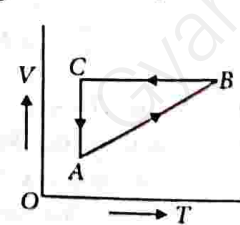# JEE Main

MOCK TEST-6

Instructions:

I. The JEE Main Test Paper consists of one paper containing 60 objective questions (four options with single correct answer) and 30 numerical value type questions from the syllabus of Physics, Chemistry and Mathematics.
II. The duration of paper would be 3 hours (180 minutes).
III. There will be total 90 questions : Physics - 30, Chemistry - 30, Mathematics - 30.
IV. Each question will carry 4 marks. For each correct response the applicant will be awarded four marks. For each incorrect answer there will be deduction of one mark.
V. There will be no negative marking for unattended questions. More than one answer of single question will also be considered as incorrect response and will be negatively marked.

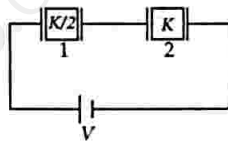**Max. Marks : 300**　　　　　　　　　　　　　　　　　　　　　　　　　**Time : 180 minutes**

PHYSICS
Section-A (Multiple Choice Questions)

1. A hole is drilled in a copper sheet. The diameter of the hole is 4.24 cm at 27.0°C. What is the change in the diameter of the hole when the sheet is heated to 227 °C? Coefficient of linear expansion of copper is $1.70 \times 10^{-5}\ °C^{-1}$.
   (a) 1.44×10^{-2} cm
   (b) 2.44×10^{-3} cm
   (c) 1.44×10^{-2} mm
   (d) 2.44×10^{-3} mm

2. A lens behaves as a converging lens in air and a diverging lens in water. The refractive index of the material of the lens is
   (a) equal to unity
   (b) equal to 1.33
   (c) between unity and 1.33
   (d) greater than 1.33

3. Two pendulum have time periods T and $\dfrac{5T}{4}$. They start SHM at the same time from the mean position. What will be the phase difference between them after the bigger pendulum has completed one oscillation?
   (a) 45°
   (b) 90°
   (c) 60°
   (d) 80°

4. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions.
   If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is
   (a) 0.9%　　(b) 2.4%　　(c) 3.1%　　(d) 4.2%

5. A carpet of mass M, made of an extensible material is rolled along its length in the form of a cylinder of radius R and kept on a rough floor. If the carpet is unrolled, without sliding to a radius $R/2$, the decrease in potential energy is
   (a) $\dfrac{1}{2}MgR$　(b) $\dfrac{7}{8}MgR$　(c) $\dfrac{5}{8}MgR$　(d) $\dfrac{3}{4}MgR$

6. A cyclic process $ABCA$ shown in V-T diagram, is performed with a constant mass of an ideal gas. Which of the following graphs in figure represents the corresponding process on a P-V diagram?

(a)

(b)

(c)

(d)
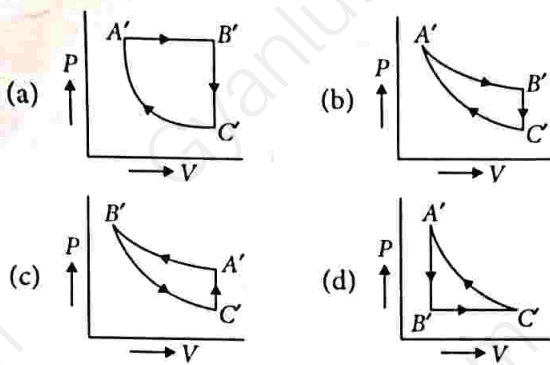
7. Two identical capacitors 1 and 2 are connected in series to a battery as shown in figure. Both the capacitors contain a dielectric slab of dielectric constants $K/2$ and K as shown. Q_1 and Q_2 are the charges stored in the capacitors. Now the dielectric slabs are removed and the corresponding charges are Q'_1 and Q'_2. Then

(a) $\dfrac{Q'_1}{Q_1} = \dfrac{4}{K}$

(b) $\dfrac{Q'_2}{Q_2} = \dfrac{3}{K}$

(c) $\dfrac{Q'_2}{Q_2} = \dfrac{3}{2K}$

(d) $\dfrac{Q'_1}{Q_1} = \dfrac{K}{4}$

8. A galvanometer of 50 Ω resistance has 25 divisions. A current of 4×10^{-4} A gives a deflection of one division. To convert this galvanometer into a voltmeter having a range of 25 V, it should be connected with a resistance of

(a) 2500 Ω as a shunt

(b) 2450 Ω as a shunt

(c) 2550 Ω in series

(d) 2450 Ω in series.

