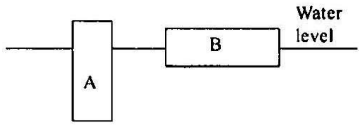
103. A block of weight W floats in a lake. If the apparent weight of the floating block is W', then which one of the following is correct?
(a) W'> W (b) W' = W/2 (c) W = W (d) W'= 0

104. Ice (specific gravity = 0.92) floats on water but sinks in ethyl alcohol (specific gravity = 0.79).In what proportion (approx.) should these liquids be mixed so that an ice cube does not sink?
(a) 62% alcohol (b) 57% alcohol
(c) 43% alcohol (d) 38% alcohol

105. When a solid object is immersed in water, there is a loss in its weight. This loss is
(a) equal to the weight of the water displaced
(b) less than the weight of the water displaced
(c) greater than the weight of the water displaced
(d) not related to the weight of the water displaced

106. For a steel boat floating on a lake, the weight of the water displaced by the boat is *(a)* less than the weight of the boat
(b) more than the weight of the boat
(c) equal to the weight of the part of the boat which is below the water level of the lake
(d) equal to the weight of the boat.

107. Two identical blocks of ice, A and B, float in water as shown in the figure given above. Which one among the following statements in this regard is correct ?
(a) Block A displaces a greater volume of water since the pressure acts on a smaller bottom area
(b) Block A displaces a greater volume of water since its submerged end is lower in the water



(c) Block B displaces a greater volume of water since its submerged end has a greater area in water
(d) The two blocks displace equal volumes of water since they have the same specific gravity and same mass

108. When a ship floats on water :
(a) it displaces no water
(b) the mass of water displaced is equal to the mass of the ship
(c) the mass of water displaced is lesser than the mass of the ship
(d) the mass of water displaced is greater than the mass of the ship

109. If some object is weighed when submerged in water, what will happen to its weight compared to its weight in air ?
(a) Increase (b) Decrease
(c) Remain exactly the same (d) Increase or decrease cannot be predicted

110. Whether an object will float or sink in a liquid, depends on
(a) mass of the object only
(b) mass of the object and density of liquid only
(c) difference in the densities of the object and the liquid
(d) mass and shape of the object only.

112. Which of the following statements about a fluid at rest in a cup is/are correct?
1. Pressure is same at all the points in the fluid.
2. Pressure is exerted on the walls.
3. Pressure exists everywhere in the fluid.
Select the correct answer using the code given below:
(a) 1 and 2 only (b) 2 and 3 only (c) 1 only (d) 1, 2 and 3

113. Which one of the following device is use to measure atmospheric pressure?
(a) Ammeter (b) Barometer (c) Potentiometer (d) Lactometer

114. Suppose we have an iron nail and iron ball of same mass. When submerged in water, the iron ball may float but the nail always sinks. This is because
(a) buoyant force on the ball is larger that of the nail due to their shapes.
(b) viscous force on the ball is higher.
(c) viscous force on the nail is higher.
(d) gravitational force affects the ball differently from the nail.

115. The temperature of water at the bottom of a lake whose upper surface has frozen to ice would be around
(a) $-10\ ^0C$ (b) $0\ ^0C$ (c) $4\ ^0C$ (d) $-4\ ^0C$

116. A balloon filled up with gas would only go up in air if it is filled up with
(a) a gas whose density is lower than air. (b) a gas whose density is higher than air
(c) cold air (d) water vapour

117. Match List I with the List II and select the correct answer using the code given bellow the list:

List I (Process)	List II (Type of changes)
A. Heating of Camphor	1. Chemical
B. Cooling of water vapour up to room temperature	2.Condensation
	3. Condensation
C. Cooling an egg	4. Sublimation
D. Formation of water vapour at room temperature	

Code:

A	B	C	D

(a)	4	3	1	2
(b)	4	1	3	2
(c)	2	1	3	4
(d)	2	3	1	4

118. Pressure is a scalar quantity because
(a) it is the ratio of force to area and both force and area are vectors
(b) it is the ratio of magnitude of force to area
(c) it is the ratio of component of force (normal to) to area
(d) none of the above

119. If we plot a graph between volume V and inverse of pressure P (i.e. $\frac{1}{P}$) for an ideal gas at constant temperature T, the curve so obtained is
(a) straight line (b) circle (c) parabola (d) hyperbola.

120. All objects experience a buoyancy when they are immersed in a liquid. Buoyancy is
(a) a downward force (b) a downward pressure (c) an upward force (d) an upward pressure

121. A wooden box of mass 2 kg and dimensions (30 cm× 15 cm×10 cm) is placed on a table with sides 30 cm and 10 cm touching the tabletop. Which one of the following is the approximate pressure exerted on the table?
(a) 111.1 N/m^2 (b) 222.2 N/m^2 (c) 333.3 N/m^2 (d) 666.6 N/m^2.

122. An object is made of two equal parts by volume; one part has density ρ_0 and the other part has density $2\rho_0$. What is the average density of the object?
(a) $3\rho_0$ (b) $\frac{3}{2}\rho_0$ (c) ρ_0 (d) $\frac{1}{2}\rho_0$

123. The volume of a sealed packet is 1 litre and its mass is 800 g. The packet is first put inside water with density $1gcm^{-3}$ and then in another liquid B with density 1.5 g cm^{-3}. Then which one of the following statements holds true?
(a) The packet will float in both water and liquid B.
(b) The packet will sink in both water and liquid B.
(c) The packet will sink in water but will float in liquid B.
(d) The packet will float in water but will sink in liquid B.

124. An iron nail sinks in water whereas an iron ship floats. Which of the following statements is correct in this regard?
1. Average density of ship is greater than that of the water
2. Average density of iron nail is greater than that of the water
3. Average density of ship is less than that of the water
4. Average density of ship is equal to that of the water

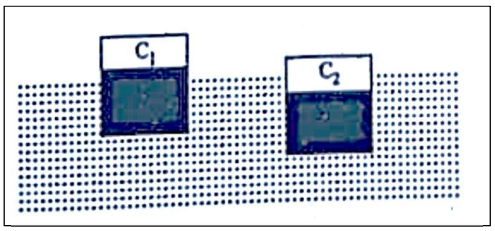
Select the correcr answer using the code given below:
(a) 1 and 2 (b) 2 and 3 (c) 2 and 4 (d) 1 and 4

125. A block of wood (dimensions: 40 cm ×20 cm ×10 cm) is kept on a tabletop in three different positions:
(a) with its side of dimensions 20 cm ×10 cm;
(b) with its side of dimensions 10 cm × 40 cm; and
(c) with its side of dimensions 40 cm × 20 cm.
The pressure exerted by the wooden block on the tabletop in these positions is
(a) $P_A > P_B > P_C$ (b) $P_A < P_B < P_C$ (c) $P_A = P_B = P_C$ (d) $P_A < P_B = P_C$

126. A pumpkin weighs 7.5 N. On sub merging it completely in water, $\frac{3}{4}$L of water gets displaced. The acceleration due to gravity at the place where the pumpkin was weighed is 10 m/s^2. Which one of the

following is the correct value of the density of the pumpkin?
(a) 10 kg/m^3 (b) 100 kg/m^3 (c) 1000 kg/m^3 (d) 10000 kg/m^3

127. Shown in the figure are two hollow cubes C_1 and C_2 of negligible mass partially filled (depicted by darkened area) with liquids of densities ρ_1 and ρ_2 respectively, floating in water (density ρ_w). The relationship between ρ_1, ρ_2 and ρ_w is



(a) $\rho_2 < \rho_w < \rho_1$ (b) $\rho_2 < \rho_2 < \rho_w$ (c) $\rho_1 < \rho_2 < \rho_w$ (d) $\rho_1 < \rho_w < \rho_2$

128. An iron nail sinks in water whereas an iron ship floats. Which of the following statements is correct in this regard?
1. Average density of ship is greater than that of the water
2. Average density of iron nail is greater than that of the water
3. Average density of ship is less than that of the water
4. Average density of ship is equal to that of the water

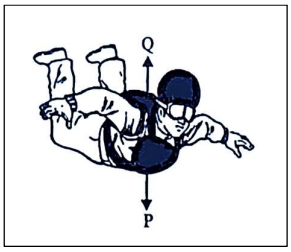
Select the correcr answer using the code given below:
(a) 1 and 2 (b) 2 and 3 (c) 2 and 4 (d) 1 and 4

129. Kinetic viscosity of a given liquid is the ratio of
(a) the coefficient of viscosity to the density (b) the coefficient of viscosity to the surface tension
(c) the density to the coefficient of viscosity (d) the surface tension to the coefficient of viscosity.

130. Flow velocities in an incompressible fluid can be measured with which one of the following?
(a) Barometer (b) Venturi tube (c) Strain gauge (d) Manometer

131. Bernoulli's principle is based on which one among the following laws?
(a) Conservation of mass (b) Conservation of momentum
(c) Conservation of angular momentum (d) Conservation of energy

132. The figure given below shows the direction of the two forces P and Ì acting on a skydiver :



Which one among the following statements is correct about the two forces?
(a) Force P is caused by the gravity and force Q is caused by the friction
(b) When the force P is bigger than the force Q, the speed of the skydiver remains the same
(c) After the parachute opens, force P remains the same while force) increases
(d) After the parachute opens, force P decreases while force Q increases

133. Along streamline flow of fluid
(a) the velocity of all fluid particles at a given instant is constant.
(b) the speed of a fluid particles remains constant.
(c) the velocity of all fluid particles crossing a given position is constant.
(d) the velocity of a fluid particle remains constant.

134. 1 gm of ice at O°C is mixed with 1 gm of steam at 100°C.After thermal equilibrium, the temperature of the mixture is
(a) O°C (b) 50°C (c) 80°C (d) 100°C

135. A fan produces a feeling of comfort during hot weather, because
(a) our body radiates more heat in air (b) fan supplies cool air
(c) conductivity of air increases (d) our perspiration evaporates rapidly

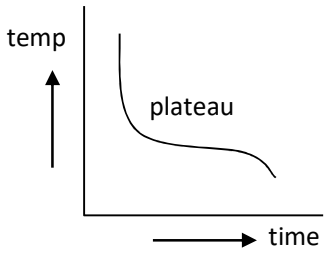
136. Which one among the following denotes the smallest temperature?
(a) l^O on the Celsius scale (b) 1^0 on the Kelvin scale
(c) l^O on the Fahrenheit scale (d) I^0 on the Reaumur scale

137. Which among the following thermometers is preferred for measuring temperature around 1250°C?
(a) Mercury thermometer (b) Constant volume gas thermometer
(c) Optical pyrometer (d) Platinum resistance thermometer

138. Which one of the following is the amount if heat given up when 20 g of steam at 100°C is condensed and cooled to 20°C?
(a) 10000 cal (b) 11400 cal (c) 12400 cal (d) 13600 cal

139. Which one of the following is the mode of heat transfer in which warm material is transported so as to displace a cooler material?
(a) Conduction only (b) Convection only (c) Radiation (d) Both conduction and convection

140. A solid is melted (above the melting point) and allowed to cool down at normal condition. Its variation of temperature as a function of time is as shown in the figure given above. What is the reason for the plateau (flat position) in the central region of the cooling curve as shown in the figure?
(a) Latent heat of fusion of the solid
(b) Specific heat of the solid
(c) Thermal conductivity of the solid
(d) Thermal capacity of the solid



141. Why do two ice blocks join to form one block when pressed together?
(a) Melting point of ice is lowered with increase in pressure.
(b) Melting point of ice increases with increase in pressure.
(c) Melting point of ice remains unchanged with increase in pressure.
(d) Melting point of ice is O°C

142. Two equal amounts of water are mixed by gently pouring both into an insulated cup. One part is initially at 90°C, and the other part is initially at T_i °C. If the final temperature of the mixture is 131°F, what is the value of T_i?
(a) 90 (b) 68 (c) 20 (d) 0

143. Two spheres of the same metal have radii in the ratio 1 : 2. Their heat capacities are in what ratio?
(a) 1 : 2 (b) 1 : 4 (c) 2 : 1 (d) 1 : 8

144. Which of the following properties are most desirable for a cooking pot?
(a) High specific heat capacity and low conductivity
(b) Low specific heat capacity and high conductivity
(c) High specific heat capacity and high conductivity
(d) Low specific heat capacity and low conductivity

145. A Centigrade thermometer and a Fahrenheit thermometer are dipped into boiling water. The temperature of water is lowered till the Fahrenheit thermometer registers half of its upper fixed point. What is the corresponding fall in temperature registered by the Centigrade thermometer?

