
All The Best.... 😊

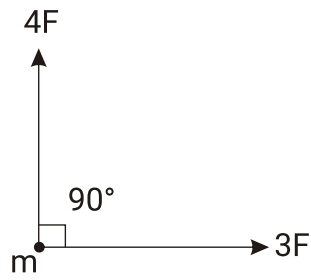
Part - A Physics

Section - I: Single Correct

*This section contains a total of 20 questions.
All questions in this section are mandatory.
For every correct response you shall be awarded 4 marks.
For every incorrect response -1 marks shall be deducted.
For more details refer the first page of this booklet.*

1. A mass 2 kg is put on flat pan attached to vertical spring fixed on ground. Mass of spring and pan are negligible. When pressed slightly & released the mass executes SHM. Spring constant is 200 N/m. What should be minimum amplitude of motion so that mass gets detached from pan?
- (a) 10 cm
 - (b) 4 cm
 - (c) 8 cm
 - (d) any value less than 12 cm

2. When a force F acts on a particle of mass m , the acceleration of particle becomes a . Now if two forces of magnitude $3F$ and $4F$ acts on the particle simultaneously as shown in the figure, then the acceleration of the particle is



- (a) a
- (b) $2a$
- (c) $5a$
- (d) $8a$

3. A body weighs 200 gm in air, 180 gm in a liquid, and 175 gm in water. The density of the material of the body is
- (a) 8000 kg/m^3
 - (b) 800 kg/m^3
 - (c) 8 kg/m^3
 - (d) none

4. The rate of radiation of energy from a hot object is maximum, if its surface is
- (a) White and smooth
 - (b) Black and rough
 - (c) Black and smooth
 - (d) White and rough

5. The correct increasing order of the penetrating powers of α particles, β particles and γ rays is
- (a) α , β , γ
 - (b) β , α , γ
 - (c) γ , β , α
 - (d) All have the same penetrating power

6. A parallel plate capacitor with air as medium between the plates has a capacitance of $10\ \mu\text{F}$. The area of the capacitor is divided into two equal halves and filled with two media having dielectric constants $K_1 = 2$ and $K_2 = 4$. Find out the capacitance of the system?
- (a) $10\ \mu\text{F}$
 - (b) $20\ \mu\text{F}$
 - (c) $30\ \mu\text{F}$
 - (d) $40\ \mu\text{F}$

7. One mole of an ideal gas undergoes an isothermal change at a temperature T so that its volume V is doubled. R is the universal gas constant. Work done by the gas during this change is
- (a) $RT \ln 4$
 - (b) $RT \ln 2$
 - (c) $RT \ln 1$
 - (d) $RT \ln 3$

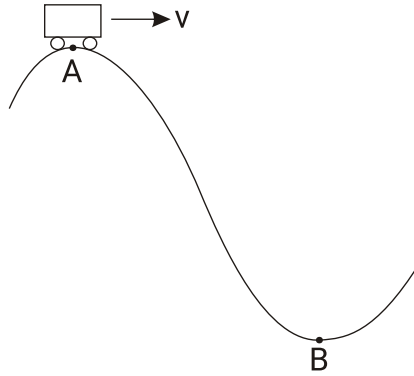
8. If the tension and the diameter of a sonometer wire of fundamental frequency n are doubled and the density is halved while keeping its length the same, its fundamental frequency will become
- (a) $\frac{n}{4}$
 - (b) $\sqrt{2n}$
 - (c) n
 - (d) $\frac{n}{\sqrt{2}}$

9. The force required to pull a circular flat plate of radius 5 cm out from the surface of water is (the surface tension of water is 75 dyne/cm and ignore the weight of the plate).
- (a) 30 dyne
 - (b) 60 dyne
 - (c) 750 dyne
 - (d) 750π dyne

