S·C·R·A-2009

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T.B.C. : Q–TDS–J–NC

Test Booklet Series

Serial No. 125153

A

TEST BOOKLET

MATHEMATICS

Paper—III

Time Allowed : Two Hours **Maximum Marks : 200**

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.
4. This Test Booklet contains **100** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose *ONLY ONE* response for each item.
5. You have to mark all your responses *ONLY* on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. Let A_1, A_2 and A_3 be subsets of a set X. Which one of the following is correct?

   (a) $A_1 \cup A_2 \cup A_3$ is the largest subset of X containing A_1, A_2 and A_3

   (b) $A_1 \cup A_2 \cup A_3$ is the smallest subset of X containing elements of each of A_1, A_2 and A_3

   (c) The smallest subset of X containing $A_1 \cup A_2$ and A_3 equals the smallest subset of X containing both A_1 and $A_2 \cup A_3$ only if $A_2 = A_3$

   (d) $A_1 \cup A_2 \cup A_3$ is the smallest subset of X containing either A_1 or $A_2 \cup A_3$ but not both

2. If $T_r = V_{r+1} - V_r - 2$, $r = 1, 2, 3, \ldots$, where V_r is the sum of the first r terms of an AP whose first term is r and common difference is $(2r - 1)$, then T_r is always

   (a) prime and odd

   (b) composite and odd

   (c) composite and even

   (d) odd but not prime

3. If

$$x = \sum_{n=0}^{\infty} a^n, \quad y = \sum_{n=0}^{\infty} b^n, \quad z = \sum_{n=0}^{\infty} c^n$$

   where a, b and c are in AP, and $|a| < 1$, $|b| < 1$, $|c| < 1$; then x, y and z are in

   (a) AP

   (b) GP

   (c) HP

   (d) AGP

4. For what values of x and y, the expression $(|z|^2 + |z - 5|^2 - |z - zi|^2)$ where $z = x + iy$, assumes minimum value?

   (a) $x = 5$, $y = -3$

   (b) $x = -5$, $y = 3$

   (c) $x = 3$, $y = -5$

   (d) $x = -3$, $y = 5$

5. If the expansion in powers of x of the function

$$\frac{1}{(1 - ax)(1 - bx)}$$

   is $a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots\ldots$, where $|ax|$, $|bx| < 1$, then what is a_n equal to?

   (a) $\dfrac{a^n - b^n}{b - a}$

   (b) $\dfrac{a^{n+1} - b^{n+1}}{b - a}$

   (c) $\dfrac{b^{n+1} - a^{n+1}}{b - a}$

   (d) $\dfrac{b^n - a^n}{b - a}$

6. What is the number of integral points (integral points mean both coordinates must be integers) exactly in the interior of the triangle with vertices (0, 0), (0, 21) and (21, 0)?

(a) 105

(b) 133

(c) 190

(d) 233

7. A man has 7 relatives, 4 women and 3 men. His wife also has 7 relatives, 3 women and 4 men. What is the number of ways can they invite 3 women and 3 men so that 3 of them are the man's relatives and 3 of them are his wife's relatives?

(a) 485

(b) 484

(c) 468

(d) 467

8. If $a_1, a_2, \ldots, a_{50}$ are in GP, then what is

$$\frac{a_1 - a_3 + a_5 - \ldots + a_{49}}{a_2 - a_4 + a_6 - \ldots + a_{50}}$$

equal to?

(a) 0

(b) 1

(c) $\frac{a_1}{a_2}$

(d) $\frac{a_{25}}{a_{24}}$

9. Let U be a set with number of elements in U is 2009.

Consider the following statements :

1. If A, B are subsets of U with $n(A \cup B) = 280$, then

   $n(A' \cap B') = x_1^3 + x_2^3 = y_1^3 + y_2^3$

   for some positive integers x_1, x_2, y_1, y_2.

2. If A is a subset of U with $n(A) = 1681$ and out of these 1681 elements, exactly 1075 elements belong to a subset B of U, then $n(A - B) = m^2 + p_1 p_2 p_3$ for some positive integer m and distinct primes p_1, p_2, p_3.

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

10. What is the probability that three randomly selected persons will be born on different days of the week?

(a) $\frac{36}{49}$

(b) $\frac{30}{49}$

(c) $\frac{25}{49}$

(d) $\frac{19}{49}$

11. A measure of central tendency $M(x_1, x_2, ..., x_n)$ of n discrete observations $x_1, x_2, ..., x_n$ satisfies the property P, if

$$M(x_1 + a, x_2 + a, ..., x_n + a) = M(x_1, x_2, ..., x_n) + a$$

for every a.

Some measures of central tendency are given below :

1. Arithmetic mean
2. Geometric mean
3. Harmonic mean
4. Median

Which of the above measures satisfies/satisfy the property P?

(a) 1 only

(b) 1 and 4

(c) 1, 2 and 3

(d) 4 only

12. Let $n \in N$ be such that $n \geq 1$. Let $A = \{1, 2, ..., n\}$. Let $f : P(A) \to \{0, 1\}$ be defined by

$$f(B) = 0, \text{ if } 1 \notin B$$
$$= 1, \text{ if } 1 \in B$$

Consider the following statements :

1. f can never be a bijection. That is there exists no $n \in N$ for which f is a bijection.
2. There exists at least one $n \in N$ for which f is not onto.
3. If n is a prime number, then f will be one-to-one.

Which of the statements given above are ***not*** correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

13. Let $A = N \times N$ be the Cartesian product of N and N. Let

$$S = \{((m, n), (p, q)) \in A \times A : m + q = n + p\}$$

Consider the following statements :

1. If $((m, n), (p, q)) \in S$ and $((p, q), (r, s)) \in S$, then $((r, s), (m, n)) \in S$.
2. There exists at least one element $((m, n), (p, q)) \in S$ such that $((p, q), (m, n)) \notin S$.

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

14. Let M be a set of all 2×2 matrices over a set of rational numbers such that for any $A, B \in M$, the operation $*$ is defined as

$$A * B = \frac{AB + BA}{2}$$

Which one of the following is ***not*** correct?

(a) $*$ is associative

(b) $*$ is commutative

(c) $*$ is binary operation on M

(d) M is closed under $*$

15. Let $A = \{1, 2, 3\}$. Let $B = P(A)$, the power set of A.

Consider the following statements :

1. The number of binary operations that can be defined on B is 8^{16}.
2. The number of binary operations that can be defined on $A \times A$ is 9^{81}.

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

16. If

$$\sin^2 \theta = \frac{x^2 + y^2}{2xy}, \quad x, y \in R$$

then which one of the following is correct?

(a) $x \neq y$

(b) $x = y \neq 0$

(c) $x \neq y \neq 0$

(d) $x > 0$, y may be zero

17. What is the value of

$$\sum_{k=0}^{100} ki^k$$

where $i^2 = -1$?

(a) $50 - 50i$

(b) $50 - 49i$

(c) $49 - 50i$

(d) $51 - 50i$

18. Let ω be complex (but not real) cubic root of unity. Which one of the following is correct?

(a) $\overline{\omega}$ is of absolute value greater than 1

(b) $-\omega$ will be a cubic root of unity

(c) The absolute value of $(-1 - \omega)$ is 1

(d) $(\overline{\omega})^6 = 1$ but $(\overline{\omega})^3 \neq 1$

19. Let n be a positive integer whose representation in the binary form is given by $(y_1\ y_2\ y_3\ \ldots\ y_k)_2$, where k is even. Suppose

$$y_1 = y_3 = \ldots = y_{k-1} = 1$$

$$y_2 = y_4 = \ldots = y_k = 0$$

Which one of the following is correct?

(a) $n = \dfrac{2^k - 2}{3}$

(b) $n = \dfrac{2^{k+1} - 2}{3}$

(c) $n = \dfrac{2^{\frac{k}{2}} - 1}{3}$

(d) $n = \dfrac{2^{\frac{k}{2}} - 2}{3}$

20. What is the number of positive integral solutions of $x_1x_2x_3 = 30$?

(a) 25

(b) 26

(c) 27

(d) 28

21. If a, b and c are in GP such that $a + b + c = xb$, then which one of the following is correct?

(a) $x < -1$ or $x > 3$

(b) $x < -1$ and $x > 3$

(c) $x > -1$ or $x < 3$

(d) $x > -1$ and $x < 3$

22. Which term of the sequence $9 - 8i$, $8 - 6i$, $7 - 4i$ is purely imaginary?

(a) 5th

(b) 9th

(c) 10th

(d) None of the above

23. If

$$\sum_{i=1}^{n} t_i = \frac{(n+2)(n+1)n}{6}$$

then what is $\sum_{i=1}^{n} \dfrac{1}{t_i}$ equal to?

(a) $\dfrac{2n}{n+1}$

(b) $\dfrac{2n}{n+2}$

(c) $\dfrac{n}{n+1}$

(d) $\dfrac{n}{n+2}$

24. The roots of the equation

$$(a^4 + b^4)x^2 + (4abcd)x + (c^4 + d^4) = 0$$

are given to be real. Then which one of the following is correct?

(a) The roots are always different

(b) The roots are always identical

(c) The roots may be different or identical

(d) No conclusion can be drawn

25. What is the remainder when $(27^{10} + 7^{51})$ is divided by 10?

(a) 1 *(b)* 2

(c) 3 *(d)* 5

26. What is the coefficient of x^5 in the expansion of

$(1+x)^{21} + (1+x)^{22} + (1+x)^{23} + \ldots + (1+x)^{30}$?

(a) $C(51, 5)$

(b) $C(31, 5) - C(21, 5)$

(c) $C(31, 6) - C(21, 6)$

(d) $C(31, 6) + C(21, 6)$

27. Consider

$$G = \left\{ \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} : \theta \in R \right\}$$

For any $\theta \in R$, denote the matrix

$$\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$$

by A_θ.

Consider the following statements :

1. $\text{Adj}(A_\theta) = -A_\theta$ for some $\theta \in R$, then $\theta = \dfrac{(2r+1)\pi}{2}$ for some integer r.
2. $\text{Adj}(A_\theta) = A_\theta^T$ holds for only finitely many $\theta \in R$.

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

28. Let p be any prime > 2 and $S = \{2, 4, 6, \ldots, 2(p-1)\}$. Define the operation $(p \odot_n q)$ as remainder when pq is divided by n, where n is a natural number and $q \in S$. What is the identity element of $(S, \odot_{2p})$?

(a) $p - 1$

(b) $p + 1$

(c) $p + 3$

(d) None of the above

29. If $\cos(\theta - \alpha) = a$ and $\cos(\theta - \beta) = b$, then what is the value of

$$\sin^2(\alpha - \beta) + 2ab\cos(\alpha - \beta)?$$

(a) $a^2 + b^2$

(b) $a^2 - b^2$

(c) $-a^2 - b^2$

(d) $-a^2 + b^2$

30. Let $\frac{\pi}{2} < \theta < \pi$ and $\pi < \phi < \frac{3\pi}{2}$. If $\sin\theta + \sin(\theta + \phi) + \sin(\theta - \phi) = 0$, then which one of the following is correct?

(a) $\sin^2\phi\cot^2\theta$ is an integer

(b) $\text{cosec}^2\phi\tan^2\theta$ is an integer

(c) $\sin^2\phi\cot^2\theta$ is irrational

(d) $\text{cosec}\,\phi\tan\theta < -3$

31. If $\sin x + \sin y = 3(\cos y - \cos x)$, then what is the value of

$$\sin 3x \,\text{cosec}\, 3y?$$

(a) -1

(b) 0

(c) 1

(d) None of the above

32. What is the image of

$$\left[0, \frac{\sqrt{3}-1}{2\sqrt{2}}\right]$$

under the inverse sine function?

(a) $\left[0, \frac{\pi}{10}\right]$

(b) $\left[0, \frac{\pi}{8}\right]$

(c) $\left[0, \frac{\pi}{15}\right]$

(d) $\left[0, \frac{\pi}{12}\right]$

33. The real value of x such that $e^{\sin x} - e^{-\sin x} = 4$

(a) is $\frac{3\pi}{4}$

(b) is $\frac{\pi}{3}$

(c) is $\frac{\pi}{6}$

(d) does not exist

34. AB is a vertical pole. The end A is on the level of ground. C is the middle point of AB. P is a point on the level of ground. The portion BC subtends an angle β at P. If $AP = n(AB)$, then what is $\tan\beta$ equal to?

(a) $\frac{n}{2n^2+1}$ *(b)* $\frac{n}{n^2-1}$

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

35. Let

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$$

If U_1, U_2 and U_3 are column matrices satisfying

$$AU_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \; AU_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}, \; AU_3 = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$$

and U is 3×3 matrix whose columns are U_1, U_2 and U_3, then what is $|U|$ equal to?

(a) -3 *(b)* $\frac{3}{2}$

(c) 2 *(d)* 3

36. If

$$A = \begin{bmatrix} 2 & -3 \\ 1 & -1 \end{bmatrix}$$

then what is $|A^{1003} - 5A^{1002}|$ equal to?

(a) -5 *(b)* 1

(c) 8 *(d)* 21

37. If

$$f(x) = \begin{vmatrix} 1+a^2x & (1+b^2)x & (1+c^2)x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & 1+c^2x \end{vmatrix}$$

and $a^2 + b^2 + c^2 = -2$, then what is the degree of the polynomial $f(x)$?

(a) 0

(b) 1

(c) 2

(d) 3

38. Let

$$A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{pmatrix}$$

and $(10)B = \begin{pmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{pmatrix}$

If B is the inverse of matrix A, then what is the value of α?

(a) -2 *(b)* -1

(c) 2 *(d)* 5

39. Let ABC be an equilateral triangle. If R is the circumradius and r is the inradius of triangle ABC, then what is $\sqrt{R^2 - r^2}$ equal to?

(a) $\sqrt{5}r$

(b) $\sqrt{7}r$

(c) $\sqrt{3}r$

(d) $2r$

40. ABC is a triangle in which $BC = a$, $CA = b$ and $AB = c$. Let Δ denote the area of triangle ABC.

Consider the following statements :

1. $\Delta > \min\left(\frac{ab}{2}, \frac{bc}{2}, \frac{ca}{2}\right)$
   (min stands for minimum)
2. If $\Delta = \min\left(\frac{ab}{2}, \frac{bc}{2}, \frac{ca}{2}\right)$, then ABC is a right-angled triangle.

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

41. Let $0° < \theta < 90°$. Let $\alpha = \sec^2\theta$, $\beta = \tan^2\theta$.

Consider the following statements :

1. $(\alpha^2 - \beta^2)^2 > (\alpha^3 - \beta^3)$

2. There exists a natural number n such that $(\alpha + \beta)^n$ cannot be expressed as a polynomial expression in β with integral coefficients.

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

42. Let A, B be the acute angles such that $\cos A = \dfrac{n+1}{\sqrt{(n+1)^2 + n^2}}$ and $\cos B = \dfrac{2n+1}{\sqrt{(2n+1)^2 + 1}}$ for some positive integer n. Which one of the following is correct?

(a) $(A + B) > 90°$

(b) $60° < (A + B) < 90°$

(c) $15° < (A + B) < 30°$

(d) $30° < (A + B) < 60°$

43. Let P_1T_1 and P_2T_2 denote two towers of equal height h; T_1 and T_2 denote respectively their tops; P_1 and P_2 denote respectively their bases. Let A be a point on the line segment joining P_1 and P_2 such that $P_1A = x$ and $AP_2 = y$. If α is the angle of elevation of T_1 as seen from A and β is the angle of elevation of T_2 as seen from A, then consider the following statements :

1. $\dfrac{x}{y} = \tan\alpha \cot\beta$

2. If $(\alpha + \beta)$ is acute, then $xy > h^2$

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

44. If

$$f(x) = \lim_{n \to \infty} \frac{\ln(2 + x) - x^{2n} \sin x}{1 + x^{2n}}$$

then what is $\lim_{x \to 1} f(x)$ equal to?

(a) $\ln 3$

(b) $-\sin 1$

(c) 0

(d) Limit does not exist

45. Consider the following statements :

The derivative of $\sin^{-1}(3x - 4x^3)$ is

1. $\frac{3}{\sqrt{1-x^2}}$ for all $x \in R$
2. $\frac{3}{\sqrt{1-x^2}}$ for $|x| < \frac{1}{2}$
3. $\frac{-3}{\sqrt{1-x^2}}$ for $x \in \left(-1, \frac{-1}{2}\right) \cup \left(\frac{1}{2}, 1\right)$

Which of the statements given above is/are correct?