(a) Half of its range of temperature between the upper and he lower fixed points
(b) Approximately 41°C
(c) Approximately 59°C
(d) 18°C

Codes :(146 to148)
(a) Both A and R are individually true and R is the correct explanation of A.
(b) Both A and R are individually true but R is not the correct explanation of A.
(c) A is true but r is false
(d) A is false but R is true.

146. Assertion (A) : Water gets heated quickly although it is a bad conductor of heat.
Reason (R) : Water gets heated mainly by the mode of convection.

147. Assertion (A): Ice melts at a temperature lower than 0^0C at a pressure higher than the normal pressure.
|Reason (R) : The melting point of a substance always decreases with increase in pressure.

148. Assertion (A): In the atmosphere, the air near the ground is warmer than in its upper layers.
Reason (R): The higher content of oxygen in the air near the ground absorbs a part of terrestrial radiation leading to higher temperature.

149. The thermal capacity of a substance is 5 cal/ ^{0}F. What is water equivalent of the stance?
(a) 5 gm (b) 9 gm (c) 25/9 gm (d) 5 kg

Directions: (150 to 152) The following questions consist of two statements, Statement I and Statement II. You are to examine these two statements carefully and select the answers to these items using the code given below :

Code :
(a) Both the statements are individually true and Statement II is the correct explanation of Statement I
(b) Both the statements are individually true but Statement II is not the correct explanation of Statement I
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

150. Statement I: A thermos flask is made of double-walled glass bottles.
Statement II: Metals are good conductors while gas and air are poor conductors of heat.

151. Statement I: The pitch of sound wave depends upon its frequency.
Statement II: The loudness of sound wave depends upon its amplitude.

152. Statement I: Sound wave cannot propagate in vacuum.
Statement II: Sound waves re elastic waves and requires a medium to propagate.

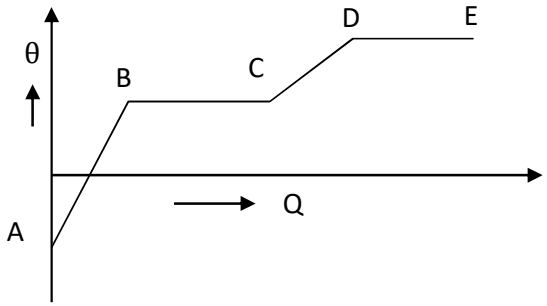
153. A glass of water does not turn into ice as it reaches 0 °C. It is because
(a) water does not solidify at 0 °C
(b) a certain amount of heat must be supplied to the glass of water so as to solidify
(c) a certain amount of heat must be taken out from the glass of water so as to solidify
(d) water solidifies at 0 K only

154. Body *A* of mass 2 kg and another body *B* of mass 4 kg and of same material are kept in the same sunshine for some interval of time. If the rise in temperature is equal for both the bodies, then which one among the following in this regard is correct?
(a) Heat absorbed by B is double because its mass is double
(b) Heat absorbed by *A* is double because its mass is half
(c) Heat absorbed by both *A* and B is equal because the quantity of heat absorbed does not

depend upon mass

(d) Heat absorbed by B is four times than the heat absorbed by *A* because the quantity of heat absorbed is proportional to square of the mass.

155. The graph given above indicates change in temperature (θ) when heat (Q) was given to a substance. Which among the following parts of the graph correctly depict the latent heat of the substance?



(a) AB and BC (b) BC and DE
(c) CD and DE (d) DE and AB

156. The thermal conductivity of copper is 4 times that of brass. Two rods of copper and brass having same length and cross-section are joined end to end. The free end of copper is at 0 °C and the free end of brass is at 100 °C. The temperature of the junction is
(a) 20 "C (b)40 °C (c) 60 °C (d)10 °C

157. Metal pipes used to carry water sometimes burst in the winter. This is because :
(a) water expands when it freezes (b) metal contracts more than water
(c) outside of the pipe contracts more than inside (d) metal expands more than water

158. The time period of a simple pendulum made using a thin copper wire of length L is T. Suppose the temperature of the room in which this simple pendulum is placed increases by 30 °C, what will be the effect on the time period of the pendulum ?
(a) T will increase slightly (b) T will remain the same
(c) T will decrease slightly (d) T will become more than 2 times

159. Which one of the following statements is NOT correct?
(a) In the conduction mode of transference of heat, the molecules of solid pass heat from one molecule to another without moving from their positions.
(b) The amount of heat required to raise the temperature of a substance is called its specific heat capacity.
(c) The process of heat transfer in liquids and gas is through convection mode.
(d) The process of heat transfer from a body at higher temperature to a body at lower temperature without heating the space between them is known as radiation.

160. The amount of heat required to change a liquid to gaseous state without any change in temperature is known as
(a) specific heat capacity (b) mechanical equivalent of heat
(c) latent heat of vapourization (d) quenching

161. A Kelvin thermometer and a Fahrenheit thermometer both give the same reading for a certain sample. What would be the corresponding reading in a Celsius thermometer ?
(a) 574 (b) 301 (c) 273 (d) 232

162. Why is it difficult to measure the coefficient of expansion of a liquid than solid?
(a) Liquids tend to evaporate at all temperatures (b) Liquids conduct more heat
(c) Liquids expand too much when heated (d) Their containers also expand when heated.

163. Water boils at a lower temperature at high altitudes, because
(a) the air pressure is less (b) outside temperature is less
(c) latent heat is less (d) None of the above

164. The statement that heat cannot flow by itself from a body at a lower temperature to a body at a higher temperature', is known as
(a) Zeroth law of thermodynamics (b) First law of thermodynamics
(c) Second law of thermodynamics (d) Third law of thermodynamics

165. Which of the following statements about specific heat of a body is/are correct?
1. It depends upon mass and shape of the body.
2. It is independent of mass and shape of the body.
3. It depends only upon the temperature of the body.
Select the correct answer using the code given below:
(a) 1 only (b) 2 and 3 (c) 1 and 3 (d) 2 only.

166. Which one of the following statements is correct?
(a) Any energy transfer that does not involve temperature difference is some way is not heat.
(b) Any energy transfer always requires a temperature difference.
(c) On heating the length and volume of the object remain exactly the same.
(d) Whenever there is a temperature difference, heat is the only way of energy transfer.

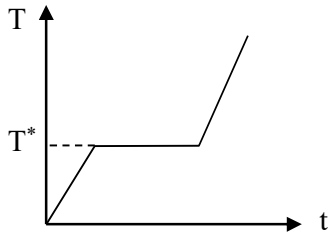
167. Thermal capacity of a body depends on the
(a) mass of the body only (b) mass and shape of the body only
(c) density of the body (d) mass, shape and temperature of the body

168. Which of the following statements about latent heat for a given substance is/are correct?
1. It is fixed at a given temperature.
2. It depends upon the temperature and volume.
3. It is independent of temperature and volume.
4. It depends on the temperature but independent of volume.
Select the correct answer using the code given bellow:
(a) 2 only (b) 1 and 3 (c) 4 only (d) 1 and 4

169. A pressure cooker works on the principle of
(a) elevation of boiling point of water by application of pressure.
(b) making the food grain softer by application of pressure.
(c) making the food grain softer by application of pressure and temperature.
(d) keeping the food grains inside steam for longer time.

170. Pressure of a gas increases due to increase of its temperature because at higher temperature
(a) gas molecules repel each other more.
(b) potential energy of the gas molecules is higher.
(c) kinetic energy of the gas molecules are higher.
(d) gas molecules attract each other more.

171. The figure given bellow shows the temperature (T) – time (t) when we start heating a piece of naphthalene.
The temperature (T^*) at the peak of the plateau of the curve signifies
(a) boiling point of naphthalene
(b) freezing point of naphthalene
(c) melting point of naphthalene
(d) the temperature when naphthalene undergoes a chemical change upon heating.



172. The pressure of an ideal gas undergoing isothermal change is increased by 10%. The volume of the gas must decreases by about
(a) 0.1 % (b) 9 % (c) 10 % (d) 0.9 %

173. The absolute zero temperature is 0 kelvin. In ^{0}C unit, which one of the following is the absolute zero temperature?
(a) 0 ^{0}C (b) -100 ^{0}C (c) -273.15 ^{0}C (d) -173.15 ^{0}C

174. The coefficient of areal expansion of a material is $1.6 \times 10^{-5}K^{-1}$. Which one of the following gives the value of coefficient of volume expansion of this material?
(a) $0.8 \times 10^{-5}K^{-1}$ (b) $2.4 \times 10^{-5}K^{-1}$ (c) $3.2 \times 10^{-5}K^{-1}$ (d) $4.8 \times 10^{-5}K^{-1}$

175. Which one of the following statements regarding thermos flask is NOT correct?
(A) The walls of flask are separated by vacuum and made of glass which is a poor conductor of heat
(B) The glass walls themselves have shiny surfaces
(C) The surface of inner wall radiates good amount of heat and the surface of outer wall absorbs some of the heat that is radiated from the inner wall
(D) The cork supports are poor conductors of heat

176. The formula for conversion between Fahrenheit and Celsius is ^0F = x + (1 · 8 × ^0C). What is factor ?
(A) 32 (B) 22 (C) 98 (D) 42

177. What is the mass of a material, whose specific heat capacity is 400 J(kg ^{0}C) for rise in temperature from 15 0C to 25 0C, when heat received is 20 kJ?
(a) 0.1 kg (b) 1 kg (c) 10 kg (d) 5kg

178. The specific latent heat of vaporization of a substance is the quantity of heat needed to change unit mass from
(a) liquid to vapour with a change of temperature
(b) liquid to vapour without a change of temperature
(c) vapour to liquid without a change of temperature
(d) vapour to liquid with change of temperature

179. Evaporation from the surface of a given liquid takes place more rapidly when
(a) the temperature is high and the surface area of the liquid is large
(b) the temperature is low and the surface area of the liquid is large
(c) the temperature is low and the surface area of the liquid is small
(d) the temperarue is high and the surface area of the liquid is small

180. A pressure cooker cooks food faster by
(a) increasing the boiling point of water (b) decreasing the boiling point of water
(c) increasing the melting point of water (d) decreasing the melting point of water

181. Which one of the following statements best defines the concept of heat?
(a) The transformation of energy from one form to another
(b) The conversion of energy into mass and vice-versa due to temperature difference
(c) The transfer of energy due to temperature difference
(d) The change in volume of a substance with temperature

182. Given below are the four cases in which certain heat transfer is taking place:
1. Ice is melting in a glass full of water
2. Water is boiling in an open container
3. A metal rod is heated in a furnace
4. A cup of coffee is allowed to cool on a table.
In which of the above cases, the Newton's Law of Cooling is applicable?
(a) l only (b) 4 only (c) 1 and 4 only (d) 1, 2 and 3

183. At which temperature does liquid water show maximum density ?
(a) 299K (b) 277 K (c) 285 K (d) 373 K

184. A stainless steel chamber contains Ar gas at a temperature T and pressure P. The total number of Ar atoms in the chamber is 'n'. Now Ar gas in the chamber is replaced by CO_2 gas and total number of CO_2 gas molecules in the chamber is $n/2$ at the same temperature. The pressure in the chamber now is P'. Which one of the following relations holds true? (Both the gases behaves as ideal gases)
(a) $P' = P$ (b) $P' = 2P$ (c) $P' = P/2$ (d) $P' = P/4$

185. When a mass m is hung on a spring, the spring stretched by 6 cm. If the loaded spring is pulled downward a little and released, then the period of vibration of the system will be
(a) 0.27 s (b) 0.35 s (c) 0.49 s (d) 0.64 s

186. For a simple pendulum in simple harmonic motion, which of the following statements is/are correct?
1. The kinetic energy is maximum at the mean position.
2. The potential energy is maximum at the mean position.
3. Acceleration is maximum at the mean position.