10. Morning breakfast gives 5000 cal to a 60 kg person. The efficiency of the person is 30%. The height up to which the person can climb up by using the energy obtained from breakfast is ($g = 10 \text{ m/s}^2$ and $1 \text{ cal} = 4.2 \text{ J}$)
- (a) 5 m
 - (b) 10.5 m
 - (c) 15 m
 - (d) 16.5 m

11. A ball is thrown at an angle θ with the horizontal. Its horizontal range is equal to its maximum height. This is possible only when the value of $\tan \theta$ is
- (a) 4
 - (b) 2
 - (c) 1
 - (d) 0.5

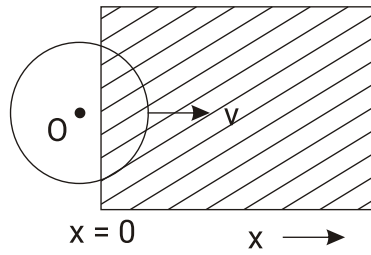
12. A car moves at a constant speed on a road. The normal force by the road on the car is N_A and N_B when it is at the points A and B.



- (a) $N_A = N_B$
- (b) $N_A > N_B$
- (c) $N_A < N_B$
- (d) Information insufficient

13. A ball is thrown vertically downwards with velocity $\sqrt{2gh}$ from a height h . After colliding with the ground it just reaches the starting point. Find out the coefficient of restitution?
- (a) $\frac{1}{\sqrt{2}}$
 - (b) $\frac{1}{2}$
 - (c) 1
 - (d) $\sqrt{2}$

14. A constant magnetic field of 1 T is applied in the $x > 0$ region. A metallic circular ring of radius 1 m is moving with a constant velocity of 1 m/s along the X-axis. At $t = 0$, the centre of O of the ring is at $x = -1$ m. What will be the value of the induced emf in the ring at $t = 1$ s? (Assume that the velocity of the ring does not change.)

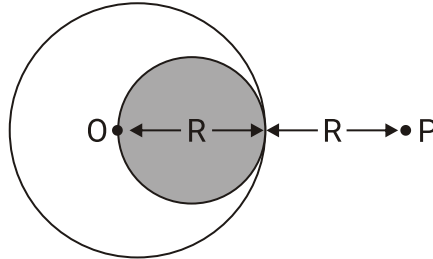


- (a) 1 Volt
- (b) 2π Volt
- (c) 2 Volt
- (d) 0 Volt

15. The root-mean-square (thermal) speed for a certain ideal gas at $100\text{ }^{\circ}\text{C}$ is 0.500 km/s . If the temperature of the gas is now increased to $200\text{ }^{\circ}\text{C}$, the root-mean-square (thermal) speed will be closest to
- (a) 563 m/s .
 - (b) 634 m/s .
 - (c) 707 m/s .
 - (d) 804 m/s .

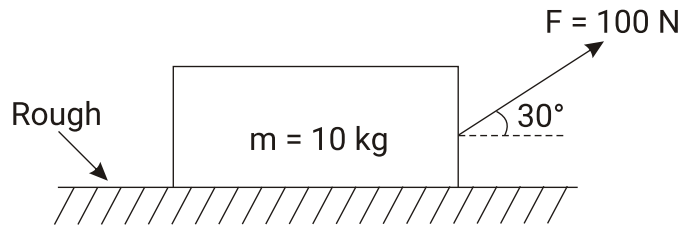
16. A 2 g bullet moving with a velocity of 200 m/s is brought to a sudden stoppage by an obstacle. The total heat produced goes to the bullet. If the specific heat of the bullet is $0.03 \text{ cal/g}^\circ\text{C}$, the rise in its temperature will be approximately:
- (a) 158.7°C
 - (b) 15.87°C
 - (c) 1.58°C
 - (d) 0.158°C

17. A solid sphere of uniform density and radius R applies a gravitational force of attraction equal to F_1 on a particle placed at P , distance $2R$ from the centre O of the sphere. A spherical cavity of radius $\frac{R}{2}$ is now made in the sphere as shown in the figure. The sphere with cavity now applied an gravitational force F_2 on same particle placed at P . Find out the ratio $\frac{F_2}{F_1}$?