(a) 1

(b) 2 only

(c) 3 only

(d) Both 2 and 3

46. If $A_i = \frac{x - a_i}{|x - a_i|}$, $i = 1, 2, 3, \ldots, n$ and $a_1 < a_2 < a_3 < \ldots < a_n$, then

$$\lim_{x \to a_m} (A_1 A_2 A_3 \ldots A_n)$$

where $1 \le m \le n$

(a) is equal to $(-1)^m$

(b) is equal to $(-1)^{m+1}$

(c) is equal to $(-1)^{n-m}$

(d) does not exist

47. If x and y are the sides of two squares such that $y = x - x^2$, then what is the rate of change of the area of second square with respect to the area of first square?

(a) $(1 - x^2)x$

(b) $2(1 - x^2)x$

(c) $2x^2 - 3x + 1$

(d) $2(2x^2 - 3x + 1)$

48. If $[x]$ denotes the greatest integer function, then what is

$$\int_1^3 \frac{dx}{x^2 + [x]^2 + 1 - 2x[x]}$$

equal to?

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{2}$

(d) 1

49. If $u = \cot x$ and $I_n = \int u^n \, dx$, then what is

$I_0 + I_1 + 2(I_2 + I_3 + \ldots + I_8) + I_9 + I_{10}$

equal to?

(a) $u + \frac{u^2}{2} + \ldots + \frac{u^9}{9}$

(b) $-\left(u + \frac{u^2}{2} + \ldots + \frac{u^9}{9}\right)$

(c) $-\left(u + \frac{u^2}{2!} + \ldots + \frac{u^9}{9!}\right)$

(d) $\frac{u}{2} + \frac{2u^2}{3} + \ldots + \frac{9u^9}{10}$

50. If $f(x)$ is continuous at $x = 0$ and $f(0) = 2$, then what is the value of

$$\lim_{x \to 0} \left[\frac{\int_0^x f(u)\, du}{x}\right]?$$

(a) 0

(b) 1

(c) 2

(d) $f(2)$

51. If

$$f(x) = \frac{x}{2} - 1$$

then on the interval $[0, \pi]$

(a) $\tan(f(x))$ and $\frac{1}{f(x)}$ are both continuous

(b) $\tan(f(x))$ and $\frac{1}{f(x)}$ are both discontinuous

(c) $\tan(f(x))$ and $f^{-1}(x)$ are both continuous

(d) neither $\tan(f(x))$ nor $f^{-1}(x)$ is continuous

52. If

$$F(x) = \frac{1}{x^2}\int_4^x [4t^2 - 2F'(t)]\,dt$$

then what is $F'(4)$ equal to?

(a) $\frac{32}{9}$

(b) $\frac{64}{3}$

(c) $\frac{64}{9}$

(d) None of the above

53. If

$$y = \int_0^x f(t)\sin[k(x-t)]\,dt$$

then what is $\frac{d^2y}{dx^2} + k^2 y$ equal to?

(a) 0 *(b)* y

(c) $kf(x)$ *(d)* $k^2 f(x)$

54. If $\phi(a - x) = \phi(x)$, then what is

$$\int_0^a x\,\phi(x)\,dx$$

equal to?

(a) $a\int_0^a \phi(x)\,dx$

(b) $x\int_0^a \phi(x)\,dx$

(c) $2a\int_0^{\frac{a}{2}} \phi(x)\,dx$

(d) $\frac{a}{2}\int_0^a \phi(x)\,dx$

55. The general solution of the differential equation

$$\frac{dy}{dx} + y\frac{d\phi}{dx} = \phi(x)$$

where ϕ is a function of x alone is given by

(a) $y = \phi + ce^{-\phi}$

(b) $y = \phi + 1 - ce^{-\phi}$

(c) $y = \phi - 1 + ce^{\phi}$

(d) $y = \phi - 1 + ce^{-\phi}$

where c is a constant.

56. If $[x]$ and $\{x\}$ represent integer and fractional parts of x respectively, then what is the expression

$$[x] + \sum_{r=1}^{2000} (\{x + r\}/2000)$$

equal to?

(a) $\frac{2001}{2}x$

(b) $x + 2001$

(c) x

(d) $[x] + \frac{2001}{2}$

57. If $A > 0$, $B > 0$ and $A + B = \frac{\pi}{3}$, then what is the maximum value of $\tan A \tan B$?

(a) 3 (b) $\frac{1}{3}$

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

58. Let f be a positive function. Let

$$I_1 = \int_{1-k}^{k} x f\{x(1-x)\}\, dx$$

$$I_2 = \int_{1-k}^{k} f\{x(1-x)\}\, dx$$

where $(2k - 1) > 0$, then what is $\frac{I_1}{I_2}$ equal to?

(a) 2 (b) k

(c) $\frac{1}{2}$ (d) 1

59. A point moves along the curve $y = (\sin 2x) + 1$, $-2\pi \le x \le 2\pi$. How many times does the point attain the maximum height from the x-axis?

(a) 8 (b) 4

(c) 2 (d) 1

60. The equation

$$a_0 x^n + a_1 x^{n-1} + \ldots + a_n = 0$$

has at least one root between 0 and 1, if

(a) $\frac{a_0}{n} + \frac{a_1}{n-1} + \ldots + a_{n-1} = 0$

(b) $\frac{a_0}{n-1} + \frac{a_1}{n-2} + \ldots + a_{n-2} = 0$

(c) $na_0 + (n-1)a_1 + \ldots + a_{n-1} = 0$

(d) $\frac{a_0}{n+1} + \frac{a_1}{n} + \ldots + a_n = 0$

61. If

$$2f(x) - 3f\left(\frac{1}{x}\right) = x^2,\ x \neq 0$$

then what is $f(2)$ equal to?

(a) $\frac{3}{4}$

(b) $-\frac{3}{4}$

(c) $\frac{5}{4}$

(d) $-\frac{7}{4}$

62. If the sets $\{(t, t) \mid t \in R\}$ and $\{(t, t^2) \mid t \in R\}$ represent the graphs of two functions f and g on R respectively, then what is the nature of the graph of $(f + g)$?

(a) Straight line passing through origin

(b) A parabola through origin

(c) A parabola through origin symmetrical about y-axis

(d) A parabola through origin symmetrical about x-axis

63. The differential equation

$$y'' + ky' + 4y = 0$$

has solution of the form

$$y = Ae^{ax}\cos bx + Be^{ax}\sin bx$$

for all values of k, if

(a) $-4 < k < 4$

(b) $k < -4$, $k > 4$

(c) $k = 0$ or 4

(d) None of the above

64. Let f be twice differentiable function such that $f'''(x) = -f(x)$ and $f'(x) = g(x)$, $h(x) = \{f(x)\}^2 + \{g(x)\}^2$. If $h(5) = 11$, then what is $h(10)$ equal to?

(a) 22

(b) 11

(c) 0

(d) Cannot be determined due to insufficient data

65. It is given that three distinct points (x_1, y_1), (x_2, y_2) and (x_3, y_3) are collinear. Then a necessary and sufficient condition for (x_2, y_2) to lie on the line segment joining (x_3, y_3) to (x_1, y_1) is

(a) either
$(x_1 + y_1) < (x_2 + y_2) < (x_3 + y_3)$
or
$(x_1 + y_1) > (x_2 + y_2) > (x_3 + y_3)$

(b) either
$(x_1 - y_1) < (x_2 - y_2) < (x_3 - y_3)$
or
$(x_1 - y_1) > (x_2 - y_2) > (x_3 - y_3)$

(c) either $0 < \left(\frac{x_2 - x_3}{x_1 - x_3}\right) < 1$

or $0 < \left(\frac{y_2 - y_3}{y_1 - y_3}\right) < 1$

(d) None of the above

66. The difference between the radii of the largest and the smallest circles, which have their centres on the circumference of the circle

$$x^2 + y^2 + 2x + 4y = 4$$

and pass through the point (a, b) lying outside the given circle, is

(a) 1

(b) 2

(c) 3

(d) 6

67. All points whose distance from the nearest point on the circle $(x - 1)^2 + y^2 = 1$ is half the distance from the line $x = 5$ lie on

(a) an ellipse

(b) a pair of straight lines

(c) a parabola

(d) a circle

68. The locus of a moving point $P(x, y)$ in the plane satisfies the equation

$$2x^2 = r^2 + r^4$$

where $r^2 = x^2 + y^2$. Which one of the following is correct?

(a) For every positive real number d, there is a point (x, y) on the locus such that $r = d$

(b) For every value of d, $0 < d < 1$, there are exactly four points on the locus each of which is at a distance d from the origin

(c) The point P always lies in the first quadrant

(d) None of the above

69. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors, then

$|\vec{a}-\vec{b}|^2+|\vec{b}-\vec{c}|^2+|\vec{c}-\vec{a}|^2$

does ***not*** exceed

(a) 12

(b) 9

(c) 8

(d) 6

70. The vectors $2\hat{i}+\log_3 x\,\hat{j}+a\hat{k}$ and $-3\hat{i}+a\log_3 x\,\hat{j}+\log_3 x\,\hat{k}$, where $x > 3$ are inclined at an angle for

(a) $a = 0$

(b) $a < 0$

(c) $a > 0$

(d) No real value of a

71. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three non-coplanar vectors such that $\vec{a}+\vec{b}+\vec{c}=\alpha\vec{d}$ and $\vec{b}+\vec{c}+\vec{d}=\beta\vec{a}$, then what is $\vec{a}+\vec{b}+\vec{c}+\vec{d}$ equal to?

(a) $\vec{0}$ *(b)* $\alpha\vec{a}$

(c) $\beta\vec{b}$ *(d)* $(\alpha+\beta)\vec{c}$

72. The vector $\vec{a}$ coplanar with the vectors $\hat{i}$ and $\hat{j}$, perpendicular to the vector $\vec{b}=4\hat{i}-3\hat{j}+5\hat{k}$ such that $|\vec{a}|=|\vec{b}|$, is

(a) $\pm\sqrt{2}(3\hat{i}+4\hat{j})$

(b) $\pm\sqrt{2}(4\hat{i}+3\hat{j})$

(c) $\pm\sqrt{2}(4\hat{i}+5\hat{j})$

(d) $\pm\sqrt{2}(5\hat{i}+4\hat{j})$

73. One end of a focal chord of the parabola $y^2 = 8ax$ is the point $(2at^2, 4at)$. What is the other end of the chord?

(a) $\left(\frac{a}{t^2}, \frac{-2\sqrt{2}a}{t}\right)$

(b) $\left(\frac{a}{2t^2}, \frac{-2a}{t}\right)$

(c) $\left(\frac{2a}{t^2}, \frac{-4a}{t}\right)$

(d) $\left(\frac{2a}{t^2}, \frac{4a}{t}\right)$

74. A point P lies on the line passing through the points (12, 3, 3) and (–3, 0, 9). If the z-coordinate of P is 1, what are the x and y coordinates?

(a) $x = 4,\ y = 17$

(b) $x = 7,\ y = 2$

(c) $x = 2,\ y = 7$

(d) $x = 17,\ y = 4$

75. The position vectors of two points P and Q are $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-2\hat{j}-4\hat{k}$ respectively. The position vector of the middle point of the segment PQ makes an angle ϕ with the position vector of Q. What is ϕ equal to?

(a) $\cos^{-1}\frac{2}{3}$

(b) $\cos^{-1}\frac{1}{3}$

(c) $\cos^{-1}\frac{1}{\sqrt{3}}$

(d) $30°$

76. If $\vec{\alpha}$, $\vec{\beta}$, $\vec{\gamma}$ and $\vec{\delta}$ be four vectors such that $\vec{\delta} = (\vec{\alpha} \cdot \vec{\gamma})\vec{\beta} - (\vec{\alpha} \cdot \vec{\beta})\vec{\gamma}$, then which one of the following is correct?

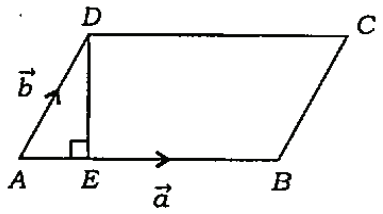
(a) $\vec{\alpha}$ is parallel to $\vec{\delta}$

(b) $\vec{\alpha} \cdot \vec{\beta} = \vec{\alpha} \cdot \vec{\gamma}$

(c) $\vec{\alpha}$ is perpendicular to $\vec{\delta}$

(d) None of the above

77.



What is $\overrightarrow{ED}$ in the above diagram?

(a) $\dfrac{|\vec{a}|^2 \vec{b} - (\vec{a} \cdot \vec{b})\vec{a}}{|\vec{a}|^2}$

(b) $\dfrac{|\vec{a}|^2 \vec{b} + (\vec{a} \cdot \vec{b})\vec{a}}{|\vec{a}|^2}$

(c) $\dfrac{-|\vec{a}|^2 \vec{b} + (\vec{a} \cdot \vec{b})\vec{a}}{|\vec{a}|^2}$

(d) $\dfrac{-|\vec{a}|^2 \vec{b} - (\vec{a} \cdot \vec{b})\vec{a}}{|\vec{a}|^2}$

where $\vec{a}$ and $\vec{b}$ are the vectors representing the adjacent sides of parallelogram *ABCD* as shown in the figure.

78. Let $\vec{r}$ be the position vector of a point $P(x, y, z)$, where x, y and z are natural numbers and $\vec{a} = \hat{i} + \hat{j} + \hat{k}$. What is the total number of possible positions of point P for which $\vec{r} \cdot \vec{a} = 10$?

(a) 18

(b) 36

(c) 66

(d) 72

79. If $\vec{a}$ and $\vec{b}$ are mutually perpendicular unit vectors and $\vec{r}$ is a vector satisfying

$$\vec{r} \cdot \vec{a} = \vec{r} \cdot \vec{b} = [\vec{r} \ \ \vec{a} \ \ \vec{b}] = 1$$

then what is $\vec{r}$ equal to?

(a) $(\vec{a} \times \vec{b}) + \vec{a} + \vec{b}$

(b) $(\vec{a} \times \vec{b}) - \vec{a} + \vec{b}$

(c) $(\vec{a} \times \vec{b}) - (\vec{a} + \vec{b})$

(d) $(\vec{a} \times \vec{b}) + \vec{a} - \vec{b}$

80. A ray of light coming from origin after reflection at a point $P(x, y)$ of a curve becomes parallel to x-axis. What may be the differential equation of the curve?

(a) $y\left(\dfrac{dy}{dx}\right)^2 + 2x\left(\dfrac{dy}{dx}\right) + y = 0$

(b) $y\left(\dfrac{dy}{dx}\right)^2 + 2x\left(\dfrac{dy}{dx}\right) - y = 0$

(c) $y\left(\dfrac{dy}{dx}\right)^2 - 2x\left(\dfrac{dy}{dx}\right) + y = 0$

(d) $y\left(\dfrac{dy}{dx}\right)^2 + 2x\left(\dfrac{dy}{dx}\right) = 0$

81. What is the general solution of the differential equation

$$\frac{dy}{dx} + y\frac{dh(x)}{dx} = h(x)\frac{dh(x)}{dx}$$

where $h(x)$ is given function of x?

(a) $h(x) + \ln[1 + y - h(x)] = c$

(b) $h(x) + \ln[1 + y + h(x)] = c$

(c) $h(x) + \ln[y - h(x)] = c$

(d) $h(x) + \ln[1 - y - h(x)] = c$

where c is a constant.

82. A curve $y = f(x)$ passes through origin O and lies in the first quadrant. Let PQ, PR be the perpendiculars drawn on x, y axes respectively from the point $P(x, y)$ such that the area of the region OPR is twice that of region OPQ. What is the equation of the curve?

(a) $y = cx^2$

(b) $y^2 = cx$

(c) $y = cx^3$

(d) $y^2 = cx^3$

where c is a constant.

83. What does the equation

$$x^2 - 5x + 6 = 0$$

represent in three-dimensional space?

(a) Skew lines

(b) A pair of non-parallel planes

(c) A pair of parallel planes

(d) None of the above

84. Consider the following statements :

1. Three planes may intersect in a point.
2. Three planes may intersect in a line.
3. Three planes may be such that two of them are parallel and the third one may intersect them in parallel lines.
4. Three planes may not intersect.

How many possibilities are correct?