Select, the correct answer using the code given below:
Code :
(a) 1 only (b) 2 only (c) I and 3 (d) 2 and 3

187. A particle oscillates in one dimension about the equilibrium position subject to a force F,(x) that has an associated potential energy U(x).If k is the force constant, which one of the following relations is true?
(a) $F_x(x) = -kx^2$ (b) $F_x(x) = -kx$ (d) $U(x) = -\frac{1}{2}k.x$ (d) $U(x) = -\frac{1}{2}k^2.x$

188. When a body moves with simple harmonic motion, then the phase difference between the velocity and the acceleration is
(a) 0^0 (b) 90^0 (c) 180^0 (d) 270^0

189. Which among the following is the necessary condition for simple harmonic motion?
(a)Constant period (b)Constant acceleration
(c)Displacement and acceleration are proportional (d)Displacement and torque are proportional

190. The simple harmonic motion of a particle is given by $y = 3\,sin\,\omega t + 4\,cos\omega t$. Which one of the following is the amplitude of such motion?
(a) 1 (b) 5 (c) 7 (d) 12

191. A pendulum clock is set to give correct time at the sea level. The clock is moved to a hill station at an altitude 'h' above sea level. In order to keep correct time on the hill station which one of the following adjustments is required?
(a) The length of the pendulum has to be reduced
(b) The length of the pendulum has to be increased
(c) The mass of the pendulum has to be increased
(d) The mass of the pendulum has to be reduced

192. If the length of second's pendulum is increased by 2%, how many seconds will it lose per day?
(a) 3600 s (b) 3456 s (c) 1728 s (d) 864 s

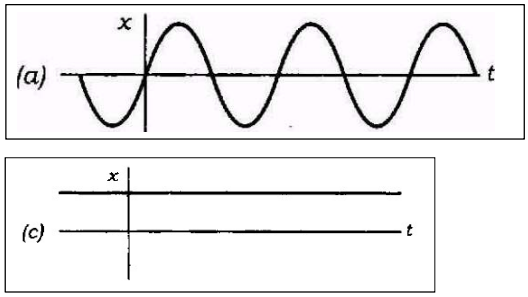
193. The time period of a simple pendulum oscillating in a laboratory at north pole is 4 s. Accounting for earth's rotation only, what will be the time period of this pendulum oscillating in a laboratory at equator?
(a) Less than 4 s (b) More than 4 s (c) Equal to 4 s (d) Infinity

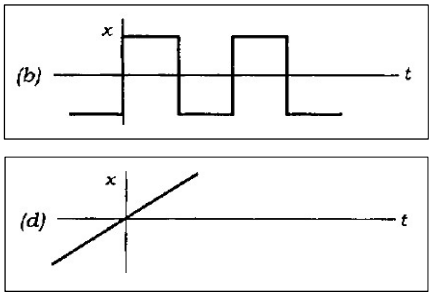
194. How does time period (T) of a seconds pendulum varies with length (l)?
(a) $T \propto \sqrt{l}$ (b) $T \propto l^2$ (c) $T \propto l$ (d) T does not depend on l.

195. Consider the following statements for a simple harmonic motion :
1. The magnitude of the velocity of the body is proportional to its displacement from the mean position.
2. The magnitude of the acceleration of the body is proportional to its displacement from the mean position.
3. The sum of the kinetic energy and potential energy of the body is always constant.

Which of the statements given above is/are correct?
(a) 1 and 3 (b) 2 and 3 (c) Only 3 (d) Only 2

196. An object is in uniform circular motion on a plane. Suppose that you measure its displacement from the centre along one direction, say, along the x-axis. Which one among the following graphs could represent this displacement *(x)* ?





197. A pendulum beats faster than a standard pendulum. In order to bring it to the standard beat, the length of the pendulum is to be :
(a) reduced (b) increased
(c) reduced and the mass of the bob increased (d) reduced and also the mass of the bob reduced

198. Which one of the following is the correct relation between frequency f and angular frequency ω?
(a) $f = \pi\omega$ (b) $\omega = 2\pi f$ (c) $f = 2\,\omega/\pi$ (d) $f = 2\pi\omega$

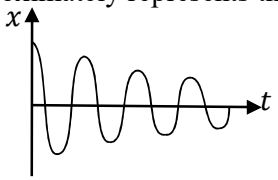
199. The following figure shows displacement versus time curve for a particle executing simple harmonic motion :
Which one of the following statements is correct?
(a) Phase of the oscillating particle is same at t=1s and t=3s
(b) Phase of the oscillating particle is same at t=2s and t=8s
(c) Phase of the oscillating particle is same at t=3s and t=7s
(d) Phase of the oscillating particle is same at t=4s and t=10s

200. If T is the time period of an oscillating pendulum, which one of the following statement is NOT correct?
(a) The motion repeats after time T only once.
(b) T is the least time after which motion repeats itself.
(c) The motion repeats itself after nT, where n is a positive integer.
(d) T remains the same only for small angular displacement.

201. Motion of a particle can be described in x-direction by $x = a\,sin\omega t$, and y-direction by $y = b\,cos\omega t$. The particle is moving on
(a) a circular path of radius 'a'. (b) a circular path of radius 'b'.
(c) an elliptical path. (d) a straight line.

202. If the length of a simple pendulum is being increased by 4 fold, time period of oscillation will be
(a) decreased by 4- fold. (b) increased y 4- fold.
(c) decreased to half of the initial value. (d) increased by a factor of 2 of its initial value.

203. The displacement (x) – time (t) graph given below approximately represents the motion of a
(a) simple pendulum placed in vacuum.
(b) simple pendulum immersed in water
(c) simple pendulum placed in outer space
(d) point mass moving in air.



204. A particle is executing simple harmonic motion. Which one of the following statements about the acceleration of the oscillating particles is true?
(a) It is always in the opposite direction of velocity
(b) It is proportional to the frequency of the oscillation
(c) It is minimum when the speed is maximum
(d) It decreases as the potential increases

205. Which one of the following four particles whose displacement 'x' and acceleration 'a_x' are related as follows, is executing simple harmonic motion?
(a) $a_x = +3x$ (b) $a_x = +3x^2$ (c) $a_x = -3x^2$ (d) $a_x = -3x$

206. A particle executes linear simple harmonic motion with amplitude of 2 cm. When the particle is at 1 cm from the mean position, the magnitudes of velocity and acceleration are equal. Then its time period (in seconds) is
(a) $\frac{2\pi}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2\pi}$ (c) $\frac{\sqrt{3}}{\pi}$ (d) $\frac{1}{2\pi\sqrt{3}}$

207. The time period of oscillation of a simple pendulum having length L and mass of bob m is given as T. If the length of the pendulum is increased to 4L and the mass of the bob is increased to 2m, then which one of the following is the new time period of oscillation?
(a) T (b) 2T (c) 4T (d) T/2

208. The frequency of an alternating current is 3 Hz. It implies that
(a) there are 6 cycles/s (b) there are 3 cycles/s
(c) there are 2 cycles/s (d) there is only 1 cycle/s

209. The time period of a 1 m long pendulum approximates to
(a) 6 s (b) 4 s (c) 2 s (d) 1 s

210. A simple pendulum having a bub of mass m and length of string *l* has time period T. If the mass of the bob is doubled and length of the string is halved, then the time period of this pendulum will be
(a) T (b) $\frac{T}{\sqrt{2}}$ (c) 2T (d) $\sqrt{2}$T

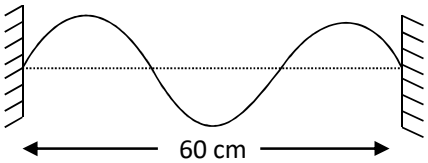
211. The audible frequency range of a human ear is
(a) 20 hertz to 200 hertz (b) 2 hertz to 20 hertz
(c) 200 hertz to 2000 hertz (d) 20 hertz to 20000 hertz

212. 'Pitch' is· a characteristic of sound that depends upon its
(a) intensity (b) frequency (c) Quality (d) none of the above

213. A sonometer wire having a length of 50 cm is vibrating m the fundamental mode with a frequency of 100 Hz. Which of the following is the type of propagating wave and its speed?
(a) Longitudinal, 50 m/s (b) Transverse, 50 m/s
(c) Longitudinal, 100 m/s (d) Transverse, 100 m/s

214. A sonometer wire having a length of 50 cm is vibrating m the fundamental mode with a frequency of 100 Hz. Which of the following is the type of propagating wave and its speed?
(a) Longitudinal, 50 m/s (b) Transverse, 50 m/s
(c) Longitudinal, 100 m/s (d) Transverse, 100 m/s

215. The standing wave pattern along a string of length 60 cm shown in the above diagram. If the speed of the transverse yes on this string is 300 m/s, in which one of the following is the string vibrating?



(a) Fundamental (b) First overtone
(c) Second overtone (d) Third overtone

216. In a sitar wire which one at the following types of vibration is produced?
(a) Progressive longitudinal (b) Stationary longitudinal
(c) Progressive transverse (d) Stationary transverse

217. Some common mediums in which speed of sound waves is measured are mentioned below
I. Air 2. Steel 3. Copper 4. Water

What is the correct increasing order of the speed of sound?
(a) 1 < 4 < 2 < 3 (b) 4 < 1 < 2 < 3 (c) 1 < 4 < 3- < 2 (d) 4 < 1 < 3 < 2

218. A man standing between two parallel hills fires a gun and hears two echoes, one 2.5 s and the other 3.5 s after the firing. If the velocity of sound is 330 ms^{-1}, how long will it take him to hear the third echo?
(a) 4 s (b) 5 s (c) 6 s (d) 8 s

219. Consider the following statements:
Sound waves can undergo
1. reflection 2. refraction 3. interference

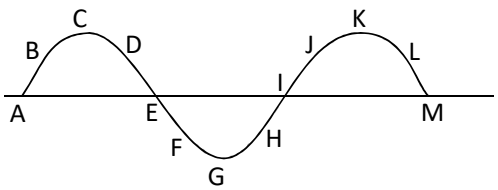
Which of the statements given above are correct?
(a) I and 2 only (b) 2 and 3 only (c) I and 3 only (d) 1, 2 and 3

220. Consider the following statements:
If the same note is played on a flute and a sitar, one can still distinguish between them because they differ in
1. frequency 2. intensity 3. quality

Which of the statements give above is/are correct?
(a) 1 and 2 only (b) 2 and 3 only (c) 3 only (d) 2 only

221. Which one of the following properties distinguishes ultrasound from normal audible sound?
(a) Intensity (b) Speed of propagation (c) Frequency (d) Quality

222. Figure given above shows the part of a long string in which transverse waves are produced.
Which pair of points is in phase?
(a) A and E (b) B and J
(c) D and J (d) C and G (ap-06)



223. Sound moves with higher velocity if:
(a) pressure of the medium is decreased (b) temperature of the medium is increased
(c) humidity of the medium is increased (d) both (b) and (c) above

224. The speed of a body that has Mach number more than 1 is
(a) supersonic (b) subsonic (c) $300 m/s$ (d) about 10 m/s

225. Which one of the following statements is not correct ?
(a) Ultrasonic waves cannot get reflected, refracted or absorbed.
(b) Ultrasonic waves are used to detect the presence of defects like cracks, porosity, etc. in the internal structure of common structure materials.