- (a) $\frac{1}{2}$
- (b) $\frac{7}{9}$
- (c) 3
- (d) 7

18. A block of mass 10 kg is placed on a horizontal rough surface as shown in the figure and a force, $F = 100\text{ N}$ is applied on the block as shown in the figure. The block is at rest with respect to the ground. If the contact force between the block and the ground is $25n$ (in Newton), then the value of n is: (Take $g = 10\text{ m/s}^2$)



- (a) 1
- (b) 2
- (c) 3
- (d) 4

19. In LC circuit the inductance $L = 40 \text{ mH}$ and capacitance $C = 100 \mu\text{F}$. If a voltage $V(t) = 10\sin(314t)$ is applied to the circuit, find out the current in the circuit?
- (a) $0.52 \cos(314t)$
 - (b) $10 \cos(314t)$
 - (c) $5.2 \cos(314t)$
 - (d) $0.52 \sin(314t)$

20. The maximum and minimum values of $f(x) = 4x^3 + 3x^2 - 6x + 5$ are

(a) $8, \frac{7}{2}$

(b) $10, \frac{13}{4}$

(c) $3, \frac{5}{7}$

(d) $2, \frac{8}{7}$

Section - II: Numerical

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21. The horizontal component of the Earth's magnetic field is 0.3 G. A bar magnet is oscillating in the horizontal plane at the rate of 5 oscillations/min. By how much (in G) should the horizontal component of the magnetic field of the earth be increased, so that the number of oscillations becomes 10 per minute?

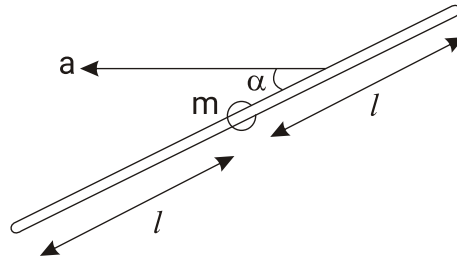
22. The ends of two rods of different materials with their thermal conductivities, areas of cross-section and lengths, all in the ratio 1 : 2 are maintained at the same temperature difference. If the rate of flow of heat in the first rod is 4 cal/s, then in the second rod the rate of heat flow in cal/s is $8p$. Then p is equal to

23. A closed vessel contains 0.1 mole of a monoatomic ideal gas at 200 K. If 0.05 mole of the same gas at 400 K is added to it, the final equilibrium temperature (in K) of the gas in the vessel will be close to _____.
Note: No amount of heat is lost to the surroundings.

24. A series LCR circuit of $R = 5 \Omega$, $L = 20 \text{ mH}$ and $C = 0.5 \mu\text{F}$ is connected across an AC supply of 250 V, having variable frequency. The power dissipated at resonance condition is $\text{_____} \times 10^2 \text{ W}$.

25. The area of a triangle having vertices at $A = (1, 3, 2)$, $B = (2, -1, 1)$ and $C = (-1, 2, 3)$ is $\sqrt{\frac{107}{n}}$ square units.
Find n .

26. A bead of mass m is fitted onto a rod with a length $2l = 1.2$ m and can move on it with friction having the coefficient of friction $\mu = 1$. The arrangement is kept in a gravity-free space. At the initial moment, the bead is in the middle of the rod. The rod moves translationally in a horizontal plane with an acceleration $a = \frac{50}{3}$ m/s² in a direction forming an angle $\alpha = 37^\circ$ with the rod. Find the time (in s) when the bead will leave the rod.



27. A hydrogen atom in its ground state is irradiated by light of wavelength 970 \AA . Taking $\frac{hc}{e} = 1.237 \times 10^{-6} \text{ eV/m}$ and the ground state energy of hydrogen atom as -13.6 eV , the number of lines present in the emission spectrum is_____.