(a) One

(b) Two

(c) Three

(d) Four

85. Which one of the following statements best describes the relationship between a frequency distribution and the data set it represents?

(a) The frequency distribution is a simpler but completely equivalent representation of the parent data

(b) The frequency distribution is constructed to identify errors in the original data

(c) In a frequency distribution, values in certain ranges are clubbed together at the midrange value, which makes the representation easy to comprehend

(d) The frequency distribution is simple to understand but not useful for any computation of practical importance

86. The statements below relate to the histogram of a frequency distribution. Which one of the following is ***not*** correct?

(a) The area included in the histogram represents the total frequency of the frequency distribution

(b) If all class intervals are equal, the width of the tallest rectangular bar of the histogram represents the modal class

(c) If all class intervals are equal, the midpoint of the width of the tallest rectangular bar is the mode of the distribution

(d) The height of the histogram at any point represents the frequency per unit interval for the relevant interval

87. A symmetric coin is tossed until the first head is observed. What is the probability that more than seven tosses will be required?

(a) $\frac{1}{7}$

(b) $\frac{1}{49}$

(c) $\frac{1}{64}$

(d) $\frac{1}{128}$

88. A wall measures 40 m by 30 m and contains a window of size 20 m by 20 m. The wall is hit by four stones thrown up by a mower. Assuming that each stone hits the wall in a random position independently of other stones, what is the probability that at least one throw would hit the window?

(a) $\frac{16}{81}$

(b) $\frac{1}{81}$

(c) $\frac{65}{81}$

(d) $\frac{1}{256}$

89. A number is selected at random from a set of first 100 natural numbers. What is the probability that it will be divisible neither by 5 nor by 6?

(a) 0·67

(b) 0·54

(c) 0·33

(d) 0·16

90. The arithmetic mean and variance of 20 numbers were computed as 12 and 9 respectively. It was then found on scrutiny that a number 8 has been misread as 18. What is the correct variance?

(a) 7·75

(b) 8·50

(c) 8·60

(d) This cannot be computed from the given data

91. If one of the regression coefficients $b_{xy} = 0 \cdot 8$, what are the limits of other regression coefficient b_{yx}?

(a) $0 < b_{yx} \leq 0 \cdot 8$

(b) $0 \leq b_{yx} < 1 \cdot 25$

(c) $0 \leq b_{yx} \leq 1 \cdot 25$

(d) $0 < b_{yx} \leq 1 \cdot 25$

92. The marks secured by two students A and B in six subjects are given below :

A	36	28	24	45	27	22
B	28	37	42	27	19	26

Which one of the following statements is correct?

(a) The average scores of A and B are same but A is consistent

(b) The average scores of A and B are not same but A is consistent

(c) The average scores of A and B are same but B is consistent

(d) The average scores of A and B are not same but B is consistent

93. Two persons A and B alternately toss a die, A starting the process. He who throws a six score first wins the game. What is the probability that A wins the game?

(a) $\frac{1}{2}$

(b) $\frac{2}{3}$

(c) $\frac{4}{7}$

(d) $\frac{6}{11}$

94. What is the equation of plane containing the lines $\vec{r} = \vec{a} + \lambda\vec{b}$ and $\vec{r} = \vec{c} + \lambda\vec{d}$?

(a) $[\vec{r}\ \vec{a}\ \vec{c}] = 0$

(b) $[\vec{r}\ \vec{a}\ \vec{c}] = 1$

(c) $[\vec{r}\ \vec{a}\ \vec{c}] = \vec{a} \cdot \vec{c}$

(d) None of the above

95. A straight line $\vec{r} = \vec{a} + \lambda\vec{b}$ meets the plane $\vec{r} \cdot \vec{n} = 0$ in P. What is the position vector of P?

(a) $\vec{r} = \vec{a} - \frac{\vec{a} \cdot \vec{n}}{\vec{b} \cdot \vec{n}} \vec{b}$

(b) $\vec{r} = \vec{a} + \frac{\vec{a} \cdot \vec{n}}{\vec{b} \cdot \vec{n}} \vec{b}$

(c) $\vec{r} = \vec{a} - \frac{\vec{a} \cdot \vec{n}}{\vec{b} \cdot \vec{n}} \vec{a}$

(d) None of the above

Directions :

Each of the following **five (5)** items consists of two statements, one labelled as 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the code given below :

Code :

(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

96. Assertion (A) :

The range of the inverse tangent function is the complement of S in $\mathbb{R}$ for some subset S of $\mathbb{R}$ such that $S = P \cup Q$, where $P = \{r \in \mathbb{R} : r \leq \theta\}$ and $Q = \{r \in \mathbb{R} : r \geq -\theta\}$ for some $\theta < 0$.

Reason (R) :

The complement in $\mathbb{R}$ of the domain of definition of the inverse cotangent function is the null set.

97. Assertion (A) :

There exists only a finite number of real numbers θ for which

$4(\cos^3\theta + \sin^3 3\theta) \neq 3(\cos\theta + \sin 3\theta)$

Reason (R) :

There exist exactly two real numbers $\theta \in [0, \pi/2)$ for which

$4(\cos^3\theta + \sin^3 2\theta) = 3(\cos\theta + \sin 2\theta)$

98. Let m and n be even positive integers with $n < m$. Let n be a multiple of 4 and m leave remainder 2 on division by 4.

Assertion (A) :

The sum of the odd integers between n and m is odd.

Reason (R) :

The number of odd integers between n and m is $\frac{m-n+2}{2}$.

99. Let m and n be integers such that $(m^2 - 4n) > 0$.

Assertion (A) :

If $m < 0$, then there exists exactly one real number k for which the quadratic equations

$x^2 + mx + n = 0$ and $x^2 - 5x + k = 0$

have a common root.

Reason (R) :

If $m > 0$, then there are exactly two real numbers k for which the quadratic equations $x^2 + mx + n = 0$ and $x^2 - 5x + k = 0$ have a common root.

100. Let p be a prime number. Let

$$q = \frac{2p-1}{2p+2}$$

Assertion (A) :

The $(2p-1)$th term and $(2p)$th term of $(1+q)^{4p}$ are equal.

Reason (R) :

If p is odd and $(2p-1)$ is also a prime number, then HCF of $(2p-1)$ and $(2p+2)$ is 1.

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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S·C·R·A–2009

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A

TEST BOOKLET

PHYSICAL SCIENCES

PAPER II

Time Allowed : Two Hours *Maximum Marks : 200*

INSTRUCTIONS

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2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong Answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. A particle of mass m is at $x = 0$ and moving along the x axis with velocity v_0, at time $t = 0$. It is subjected to a frictional force $-bv_x$ where b is a constant and v_x is the velocity in the x-direction. At what position x on the x-axis will it come to rest ?

(a) $x = bv_0$

(b) $x = \frac{bv_0}{m}$

(c) $x = mbv_0$

(d) $x = \frac{mv_0}{b}$

2. A large tank filled with water to a height h is to be emptied through a small hole at the bottom. What is the ratio of the time taken for the level to fall from h to $\frac{h}{2}$ and that taken for the level to fall from $\frac{h}{2}$ to 0 ?

(a) $\sqrt{2}$

(b) $\frac{1}{\sqrt{2}}$

(c) $\sqrt{2} - 1$

(d) $\frac{1}{\left(\sqrt{2} - 1\right)}$

3. A body kept on a smooth inclined plane having inclination 1 in l will remain stationary relative to the inclined plane if the plane is given a horizontal acceleration equal to

(a) $\frac{g}{\sqrt{l^2 - 1}}$

(b) $\frac{gl}{\sqrt{l^2 - 1}}$

(c) $\frac{g}{2\sqrt{l^2 - 1}}$

(d) $\frac{2g}{\sqrt{l^2 - 1}}$

4. A body of mass m falling vertically downward with speed v_0 is given an upward impulse $I = F\,\Delta t > mv_0$. What is the maximum height h that it will reach from the location of the impulse source ?

(a) $h = \frac{\left[\left(\frac{I}{m}\right) - v_0\right]^2}{(4g)}$

(b) $h = \frac{\left[\left(\frac{I}{m}\right) - v_0\right]^2}{(2g)}$

(c) $h = \frac{\left[\left(\frac{I}{m}\right) - v_0\right]^2}{g}$

(d) $h = \frac{\left[2\left(\frac{I}{m}\right) - v_0\right]^2}{g}$

5. A body B of mass m moving forward with velocity v along the x-axis, collides elastically with a stationary object C of mass $2m$ at the origin. After the collision, body B moves backward along the x-axis. Given that the kinetic energy of the system is conserved, what is the speed of the object C after the collision ?

(a) $\frac{2v}{3}$

(b) $\frac{v}{2}$

(c) $\frac{v}{3}$

(d) $\frac{3v}{4}$

6. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

(a) $t^{1/2}$

(b) $t^{3/4}$

(c) $t^{3/2}$

(d) t^2

7. A body of mass 3 kg is under a force which causes displacement in it, given by $s = \frac{t^2}{3}$ in metre, with time t in seconds. What is the work done by the force between time $t = 0$ and $t = 2$?

(a) 8 J

(b) 5·2 J

(c) 3·9 J

(d) 2·6 J

8. A given object takes n times as much time to slide down a 45° rough incline as it takes to slide down a perfectly smooth 45° incline. What is the coefficient of kinetic friction between the object and the incline ?

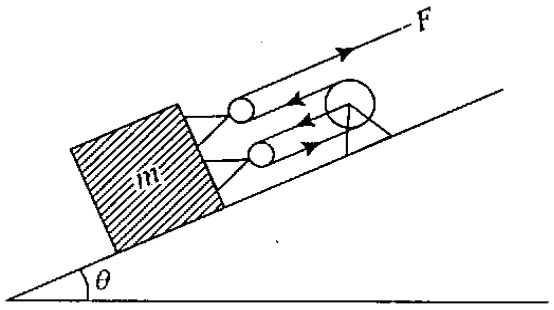
(a) $\frac{1}{\sqrt{1-n^2}}$

(b) $\frac{1}{1-n^2}$

(c) $\sqrt{1-\left(\frac{1}{n^2}\right)}$

(d) $1-\left(\frac{1}{n^2}\right)$

9.



A force F pulls on a mass m using a massless cable and pulley system as shown in the figure given above. What is the acceleration of the block, if the surface is frictionless ?

(a) $a = \left(\frac{F}{m}\right) - g \sin\theta$

(b) $a = 2\left(\frac{F}{m}\right) - g \sin\theta$

(c) $a = 3\left(\frac{F}{m}\right) - g \sin\theta$

(d) $a = 4\left(\frac{F}{m}\right) - g \sin\theta$

10. Consider a simple pendulum of mass m suspended by a thin string. The mass m is subjected to an external horizontal force F. In equilibrium, the string makes an angle θ with the vertical. What is F equal to ?

(a) $F = mg \sin\theta \cos\theta$

(b) $F = mg \cos\theta$

(c) $F = mg \sin\theta$

(d) $F = mg \tan\theta$

11. A satellite is orbiting close to the surface of earth. In order to make it move to infinity, its velocity must be increased by about

(a) 50%

(b) 40%

(c) 30%

(d) 20%

12. A particle is projected upwards with a velocity of 100 m/s at an angle of 60° with the vertical. What is the time when particle moves perpendicular to its initial direction ? ($g = 10\ m/s^2$)

(a) 10 s

(b) 20 s

(c) 5 s

(d) $10\sqrt{3}$ s

13. A particle is projected vertically upward with a velocity $\sqrt{gR}$ where R is radius of earth. What is the maximum height ascended by the particle ?

(a) $\frac{R}{2}$

(b) R

(c) $2R$

(d) $\frac{5R}{4}$

14. A small table is orbiting with a constant angular velocity on a circular track. A glass half full of water is fixed on the table. The surface of water in the glass is

(a) horizontal

(b) inclined with radially outer side being higher

(c) inclined with radially outer side being lower

(d) like a whirlpool with a dip in the centre

15. A particle of mass m moves in a circular path of constant radius r such that its centripetal acceleration a_c varies with time as $a_c = k^2rt^2$ where k is a constant. What is the power delivered to the particle by the forces acting on it ?

(a) mk^2r^2t

(b) $2\,mk^2r^2t$

(c) $2\,mk^2r^2t^2$

(d) $\pi\,mk^2r^2t$

16. A particle P of mass m is tied to a string of length l with one end fixed at the origin. The particle moves around with speed v in a circle in the xy-plane, with radius l and centre at the origin. If the string can withstand a maximum force up to F, at what critical speed v_c of particle P will the string break ?

(a) $v_c = 2\left(\frac{lF}{m}\right)^{1/2}$

(b) $v_c = \left(\frac{lF}{m}\right)^{1/2}$

(c) $v_c = \left(\frac{2lF}{m}\right)^{1/2}$

(d) $v_c = \left(\frac{3lF}{m}\right)^{1/2}$

17. Consider a particle of mass m in a simple harmonic oscillator potential $V(x) = \frac{(kx^2)}{2}$ in one dimension. At time $t = 0$, it is at $x = x_0$ with velocity v_0. At later time, with $\omega = \left(\frac{k}{m}\right)^{1/2}$, what is the maximum possible displacement of the particle from the origin ?

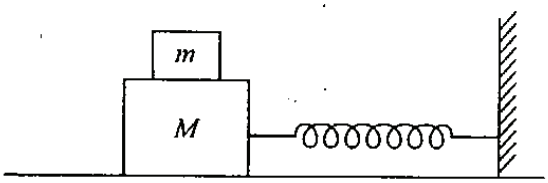
(a) $x_0 + \left(\frac{v_0}{\omega}\right)$

(b) $\left[x_0^2 + \left(\frac{v_0^2}{\omega^2}\right)\right]^{\frac{1}{2}}$

(c) $x_0 + \omega v_0$

(d) $\left[x_0^2 + \left(\frac{2v_0^2}{\omega^2}\right)\right]^{\frac{1}{2}}$

18.



A block m of mass 1 kg is placed over a bigger block M of mass 10 kg as shown in the figure above. The coefficient of static friction between the two blocks is 0·4 and the acceleration due to gravity is 10 m/s^2. The bigger block, connected to a spring of force constant 200 N/m can oscillate on a frictionless table as shown in the figure. What can be the maximum amplitude of simple harmonic motion, if no slippage is to occur between the blocks ?

(a) 0·19 m

(b) 0·22 m

(c) 0·25 m

(d) 0·30 m

19. The work done while stretching an ideal spring of natural length L to stretched length 1·5 L is W. How much energy is needed to compress it to length $\left(\frac{L}{4}\right)$?

(a) 2 W

(b) 1·5 W

(c) 2·25 W

(d) 0·25 W

20. Let C_v be the molar heat capacity of an ideal gas at constant volume. What is the molar heat capacity of this gas, if the gas undergoes the process $Te^{-aV} = T_o$, where a and T_o are constants ?

(a) $C_v + aRV^{-1}$

(b) $C_v + R(aV)^{-1}$

(c) $C_v + aRV^{-2}$

(d) $C_v + 2aRV^{-1}$

where V is the volume.

21. An ice cube of volume Vm^3 and density 0·9 gm/cc, is floating in water. What is the minimum vertical downward force (in Newton) needed to be applied to totally immerse the ice cube into water ?

(a) Vg

(b) 10 Vg

(c) 100 Vg

(d) 0·1 Vg

where g is in m/s^2.

22. The function of hydraulic mechanism in a wheel chair is based on

(a) Pascal's principle

(b) Archimedes' principle

(c) Bernoulli's principle

(d) Stefan-Boltzmann law

23. Take the air density near the earth's surface to be $\rho(h) = \rho_0 e^{-ah}$ where h is the height from the surface, and ρ_0, a are constants. What is the pressure difference at height h and at the surface with $h = 0$?

(a) $\rho_0 gha$

(b) $\rho_0 gh\left(1+e^{-ah}\right)$

(c) $\dfrac{\rho_0 g\left(1-e^{-ah}\right)}{a}$

(d) $\dfrac{2\rho_0 g\left(1-e^{-ah}\right)}{a}$

24. A pendulum clock gains 5 seconds per day at a temperature of 15°C and loses 10 seconds per day at a temperature 30°C. At what temperature, the pendulum clock will neither gain nor lose time ?