(c) Ultrasonic waves can be used for making holes in very hard materials like diamond.
(d) Ultrasonic waves cannot travel through vacuum.

226. Bats detect obstacles in their path by receiving the reflected
(a) Infrasonic waves (b) Ultrasonic waves (c) Radio waves (d) Microwaves

227. Which one of the following statements is not correct ?
(a) Ultrasonic waves cannot get reflected, refracted or absorbed.
(b) Ultrasonic waves are used to detect the presence of defects like cracks, porosity, etc. in the internal structure of common structure materials.
(c) Ultrasonic waves can be used for making holes in very hard materials like diamond.
(d) Ultrasonic waves cannot travel through vacuum.

228. Which one of the following frequency ranges is sensitive to human ears?
(a) $0 - 200$ Hz (b) $20 - 20{,}000$ Hz
(c) $200 - 20{,}000$ Hz (d) $2{,}000 - 20{,}000$ Hz only

229. Which of the following statements about electromagnetic waves, sound waves and water waves is/are correct?
1. They exhibit reflection
2. They carry energy
3. They exerts pressure
4. They can travel in vacuum
Select the correct answer using the code given below:
(a) 1, 2 and 3 (b) 2 and 4 (d) 1 and 3 (d) 1 only

230. The ceilings of a concert hall are generally curved
(a) because they reflect the sound to the audience.
(b) because they can absorb noise.
(c) to have aeration in the hall.
(d) as any sound from outside cannot pass through a curved ceiling.

231. Bats can know about their prey at a distance even in the night emitting
(a) infra-red lights. (b) ultraviolet lights
(c) chemicals from their body (d) ultrasonic sounds

231. Sound waves are similar to the waves
(a) of laser light passing through air.
(b) generated in a stretched wire by hitting or plucking the wire.
(c) generated in a pipe filled with air by moving the piston attached to the pipe up and down
(d) generated by the mobile phone tower.

232. A sound wave has frequency of 2 kHz and wavelength of 35 cm. If an observer is 1.4 km from the source, after what time interval could the observer hear the sound?
(a) 2 s (b) 20 s (c) 0.5 s (d) 4 s

233. Which one among the following waves bats use to detect the obstacles in their flying path?
(a) Infrared waves (b) Electromagnetic waves
(c) Ultrasonic waves (d) Radio waves

234. When sound waves are propagated through a medium, the physical quantity/ quantities transmitted is/are
(a) matter only (b) energy only
(c) energy and matter (d) energy, momentum and matter

235. Which one of the following statements is correct?
(a) The speed of sound waves in a medium depends upon the elastic property of the medium but not on

inertia property.
(b) The speed of sound waves in a medium depends upon the inertia property of the medium but not on elastic property.
(c) The speed of sound waves in a medium depends neither on its elastic property nor on its inertia property
(d) The speed of sound waves in a medium depends both on the elastic and inertial property of the medium

236. Which one of the following statements is not correct?
(a) Pitch of a sound is its characteristics by which we can generally differentiate between a male voice and a female voice
(b) The loudness of sound is related to its frequency
(c) A musical sound has certain well define frequencies which are generally harmonics of a fundamental frequency
(d) The timbre of a particular musical sound is related to the waveform of the sound wave

237. The frequency of ultrasound waves is
(a) less than 20 Hz (b) between 20 Hz and 2 kHz
(c) Between 2 kHz and 20 kHz (d) greater than 20 kHz

238. At 20^0C, the speed of sound in water is approximately
(A) 330 m/s (B) 800 m/s (C) 1500 m/s (D) 5000 m/s

239. Which one cannot be the unit of frequency of sound wave?
(a) dB (b) s^{-1} (c) Hz (d) min^{-1}

240. Beats is a phenomenon that occurs when frequencies of two harmonic waves are
(a) equal (b) far apart (c) multiples of each other (d) nearly same

241. Which one of the following is true for a simple harmonic oscillator?
(a) Force acting is directly proportional to the displacement and is in same direction.
(b) Force acting is directly proportional to the displacement and is in opposite direction.
(c) Acceleration of the oscillator is constant.
(d) The velocity of the oscillator is not periodic.

242. A sound wave has a frequency of 1 kHz and wavelength 50 cm. How long will it take to travel 1 km?
(a) 5 s (b) 4 s (c) 3 s (d) 2 s

243. When the pitch of sound increases, which one of the following increases?
(a) Intensity (b) Loudness (c) Wavelength (d) Frequency

244. The amplitude of sound waves is measured in the units of
(a) pressure (b) distance (c) time (d) speed

245. SONAR is a device that is used to measure the distance of underwater objects by a ship. Which of the following types of waves does it use for this purpose?
(a) Infrasonic waves (b) Sound waves in audible range for human beings
(c) Ultrasonic waves (d) ALL of the above

246. Which one of the following statements about the speed of sound waves is not correct?
(a) The speed of sound wave in steel is higher than that in water.
(b) The speed of sound waves in air decreases with increase in temperature.
(c) The speed of sound waves in air increases with increase in temperature.
(d) The speed of sound waves in water is higher than that in air.

247. The flash of lightening is seen before the thunderstorm is heard. It verifies that
(a) sound travels much faster than light

(b) light travels much faster than sound
(c) light and sound travel with same speed.
(d) intensity of flashlight is very high during thunderstorm

248. Which one of the following statements is true for sound waves propagating in air?
(a) Sound is an electromagnetic wave and traverse in nature.
(b) Sound is a mechanical wave and longitudinal in nature.
(c) Sound is a mechanical wave and transverse in nature.
(d) Sound is an electromagnetic wave and longitudinal in nature.

SAINIK SCHOOL IMPHAL

WINTER VACATION 2025-26

HOMEWORK/ASSIGNMENT

Class-XI

BIOLOGY

EXPERIMENT 10

To test the presence of urea in urine.

THEORY/PRINCIPLE

Urea is mainly excreted out of the body into urine through kidneys. An adult man normally passes out 1-1.5 L of urine per day. Its specific gravity is more than that of plasma (i.e. 1.010-1.40).

Composition Urine contains 95% water, 2% salt, 2% urea, 0.05% uric acid, traces of creatinine, creatine ammonia, etc. Urine is normally acidic, but when kept in open atmosphere, splits and ammonia is released which makes the stored urine alkaline.

Colour Pale yellow due to the pigment **urochrome** produced by the breakdown of haemoglobin.

pH Ranges from 4.5-8.2; average pH 6.0 (i.e. slightly acidic).

Odour Unpleasent; if allowed to stand for some time, it imparts strong smell like that of ammonia.

Nitrogen present in amino acids is removed as urea. Normally, a healthy adult excretes about 15 g of nitrogen per day; 95% of this is excreted as urea in urine. The amino groups of amino acids are ultimately removed as ammonia (NH_3). This NH_3 is highly toxic and is ultimately converted into urea. Urea is formed in the liver from ammonia and CO_2. Its excretion in urine is dependent on amount of protein ingested.

At optimum pH and temperature, urease enzyme decomposes urea into ammonia and carbon dioxide that forms ammonium carbonate, which is an alkaline substance. It changes the slightly acidic pH into alkaline pH. Phenol red changes the colour from yellow to pink when used as an indicator in this reaction.

Uremia

It is the presence of an excessive amount of urea in the blood. It is due to its decreased excretion.

Noticeable increase in the output of urine is called **diuresis**. Diuresis is a common symptom in patients suffering from diabetes insipidus, a disease caused due to the deficiency of ADH. In this disease, kidney tubules fail to absorb excess water from the body fluid.

The presence of urea in the urine is tested by three different tests. These are:

i. Sodium hypobromite test

Hypobromite ions are also called as alkaline bromine water (BrO^-). Bromine is in the +1 oxidation state. It is a bromine compound which is analogous to hypochlorites found in common bleaches and in immune cells.

When urine or urea tablet is treated with sodium hypobromite solution containing excess of sodium hydroxide, CO_2 and nitrogen gas are evolved. The CO_2 thus evolved reacts with NaOH and gives $NaHCO_3$ and N_2 is released. The reaction can be given as follows:

$$\underset{\text{Urea}}{(NH_2)_2CO} + \underset{\substack{\text{Sodium}\\\text{Hypobromite}}}{NaHBr} \longrightarrow CO_2 \downarrow_{+NaOH} NaHCO_3 + N_2 + NaBr + H_2$$

ii. Urease test

Urease is an enzyme which splits urea into NH_3 and CO_2, which form ammonium carbonate and the medium becomes alkaline.

Phenol red indicator detects this change which can be shown as follows:

$$\underset{\substack{\text{Urea}\\\text{(neutral)}}}{(NH_2)_2CO} \xrightarrow[Na_2CO_3]{\text{Urease}} \underset{\substack{\text{Ammonium carbonate}\\\text{(alkaline)}}}{(NH_4)_2CO_3} \xrightarrow{\text{Heating}} 2NH_3 \downarrow_{+2H_2O} 2NH_4OH + H_2CO_3$$

The enzyme urease shows its specificity for urea sample. The optimum pH (acidic) and temperature (60°C) must be maintained for the activity of the enzyme.

iii. Biuret test

The test is used for the detection of the presence of peptide bonds. It is based on the principle of reduction of Cu^{2+} to Cu^{+} ions. Copper salts in the Biuret reagent, under alkaline conditions, form purple complex with the nitrogen atoms present in the peptide bonds. This reaction is carried out at high pH and gives a violet/pink colour. The amide bond in urea is responsible for the colour production.

REQUIREMENTS

Urine sample, test tubes, test tube stand, test tube holder, spirit lamp, water, sodium hypobromite, phenol red, dilute sodium hydroxide, 2% acetic acid, urease tablet, 1% $CuSO_4$ solution and 2% Na_2CO_3 solution.

PROCEDURE AND OBSERVATIONS

1. Sodium hypobromite test

(i) Take 2 mL of urine sample in a test tube.

(ii) Add 3 to 5 drops of sodium hypobromite solution in it.

(iii) Brisk effervescence of nitrogen appears in the test tube, which indicates the presence of urea in the sample.

$$\underset{\text{Urea}}{(NH_2)_2CO} + \underset{\substack{\text{Sodium}\\\text{Hypobromite}}}{NaHBr} \longrightarrow CO_2 \downarrow_{+NaOH} NaHCO_3 + N_2 + NaBr + H_2$$

RESULT

The above tests show that the given sample of urine contains urea.

PRECAUTIONS

- The test tubes must be cleaned and dried thoroughly before use.
- Use standard reagents.
- Heating must be done carefully and by using test tube holder.
- Overheating should be avoided to prevent denaturation of enzyme.
- Required amount of reagents should be used to prevent false positive results.
- The test tubes must be washed after use.
- Fresh sample of urine should be used because if the urine is kept exposed to the atmosphere, it splits and ammonia is released.

To detect the presence of sugar in urine.

PROCEDURE

1. Benedict's test

(i) Take 0.5 mL of freshly passed urine sample in a test tube and add 5 mL of Benedict's reagent into it.

(ii) Boil the solution for 2 minutes holding the test tube firmly with a test tube holder in inclined position and keep shaking the tube continuously as the contents of the test tube have a tendency to spurt out.

(iii) Note down the colours of the precipitate.

2. Fehling's test

(i) Take equal volumes (2 mL) of Fehling's solutions A and B in a test tube and mix them well.

(ii) Add the solution prepared (i) dropwise to 1 mL of urine sample taken in another test tube.

(iii) Heat the solution for 2 minutes with continuous shaking.