28. First, a set of n equal resistors of $10\ \Omega$ each are connected in series to a battery of emf $20\ \text{V}$ and internal resistance $10\ \Omega$. A current I is observed to flow. Then, the n resistors are connected in parallel to the same battery. It is observed that the current is increased 20 times, then the value of n is

29. The amplitude of upper and lower side bands of A.M. wave where a carrier signal with frequency 11.21 MHz, peak voltage 15 V is amplitude modulated by a 7.7 kHz sine wave of 5V amplitude are $\frac{a}{10}$ V and $\frac{b}{10}$ V respectively. Then the value of $\frac{a}{b}$ is _____.

30. A vessel of volume $V = 5$ litre contains 1.4 g nitrogen and 0.4 g of He at 1500 K. If 30% of the nitrogen molecules are disassociated into atoms then the gas pressure is $\frac{11k}{8} \times 10^5$ N/m². Find k. (Assume T constant and take

$$R = \frac{25}{3} \text{ J/mol-K}$$

Part - B Chemistry

Section - I: Single Correct

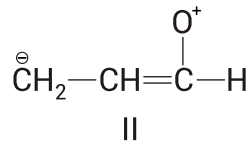
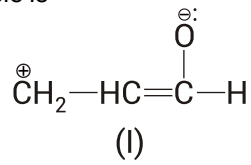
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31. In a BCC unit cell, if half of the atoms per unit cell are removed, then percentage void is
- (a) 68%
 - (b) 32%
 - (c) 34%
 - (d) 66%

32. The equivalent conductivity of 1M H_2SO_4 solution would be if the specific conductance is $26 \times 10^{-2} \text{ S cm}^{-1}$.
- (a) $1.3 \times 10^2 \text{ S cm}^2 \text{ eq}^{-1}$
 - (b) $1.6 \times 10^2 \text{ S cm}^{-1}$
 - (c) $13 \text{ S cm}^2 \text{ mol}^{-1}$
 - (d) $1.3 \times 10^3 \text{ S cm}^2 \text{ mol}^{-1}$

33. With Cr_2O_3 , colour of the bead in sodium carbonate bead test is:
- (a) red
 - (b) blue
 - (c) yellow
 - (d) green

34. In the below given two structures, the more stable is

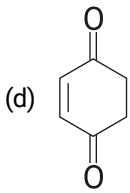
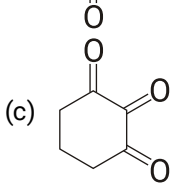
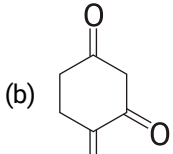
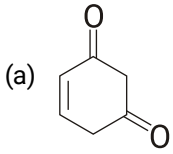


- (a) (I)
- (b) (II)
- (c) Sometimes (I) and sometimes (II)
- (d) Both are equal stable

35. Air contains 23% oxygen and 77% nitrogen by weight. The percentage of O_2 by volume is
- (a) 28.1
 - (b) 20.7
 - (c) 21.8
 - (d) 23.0

36. 5g of zinc is treated separately with an excess of
(a) dilute hydrochloric acid and
(b) aqueous sodium hydroxide.
The ratio of the volumes of H_2 evolved in these two reactions is:
- (a) 1 : 2
 - (b) 2 : 1
 - (c) 1 : 4
 - (d) 1 : 1

37. Aromatic enol is not possible in

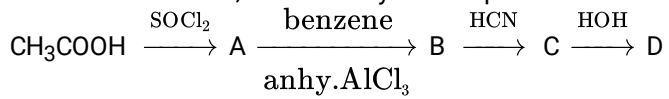


38. What volume of oxygen gas (O_2) measured at $0^\circ C$ and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
- (a) 10 L
 - (b) 7 L
 - (c) 6 L
 - (d) 5 L