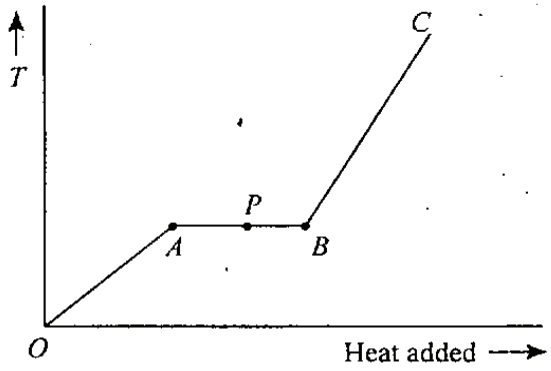
(a) 18°C

(b) 20°C

(c) 22·5°C

(d) 25°C

25.



The variation of temperature (T) of a material as heat is given to it at a constant rate is shown in the above figure. The material is in the solid state at the point O. The state of the material at the point P is

(a) Pure solid

(b) Pure liquid

(c) Mixture of solid and liquid

(d) None of the above

26. What is the change in internal energy of one mole of a gas, when volume changes from V to $2V$ at constant pressure P ?

(a) $\dfrac{R}{(\gamma-1)}$

(b) PV

(c) $\dfrac{PV}{(\gamma-1)}$

(d) $\dfrac{\gamma PV}{(\gamma-1)}$

where γ is the ratio of specific heat of the gas at constant pressure to that at constant volume.

27. An ideal gas with $\gamma = \frac{5}{3}$ is originally of volume V_0 and pressure P_0. If it expands adiabatically to final volume V_1, what is the work done by the gas in this process ?

(a) $\dfrac{3P_0V_0\left[1-\left(\dfrac{V_0}{V_1}\right)^{\frac{3}{2}}\right]}{2}$

(b) $\dfrac{2P_0V_0\left[1-\left(\dfrac{V_0}{V_1}\right)^{\frac{2}{3}}\right]}{3}$

(c) $\dfrac{2P_0V_0\left[1-\left(\dfrac{V_0}{V_1}\right)^{\frac{3}{2}}\right]}{3}$

(d) $\dfrac{3P_0V_0\left[1-\left(\dfrac{V_0}{V_1}\right)^{\frac{2}{3}}\right]}{2}$

28. A metal rod of length l consists of an aluminium sheath (of inner radius r and outer radius R) of resistivity ρ with tungsten core of resistivity 2ρ. What is the resistance of the rod ?

(a) $\dfrac{2\rho l}{\pi\left(R^2-r^2\right)}$

(b) $\dfrac{2\rho l}{\pi\left(2R^2-r^2\right)}$

(c) $\dfrac{2\rho l}{\pi\left(R^2-2r^2\right)}$

(d) None of the above

29. A wooden sphere is being weighed in a liquid whose temperature is continuously increased. What will happen to the apparent weight of the sphere ?

(a) Increases

(b) Decreases

(c) Remains unchanged

(d) Changes erratically

30. A transverse wave is represented by the equation $y = y_0 \sin 2\pi\left[ft-\left(\dfrac{x}{\lambda}\right)\right]$. The maximum particle velocity is equal to four times the wave velocity if

(a) $\lambda = \dfrac{\pi y_0}{4}$

(b) $\lambda = \dfrac{\pi y_0}{2}$

(c) $\lambda = \pi y_0$

(d) $\lambda = 2\pi y_0$

31. The work done in an isothermal expansion from volume V to $10\,V$ is W at temperature T. What is the work done for isothermal expansion from volume $10\,V$ to $100\,V$ at temperature T ?

(a) W

(b) $2{\cdot}3\,W$

(c) $9\,W$

(d) $10\,W$

32. There is a string of length l with ends fixed at $x = 0$ and $x = l$, and c is the velocity of propagation of wave. For the standing waves $A \sin\left(\frac{\omega x}{c}\right)$, what are the resonant angular frequencies ?

(a) $\omega = \frac{\left(n + \frac{1}{2}\right)\pi c}{(2l)}$

(b) $\omega = \frac{\left(n + \frac{1}{2}\right)\pi c}{l}$

(c) $\omega = \frac{n\pi c}{(2l)}$

(d) $\omega = \frac{n\pi c}{l}$

where n is an integer.

33. A concave spherical refracting surface with radius of curvature R separates a medium of refractive index 2·5 from air. As an object is approaching the surface from far away from the surface along the central axis, its image

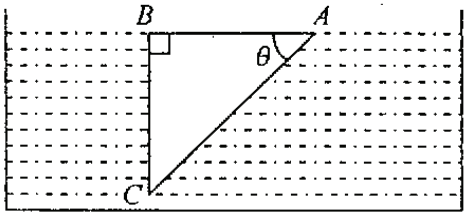
(a) always remains real

(b) always remains virtual

(c) changes from real to virtual at a distance $\frac{2R}{3}$ from the surface

(d) changes from virtual to real at a distance $\frac{2R}{3}$ from the surface

34.



A glass prism having refractive index 1·5 is immersed into water of refractive index $\frac{4}{3}$ as shown in the figure given above. A light beam incident normally on the face AB is totally reflected to reach the face BC if

(a) $\sin\theta > \frac{8}{9}$

(b) $\frac{2}{3} < \sin\theta < \frac{8}{9}$

(c) $\sin\theta < \frac{2}{3}$

(d) None of the above

35. Two plane mirrors are placed making an angle of 120° with each other (like faces of an open Lap Top). A laser beam incident on one mirror at an angle of 65° is then reflected onto the second mirror from which it is again reflected. What is the angle which this doubly reflected emergent beam makes with the normal to the first mirror ?

(a) 55°

(b) 35°

(c) 25°

(d) 5°

36. A point source of light is placed at a distance of 30 cm on the axis of a concave mirror of focal length 20 cm. Now a plane mirror is placed at right angles to the axis facing the concave mirror such that the point source and its image coincide. What is the distance between the two mirrors ?

(a) 20 cm

(b) 30 cm

(c) 45 cm

(d) 60 cm

37. A short linear object of length b lies along the axis of a concave mirror of focal length f at a distance u from the pole of mirror. What is the size of the image approximately equal to ?

(a) $b\left[\frac{(u-f)}{f}\right]^{\frac{1}{2}}$

(b) $b\frac{(u-f)}{f}$

(c) $b\left[\frac{f}{(u-f)}\right]^{\frac{1}{2}}$

(d) $b\left[\frac{f}{(u-f)}\right]^{2}$

38. In an experiment a man looks at a lamp emitting blue light in air (refractive index 1·0). Now the man and the lamp are immersed in water (refractive index 1·4). The colour of light perceived by the man will be

(a) shifted towards red

(b) shifted towards ultraviolet

(c) the same

(d) brighter

39. Two small identical balls (density of the material of the balls is σ) carrying the charges of similar nature are suspended from the same point by insulating threads of equal length L. When the surrounding space was filled with a liquid of density ρ, the divergence angle between the threads remained constant. Which one of the following is correct ?

(a) $\sigma = \frac{\rho\varepsilon}{\varepsilon+1}$

(b) $\sigma = \frac{\rho\varepsilon}{\varepsilon-1}$

(c) $\sigma = \rho$

(d) None of the above

where ε is the permittivity.

40. A stationary charge outside a hollow conductor

(a) produces an electric field in the interior of the hollow

(b) does not produce an electric field in the interior of the hollow

(c) produces magnetic field in the interior of the hollow

(d) None of the above

41. Two solid conducting spheres of radii 5 cm and 20 cm are connected by a thin short wire. 3·14 C charge is given to the system which gets distributed between the two spheres. What is the surface charge density on the bigger sphere ?

(a) 0·63 C/m^2

(b) 2·52 C/m^2

(c) 5·0 C/m^2

(d) 20 C/m^2

42. Two concentric spheres of radii R and r have similar charges with equal surface density (σ). What is the electric potential at their common centre ?

(a) $\frac{\sigma}{\varepsilon_0}$

(b) $\frac{\sigma(R-r)}{\varepsilon_0}$

(c) $\frac{\sigma(R+r)}{\varepsilon_0}$

(d) $\frac{2\sigma}{\varepsilon_0}$

43. A charge q is distributed with constant linear density around a circle of radius b with centre at the origin, in the xy-plane. What is the magnitude of electric field at point (0, 0, z) in cartesian coordinates ?

(a) $\frac{q}{4\pi\varepsilon_0}\ \frac{z}{z^2+b^2}$

(b) $\frac{q}{4\pi\varepsilon_0}\ \frac{b}{\left(z^2+b^2\right)^{3/2}}$

(c) $\frac{q}{4\pi\varepsilon_0}\ \frac{1}{z^2+b^2}$

(d) $\frac{q}{4\pi\varepsilon_0}\ \frac{z}{\left(z^2+b^2\right)^{3/2}}$

44. Point charge Q is kept fixed at the origin. Another particle of mass m and charge q with the same sign as Q, is released at $x = a$, $y = z = 0$ with speed $v_0 = 0$ at time $t = 0$. What is the limiting speed v of charge q for time t tending to infinity ?

(a) $v = \frac{qQ}{4\pi\varepsilon_0}\ \frac{1}{(ma)^{1/2}}$

(b) $v = \left[\frac{qQ}{(2\pi\varepsilon_0 ma)}\right]^{\frac{1}{2}}$

(c) $v = \frac{qQ}{2\pi\varepsilon_0}\ \frac{1}{(ma)^{1/2}}$

(d) $v = \left[\frac{qQ}{(4\pi\varepsilon_0 ma)}\right]^{\frac{1}{2}}$

45. The electric field $\vec{E}$ associated with a current flowing through a straight conductor is

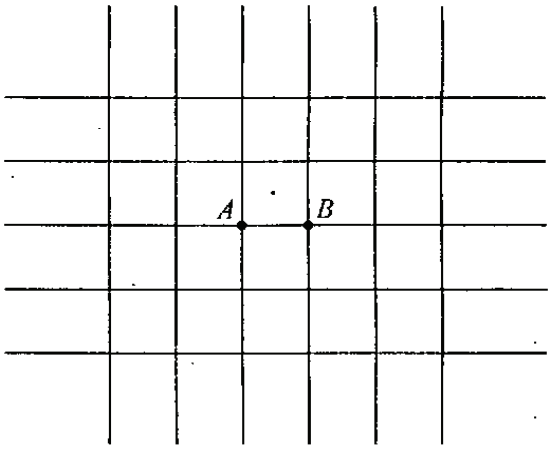
(a) zero, only inside the conductor

(b) zero, inside and outside the conductor

(c) finite inside the conductor and zero outside the conductor

(d) finite inside and outside the conductor

46.



The figure given above shows an infinite wire grid with square cells. The resistance of each wire between neighbouring joint connections is r. What is the resistance of the whole grid between the points A and B ?

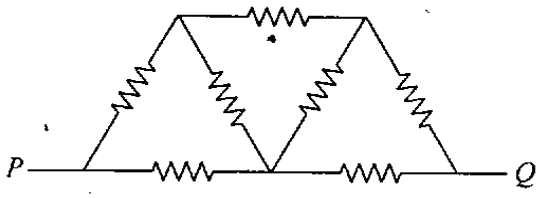
(a) r

(b) $2r$

(c) $\frac{r}{2}$

(d) $\frac{r}{4}$

47.



Seven resistors, each of 1 Ω resistance are connected as shown in the above figure. What is the effective resistance between P and Q ?

(a) $\frac{4}{7}\ \Omega$

(b) $7\ \Omega$

(c) $\frac{8}{7}\ \Omega$

(d) $\frac{3}{2}\ \Omega$

48. A long straight wire of radius a carries a steady current I. The current is uniformly distributed across its cross section. What is the ratio of the magnetic field at $\frac{a}{2}$ to that at $2a$?

(a) 4

(b) 2

(c) 1

(d) $\frac{1}{2}$

49. Two long wires are set parallel to each other. Each carries a current (i) in the same direction and the separation between them is $2r$. What is the intensity of magnetic field midway between them ?

(a) $\frac{4i}{r}$

(b) $\frac{2i}{r}$

(c) $\frac{i}{r}$

(d) Zero

50. What is the rate at which work is done on a charge q moving with a velocity v in presence of an electric and magnetic fields ?

(a) Zero

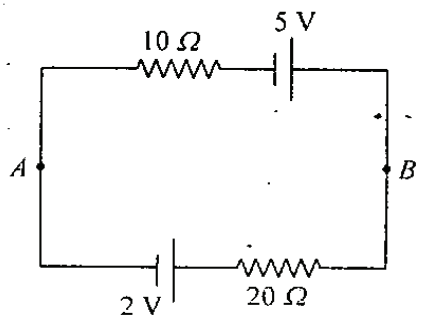
(b) $q\left(\vec{v}\cdot\vec{E}\right)$

(c) $q\left(\vec{v}\cdot\vec{B}\right)$

(d) $q\left(\vec{v}\times\vec{B}\right)$

where $\vec{E}$ is the electric field and $\vec{B}$ is the magnetic field.

51.



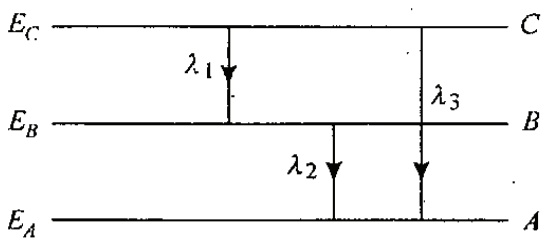
What is the potential difference between the points A and B of the circuit shown above ?

(a) −4 V

(b) 4 V

(c) 8 V

(d) None of the above

52. 

The energy levels of certain atoms are E_A, E_B and E_C such that $E_C > E_B > E_A$. If λ_1, λ_2 and λ_3 are the wavelengths of radiation corresponding to the transitions C to B, B to A and C to A as shown in the figure above, then which one of the following is correct ?

(a) $\lambda_3 = \lambda_1 + \lambda_2$

(b) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

(c) $\lambda_3 = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

(d) $\lambda_3 = \dfrac{(\lambda_1 + \lambda_2)^3}{\lambda_1 \lambda_2}$

53. In a full wave rectifier circuit operating from 50 Hz main frequency, the fundamental frequency in the ripple would be

(a) 25 Hz

(b) 50 Hz

(c) 70 Hz

(d) 100 Hz

54. Each photon in a particular electromagnetic radiation has an energy of 13·2 keV. Then the radiation belongs to the region of

(a) Visible light

(b) UV rays

(c) IR rays

(d) X-rays

55. A nucleus of mass number A emits α-rays with kinetic energy E. What is the recoil energy of the daughter nucleus ?

(a) $\dfrac{4E}{(A-4)}$

(b) $\dfrac{(A-4)E}{A}$

(c) $\dfrac{4E}{(A+4)}$

(d) $\dfrac{4E}{A}$

56. What is the order of the activity of 2 gm of ^{226}Ra whose half life is 1622 years ?

(a) 10^{20} disintegrations per second

(b) 10^{15} disintegrations per second

(c) 10^{10} disintegrations per second

(d) 10^{5} disintegrations per second

57. A uniform rope of mass M and length L hangs from a ceiling. What is the time taken by a transverse wave to travel the full length of rope ?

(a) $\sqrt{\frac{L}{g}}$

(b) $\sqrt{\frac{4L}{g}}$

(c) $\sqrt{\frac{9L}{g}}$

(d) $\sqrt{\frac{L}{4g}}$

58. The amplitude of a wave disturbance propagating in the positive x-direction is given by

$$y = \frac{1}{\left(1+x^2\right)} \qquad \text{at } t = 0$$

and $$y = \frac{1}{\left\{1+(x-1)^2\right\}} \qquad \text{at } t = 4\text{s}$$

where x and y are in metre. What is the velocity of wave assuming shape of disturbance does not change during propagation ?

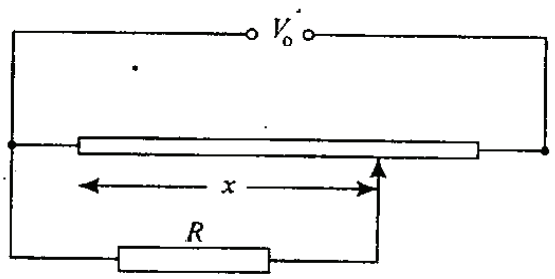
(a) 1 ms^{-1}

(b) 0·5 ms^{-1}

(c) 0·25 ms^{-1}

(d) 0·75 ms^{-1}

59.



The figure given above shows a potentiometric circuit by means of which one can vary a voltage V applied to a certain device possessing a resistance R. The potentiometer has length l and a resistance R_0 and voltage V_0 is applied to its terminals. What is the voltage fed to the device as a function of distance x ?