(iv) Observe the colour of the precipitate.

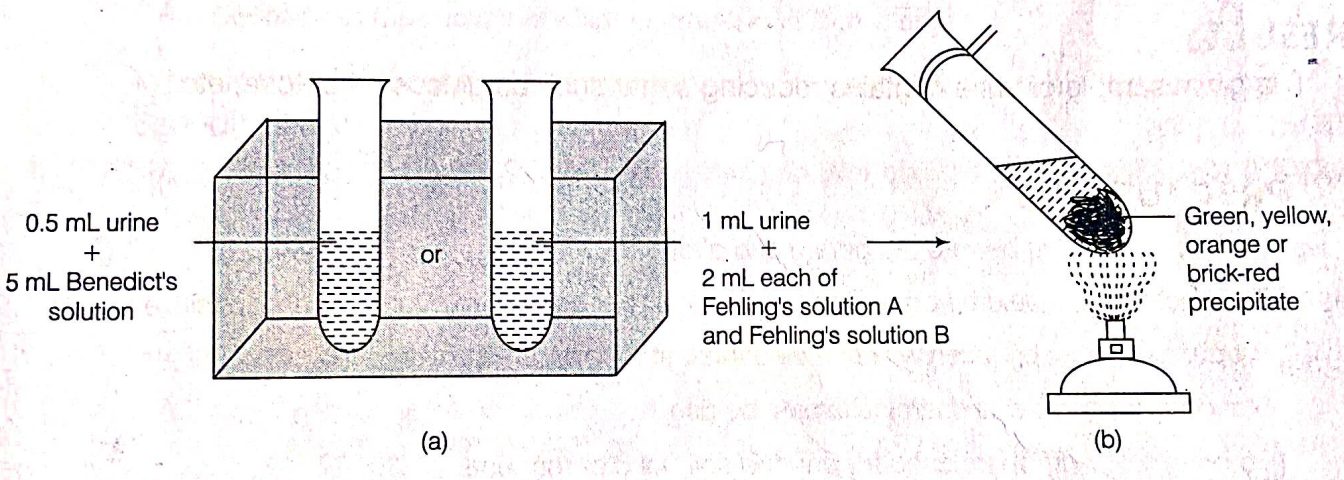


Fig. 11.1 Benedict's and Fehling's test for sugar

OBSERVATIONS

1. **Benedict's test** Green, yellow light green and brick-red coloured precipitate appears, which indicates the presence of reducing substances in urine. The various coloured precipitates depend on the concentration of reducing sugar in the urine sample as follows:

	Colour of Precipitate	% of Reducing Sugar Present
1.	Light green	0.1-0.5 (traces of glucose)
2.	Green	0.5-1.0 (moderate amount of glucose)
3.	Yellow	1.0-2.0 (moderate amount of glucose)
4.	Brick-red	above 2 (large amount of glucose)

2. **Fehling's test** A yellow or orange or brick-red coloured precipitate is formed, which indicates the presence of reducing sugars in urine.
3. **Seliwanoff's test** Presence of red or orange colour gives positive test for fructose, while appearance of faint orange or no colour gives the positive test for glucose.

RESULT

The given sample of urine contains reducing sugar such as glucose, fructose, etc.

PRECAUTIONS

The test tube must be washed before and after use.

The chemicals should be poured or used in a proper amount to avoid the false positive results.

Proper care must be taken while heating the test tube.

Standard reagents and chemicals must be used.

Do not mix the droppers used for pouring solutions or reagents.

One must use gloves, while working with the urine sample to keep themselves protected from infections.

To detect the presence of albumin in urine.

2. Nitric Acid Ring Test

(i) Take 5 mL of concentrated nitric acid in a test tube.

Note *In place of nitric acid, Robert's solution (2 g of* $MgSO_4$ *is dissolved in 10 mL of water, add 5 mL of this* $MgSO_4$ *solution in 5 mL conc.* HNO_3*) can be used. This test is also called as* ***Heller's test***.

(ii) Add the urine sample with a dropper, keeping the tube inclined, so that the urine flows down slowly along the side of the test tube to form a separate layer.

(iii) Observe any changes, and record in your notebook.

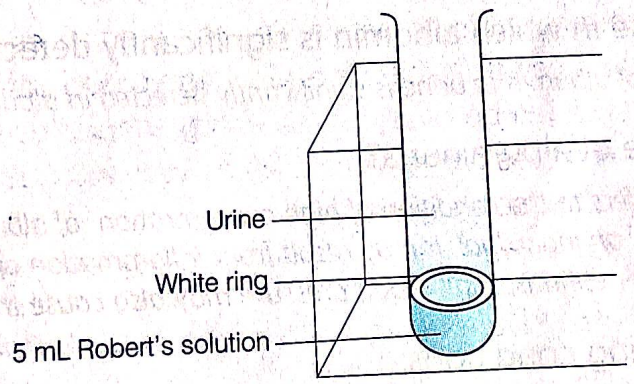


Fig. 12.2 Nitric acid ring test for presence of albumin

RESULT

The above tests confirm the presence of albumin in urine.

PRECAUTIONS

Wash the test tubes thoroughly before and after use.

Heat the contents gently, do not boil unless required.

Use standard reagents and do not waste excess of reagents or chemicals.

To detect the presence of bile salts in urine.

PROCEDURE AND OBSERVATIONS

1. Lugol's Iodine Test

(i) Take 4 mL of urine sample in a test tube.

(ii) Add 4 drops of Lugol's Iodine solution in it with the help of a dropper.

(iii) Shake the tube well.

(iv) Light to dark green colour ring indicates the presence of bile pigments, while faint yellow to brown colour indicates the absence of bile pigments.

2. Smith's Reagent Test

(i) Take 1-3 mL of Smith's reagent in a test tube. Tilt the test tube and add urine along the inner sides of the test tube.

(ii) A green coloured ring appears at the junction of the two layers. This indicates the presence of bile pigments in the urine sample.

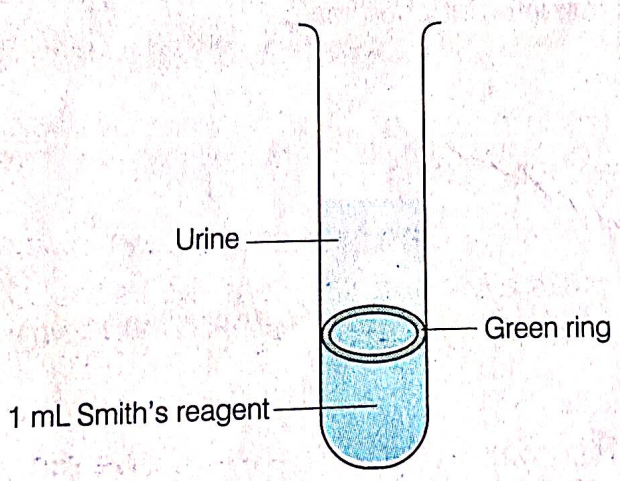


Fig. 13.1 Smith's reagent urine test for bile salts

RESULT

The above tests show the presence of bile salts in the urine sample.

PRECAUTIONS

- Urine sample taken must be fresh.
- The reagents must be prepared fresh.
- Wastage of chemicals and reagents should be avoided.
- The test tubes must be washed before and after use.
- Smith's reagent should be freshly prepared.
- Handle conc. H_2SO_4 very carefully.
- Don't mix droppers used for different chemicals.

EXPERIMENT 3

Study the characters of specimens/slides/models and their identification with reasons– Amoeba, Hydra, Liver fluke, Ascaris, Leech, Earthworm, Prawn, Silkworm, Honeybee, Snail, Starfish, Shark, Rohu, Frog, Lizard, Pigeon and Rabbit.

OBSERVATIONS

AMOEBA PROTEUS

Classification

Kingdom	–	Protista
Phylum	–	Protozoa
Class	–	Sarcodina
Order	–	Amoebida
Genus	–	*Amoeba*
Species	–	*proteus*

Identification Characteristics

1. Unicellular with irregular body shape.
2. Presence of finger-like projections (pseudopodia).
3. Presence of contractile vacuole.

General Characteristics

1. *Amoeba* are found in ponds, lakes, streams, ditches and in other places which have plenty of decaying organic matter.
2. Protoplasm is differentiated into **ectoplasm** (outer) and **endoplasm** (inner).
3. The endoplasm contains food vacuoles and a round prominent nucleus (in the centre).
4. The body of animal is covered by a soft and selectively permeable membrane called the plasma membrane.
5. It can constantly change its shape by putting forth and withdrawing small, finger-like out growths called **pseudopodia** which are the locomotory organs and also help in capturing food.
6. *Amoeba* shows holozoic mode of nutrition as it feeds on aquatic organisms like bacteria, diatoms, algae, etc. and reproduces asexually by binary fission and multiple fission.

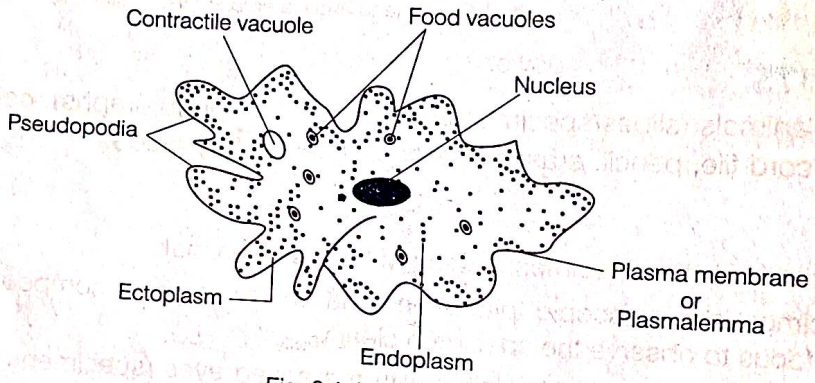


Fig. 3.1 *Amoeba proteus*

HYDRA

Classification

Kingdom	–	Animalia
Phylum	–	Cnidaria
Class	–	Hydrozoa
Order	–	Hydroida
Genus	–	*Hydra*
Species	–	*vulgaris*

Identification Characteristics

1. *Hydra* has a soft, narrow, elastic, cylindrical body which is hollow in shape. It is opened at one end and closed at another.
2. Tentacles are present at its base which help in locomotion and for capturing food.

General Characteristics

1. It is found in fresh water lakes, ponds, streams, etc. and remains either attached to the substratum or vegetation and at other times, it can be found moving in different ways like somersaulting, gliding, looping and floating.
2. Body (called **polyp**) of *Hydra* is open at one end (distal end) and closed at the other end (proximal end). Bud-like structures branch out from polyp which separate young hydra by vegetative propagation.
3. The distal end is free and has a small conical projection called oral cone or **hypostome** which has an opening called mouth.
4. The tentacles bear large number of stinging cells or **nematoblasts**, also called **cnidocytes**, for offence and defence.
5. The proximal end is flat and attached to the substratum known as **basal disc** or **foot**.
6. Body wall is **diploblastic**, i.e. made up of two layers of cells : **outer epidermis** (ectoderm) and **inner gastrodermis** (endoderm lining of central cavity). Between epidermis and gastrodermis there is a jelly-like, non-cellular layer called **mesoglea**.
7. *Hydra* reproduces asexually by budding. Gonads (testis and ovary) are seen in the middle as small bulges on the body.
8. *Hydra* is carnivorous and has power of regeneration.