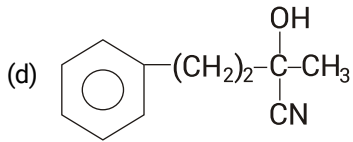
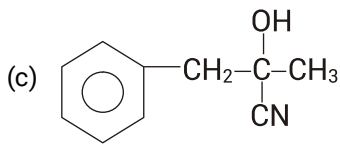
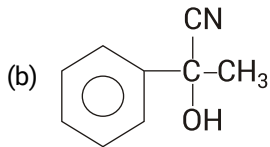
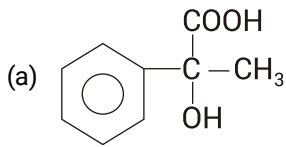
39. In the Arrhenius equation $k = Ae^{\frac{-E_a}{RT}}$, A may not be termed as a rate constant
- (a) When 100% reactant will convert into the product
 - (b) When the temperature becomes infinite
 - (c) When the fraction of molecule crossing over the energy barrier becomes unity
 - (d) At very low temperature

40. Product of Perkin reaction is :
- (a) α, β -unsaturated aldehyde
 - (b) β -cyclohexyl α, β -unsaturated aldehyde
 - (c) β -Aryl- α, β -unsaturated acid
 - (d) All of these

41. In a set of reactions, acetic acid yielded a product D.



The structure of D would be

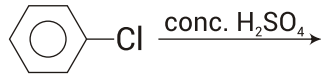


42. The IUPAC name for $[\text{Co}(\text{NCS})(\text{NH}_3)_5]\text{Cl}_2$ is -
- (a) Pentaammine(thiocyanato-N)cobalt(III) chloride
 - (b) Pentaammine(thiocyanato-S)cobalt(III) chloride
 - (c) Pentaammine(isothiocyanato-N,S)cobalt(III) chloride
 - (d) Pentaammine(mercapto-N)cobalt(III) chloride

43. Alizarin gives a red colour by mordanting it with the sulphate of a metal. The metal ion involved is
- (a) Cr^{3+}
 - (b) Fe^{3+}
 - (c) Al^{3+}
 - (d) Sn^{2+}

44. Consider a binary mixture of volatile liquids. If at $X_A = 0.4$ the vapour pressure of the solution is 580 torr then the mixture could be ($p_A^0 = 300$ torr, $p_B^0 = 800$ torr):
- (a) $\text{CHCl}_3 - \text{CH}_3\text{COCH}_3$
 - (b) $\text{C}_6\text{H}_5\text{Cl} - \text{C}_6\text{H}_5\text{Br}$
 - (c) $\text{C}_6\text{H}_6 - \text{C}_6\text{H}_5\text{CH}_3$
 - (d) $n\text{C}_6\text{H}_{14} - n\text{C}_7\text{H}_{16}$

45. Chloral +



product.

Identify the product.

- (a) Lindane
- (b) DDT
- (c) Caprolactum
- (d) Nylon-6

46. Number of electrons involved in the reaction when 0.1 mol NH_3 dissolved in water
- (a) 2
 - (b) 0.4
 - (c) 0.9
 - (d) Zero

47. The number of sigma and pi bonds present in inorganic benzene are respectively
- (a) $3\sigma, 12\pi$
 - (b) $12\sigma, 3\pi$
 - (c) $3\sigma, 3\pi$
 - (d) $12\sigma, 12\pi$

48. The compound which has one isopropyl group is
- (a) 2, 2, 3, 3 -Tetramethylpentane
 - (b) 2, 2 -Dimethyl pentane
 - (c) 2, 2, 3-Trimethylpentane
 - (d) 2-Methyl pentane

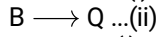
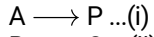
49. The (g/L) strength of 10 volume (V) of H_2O_2 solution is
- (a) 10
 - (b) 68
 - (c) 60.70
 - (d) 30.36

50. Lactic acid on oxidation by alkaline KMnO_4 gives
- (a) Tartaric acid
 - (b) Cinnamic acid
 - (c) Propionic acid
 - (d) Pyruvic acid

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51. Consider the following two first-order reactions:



Reaction (i) is 75% complete in 4 hrs. while reaction (ii) takes 16 hrs. for the same 75% completion of reaction under identical conditions.