(a) $V = \frac{V_0 Rx}{\left[lR + R_0 x\left\{1-\left(\frac{x}{l}\right)\right\}\right]}$

(b) $V = \frac{V_0 Rx}{\left[lR - R_0 x\left\{1-\left(\frac{x}{l}\right)\right\}\right]}$

(c) $V = \frac{V_0 Rx}{\left[lR - R_0 x\left\{1+\left(\frac{x}{l}\right)\right\}\right]}$

(d) None of the above

60. A generator develops an emf of 120 V and has a terminal voltage of 110 V when the armature current is 20 A. What is the resistance of the armature ?

(a) 4 Ω

(b) 2 Ω

(c) 1 Ω

(d) 0·5 Ω

61. If the velocity of the electron in the hydrogen atom in its first orbit is $2{\cdot}18 \times 10^6$ ms^{-1}, then what will be the velocity of the electron in the second orbit of Li^{2+} ?

(a) $2{\cdot}18 \times 10^6$ ms^{-1}

(b) $3{\cdot}27 \times 10^6$ ms^{-1}

(c) $6{\cdot}54 \times 10^6$ ms^{-1}

(d) $1{\cdot}45 \times 10^6$ ms^{-1}

62. Consider the following statements about d-block elements :

1. They are all metals.
2. All of them are not coloured.
3. They show variable valency.
4. Most of them form simple salts.

Which of the statements given above are correct ?

(a) 1 and 2

(b) 1 and 3

(c) 2 and 3

(d) 3 and 4

63. The bond angle in H_2O is 104·5° and in H_2S it is 92·5°. The difference is due to

(a) The smaller size of O atom compared to S atom minimizes electron repulsions and allows the bonds in H_2O to be purely p-type

(b) The larger size of S atom compared to O atom minimizes electron repulsions and allows the bonds in H_2S to be purely p-type

(c) The bond pair-lone pair repulsions are large in H_2S

(d) The size of the atom increases and electronegativity decreases while moving from oxygen to sulphur as a result bond pairs closer to the central atom

64. What is the value of internal energy change (ΔE) at 27°C of a gaseous reaction $2A_2(g) + 5B_2(g) \rightarrow 2A_2B_5(g)$ (whose heat change at constant pressure is –50700 J) ?
[$R = 8{\cdot}314$ JK^{-1} mol^{-1}]

(a) –50700 J

(b) –63171 J

(c) –38229 J

(d) +38229 J

65. The concentrations of I^- at the start and after 10 minutes of the reaction $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ which is carried in water are 0·60 mol L^{-1} and 0·56 mol L^{-1} respectively. What are the rate of disappearance of I^- and the rate of appearance of Iodine in mol L^{-1} min^{-1} respectively ?

(a) 0·004 and 0·002

(b) 0·002 and 0·004

(c) 0·004 and 0·004

(d) 0·002 and 0·002

66. Consider the following statements regarding chemical equilibrium :

1. For gaseous reaction the equilibrium can be established in open vessel.
2. The state of equilibrium is dynamic in nature but not static.
3. If temperature is kept constant the colour of the reacting system changes with time.

Which of the statements given above are correct ?

(a) 1

(b) 2 only

(c) 3 only

(d) 2 and 3

67. Consider the following statements :

In the Haber method of synthesis of ammonia

1. increase of pressure favours the formation of NH_3
2. decrease of pressure produces more NH_3
3. increase of temperature dissociates NH_3
4. addition of inert gas favours the formation of NH_3

Which of the statements given above are correct ?

(a) 1 and 3

(b) 2 and 4

(c) 1 and 4

(d) 2 and 3

68. Consider the following statements in respect of an ideal solution :

1. Raoult's law is valid for an ideal solution over the whole concentration range.
2. Enthalpy of mixing is zero i.e. $\Delta H_{mix} = 0$.
3. Volume of mixing is not zero i.e. $\Delta V_{mix} \neq 0$.
4. The components of ideal solution cannot be separated by fractional distillation.

Which of the statements given above is/are correct ?

(a) 3 and 4

(b) 1 and 4

(c) 1 and 2

(d) 2 and 3

69. An organic compound of 0·6 g when it dissolves in water of 21·7 g freezes at 272·187 K. The molar mass of the organic compound is close to : (K_f of water is 1·86 deg/molality; freezing point is 273 K)

(a) 61 g mol^{-1}

(b) 63 g mol^{-1}

(c) 65 g mol^{-1}

(d) 67 g mol^{-1}

70. Consider lowering of vapour pressure (Δp), elevation in boiling point (ΔT_b) and depression in freezing point (ΔT_f) of a solvent for the same molar concentration of each of the following three solutes :

1. $BaCl_2$
2. NaCl
3. $MgCl_2$

Which of the following is/are the correct sequence(s) ?

(a) $\Delta p : 3 < 2 < 1$

(b) $\Delta T_b : 1 > 2 > 3$

(c) $\Delta T_f : 3 < 2 < 1$

(d) All of the above

71. Consider the following :

At constant pressure, boiling point of a solution is greater than the boiling point of its pure liquid solvent because

1. solute is non-electrolyte.
2. solute is involatile.
3. chemical potential of solvent in solution is less than the chemical potential of solvent in its pure state at constant pressure.

Which of the above are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

72. A solution containing 10 g of urea (M = 60) per litre is isotonic with a solution containing 5% of solute X. What is the molar mass of the solute X ?

(a) 60

(b) 100

(c) 300

(d) 600

73. What is the osmotic pressure of the solution obtained by mixing 300 cm^3 of 2% (mass-volume) solution of urea with 300 cm^3 of 3·42% solution of sucrose at 20°C ? (R = 0·082 L atm K^{-1} mol^{-1})

(a) 5·0 atm

(b) 5·2 atm

(c) 2·6 atm

(d) 4·5 atm

74. What is the number of moles of oxygen gas evolved by electrolysis of 180 g of water ?

(a) 2·5

(b) 5·0

(c) 7·5

(d) 10·0

75. The $[Ag^+]$ in a saturated solution of Ag_2CrO_4 is $1·5 \times 10^{-4}$ M. What is the solubility product of Ag_2CrO_4 ?

(a) $3·375 \times 10^{-12}$ M^3

(b) $1·6875 \times 10^{-10}$ M^3

(c) $1·6875 \times 10^{-11}$ M^3

(d) $1·6875 \times 10^{-12}$ M^3

76. Using the Lewis concept, which one of the following has the strongest acidic strength ?

(a) H_3PO_4

(b) H_3PO_3

(c) H_3PO_2

(d) All are of equal strength

77. Which one of the following will ***not*** function as buffer solution ?

(a) Borax + Boric acid

(b) $NaH_2PO_4 + Na_2HPO_4$

(c) NaCl + NaOH

(d) $NH_4Cl + NH_4OH$

78. The reaction,

$3ClO^-(aq) \rightarrow ClO_3^-(aq) + 5Cl^-$ is an example of

(a) Oxidation reaction

(b) Reduction reaction

(c) Disproportionation reaction

(d) Decomposition reaction

79. If 0·4 Curie be the activity of 1 gram of a radioactive sample whose atomic mass is 226, then what is the half life period of the sample ? (1 Curie = $3{\cdot}7 \times 10^{10}$ disintegrations/sec)

(a) $1{\cdot}2 \times 10^{11}$ s

(b) $1{\cdot}8 \times 10^{11}$ s

(c) $1{\cdot}2 \times 10^{10}$ s

(d) $1{\cdot}8 \times 10^{10}$ s

80. An artificial transmutation was carried out on $_7N^{14}$ by an α particle which resulted in an unstable nuclide and a proton. What is the ratio of the atomic mass to the atomic number of the unstable nuclide ?

(a) $\frac{17}{8}$

(b) $\frac{15}{7}$

(c) $\frac{17}{9}$

(d) $\frac{15}{8}$

81. Given the following reactions for hydrogen atom :

1. It forms covalent bond with another atom of hydrogen $H + H \rightarrow H_2$.
2. By losing an electron it acquires positive charge $HCl \rightarrow H^+ + Cl^-$.
3. It forms H^- by gaining an electron $H + e \rightarrow H^-$.

Which of the above reactions point out that hydrogen behaves like halogens ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

82. On large scale Tritium is produced by which one of the following nuclear reactions ?

(a) $^{6}_{3}Li + ^{1}_{0}n \rightarrow ^{4}_{2}He + ^{3}_{1}T$

(b) $^{2}_{1}D + ^{2}_{1}D \rightarrow ^{3}_{1}T + ^{1}_{1}H$

(c) $^{14}_{7}N + ^{1}_{0}n \rightarrow ^{12}_{6}C + ^{3}_{1}T$

(d) $^{14}_{7}N + ^{1}_{1}H \rightarrow ^{3}_{1}T$ + other fragments

83. Which one of the following reactions is ***not*** the part of Solvay process for the manufacture of Na_2CO_3 ?

(a) $2NH_4Cl + Ca(OH)_2 \longrightarrow 2NH_3 + CaCl_2 + 2H_2O$

(b) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

(c) $NH_3 + H_2O + CO_2 \longrightarrow NH_4HCO_3$

(d) $2NaCl + CaCO_3 \longrightarrow Na_2CO_3 + CaCl_2$

84. Sodium bicarbonate on heating decomposes to sodium carbonate, CO_2 and H_2O. If 0·2 moles of sodium bicarbonate are completely decomposed, how many moles of sodium carbonate are formed ?

(a) 0·2

(b) 0·1

(c) 0·05

(d) 0·025

85. Consider the following compounds :

1. $Ba(OH)_2$
2. $Mg(OH)_2$
3. $Ca(OH)_2$

What is the correct order of their alkalinity ?

(a) $Ba(OH)_2 > Mg(OH)_2 > Ca(OH)_2$

(b) $Mg(OH)_2 > Ca(OH)_2 > Ba(OH)_2$

(c) $Mg(OH)_2 > Ba(OH)_2 > Ca(OH)_2$

(d) $Ba(OH)_2 > Ca(OH)_2 > Mg(OH)_2$

86. In borax bead test borax produces

(a) Metal metaborate

(b) Metal oxide

(c) Metal orthoborate

(d) Metal pyroborate

87. Aluminium has very strong affinity for oxygen and the enthalpy of formation of Al_2O_3 is very high. This property has been exploited in

(a) Making synthetic rubies

(b) Making blue sapphires

(c) Thermite reduction of less stable metal oxides

(d) Making spinal ($MgAl_2O_4$)

88. Consider the following statements :

1. Zeolites are aluminosilicates.
2. Aluminium can occupy two adjacent sites in zeolites.

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

89. Consider the following statements about glass :

1. Glass is a solid solution and its composition may vary.
2. For making silica glass very high temperature is required. This can be reduced by adding oxides to the melt.
3. Normal domestic glass for windows is calcium alkali silicate.
4. Al_2O_3 is added to glass to give ruby red colour to it.

Which of the statements given above are correct ?

(a) 1, 2 and 4

(b) 2, 3 and 4

(c) 1, 2 and 3

(d) 1, 3 and 4

90. Which one of the following decomposition reactions provides ammonia as one of the products ?

(a) $(NH_4)_2C_2O_7 \xrightarrow{\text{Heated}}$

(b) $(NH_4)_2SO_4 \xrightarrow{\text{Heated}}$

(c) $NH_4NO_3 \xrightarrow{\text{Heated}}$

(d) $NH_4NO_2 \xrightarrow{\text{Heated}}$

91. The elemental 'P' is made from rock phosphate $Ca_3(PO_4)_2$ by making use of which one of the following reactions ?

(a) $Ca_3(PO_4)_2 + C + CaO \xrightarrow{\Delta}$
$P_4O_{10} \xrightarrow{c} P$

(b) $Ca_3(PO_4)_2 + C + SiO_2 \xrightarrow{\Delta}$
$P_4O_{10} \xrightarrow{c} P$

(c) $Ca_3(PO_4)_2 + C + FeO \xrightarrow{\Delta}$
$P_4O_{10} \xrightarrow{c} P$

(d) $Ca_3(PO_4)_2 + C \xrightarrow{\Delta} P_4O_{10}$
$\xrightarrow{c} P$

92. Excess of concentrated sulphuric acid on heating with copper produces

(a) $CuSO_4 + H_2$

(b) $CuSO_4 + H_2O + SO_2$

(c) $CuO + H_2SO_3$

(d) $CuO + H_2S$

93. The following reactions are used for obtaining I_2 from Chile salt peter :

$$2X + 6HSO_3^- \rightarrow 2Y + 6SO_4^{2-} + 6H^+$$
$$5Y + X \rightarrow 3Z + 3H_2O$$

In these reactions X, Y, Z respectively can be

(a) I^-, IO_4^-, I_2

(b) I^-, IO_3^-, I_2

(c) IO_3^-, I^-, I_2

(d) IO_4^-, I^-, I_2

94. Which of the following quantitative methods for measuring SO_2 in atmosphere are highly developed for environment concern over acid rain ?

1. Reaction of SO_2 with acidified $K_2Cr_2O_7$ and estimated titrimetrically.
2. Reaction of SO_2 with starch iodate paper and estimated calorimetrically.
3. Burning of SO_2 in Hydrogen flame in flame photometer and measuring the spectrum of S_2.

Select the correct answer using the code given below :

(a) 1 only

(b) 1 and 3

(c) 2 and 3

(d) 3 only

95. Helium is used in diving apparatus because

(a) It is lighter than nitrogen

(b) It is completely miscible with oxygen

(c) It is insoluble in blood at high pressure

(d) None of the above

96. The bauxite ore is made up of Al_2O_3 (major) + TiO_2 + SiO_2 + Fe_2O_3. This ore is digested with concentrated NaOH solution at 550 K and 36 bar pressure and solution is filtered hot. In the filterate chemical species present are

(a) $NaAl(OH)_4$ only

(b) $NaAl(OH)_4$ and Na_2SiO_3

(c) $NaFe(OH)_4$ and $NaAl(OH)_4$

(d) $NaAl(OH)_4$ and $Na_2Ti(OH)_6$

97. Which one of the following statements is ***not*** correct ?

(a) Zn is used to extract Ag by solvent extraction from molten lead

(b) Ag and Au are extracted by making soluble cyanide complexes

(c) Argentite is impure AgCl

(d) German silver alloy contains no silver

98. When Cobaltic salt is added to the suspension of bleaching powder

(a) Cobalt metal will be deposited

(b) Oxygen will be evolved

(c) Calcium metal will be deposited

(d) Cobalt chloride will be formed

99. Which one of the following metals is extracted through alloy formation ?

(a) Manganese

(b) Silver

(c) Nickel

(d) Lead

100. Consider the following statements :

1. HF is corrosive and toxic.
2. HF is poor conductor of electricity.

Which of the statements given above is/are correct in respect of the difficulties encountered during electrolysis of anhydrous HF for the manufacture of F_2 ?

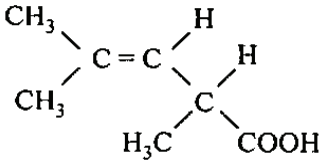
(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

101. Consider the following compound :



The above compound can exhibit

(a) geometrical isomerism only

(b) geometrical and optical isomerisms

(c) optical isomerism only

(d) tautomerism

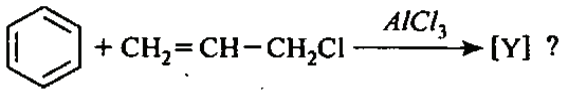
102. Match List I with List II and select the correct answer using the code given below the Lists :

List I *(Property)*	List II *(Product)*
A. Reductive ozonolysis of ethyne	1. Cannizzaro reaction
B. Hydrogenation of carbon	2. Acrolein
C. HCHO + NaOH	3. Glyoxal is one of the main products
D. Heating glycerol with Conc. H_2SO_4	4. Synthetic petrol

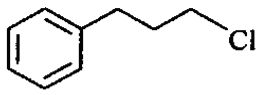
Code :

	A	B	C	D
(a)	4	3	1	2
(b)	3	4	2	1
(c)	4	3	2	1
(d)	3	4	1	2

103. What is the major product [Y] of the reaction



(a)



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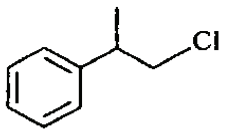
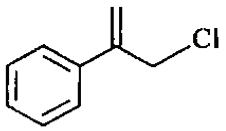
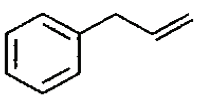


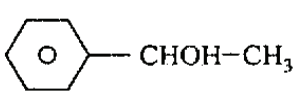
(c)

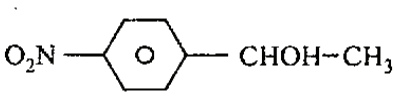


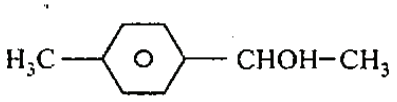
(d)

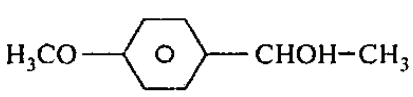


104. Which one of the following alcohols is dehydrated most easily by concentrated H_2SO_4 ?

(a) 

(b) 

(c) 

(d) 

105. Reaction of ethyl formate with excess of PhMgBr followed by hydrolysis gives

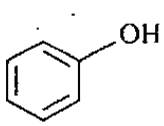
(a) Benzoic acid

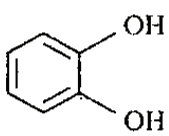
(b) Diphenyl methanol

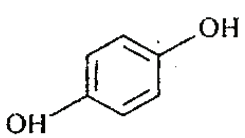
(c) Benzaldehyde

(d) Ethyl benzoate

106. Consider the following compounds :

1. 