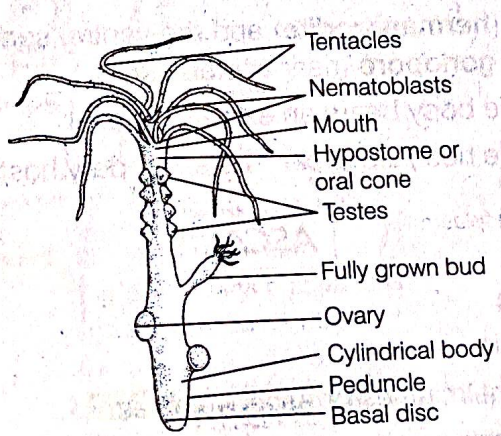


Fig. 3.2 *Hydra vulgaris*

ASCARIS

Classification

Kingdom	–	Animalia
Phylum	–	Nemathelminthes or Aschelminthes
Class	–	Nematoda
Order	–	Ascaroidea
Genus	–	*Ascaris*
Species	–	*lumbricoides*

Identification Characteristics

1. Cylindrical body that is tapering at both ends.
2. Presence of triradiate mouth.
3. Presence of penial setae in males and genital aperture in females.

General Characteristics

1. *Ascaris lumbricoides* is a common intestinal parasite of man, particularly in small children and pigs, cattle, monkey, etc. The infection occurs through contaminated food and water. This organism is commonly called as **roundworm**.
2. It has 20-40 cm long, cylindrical (5-6 mm diameter) body with no segments present on its surface.
3. A dorsal, a ventral and two lateral lines extend all along the entire length of the body of the organism.

4. The anterior or the front end of the body has a terminal **triradiate mouth** surrounded by three lips, present mid-dorsally and the rest two lips are situated ventro-laterally. A little behind anterior end, there is a small **excretory pore** which lies in mid-ventral position.
5. The animal shows **sexual dimorphism**, i.e. separate male and female individuals are found.
6. Males are smaller in size than females and in females, the genital pore and anus open separately.
7. Posterior end of male is curved having cloacal aperture with two needle-like **penial** or **copulatory setae**. While in females, genital aperture is present mid-ventrally at about one-third distance from anterior end.
8. *Ascaris* is both ammonotelic and ureotelic.

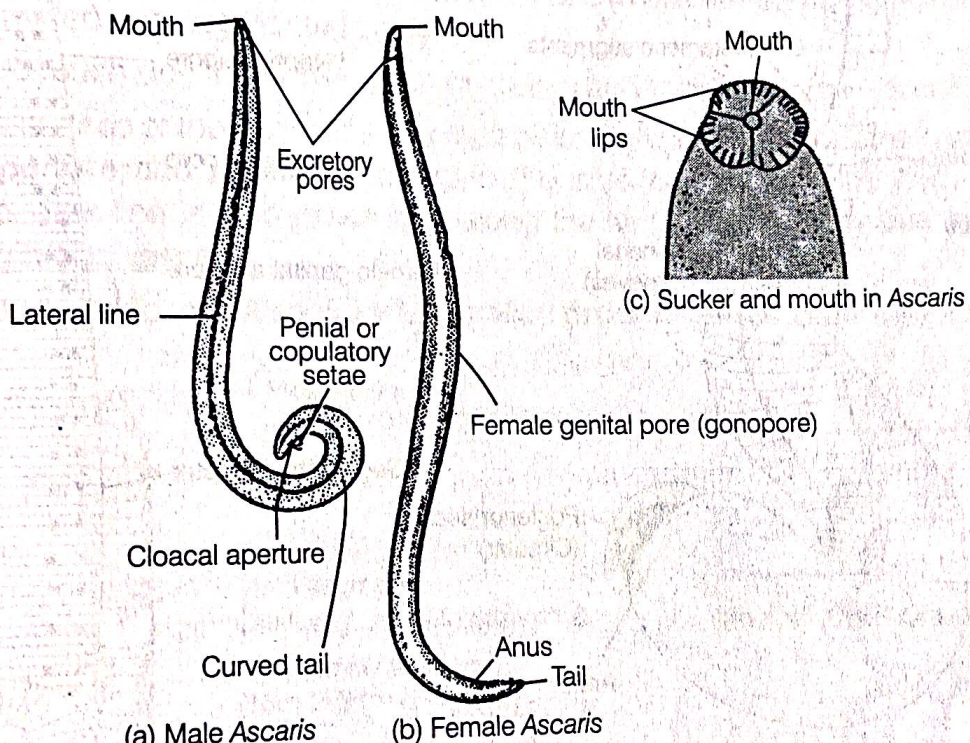


Fig. 3.4 *Ascaris lumbricoides*

APIS INDICA (HONEYBEE)

Classification

Kingdom	–	Animalia
Phylum	–	Arthropoda
Class	–	Insecta
Order	–	Hymenoptera
Genus	–	*Apis*
Species	–	*indica*

Identification Characteristics

1. Body is divisible into head, abdomen and thorax.
2. Presence of ocelli in compound eyes.
3. Presence of wax gland in sixth segment.
4. Presence of **polymorphism**.

General Characteristics

1. Honeybee is a social insect that lives in a colony. It is found in warmer environments and shows great **division of labour**. They collect nectar from flower.
2. The body is covered with thick, tough and non-living chitinous cuticle, which forms the exoskeleton.
3. Head is wide and triangular that bears a pair of antennae and a pair of **compound eyes**. The ventral side bears specialised mouthparts.
4. Thorax is divided into three segments, i.e. **anterior prothorax, middle mesothorax** and **posterior metathorax**.
5. Thorax bears three pairs of legs (one in each segment ventrally in thoracic region) and two pairs of membranous wings in metathorax region are present dorsally.
6. Abdomen is a narrow region having poisonous **sting** present behind the metathorax.
7. Honeybee produces honey, beewax and royal jelly.
8. The colony or beehive consists of **queen** (fertile female), **drones** (fertile males) and **workers** (sterile females). All these organisms can be identified by their own specific features.
   (a) **Queen** is largest in size (15-20 mm). Every colony has single queen bee. Abdomen is long and tapering. Wings, eyes and legs are small. Abdominal segment lacks wax gland.
   (b) **Drones** are larger than workers but smaller than queen. Wax gland is absent and eyes are very large.

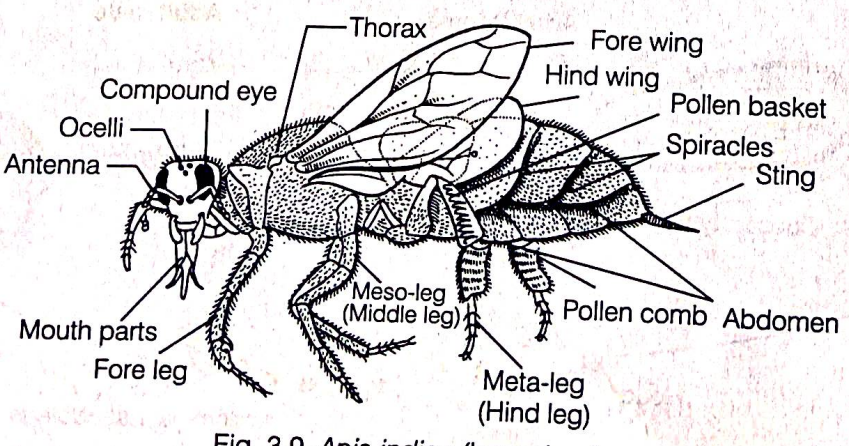


Fig. 3.9 *Apis indica* (honeybee)

ASTERIAS RUBENS (STARFISH)

Classification

Kingdom	–	Animalia
Phylum	–	Echinodermata
Class	–	Asteroidea
Order	–	Forcipulatida
Genus	–	*Asterias*
Species	–	*rubens*

Identification Characteristics

1. Star-shaped body symmetry.
2. Presence of five ambulacral grooves on the ventral surface.
3. Presence of distinct madreporite on the aboral surface.
4. Spines present all over the body.

General Characteristics

1. Starfish is an unique marine animal which is found crawling on rocky sea bottom in shallow water.
2. The whole body is covered by numerous small-sized blunt protuberances called **ossicles.**
3. Body is distinguished into **oral surface** (which is directed downward) and **aboral surface** (directed upward).
4. The oral surface bears a pentagonal mouth in the central disc.
5. Two rows of tubular projections called **tube feet** or **podia** are found on both the sides of ambulacral grooves. These help in locomotion, food capture and respiration.
6. **Aboral surface** bears large number of short and movable spines. **Anus** is present in the centre of the disc on the aboral side of body.
7. Starfish possesses power of regeneration and shows autotomy.

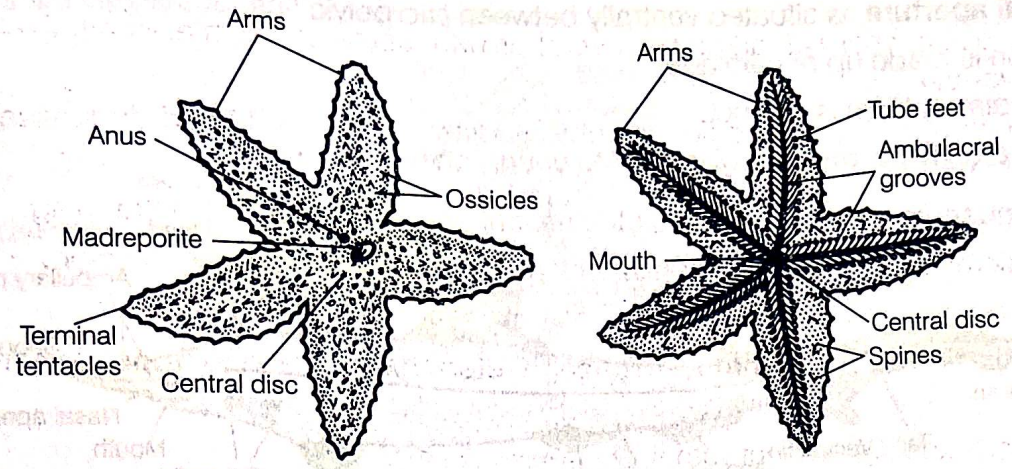


Fig. 3.11 *Asterias* (starfish)

LABEO ROHITA (ROHU)

Classification

Kingdom	–	Animalia
Phylum	–	Chordata
Sub-phylum	–	Vertebrata
Super-class	–	Pisces
Class	–	Osteichthyes (Bony endoskeleton)
Order	–	Cypriniformes
Genus	–	*Labeo*
Species	–	*rohita*

Identification Characteristics

1. Streamlined body covered with cycloid scales.
2. Operculum present on five pairs of gills.
3. Presence of thick and fringed lips.
4. Caudal fin is homocercal (symmetrical).

General Characteristics

1. Rohu or the Indian carp, is found in clear and sluggish rivers, streams, ponds, etc. These are called **freshwater dwellers** and are widely used as food in our country.
2. The body is laterally compressed and streamlined. It is grey or black on the dorsal side and silvery on the ventral surface. Its size can be 1 m in length.
3. The region extending between the depressed and obtuse **snout** and the posterior end of the operculum forms the **head** part of rohu.
4. A pair of nostrils and median eyes are present on its head. Eyes are without eyelids.
5. Fins are present for locomotion. Three median unpaired (**dorsal**, **anal** and **caudal**) fins and two paired fins (**pectoral** and **pelvic**) are present.
6. Sexes are separate and males are without **claspers**, which are present in some other types of fishes.