By how many times, the half-life of (ii) is greater than the half-life of (i)?

52. How many chiral carbon atom in one molecule of β -D(+) glucose

53. 0.01 mol of $n \text{FeS}_n$ (iron (II) sulphide) required 0.06 mole of AO_4^{3-} for complete oxidation. The species formed are FeO , SO_2 and A^{2+} . The value of n is _____

54. The unit cell of copper corresponds to a face centered cube of edge length 3.596 \AA with one copper atom at each lattice point. The calculated density of copper in kg/m^3 is _____. [Molar mass of Cu : 63.54 g ; Avogadro Number = 6.022×10^{23}]

55. The mass adsorbed per gram of adsorbed O_2 having pressure 10 atm at 400 K, if placed in contact with solid surface 2 g in one litre vessel. The pressure of O_2 after adsorption becomes 2 atm. Assume no change in temperature and $R = 0.08 \text{ L-atm. K}^{-1} \text{ mol}^{-1}$.

56. The solubility product of $\text{PbCl}_2(\text{s})$ at 20°C is 1.5×10^{-4} .
If, the solubility of $\text{PbCl}_2(\text{s})$'s' = $x \times 10^{-2}$. Find x .

57. Dichromate ion is treated with base, the oxidation number of Cr in the product formed is _____.

58. 100 mL of Na_3PO_4 solution contains 3.45 g of sodium. The molarity of the solution is $\text{_____} \times 10^{-2} \text{ mol L}^{-1}$. (Nearest integer)
[Atomic Masses – Na: 23.0 u, O: 16.0 u, P: 31.0 u]

59. In how many of the following reactions, one of the products is obtained as a yellow precipitate:
- (a) $\text{Ba}^{2+} + \text{CrO}_4^{2-} \rightarrow \text{product}$
 - (b) $\text{NH}_4^+ + [\text{PtCl}_6]^{2-} \rightarrow \text{product}$
 - (c) $\text{NH}_4^+ + [\text{Co}(\text{NO}_2)_6]^{3-} \rightarrow \text{product}$
 - (d) $\text{Ca}^{2+} + [\text{Fe}(\text{CN})_6]^{4-} + \text{K}^+ \rightarrow \text{product}$
 - (e) $\text{Sr}^{2+} + \text{CO}_3^{2-} \rightarrow \text{product}$

60. Minimum no. of carbon atom containing alcohol which show haloform reaction.

Part - C Mathematics

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61. Tangents are drawn from a point on the circle $x^2 + y^2 = 25$ to the ellipse $9x^2 + 16y^2 - 144 = 0$ then find the angle between the tangents.
- (a) $\frac{\pi}{2}$
- (b) $\frac{\pi}{3}$
- (c) $\frac{\pi}{8}$
- (d) $\frac{\pi}{5}$

62. If $\sqrt{\log_4\{\log_3\{\log_2(x^2 - x + a)\}\}}$ is defined $\forall x \in R$ then the set of values of 'a' is:
- (a) $[9, \infty)$
 - (b) $[10, \infty)$
 - (c) $[15, \infty)$
 - (d) $[2, \infty)$

63. $|3x + 5| + |4x + 7| = 12$, find x .