2. 

3. 

What is the correct order of the boiling point of the above compounds ?

(a) 3 > 1 > 2

(b) 1 > 2 > 3

(c) 3 > 2 > 1

(d) 1 > 3 > 2

107. Match List I with List II and select the correct answer using the code given below the Lists :

List I *(Commercial name)*	List II *(Formula structure)*
A. Chloral	1. Oxirane
B. Epoxide	2. 40% methanal
C. Formalin	3. Ethanal
D. Perspex	4. Acetone

Code :

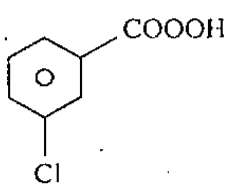
	A	B	C	D
(a)	3	1	2	4
(b)	1	3	2	4
(c)	3	1	4	2
(d)	1	3	4	2

108. Conversion of acetophenone to benzoic acid can be achieved by reaction with

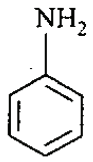
(a) I_2 | NaOH

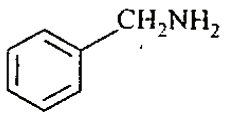
(b) NaOH

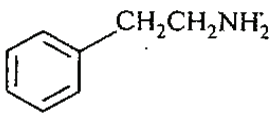
(c) NH_2OH followed by reaction with H_2SO_4

(d) 

109. Consider the following compounds :

I. 

II. 

III. 

What is the correct order of basicity of the above compounds ?

(a) I > II > III

(b) III > I > II

(c) III > II > I

(d) I > III > II

110. Iodobenzene can be prepared by treating

(a) benzene with CH_3I using $FeCl_3$ as a catalyst

(b) bromobenzene with I_2 using $AlCl_3$ as a catalyst

(c) phenol with I_2 in KOH solution

(d) benzene diazonium chloride with KI

111. Consider the following nucleophilic groups :

1. $-O-SO_2-C_6H_5$
2. $-O-\overset{\overset{O}{\|}}{C}-CH_3$
3. $-Cl$
4. $-OCH_3$

What is the correct order of leaving power of the above nucleophilic groups for nucleophilic substitution reactions ?

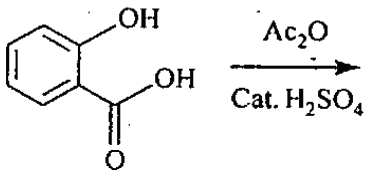
(a) 1 > 2 > 4 > 3

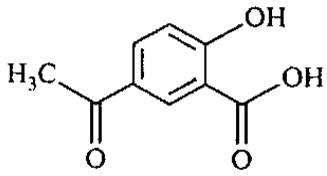
(b) 4 > 3 > 1 > 2

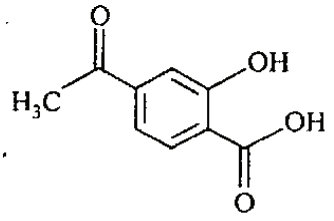
(c) 4 > 3 > 2 > 1

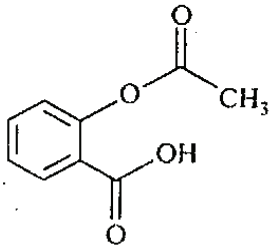
(d) 1 > 2 > 3 > 4

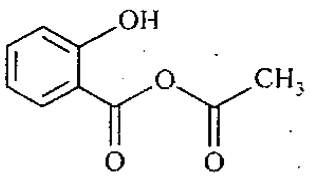
112. What is the major product [**X**] of the reaction ?



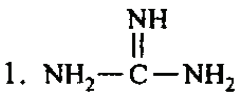
(a) 

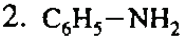
(b) 

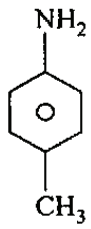
(c) 

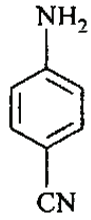
(d) 

113. Consider the following compounds :

1. 

2. 

3. 

4. 

What is the correct order of basic strength of above compounds ?

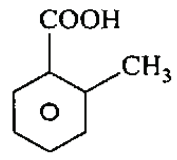
(a) 1 > 3 > 2 > 4

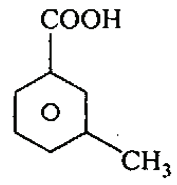
(b) 1 > 3 > 4 > 2

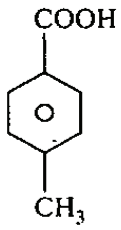
(c) 4 > 2 > 3 > 1

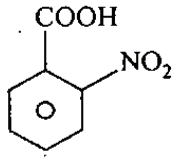
(d) 4 > 2 > 1 > 3

114. Consider the following compounds :

1. 

2. 

3. 

4. 

What is the correct order of decreasing of the acidity of the above compounds ?

(a) 4 > 1 > 3 > 2

(b) 4 > 1 > 2 > 3

(c) 3 > 2 > 1 > 4

(d) 3 > 2 > 4 > 1

115. Consider the following compounds :

1. Phenol
2. Toluene
3. Chlorobenzene
4. Benzene

What is the correct order of reactivity of the above compounds towards bromination ?

(a) 1 > 2 > 3 > 4

(b) 4 > 3 > 2 > 1

(c) 3 > 4 > 2 > 1

(d) 1 > 2 > 4 > 3

116. Consider the following carbanions :

1. $CH_3-\overset{\ominus}{C}H_2$
2. $CH_2=\overset{\ominus}{C}H$
3. $CH\equiv\overset{\ominus}{C}$
4. $C_6H_5-\overset{\ominus}{C}H_2$

What is the correct order of stability of above carbanions ?

(a) 1 > 2 > 3 > 4

(b) 4 > 3 > 1 > 2

(c) 4 > 3 > 2 > 1

(d) 1 > 2 > 4 > 3

117. Consider the following statements :

1. α-D(+) glucose and β-D(+) glucose are anomers.
2. Fructose is reducing sugar and sucrose is non-reducing sugar.
3. Glucose is non-reducing sugar.
4. Maltose shows muta rotation.

Which of the statements given above are correct ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 1, 3 and 4

(d) 2, 3 and 4

118. Consider the following statements :

1. Alkenes are more reactive than alkynes for electrophilic addition.
2. Benzaldehyde is more reactive than acetaldehyde for nucleophilic addition.

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

119. Reaction of acetylene with water in the presence of H_2SO_4 and $HgSO_4$ gives :

(a) Acetone

(b) Acetaldehyde

(c) Acetic acid

(d) Formaldehyde

120. Which one of the following compounds is achiral ?

(a) Glycine

(b) Serine

(c) Alanine

(d) Proline

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T.B.C. : Q–TDS–J–HB

Test Booklet Series

Serial No. 112513

A

TEST BOOKLET

GENERAL ABILITY TEST

Paper—I

Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your **Roll Number** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator **ONLY** the *Answer Sheet*. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

COMPREHENSION

Directions (For the 15 items which follow) :

In this Section you have ***five*** short passages. After each passage, you will find several questions based on the passage. First, read a Passage, and then answer the questions based on it. You are required to select your answers based on the contents of the passage and opinion of the author only.

Examples 'I' and 'J' are solved for you.

PASSAGE (Example)

In our approach to life, be it pragmatic or otherwise, a basic fact that confronts us squarely and unmistakably is the desire for peace, security and happiness. Different forms of life at different levels of existence make up the teeming denizens of this earth of ours. And, no matter whether they belong to the higher groups such as human beings or to the lower groups such as animals, all beings primarily seek peace, comfort and security. Life is as dear to a mute creature as it is to a man. Even the lowliest insect strives for protection against dangers that threaten its life. Just as each one of us wants to live and not to die, so do all other creatures.

I. The author's main point is that

(a) different forms of life are found on earth

(b) different levels of existence are possible in nature

(c) peace and security are the chief goals of all living beings

(d) even the weakest creature struggles to preserve its life

J. Which one of the following assumptions or steps is essential in developing the author's position ?

(a) All forms of life have a single overriding goal

(b) The will to survive of a creature is identified with a desire for peace

(c) All beings are divided into higher and lower groups

(d) A parallel is drawn between happiness and life and pain and death

Explanation :

I. The idea which represents the author's main point is 'peace and security are the chief goals of all living beings', which is response (c). So (c) is the correct answer.

J. The best assumption underlying the passage is 'The will to survive of a creature is identified with a desire for peace', which is response (b). So (b) is the correct answer.

PASSAGE—I

People start smoking for various reasons. Sometimes they get into this habit because they feel it makes them look sophisticated. People may get hooked to this habit. Then smoking becomes a part of their lifestyle. They become addicted to the nicotine in the cigarettes. However, there is a definite link between smoking and lung cancer, heart disease and chronic bronchitis. Besides heavy smokers wrinkle faster. Passive smoking is equally harmful. Non-smokers are cautioned not to stay around smokers. The inhalation of smoke by non-smokers is dangerous. Wives of smokers are more at risk of lung cancer than the wives of non-smokers.

1. In this passage, the expression "get hooked to" means to become
   (a) dull-witted
   (b) habituated and addicted
   (c) emotionally unpleasant
   (d) completely committed

2. Smoking primarily causes
   (a) lung cancer
   (b) infectious diseases
   (c) ageing
   (d) nicotine addiction

3. "Passive smoking" refers to
   (a) people who smoke occasionally
   (b) wives of smokers who inhale smoke
   (c) non-smokers who inhale smoke
   (d) people who like to inhale smoke

PASSAGE—II

My father wished me to become a carpenter like himself. For five generations we have carried on the same trade, from father to son. Perhaps that is the wisdom of life, to tread your father's steps, and look neither to the right nor to the left. When I was a little boy I said I would marry the daughter of the harness-maker who lived next door. She was a little girl with blue eyes and a flaxen pigtail. She would have kept my house like a new pin, and I should have had a son to carry on the business after me.

4. The author's father wished the author to become a carpenter because
   (a) he himself was a carpenter
   (b) he had great love for handicrafts
   (c) the author was unfit for any other thing
   (d) carpentry was their hereditary occupation

5. The phrase "the wisdom of life" in the passage means
   (a) the right way of leading one's life
   (b) following the traditional way of life faithfully
   (c) not looking either to the right or to the left
   (d) leading one's life in an independent manner

6. From the passage, we can say that the author
   (a) followed his father's occupation
   (b) did not follow the occupation of his family
   (c) did not do anything
   (d) became a harness-maker

PASSAGE—III

Men and women should be treated primarily as people, and not primarily as members of opposite sexes. Their shared humanity and common attributes should be stressed not their gender difference. Neither sex should be stereotyped or arbitrarily assigned to a leading or secondary role. Women and men should be treated with the same respect, dignity and seriousness. Women should not be described by physical attributes when men are being described by mental attributes or professional position. Instead, both sexes should be dealt with in the same terms. References to a man's or woman's appearance, charm or intuition should be avoided when irrelevant.

7. Men and women should be treated first
   (a) as human beings
   (b) as belonging to opposite sexes
   (c) in terms of their physical attributes
   (d) as stereotypes

8. Dealing with both sexes "in the same terms" means
   (a) stereotyping both men and women
   (b) describing them by physical attributes
   (c) treating them equally
   (d) describing women by mental attributes

9. All the suggestions in the passage are meant
   (a) to make women more powerful
   (b) to reduce the power of men
   (c) to minimise the possibility of conflict between men and women
   (d) to remove gender discrimination

PASSAGE—IV

Socrates used to move about the roads or stand in the market place all day long. He talked to anyone who cared to greet him. He argued and asked many questions. Sometimes he left his listeners in a very confused state of mind because he seemed to be questioning, doubting or trying to change things about which people had never really thought, but had taken for granted. Socrates believed that everyone should learn to think for himself. He believed that every one should have the power to see what was right, just, true and beautiful. He wanted Athens to be a perfect state and he believed that this could only happen if every citizen educated his own mind to see what was right and noble.

10. People were confused by Socrates' questions because
    (a) he asked them in the market place
    (b) the questions were addressed to anyone and everyone
    (c) he was argumentative and asked too many questions
    (d) the questions were on topics that people had never really thought about

11. Socrates believed that everyone should learn
    (a) to read and write
    (b) to be wise
    (c) to think for himself
    (d) whatever was good and noble

12. Socrates thought that Athens would become a perfect state if
    (a) its people attained perfection
    (b) everyone became educated in the arts
    (c) its people did great things
    (d) its people developed a sense of right and just

(Contd.)

PASSAGE—V

The difficulty of keeping the glasses clean is one of the minor discomforts of glasses, but it is nevertheless a most annoying one. On damp and rainy days, the atmosphere clouds them. On hot days the perspiration from the body may have a similar effect. On cold days, they are often clouded by the moisture of the breath. Every day they are so subject to contamination by dust and moisture, the touch of the fingers and to unavoidable handling, that they seldom afford an absolutely unobstructed view of the objects regarded.

13. The reason why glasses seldom afford an absolutely clear view of objects is that
    (a) Glasses are always contaminated by the atmosphere
    (b) People use them carelessly
    (c) It is very difficult to keep them absolutely clear
    (d) Of handling by dirty fingers

14. What is the major cause of poor view afforded by glasses on a hot day ?
    (a) Moisture in the atmosphere
    (b) Dampness of the weather
    (c) Perspiration from the body
    (d) Contamination by the touch of fingers

15. What is the general effect produced on the reader on reading the passage above ?
    (a) He knows more about weather
    (b) He knows more about glasses
    (c) He is warned against handling glasses carelessly
    (d) He is persuaded not to use glasses, if avoidable

REARRANGING SENTENCES INTO A PARAGRAPH

Directions (For the 12 items which follow) :

In the following items, each passage consists of six sentences. The *first* sentence (S_1) and the *final* sentence (S_6) are given in the beginning. The middle four sentences in each have been removed and jumbled up. These are labelled P, Q, R and S. You are required to find out the proper sequence of the four sentences and mark accordingly on the Answer Sheet.

Example 'X' has been solved for you.

X. S_1 : There was a boy named Jack.
   S_6 : At last she turned him out of the house.
   P : So the mother asked him to find work.
   Q : They were very poor.
   R : He lived with his mother.
   S : But Jack refused to work.

   Which one of the following is the correct sequence ?
   (a) R – Q – P – S
   (b) P – Q – R – S
   (c) Q – P – R – S
   (d) R – P – S – Q

Explanation :

The correct sequence in this example is R – Q – P – S which is marked by (a). Therefore, (a) is the correct answer.

16. S_1 : All men have some degree of physical courage.
    S_6 : We can use it up.
    P : Courage, you know, is like having money in the bank.
    Q : It is surprising how much courage we have.
    R : But don't forget, courage is an expendable quality.
    S : We start with a certain capital of courage, some large, some small, and we proceed to draw on our balance.

    The proper sequence should be
    (a) P – Q – S – R
    (b) Q – P – S – R
    (c) P – S – Q – R
    (d) S – Q – R – P

(Contd.)

17. S_1 : The distance between theatre and reality has stretched so far that when we come across a truly contemporary play, it is a cause for rejoicing.

S_6 : But the question is, have we forgotten his legacy in modern India.