7. Females are viviparous, i.e. they lay eggs.

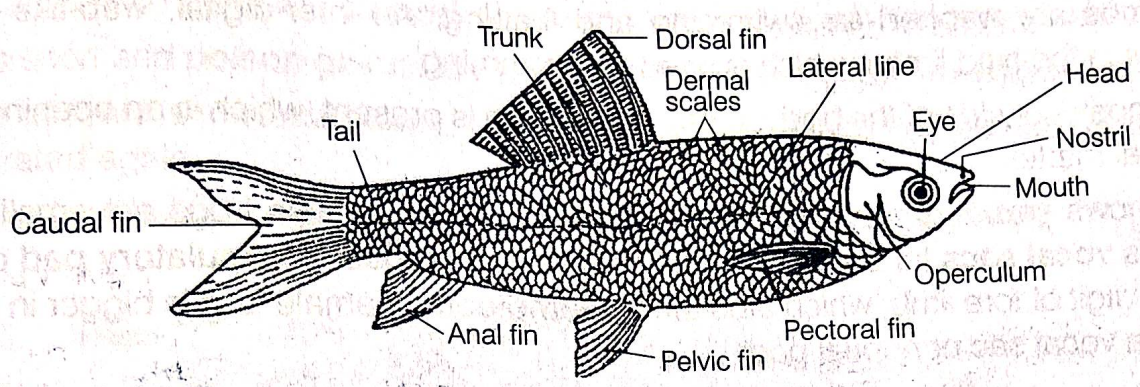


Fig. 3.13 *Labeo rohita* (Rohu : A bony fish)

EXPERIMENT 5

To study the mitosis in onion root tip cells and animal (grasshopper) cells from permanent slides.

REQUIREMENTS

Permanent slides of mitosis in onion root tip cells and animal cells (grasshopper), compound microscope, pencil, eraser, sharpner, record file and a laboratory guide.

PROCEDURE

1. Place the permanent slide on the stage of a compound microscope.
2. Observe the slide initially under lower magnification (10X objective) to locate the dividing cells.
3. Now, observe it under higher magnification (40X objective) to examine different stages of mitosis.
4. Observe all the slides in the same way.

OBSERVATIONS/RESULTS

Under lower magnification, rectangular cells with pink nucleus are seen scattered. Most of the cells were in interphase. Under higher magnification, different stages become distinct which can be described as follows:

Interphase

1. It is a non-dividing phase of the cell cycle between two successive cell divisions.
2. The cells are mostly rectangular, oval or even circular in shape.
3. Nuclear envelope is distinct.
4. The nucleus is homogenous, situated almost at centre and looks granular.
5. Chromatin fibres appear in the form of an interconnected network within the nucleus.
6. Nucleolus is also observed inside the nucleus.
7. Anima cells have a centrosome which contains two centrioles. Such a structure is absent in plant lls.

Stages of Mitosis

i. Prophase

1. Nucleus is enlarged and occupies most of the cell volume. Intact nuclear outline is seen.
2. Chromatin (seen as homogenous material in the nucleus at interphase) gets condensed and appears as long thread-like structures called **chromosomes**.
3. Nuclear membrane starts disappearing.
4. Nucleoli may or may not be visible. Nucleolus gradually disappears by the end of prophase.
5. If the cell is in early stage of prophase, then the chromatin fibres are very thin. However, in the cells observed at late prophase stage, comparatively thicker chromatin fibres would be visible with no nuclear membrane.

ii. Metaphase

1. Chromosomes become shorter and thicker and hence, become distinct and clearly visible under the compound microscope.
2. Nuclear membrane completely disappears.

3. Chromosomes orient themselves at the equator with their centromeres arranged on an equatorial line forming **metaphase plate**. The two chromatids face the opposite poles which can be seen by changing the resolution of mircoscope.
4. A **bipolar spindle** made up of fine spindle fibres appears in the cell in this phase.
5. In animal cells, **astral rays** appear around the centriole pairs at opposite poles. These aid in spindle formation and orientation by accumulation of microtubules.
6. Series of spindle fibres attach the centromeres to the opposite poles. The points of attachment are known as **kinetochores.**
7. Nucleolus is not observed during metaphase.

Note *Colchicine, an alkaloid extracted from Colchicum autumnale has a poisonous effect on mitotic division. It inhibits the assemblage of microtubules thus, preventing the formation of mitotic spindle. It is used to arrest/stop the metaphase stage of mitotic cell division.*

iii. Anaphase

1. The two sister chromatids of each chromosome separate from the centromere and move towards the opposite poles.
2. Chromatids separate due to splitting of the centromere. Each chromatid now represents a separate chromosome having its own centromere.
3. The daughter chromosomes (separated chromatids) appear in V, J, L and I shapes, depending upon the position of centromere on the chromosomes.
4. Anaphase is designated as early, mid and late, depending on the position of moving chromosomes with respect to the opposite poles.

iv. Telophase

1. Chromosomes reach the opposite poles, lose their individuality and look like a mass of chromatin again.
2. Nuclear membrane reappears to form the nuclei of two future daughter cells.
3. Nucleolus gets reconstituted.
4. Two daughter nuclei formed at the two poles of a cell, are similar to the parent nucleus both quantitatively and qualitatively.

Cytokinesis

It is commonly known as division of the cytoplasm of parent cell into two daughter cells. Cytokinesis in plant cells is different from animal cells due to the presence of a rigid cell wall.

In Plant Cells

1. The **cell plate** is formed in the centre which extends laterally until it completely divides the cell into two halves.
2. The cell plate represents the middle lamella.
3. The cell wall is finally formed which produces two different cells.
4. As a result of mitosis, two daughter cells are formed which are qualitatively and quantitatively similar to the parent nucleus.

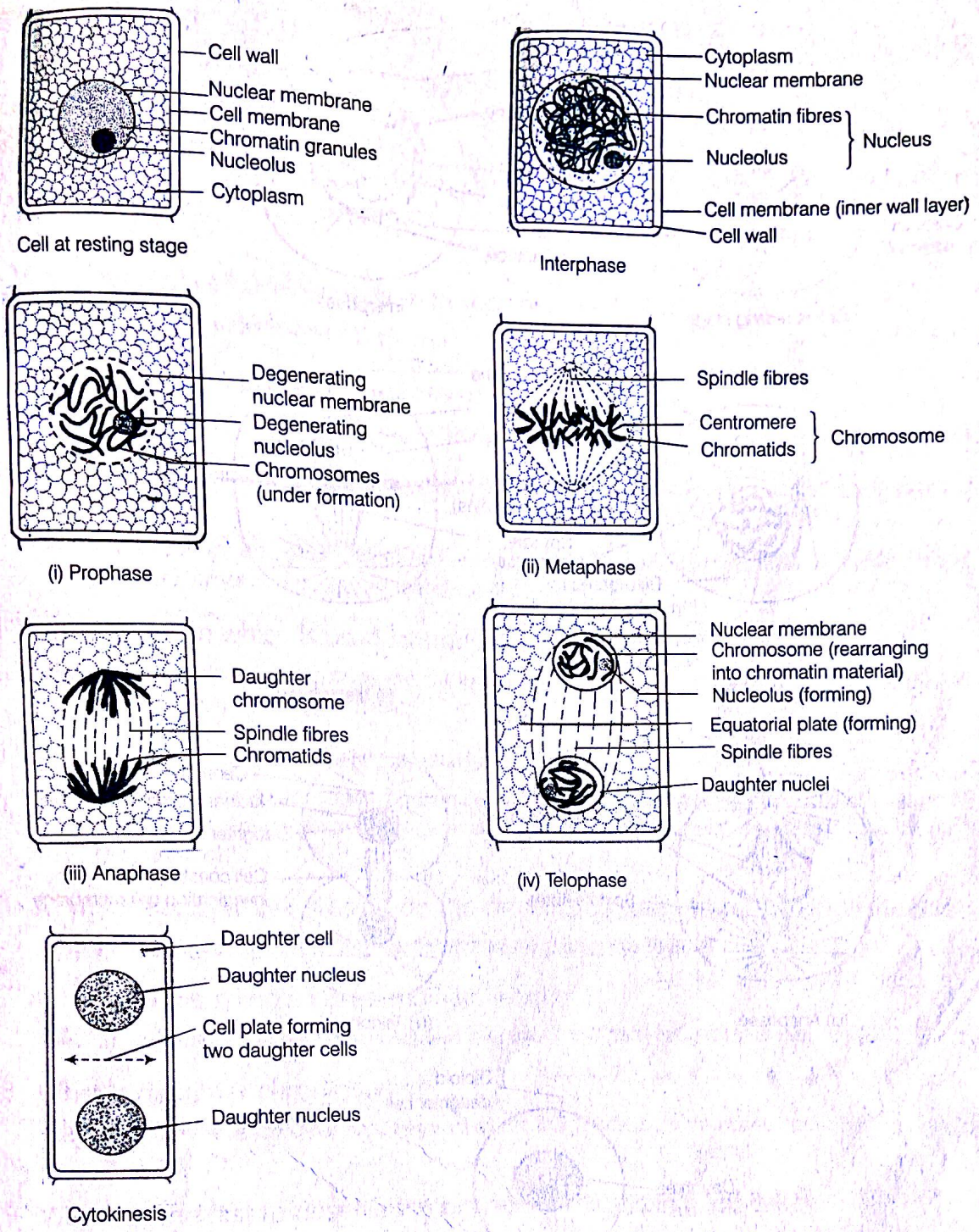


Fig. 5.1 Stages of mitotic cell division in onion root tip cells

In animal cells

1. In animal cells, a constriction starts developing between the two nuclei.
2. Cytokinesis in animals takes place by infolding or **invagination of plasma membrane** towards the middle of parent cell and finally, the cell is pinched off into two daughter cells.

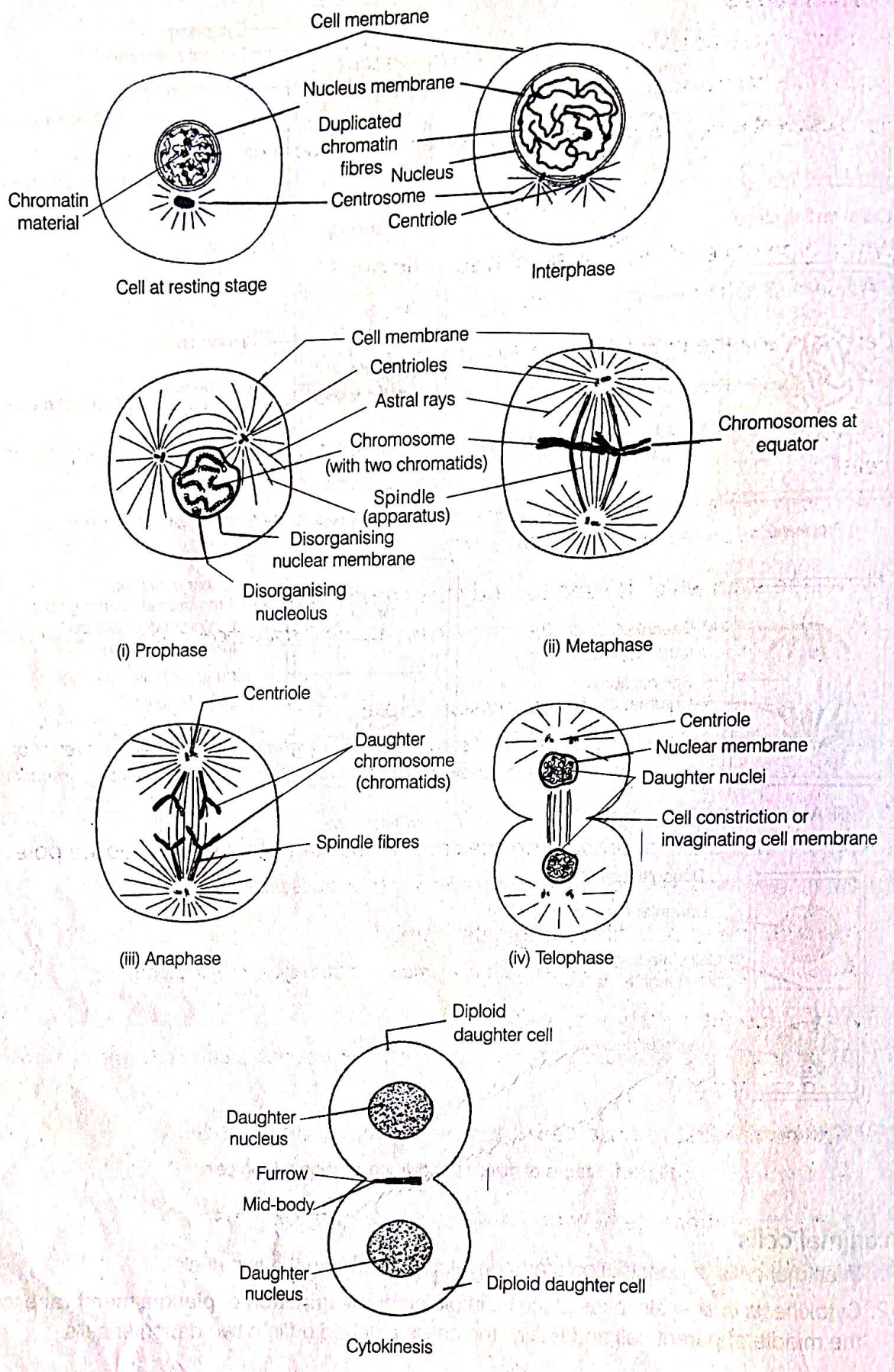


Fig. 5.2 Stages of mitosis in animal cell

PRECAUTIONS

Proper care should be taken while handling the microscope.