(a) $\left\{-1, \frac{24}{7}\right\}$

(b) $\left\{0, -\frac{24}{7}\right\}$

(c) ϕ

(d) none of these

64. A, B are symmetric matrices of the same order then $(AB - BA)$ is:
- (a) symmetric matrix
 - (b) skew symmetric matrix
 - (c) null matrix
 - (d) unit matrix

65. A variable plane at a constant distance p from origin meets the coordinates axes in A, B, C . Through these points planes are drawn parallel to co-ordinate planes. Then locus of the point of intersection is

(a) $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$

(b) $x^2 + y^2 + z^2 = p^2$

(c) $x + y + z = p$

(d) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = p$

66.

The value of the integral $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^{-4} x dx$ is

- (a) $\frac{3}{2}$
- (b) $-\frac{8}{3}$
- (c) $\frac{3}{8}$
- (d) $\frac{8}{3}$

67. $\int \frac{1}{(x^2 - 1)\sqrt{x^2 + 1}} dx$

(a) $\frac{1}{2\sqrt{2}} \log_e \left\{ \frac{\sqrt{1+x^2} + x\sqrt{2}}{\sqrt{1+x^2} - x\sqrt{2}} \right\} + c$

(b) $\frac{1}{2\sqrt{2}} \log_e \left\{ \frac{\sqrt{1+x^2} - \sqrt{2}}{\sqrt{1+x^2} + \sqrt{2}} \right\} + c$

(c) $\frac{1}{2\sqrt{2}} \log_e \left(\frac{x\sqrt{2} - \sqrt{1+x^2}}{x\sqrt{2} + \sqrt{1+x^2}} \right) + c$

(d) None of these

68. Let $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$ ($x \neq 0$), then $f(x)$ equals -

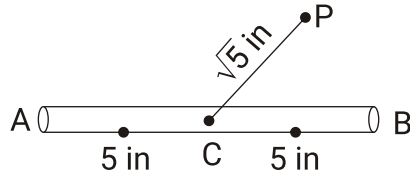
(a) $x^2 - 2$

(b) $x^2 - 1$

(c) x^2

(d) None of these

69. A 10 inches long pencil AB with mid-point C and a small eraser P are placed on the horizontal top of a table such that $PC = \sqrt{5}$ inches and $\angle PCB = \tan^{-1}(2)$. The acute angle through which the pencil must be rotated about C so that the perpendicular distance between eraser and pencil becomes exactly 1 inch is:



- (a) $\tan^{-1}\left(\frac{3}{4}\right)$
 (b) $\tan^{-1}(1)$
 (c) $\tan^{-1}\left(\frac{4}{3}\right)$
 (d) $\tan^{-1}\left(\frac{1}{2}\right)$

70. The value of $\lim_{x \rightarrow 0} \left(\frac{x}{\sqrt[3]{1 - \sin x} - \sqrt[3]{1 + \sin x}} \right)$ is equal to

- (a) 4
- (b) -4
- (c) -1
- (d) 0

71. The equation of a tangent parallel to $y = x$ drawn to $\frac{x^2}{3} - \frac{y^2}{2} = 1$ is:

- (a) $x - y + 1 = 0$
- (b) $x - y + 2 = 0$
- (c) $x + y - 1 = 0$
- (d) $x - y + 2 = 0$

72. Let $y = y(x)$ be the solution of the differential equation $e^x \sqrt{1 - y^2} dx + \left(\frac{y}{x}\right) dy = 0, y(1) = -1$.

Then the value of $(y(3))^2$ is equal to

- (a) $1 + 4e^6$
- (b) $1 - 4e^6$
- (c) $1 - 4e^3$
- (d) $1 + 4e^3$

73. If $y = (x^x)^x$, then $\frac{dy}{dx} =$

- (a) $(x^x)^x(1 + 2 \log x)$
- (b) $(x^x)^x(1 + \log x)$
- (c) $x(x^x)^x(1 + 2 \log x)$
- (d) $x(x^x)^x(1 + \log x)$

74. If \bar{x} is the mean of a set of n observations $x_1, x_2, x_3, \dots, x_n$ then $\sum_{i=1}^n (x_i - \bar{x})$ is equal to