P : It searches our collective psyche like an unrelenting laser beam.

Q : Most importantly, the play questions whether religion and politics can fuse together in modern India.

R : Gandhiji had both the spiritual and political dimensions that we so lack today.

S : Prasanna's 'Gandhi' staged recently by the National School of Drama is one such play.

The proper sequence should be

(a) R – Q – P – S

(b) S – R – P – Q

(c) P – R – S – Q

(d) S – P – Q – R

18. S_1 : Professional education is to be distinguished from other forms of education.

S_6 : But it is not all that dissimilar either.

P : Students accepted the fee-increase readily because they knew that as soon as they graduated, they would start recovering the amount.

Q : Here, the pay off is more or less immediate.

R : The situation may not be as favourable in every branch of professional education.

S : When, for instance, the Institutes of Management raised their fee from Rs. 600 per year to Rs. 6,000 there was no resistance.

The proper sequence should be

(a) Q – S – P – R

(b) P – S – R – Q

(c) R – S – Q – P

(d) Q – R – P – S

19. S_1 : The history of life on earth has been a history of interaction between living things and their surroundings.

S_6 : The most alarming of all man's assaults upon the environment is the contamination of air, earth and water with dangerous and even lethal material.

P : Only within the moment of time represented by the twentieth century has one species—man-acquired significant power to alter the nature of his world.

Q : Considering the whole span of earthly time, the opposite effect, in which life actually modifies its surroundings, has been relatively slight.

R : To a large extent, the physical form and the habits of the earth's vegetation and its animal life have been moulded by the environment.

S : During the past few decades this power has not only increased to one of disturbing magnitude but it has changed in character.

The proper sequence should be

(a) R – Q – P – S

(b) Q – P – R – S

(c) P – R – Q – S

(d) Q – R – P – S

(Contd.)

20. S_1 : AIDS is the most dreaded disease of modern times, as it results in the slow and painful death of its victim.

S_6 : As it is difficult to detect it early, the best method is to go in for a special AIDS test.

P : Of course, it is possible that a person with one or two or any of these symptoms may not have AIDS at all.

Q : The affected person seems to have nothing wrong with his body at the initial stages.

R : But as the disease takes root, he begins to suffer general weakness, loss of weight, a mild unidentified fever and night sweat.

S : It is difficult to detect the symptoms of AIDS at the outset.

The proper sequence should be

(a) S – Q – P – R

(b) R – P – S – Q

(c) S – Q – R – P

(d) P – Q – R – S

21. S_1 : An old fable tells of a blind man who felt an elephant's tail and concluded the animal was made of rope, while another grabbed its trunk and described it as a snake and another felt a leg and decided it was like a tree.

S_6 : Until recently little else was known.

P : The presence of an atmosphere was deduced in 1761.

Q : Astronomers have had the same trouble with Venus.

R : No one has ever seen its clouded–shrouded surface, and for centuries there were not enough facts to draw a picture from.

S : Galileo discovered the planet's phases in 1610, but that gave no hint about its physical appearance.

The proper sequence should be

(a) S – P – R – Q

(b) Q – R – S – P

(c) S – P – Q – R

(d) P – Q – R – S

22. S_1 : The bus stopped.

S_6 : Then his eyes rested with cold malice on the dog.

P : The conductor came in and took the fares.

Q : A woman and a man got in together.

R : The young woman was carrying a pet dog.

S : They took their seats.

The proper sequence should be

(a) P – Q – R – S

(b) Q – S – R – P

(c) Q – P – S – R

(d) Q – S – P – R

23. S_1 : Out of every hundred Indians, eighty live in villages.

S_6 : In India, however, agriculture has been the main occupation for thousands of years.

P : This is not true of all countries.

Q : Of these, as many as sixty make a living from the land.

R : In Britain, for instance, only nine out of a hundred people depend on farming.

S : Only twenty do other kinds of jobs.

The proper sequence should be

(a) R – Q – S – P

(b) Q – S – P – R

(c) S – R – P – Q

(d) R – P – S – Q

(Contd.)

24. S_1 : A dagona tree has many uses.

S_6 : And the spiky branches can be hollowed out and used as musical pipes.

P : Or else the flesh of the fruit can be dried and made into flour.

Q : Similarly, the bark of the tree, made up of fibres of great strength, is used to make ropes.

R : In October it produces a large round fruit with yellow flesh which can be eaten raw or made into a refreshing drink.

S : The outer skin of the fruit can be used for making glue; first it is dried, then the skin is pounded and mixed with water to make the glue.

The proper sequence should be

(a) R – S – P – Q

(b) Q – R – S – P

(c) R – P – S – Q

(d) R – S – Q – P

25. S_1 : Vertebrates are animals which have a skeleton in their bodies.

S_6 : Animals which do not have an internal skeleton are known as "invertebrates".

P : Fish, frogs, salamanders, crocodiles, turtles, lizards, snakes, birds and mammals are all vertebrates.

Q : This skeleton is made up of many bones, including the bones of the skull, or head, and the arms and legs.

R : These small spinal bones are known as "vertebrae" : the word "vertebrate" comes from this.

S : There are many small bones which make up the spine or backbone.

The proper sequence should be

(a) S – R – P – Q

(b) S – P – R – Q

(c) Q – S – R – P

(d) R – S – Q – P

26. S_1 : George worked for British Railways.

S_6 : He spent his evenings playing tunes that ranged from hymns to jazz pieces.

P : He was a ticket collector at one of the underground stations.

Q : Among other accomplishments he could play the piano.

R : He liked his work and received about ten pounds a week for collecting tickets.

S : A large, stout man, he always had a gentle, kindly expression on his mobile face.

The proper sequence should be

(a) P – R – S – Q

(b) R – S – P – Q

(c) Q – P – S – R

(d) S – Q – P – R

27. S_1 : Tornados can be devastating.

S_6 : Even though not all tornados cause such massive devastation, if they touch down in populated areas, you can expect considerable damage.

P : This tornado destroyed an entire block of homes and damaged many other houses and places of business.

Q : More recently, a series of tornadoes hit the Midwest and levelled blocks of houses and businesses, as well as caused the death of several people.

R : Take for example, the tornado which hit Wichita Falls, Texas, in 1979.

S : In addition, the tornado caused the death of several people.

The proper sequence should be

(a) P – S – Q – R

(b) S – Q – P – R

(c) R – P – S – Q

(d) Q – P – S – R

(Contd.)

SPOTTING ERRORS

Directions (For the 9 items which follow) :

(i) In this Section a number of sentences are given. The sentences are underlined in three separate parts and each one is labelled (a), (b) and (c). Read each sentence to find out whether there is an error in any underlined part. No sentence has more than one error. When you find an error in any one of the underlined parts (a), (b) or (c), indicate your response on the separate Answer Sheet at the appropriate space. You may feel that there is no error in a sentence. In that case letter (d) will signify a 'No error' response.

(ii) You are to indicate only one response for each item in your Answer Sheet. (If you indicate more than one response, your answer will be considered wrong.) Errors may be in grammar, word usage or idioms. There may be a word missing or there may be a word which should be removed.

(iii) You are ***not*** required to correct the error. You are required ***only*** to indicate your response on the Answer Sheet.

Examples 'P' and 'Q' have been solved for you.

P. The young child (a) singed (b) a very sweet song. (c) *No error* (d)

Q. We worked (a) very hard (b) throughout the season. (c) *No error* (d)

Explanation :

In item P, the word 'singed' is wrong. The letter under this part is (b); so (b) is the correct answer. Similarly, for item Q, (d) is the correct answer, as the sentence does not contain any error.

28. The hundred-rupees notes (a) that he gave them for the goods bought from them looked genuine, (b) but later they reliably learnt that the notes were all counterfeit. (c) No error (d)

29. The books which you have given me (a) are not enough (b) and I request you to give me a little more (c) No error (d)

30. When the Supervisor and his assistant were going for a walk (a) the later slipped (b) and fell into a pit. (c) No error (d)

31. She says (a) that she is living in the flat for ten years (b) and does not want to leave. (c) No error (d)

32. I'm having a motor cycle (a) these days (b) to go to work. (c) No error (d)

33. Whenever you are not sure (a) about the meaning of a word (b) refer the dictionary. (c) No error (d)

34. Now a days (a) five rupees is (b) a very small amount. (c) No error (d)

35. This variety of cloth is (a) superior than any other (b) in the shop. (c) No error (d)

36. He wears (a) only clothes (b) made of cotton. (c) No error (d)

REARRANGING PARTS OF A SENTENCE

Directions (For the 9 items which follow) :

In the following items, some parts of the sentence have been jumbled up. You are required to rearrange these parts which are labelled P, Q, R and S to produce the correct sentence. Choose the proper sequence and mark in your Answer Sheet accordingly.

Example 'Z' has been solved for you.

Z. It is well-known that the effect (P) is very bad (Q) on children (R) of cinema (S)

Which one of the following is the correct sequence ?

(a) P – S – R – Q

(b) S – P – Q – R

(c) S – R – P – Q

(d) Q – S – R – P

Explanation :

The proper way of writing the sentence is "It is well-known that the effect of cinema on children is very bad". This is indicated by the sequence P – S – R – Q and so (a) is the correct answer.

37. National integration cannot be achieved (P) without harnessing (Q) in the country (R) the communal forces (S)

The correct sequence should be

(a) R – S – P – Q

(b) Q – P – R – S

(c) P – Q – R – S

(d) P – Q – S – R

38. He promised in the office (P) for a suitable post (Q) to consider me (R) when a vacancy arose (S)

The correct sequence should be

(a) S – R – Q – P

(b) R – Q – P – S

(c) Q – R – P – S

(d) Q – R – S – P

39. lived in the Lake District (P) which lies (Q) in the North of England (R) Wordsworth the great nature poet (S)

The correct sequence should be

(a) P – Q – R – S

(b) P – S – Q – R

(c) S – P – Q – R

(d) Q – R – P – S

40. The poems and stories have been taken (P) for this book (Q) from a variety of sources (R) that have been selected (S)

The correct sequence should be

(a) S – Q – P – R

(b) Q – P – S – R

(c) R – P – Q – S

(d) P – Q – R – S

. in India | of all the magazines | widely read | Readers Digest is the most
(P) (Q) (R) (S)

The correct sequence should be

a) Q – S – R – P
) P – S – Q – R
) S – P – Q – R
) S – R – Q – P

as arrested | he | for stealing | by the police.
(P) (Q) (R) (S)

The correct sequence should be

(a) Q – P – S – R
(b) Q – P – R – S
(c) S – P – Q – R
(d) R – P – Q – S

at a remarkably early age | aggressive behaviour | children | can show
(P) (Q) (R) (S)

The correct sequence should be

(a) P – Q – R – S
(b) P – S – Q – R
(c) R – S – Q – P
(d) R – P – S – Q

4. in the richness and variety | in the world | of its wild life | India is unique
(P) (Q) (R) (S)

The correct sequence should be

(a) P – Q – R – S
(b) Q – S – P – R
(c) Q – R – P – S
(d) S – Q – P – R

45. neither | he was | intelligent | nor hardworking.
(P) (Q) (R) (S)

The correct sequence should be

(a) P – Q – R – S
(b) Q – S – P – R
(c) Q – P – R – S
(d) R – S – P – Q

ANTONYMS

Directions (For the 10 items which follow) :

Each of the following ***10*** items consists of a word in capital letters, followed by four words or groups of words. Select the word or group of words that is ***furthest*** in meaning to the word in capital letters.

46. OMINOUS
    (a) Powerful
    (b) Depressing
    (c) Encouraging
    (d) Hopeless

47. FICTITIOUS
    (a) Detailed
    (b) Short
    (c) Factual
    (d) Dull

48. PRIMITIVE
    (a) Forward
    (b) Modern
    (c) Advanced
    (d) Progressive

49. ADVERSITY
    (a) Indigence
    (b) Poverty
    (c) Prosperity
    (d) Perspicacity

50. OCCIDENTAL
    (a) Ancient
    (b) Modern
    (c) Oriental
    (d) Medieval

51. SCORNED
    (a) Welcomed
    (b) Questioned
    (c) Suspected
    (d) Hated

52. HECTIC
    (a) Steady
    (b) Leisurely
    (c) Smooth
    (d) Boring

53. ARROGANT
    (a) Humble
    (b) Timid
    (c) Humorous
    (d) Amicable

54. REPUGNANT
    (a) Agreeable
    (b) Sensible
    (c) Favourable
    (d) Unpleasant

55. RUDIMENTARY
    (a) Basic
    (b) Advanced
    (c) Simple
    (d) Clear

SYNONYMS

Directions (For the 5 items which follow) :

Each of the following *5* items consists of a word in capital letters, followed by four words or groups of words. Select the word or group of words that is most ***similar*** in meaning to the word in capital letters.

56. RECOMPENSE
    (a) Damages
    (b) Praise
    (c) Compensation
    (d) Apology

57. FRAGILE
    (a) Fragmented
    (b) Weak
    (c) Breakable
    (d) Soft

58. CIRCUMSPECT
    (a) Restrained
    (b) Confident
    (c) Cautious
    (d) Honest

59. HARDLY
    (a) Visibly
    (b) Merely
    (c) Barely
    (d) Plainly

60. TIER
    (a) Level
    (b) Step
    (c) Site
    (d) Berth

61. Match List I with List II and select the correct answer using the code given below :

List I (Brand Slogan)	*List II (Corporate Entity)*
A. Making tomorrow brighter	1. UTI bank
B. Energising lives	2. Larsen & Toubro
C. Its all about imagineering	3. Bharat Petroleum
D. Solutions for a lifetime	4. ONGC

Code :

	A	B	C	D
(a)	4	3	2	1
(b)	4	2	3	1
(c)	1	2	3	4
(d)	1	3	2	4

62. Who among the following is a member of both Investment Commission of India as well as National Knowledge Commission ?
    (a) Shri Ratan Tata
    (b) Dr. Ashok Ganguly
    (c) Shri Deepak Parekh
    (d) Dr. Deepak Nayyar

63. Headquarters of which one of the following zones of Indian Railways is located at the eastern most part of India ?
    (a) Eastern Railway
    (b) North Eastern Railway
    (c) East Central Railway
    (d) East Coast Railway

(Contd.)

64. The first railway in the Indian sub-continent ran over a stretch of 21 miles from Bombay to Thane in the year 1853. Which of the following statements with respect to railway line in India is/are correct ?

1. In Eastern India, the first Rail line was opened to the public in 1884 between Dibrugarh and Sadiya to facilitate tea industry.
2. In Southern India, the first line was opened to the public in 1856 by Madras Railway Company between Veyasarpandy and Walajah Road (Arcot).
3. In the Northern India the first section of the railway line from Hathras Road to Mathura Cantonment was opened to the public in 1875.

Select the correct answer using the code given below :

(a) 1, 2 and 3
(b) 2 and 3 only
(c) 3 only
(d) 1 and 3 only

65. Consider the following statements :

1. Agartala is only the second state capital of the north eastern region of India to have rail connectivity.
2. The first rail services in the Kashmir Valley was started between Anantnag and Rajwansher.

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

66. Match List I with List II and select the correct answer using the code given below :

List I (Prominent Indian personality)	*List II (Associated with)*
A. Tessy Thomas	1. Hindustan Unilever
B. Kiran Datar	2. Bharat Hotels
C. Jyotsana Suri	3. National Knowledge Commission
D. Leena Nair	4. DRDO

Code :

	A	B	C	D
(a)	4	2	3	1
(b)	4	3	2	1
(c)	1	3	2	4
(d)	1	2	3	4

67. Which one of the following became the first legal services authority of the country to ensure "access to justice" to the poor and the needy by organizing a workshop-cum-lok adalat on NREGA (National Rural Employment Guarantee Act) successfully in February, 2009 ?

(a) Andhra Pradesh State Legal Services Authority
(b) Jharkhand State Legal Services Authority
(c) Bihar State Legal Services Authority
(d) Madhya Pradesh State Legal Services Authority

(Contd.)

68. To set up *Sharia* Courts, in which among the following countries was the *Nizam-e—Adl Regulation* (NAR), 2009 was signed between the militants and the government in February 2009 ?

(a) Bangladesh
(b) Saudi Arabia
(c) Pakistan
(d) Afghanistan

69. Consider the following statements and using the code given below identify the district with which these statements are associated :

1. It is the first District Administration in North East India to receive ISO 9001 : 2000 certificate from *Det Norske Veritas,* the Netherlands for the quality management system for handling public grievances, establishment management and public facilitation services.
2. The district enjoys autonomy under the provision of Sixth Schedule of the Indian Constitution.
3. The district is known for world's finest organic ginger produced by the genuine small and marginal farmers.