Objective lens should not touch the slide.

Fine adjustment knob should be used, while focussing the slide under high power mircoscope..

Study of different types of human skeletal joints.

REQUIREMENTS

Specimen of human skeleton, charts and models of skeleton, pencil, eraser, practical record book, laboratory guide.

PROCEDURE

1. Observe the different types of bones and joints present in a human skeleton.
2. Draw the well labelled diagrams of the joints and write the comments in your practical record book.

OBSERVATIONS

A. Fibrous Joints

Characteristics

1. These are immovable joints which do not allow the mof bones.
2. Bones are held firmly by bundles of **white fibrous collagen**.
3. The place of immovable joints are often called as **sutures**.
4. Syndesmosis or joint between tibia and fibula also shows fibrous joints besides skull joints.

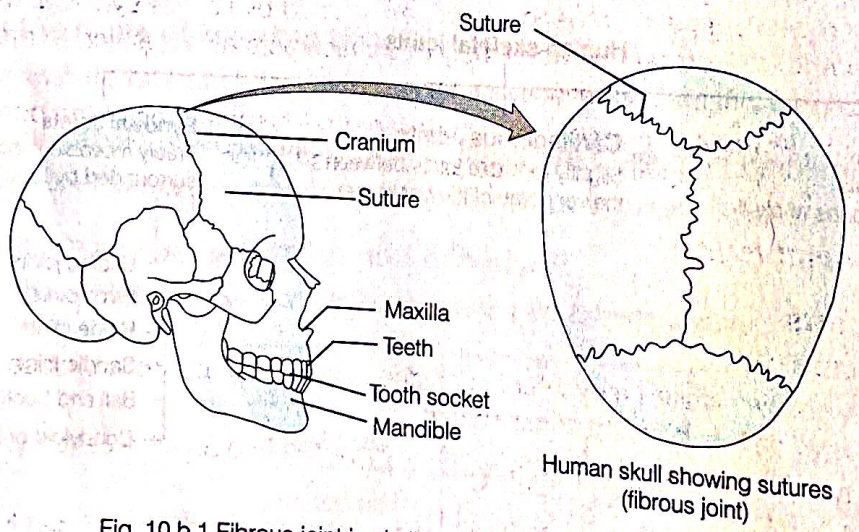


Fig. 10.b.1 Fibrous joint in skull of human and in tooth sockets

B. Cartilaginous Joints

Characteristics

1. These are slightly movable joints, also called as **symphysis**.
2. **Fibro-cartilage** or **white fibrous** cartilage is present between the ends of the bones taking part in the joint formation.
3. The bones are joined together by ligaments extending across the joints.

4. **Pubic symphysis** between the pubic bones of pelvic girdles also show cartilaginous joints besides joints of vertebral column.

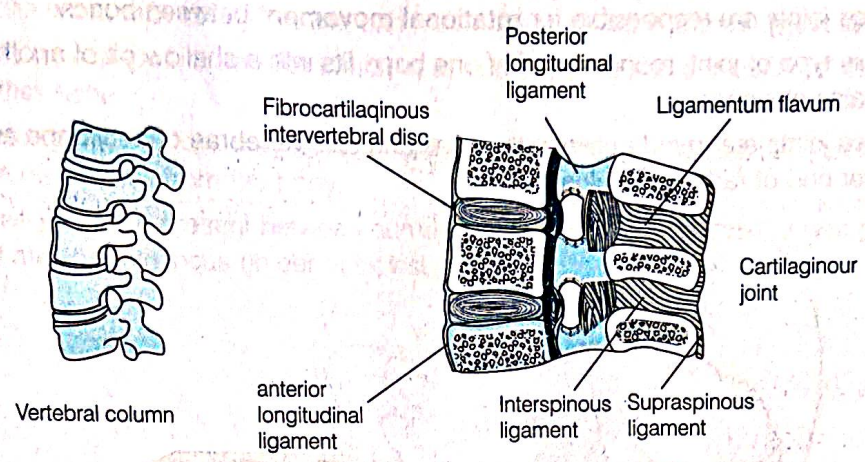


Fig. 10.b.2 Cartilaginous joint

C. Synovial Joints

Characteristics

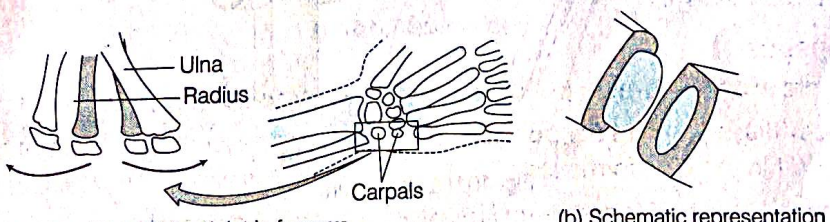
1. These are freely movable joints.
2. The enlargement of one bone fits into a depression of other in this type of joint.
3. **Synovial cavity** (space between two bones) is lined by fibrous **synovial membrane. Synovial fluid** is present between the joints which acts as a cushion to prevent friction between the joints. It is gelatinous in nature.
4. **Articular cartilage** (a layer of hyaline cartilage) covers the ends of the bones which provides smooth and elastic surface and reduces friction.

Types of Synovial Joints

i. Gliding Joints

Characteristics

1. This joint allows limited movement in all directions as the bones are closely packed together or held in place by ligaments.
2. In this type of joint, an oval condyle of one bone fits into an elliptical concavity of the other.
3. No twisting is allowed as articular surfaces of gliding bones are **flat**. Back and forth and side to side movements are allowed, but only for a few joining elements.
4. Joints found in carpals of wrist and tarsals of ankle and foot are gliding joints.



(a) Gliding joint in forearm and wrist

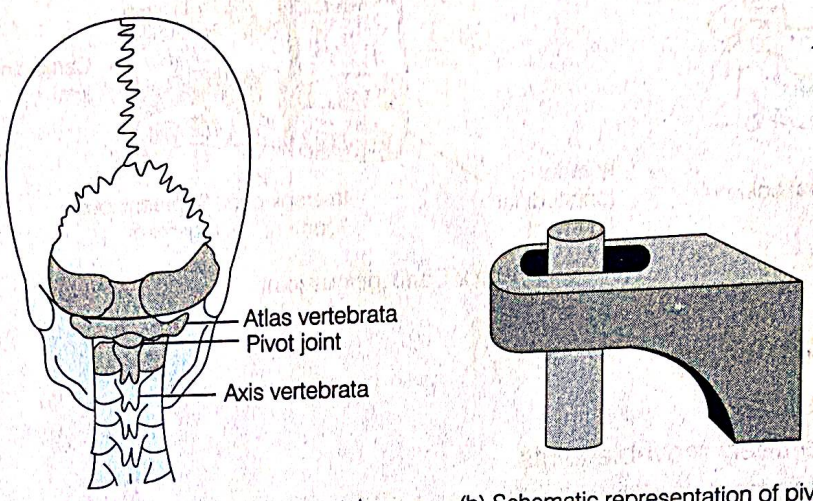
(b) Schematic representation of gliding joint

Fig. 10.b.3 Gliding joint

ii. Pivot Joints

Characteristics

1. These joints are responsible for **rotational movement** between bones.
2. In this type of joint, rounded end of one bone fits into a shallow pit of another bone which remains stationary.
3. These joints are found between the atlas and axis vertebrae of backbone and also at the upper end of radius and ulna.



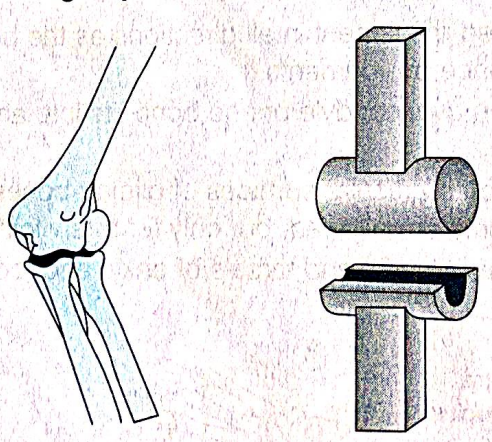
(a) Pivot joint between atlas and axis vertebrae (b) Schematic representation of pivot joint

Fig. 10.b.4 Pivot joint

iii. Hinge Joints

Characteristics

1. This joint allows the **movement in one plane only** and is held intact by ligament.
2. In this type of joint, one edge of the socket is prolonged to check the movement of ball in that direction.
3. This type of joint is found in knee joint, elbow joint, ankle joint and joints between phalanges or interphalangeal joints.



(a) (b)

Fig. 10.b.5 Hinge joint

iv. Ball and Socket Joints

Characteristics

1. It is the **most movable joint** and can move freely in all the planes or directions.
2. In this type of joint, a ball-like structure of one bone fits into a socket-like structure of another bone.
3. Movement at this joint may stretch, fold and rotate limbs and also can draw the limb towards or away from the body.
4. These joints are present between humerus with pectoral girdle, femur with pelvic girdle, and maleus with incus (in ear ossicles).

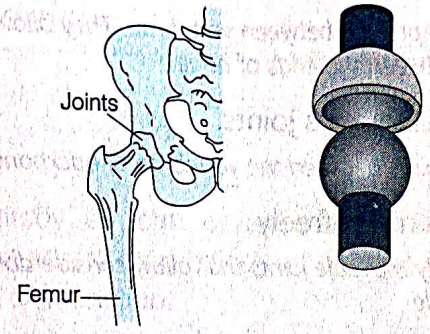


Fig. 10.b.6 Ball and socket joint

v. Saddle Joints

Characteristics

1. These joints allow **movement in two planes**.
2. These resemble ball and socket joints but are less developed than the latter.
3. The ball in this joint is a small projection of one bone which fits into a saddle-like depression of another bone.
4. These joints are found in bones of metacarpals and carpals of thumb.

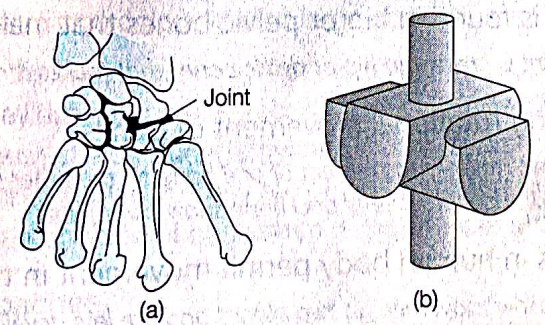


Fig. 10.b.7 Saddle joint

PRECAUTIONS

Specimen should be handled carefully.

The joints must be observed and drawn carefully.