- (a) M.D. about mean
- (b) S.D.
- (c) 0
- (d) None of these

75. The smallest angle of the triangle whose sides are $6 + \sqrt{12}$, $\sqrt{48}$, $\sqrt{24}$ is

- (a) $\frac{\pi}{4}$
- (b) $\frac{\pi}{6}$
- (c) $\frac{\pi}{3}$
- (d) $\frac{\pi}{2}$

76. If $\tan \theta + \tan 2\theta + \tan \theta \tan 2\theta = 1$ then general value of θ is -
- (a) $n\pi, n \in I$
 - (b) $n\pi \pm \frac{\pi}{3}; n \in I$
 - (c) $\frac{n\pi}{3} + \frac{\pi}{12}; n \in I$
 - (d) None of these

77. The area of the closed figure bounded by $y = \cos x$, $y = 1 + \left(\frac{2}{\pi}\right)x$ and $x = \frac{\pi}{2}$ is

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

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

(c) $\frac{3\pi - 4}{4}$

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

78. If $7^{\log_7(x^2-4x+5)} = x - 1$, then x may have values -
- (a) 2, 3
 - (b) 7
 - (c) -2, -3
 - (d) 2, -3

79. The determinant $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 - bc & b^2 - ca & c^2 - ab \end{vmatrix}$ is equal to -

- (a) 0
- (b) 1
- (c) -1
- (d) None

80. If the 4th term in the expansion of $\left(ax + \frac{1}{x}\right)^n$ is $\frac{5}{2}$, then the values of a and n are -
- (a) $\frac{1}{2}, 6$
 - (b) $1, 3$
 - (c) $\frac{1}{2}, 3$
 - (d) can not be found

Section - II: Numerical

*This section contains a total of 10 questions.
Out of the 10 questions, 5 questions are mandatory.
For every correct response you shall be awarded 4 marks.
For every incorrect response -1 marks shall be deducted.
For more details refer the first page of this booklet.*

81. If $2y \cos \theta = x \sin \theta$ and $2x \sec \theta + y \operatorname{cosec} \theta = 5$ then value of $x^2 + 4y^2$ is

82. $(\sqrt{108} + 10)^{1/3} - (\sqrt{108} - 10)^{1/3} =$

83. If $\Delta = \begin{vmatrix} 1 & 3 \cos \theta & 1 \\ \sin \theta & 1 & 3 \cos \theta \\ 1 & \sin \theta & 1 \end{vmatrix}$, then the value of $(\Delta_{\max})/2$ is _____.

84. A hyperbola passes through the point $(3, 2)$ and $(-17, 12)$, has its centre at origin and its transverse axis along the x -axis. The length of its transverse axis is

85. $\sec^2(\tan^{-1} 2) + \operatorname{cosec}^2(\cot^{-1} 3)$ is equal to

86. If $\int_0^{\pi} (\sin^3 x) e^{-\sin^2 x} dx = \alpha - \frac{\beta}{e} \int_0^1 \sqrt{t} e^t dt$, then $\alpha + \beta$ is equal to

87. The number of three-digit even numbers, formed by the digits 0, 1, 3, 4, 6, 7 if the repetition of digits is not allowed, is

88. $\int \frac{\sin^8 x - \cos^8 x}{1 - 2 \sin^2 x \cos^2 x} dx = \frac{(\sin Ax)}{B + C}$. Find $A + B$.

89. Let T be the tangent to the ellipse $E : x^2 + 4y^2 = 5$ at the point $P(1, 1)$. If the area of the region bounded by the tangent T , ellipse E , lines $x = 1$ and $x = \sqrt{5}$ is $\alpha\sqrt{5} + \beta + \gamma \cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$, then $|\alpha + \beta + \gamma|$ is equal to.....

90. Let $A = \{1, 2, 3, 4, 5\}$; $B = \{2, 3, 6, 7\}$. Then the number of elements in $(A \times B) \cap (B \times A)$ is