Code :

(a) North Cachar Hills
(b) Karbi Anglong
(c) Ri Bhoi
(d) Ukhrul

70. Which one of the following pairs with regard to the award winning film *Slumdog Millionaire* is ***not*** correct ?

(a) Resul Pookutty : Sound mixing
(b) Loveleen Tandan : Co-director
(c) Simon Beaufoy : Author of the novel based on which the film is made
(d) Dev Patel : Actor

71. Match List I with List II and select the correct answer using the code given below :

List I (Prominent Indian Sports Personality)	*List II (Sports)*
A. Limba Ram	1. Boxing
B. T.C. Yohannan	2. Archery
C. Michael Ferreira	3. Billiards
D. Dingko Singh	4. Athletics

Code :

	A	B	C	D
(a)	2	3	4	1
(b)	1	4	3	2
(c)	1	3	4	2
(d)	2	4	3	1

72. During the Eleventh Five Year Plan, which one of the following sectors has been assigned the highest percentage of allocation of resources ?

(a) Rural development, land resources and panchayati raj
(b) Education
(c) Agriculture and irrigation
(d) Energy

73. In which of the following conditions the *Miniratna* industries are granted enhanced financial, managerial and operational autonomy ?

1. Earned profits continuously for the previous three years.
2. Have positive net worth.
3. Do not seek budgetary support.
4. Have not defaulted in the payment of loans/interests.

Select the correct answer using the code given below :

(a) 1, 2, 3 and 4
(b) 1, 2 and 4 only
(c) 2, 3 and 4 only
(d) 1 and 3 only

(Contd.)

74. In India which of the following taxes are levied by the Union Government and ***not*** shared between the Union and the State Governments ?

1. Income tax
2. Union excise duties
3. Custom duties
4. Corporation tax

Select the correct answer using the code given below :

(a) 1, 2, 3 and 4
(b) 1, 2 and 3 only
(c) 3 and 4 only
(d) 1 and 2 only

75. India is said to be in the Second stage of the demographic transition because :

(a) both birth and death rates are high
(b) both birth and death rates are declining sharply
(c) birth rate is high but death rate is declining
(d) death rate is high but birth rate is declining

76. Match List I with List II and select the correct answer using the code given below :

List I (Cricket Stadium)	*List II (Country)*
A. Riverside Ground	1. South Africa
B. Bellerive Oval	2. New Zealand
C. Basin Reserve	3. Australia
D. The Wanderers	4. England

Code :

	A	B	C	D
(a)	4	3	2	1
(b)	4	2	3	1
(c)	1	2	3	4
(d)	1	3	2	4

77. Which one of the following diseases is transmitted by a vector ?

(a) Japanese Encephalitis
(b) Influenza
(c) Tuberculosis
(d) Syphilis

78. Which one of the following is ***not*** a social insect ?

(a) Termite
(b) Ant
(c) Butterfly
(d) Bee

79. If we consume only meat, egg and bread, we will develop

(a) Marasmus
(b) Kwashiorkor
(c) Scurvy
(d) Rickets

80. Which of the following animals has the power of regeneration ?

(a) Frog
(b) Lizard
(c) Tortoise
(d) Turtle

81. Hydrophobia or fear of water may affect a person having

(a) Diphtheria
(b) Pneumonia
(c) Tetanus
(d) Rabies

82. Which one of the following is an occupational disease ?

(a) Silicosis
(b) Sickle cell anemia
(c) Osteoporosis
(d) Goitre

(Contd.)

83. Minamata disease, first identified in fish in Japan, is caused due to the poisoning effect of which one of the following heavy metals ?

(a) Chromium

(b) Arsenic

(c) Lead

(d) Mercury

84. Match List I with List II and select the correct answer using the code given below :

List I (National Park/ Sanctuary)	*List II (Important Protected Species)*
A. Kaziranga National Park	1. Tiger
B. Dachigam Wild Life Sanctuary	2. One horned rhinoceros
C. Jim Corbett National Park	3. Hangul
D. Mudumalai Wild Life Sanctuary	4. Elephant

Code :

	A	B	C	D
(a)	2	3	1	4
(b)	4	1	3	2
(c)	4	3	1	2
(d)	2	1	3	4

85. Which part of the olive plant contains edible oil ?

(a) Fruit

(b) Leaves

(c) Stem

(d) Roots

86. Identify the correct chronological sequence of the following with the help of the code given below :

1. Green revolution
2. Blue revolution
3. White revolution

Code :

(a) 1–2–3

(b) 1–3–2

(c) 2–1–3

(d) 3–1–2

87. In which one of the following planets of the solar system, the Sun rises in the west ?

(a) Uranus

(b) Mars

(c) Venus

(d) Jupiter

88. Which one of the following statements is ***not*** correct ?

(a) The deep black soils of the Telangana region are alluvial soils

(b) Lateratic soils are predominantly found in Konkan region

(c) Calcareous soils are found in North East Uttar Pradesh and North West Bihar

(d) Bhangar soils are found in Terai region

89. Which city celebrates Christmas day during summer ?

(a) Montevideo

(b) Madrid

(c) Montreal

(d) Mumbai

(Contd.)

90. Given below are the four Indian cities known for steel industry. Which one is different from the rest ?

(a) Rourkela

(b) Bokaro

(c) Bhilai

(d) Jamshedpur

91. Arrange the following principal gases of the atmosphere in descending order of their volumetric proportions :

1. Argon
2. Carbon-dioxide
3. Nitrogen
4. Oxygen

Select the correct answer using the code given below :

(a) 1–2–4–3

(b) 4–3–2–1

(c) 3–4–1–2

(d) 3–4–2–1

92. Match List I with List II and select the correct answer using the code given below :

List I (Tropical Cyclone)	*List II (Region)*
A. Hurricane	1. East coast of Asia
B. Willy-Willy	2. North-Western coast of Australia
C. Typhoon	3. West Indies islands

Code :

	A	B	C
(a)	3	2	1
(b)	3	1	2
(c)	1	2	3
(d)	1	3	2

93. Which of the following are the main characteristics of temperate cyclones ?

1. 30° N to 30° S latitude
2. High air pressure in the centre
3. Low air pressure in the centre

Select the correct answer using the code given below :

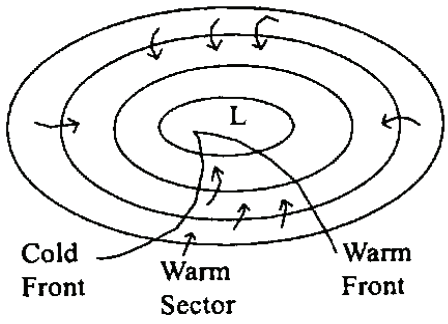
(a) 1 and 2

(b) 2 only

(c) 1 and 3

(d) 3 only

94.



The diagram given above presents which one of the following types of atmospheric disturbance ?

(a) Anticyclone

(b) Hurricane

(c) Tropical Cyclone

(d) Temperate Cyclone

95. Consider the following :

Under the Mughals, the use of hundi was a system which

1. facilitated the movement of goods.
2. permitted easy transaction of money from one part of the country to another.
3. included insurance which was charged at different rates on the basis of the value of the goods, destination, means of transport etc.

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 2 and 3 only

(d) 1 and 3 only

(Contd.)

96. Consider the following statements :

Tipu Sultan of Mysore

1. was interested in state power and its commercial capacity.
2. regarded Islam as a great ideological prop for his power.
3. took recourse to Brahman prayers in times of danger.
4. made several endowments to Hindus and Hindu institutions.

Which of the statements given above are correct ?

(a) 1 and 2 only
(b) 3 and 4 only
(c) 2 and 4 only
(d) 1, 2, 3 and 4

97. Consider the following statements :

Pushyamitra Sunga, a general of Brihadratha, the last Mauryan king, seized power in Magadha in about 185 B.C. He is known to have

1. been a staunch follower of Buddhism as is evident from the flourishing state of the religion from the remains at Bharhut of this period.
2. been a supporter of the orthodox Brahmanical faith.
3. revived the Vedic sacrifices, including the horse-sacrifice.
4. started a process of decentralization of authority.

Which of the statements given above are correct ?

(a) 1 and 4 only
(b) 2, 3 and 4 only
(c) 2 and 3 only
(d) 1, 2, 3 and 4

98. The phrase "*yogaksema vahamyaham*" adopted by the Life Insurance Corporation of India in its logo (emblem) is an extract from

(a) Rig Veda
(b) Manu Smriti
(c) Arthasastra
(d) Srimad Bhagavadgita

99. Consider the following statements :

Jainism was associated with the spread of urban culture in the Sixth Century because

1. Jainism was atheistic in nature, the existence of God being considered as irrelevant to its doctrine.
2. The emphasis on non-violence (ahimsa) prevented agriculturists from accepting Jainism, since cultivation involved killing of insects.

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

100. The brick temple at Bhitargaon near Kanpur is noted for its technique and architectural beauty. To which period does it belong ?

(a) Kushan period
(b) Mauryan period
(c) Gupta period
(d) Harshavardhan's period

101. The term used to describe the process by which an outsider, immigrant or subordinate group becomes indistinguishably integrated into the dominant host society is called :

(a) Assimilation
(b) Cooperation
(c) Accommodation
(d) Integration

(Contd.)

102. Consider the following :

"People living near a sea coast can engage in fishing and ocean trade, whereas people living inland must find other pursuits."

To which one among the following does the above situation relate ?

(a) Adaptation

(b) Goal attainment

(c) Integration

(d) Pattern maintenance

103. With regard to which one of the following exogamic rules of Hindu marriage a man shall not marry a woman who belongs up to the Sixth degree in ascending or descending lineage with reference to the maternal side ?

(a) *Gotra*

(b) *Pravara*

(c) *Sapinda*

(d) Lineage

104. Which one of the following is ***not*** a tribal uprising ?

(a) Moplah Rebellion of 1851

(b) Santhal Rebellion of 1855

(c) Phulaguri Uprising of 1861

(d) Kol Uprising of 1831

105. Which of the following has been losing its relevance under the present market driven economy in India ?

(a) Foot-loose labour

(b) Social reproduction of labour

(c) Feminisation of labour

(d) Informalisation of labour market

106. Which one of the following is the 'invisible hand' in Adam Smith's doctrine of economic development ?

(a) Market

(b) Labour

(c) Technology

(d) Capital

107. The expression "we, the people" appearing in the preamble to the Constitution of India, has been borrowed from the constitutional experience of

(a) United Kingdom

(b) Australia

(c) United States of America

(d) Canada

108. Which among the following is ***not*** a feature of the Indian Constitution ?

(a) Republican form of Government

(b) Existence of a Preamble

(c) Promotion of International Peace

(d) Direct Democracy

109. The Latin word '*Mandamus*' which is issued as a writ by the court for protection of Fundamental Rights in India means :

(a) you may have the body

(b) we order

(c) prevention

(d) injunction

110. Which of the following fundamental rights was described by Dr. B.R. Ambedkar as the very soul of the Constitution and the very heart of it ?

(a) Right to Equality

(b) Right to Freedom of Religion

(c) Right to Constitutional Remedies

(d) Right to Freedom of Occupation

(Contd.)

111. A bus traveling at a speed of 40 km per hour reaches its destination in 8 minutes and 15 seconds. How far is the destination ?

(a) 5·43 km

(b) 5·44 km

(c) 5·50 km

(d) 9·06 km

112. If the third day of a month is Monday, which of the following will be the fifth day from 21st of the month ?

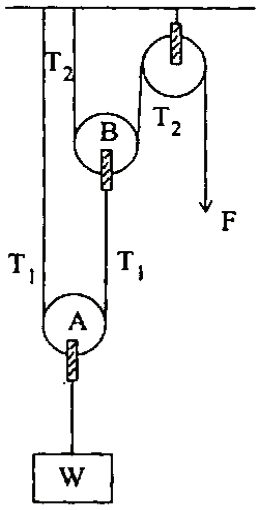
(a) Monday

(b) Tuesday

(c) Wednesday

(d) Friday

113.



Neglecting the friction and weights of the pulley, which one of the following is the force 'F' required to lift a 100 N load in the system of pulleys as shown in the above figure ?

(a) 20 N

(b) 25 N

(c) 30 N

(d) 35 N

114. A sample of cement is acceptable if the cement conforms to the following requirements :

(i) Initial Setting Time ⩽ 30 minutes

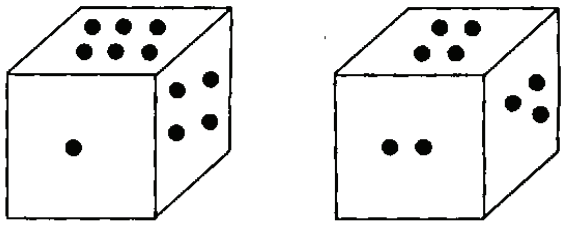
(ii) Final Setting Time ⩾ 10 hours

(iii) Compressive Strength ⩽ 225 kg/cm²

The results of testing of 4 samples of cement are given below. Which one of the following samples of cement is acceptable if the cement should conform to the above requirements ?

	Initial Setting Time (Minutes)	Final Setting Time (Hours)	Compressive Strength (n/cm²)
(a) Sample 1	35	12	225
(b) Sample 2	25	11	230
(c) Sample 3	40	8	240
(d) Sample 4	38	9	200

115.



A cube, as shown above, has dots pointed on each of its faces starting with one dot to six dots on each of its faces. When six dots are on the top of the cube, how many dots will there be at the bottom ?

(a) 3

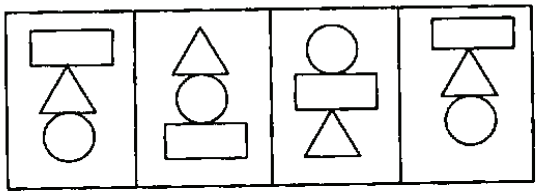
(b) 2

(c) 1

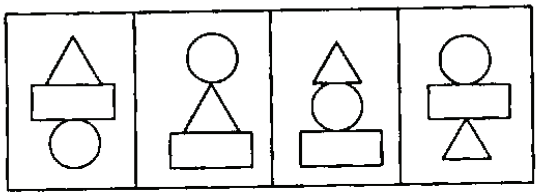
(d) Incomplete data

(Contd.)

116.

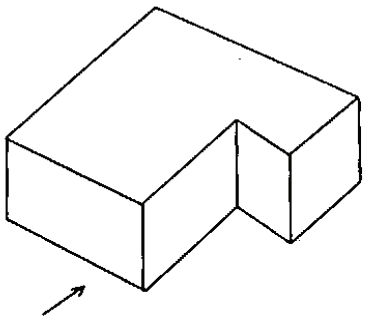


Consider the figures given above and identify which one of the following figures will come next in the series.



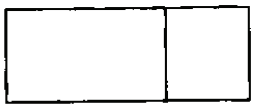
(a) (b) (c) (d)

117.



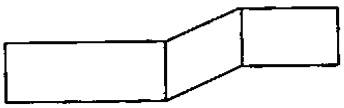
Looking in the direction of the arrow identify which one of the following figures correctly represents the front view (in the direction of the arrow) of the object shown above ?

(a)

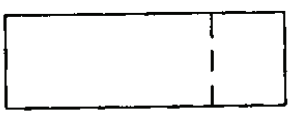


(b)

(c)



(d)



118. Examine the following random sets of words :

1. Think, Act, Plan
2. Listen, Believe, Confirm
3. Chew, Cook, Digest
4. Strategy, Problem, Solution

Which of the above two sets can be combined together ?

(a) 1 and 2
(b) 1 and 4
(c) 2 and 4
(d) 2 and 3

119. Consider the following statements :

Students who study throughout the year may succeed. Miss X is studying hard right from the beginning of the year. Therefore, she must succeed.

On the basis of the above identify which one of the following is correct.

(a) Conclusion necessarily follows from the statements
(b) Conclusion is only a long-drawn one
(c) Conclusion definitely does not follow from the statements
(d) Conclusion drawn is doubtful

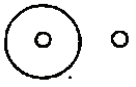
120. Which one of the four diagrams given below illustrates relationships among the three classes : fluid, liquid, gas ?

(a)

(b)

(c)

(d)



SPACE FOR ROUGH WORK