9. A current carrying loop is placed in a uniform magnetic field in four different orientations, I, II, III and IV, arrange them in the decreasing order of potential energy.
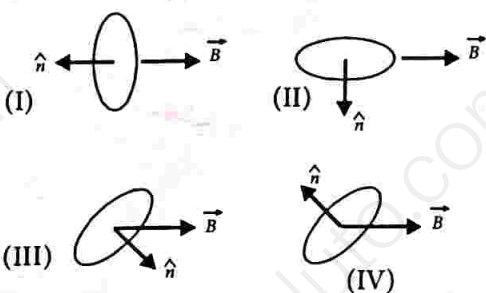
(a) I > III > II > IV

(b) I > II > III > IV

(c) I > IV > II > III

(d) III > IV > I > II

10. A particle executes SHM with an amplitude of 2 cm. When the particle is at 1 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is

(a) $\dfrac{1}{2\pi\sqrt{3}}$

(b) $2\pi\sqrt{3}$

(c) $\dfrac{2\pi}{\sqrt{3}}$

(d) $\dfrac{\sqrt{3}}{2\pi}$

11. The Poisson's ratio of a material is 0.4. If a force is applied to a wire of this material, there is a decrease of cross-sectional area by 2%. The percentage increase in its length is

(a) 3%

(b) 2.5%

(c) 1%

(d) 0.5%

12. When an AC source of emf $\varepsilon = \varepsilon_0 \sin(100\,t)$ is connected across a circuit, the phase difference between emf (ε) and current (i) in the circuit is observed to be $\pi/4$, as shown in figure. If the circuit consist possibly only of RC or RL in series, find the resistance, capacitance or inductance in the circuit.
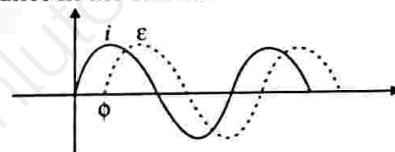

(a) $R = 1\,\text{k}\Omega,\ C = 5\,\mu\text{F}$

(b) $R = 1\,\text{k}\Omega,\ C = 10\,\mu\text{F}$

(c) $R = 1\,\text{k}\Omega,\ C = 1\,\text{F}$

(d) $R = 1\,\text{k}\Omega,\ L = 10\,\text{H}$

13. What minimum acceleration must the cart in figure have in order that the block A will not fall? (μ is coefficient of friction between cart and block)


(a) μg

(b) $\dfrac{g}{\mu}$

(c) $\dfrac{g}{\mu+1}$
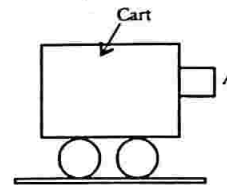
(d) $(m-1)g$

14. The figure shows four orientation of an electric dipole in an external electric field. The correct ranking of the magnitude of the torque and the potential energy of the dipole is
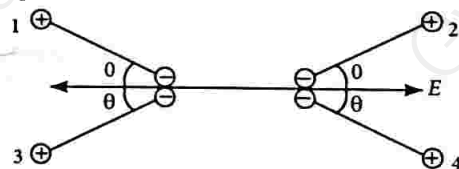

(a) $\tau_1 = \tau_3 > \tau_2 = \tau_4$ and $U_1 = U_2 = U_3 = U_4$

(b) $\tau_1 > \tau_2 = \tau_3 > \tau_4$ and $U_1 > U_2 = U_3 > U_4$

(c) $\tau_1 = \tau_2 > \tau_3 = \tau_4$ and $U_2 = U_4 > U_1 = U_3$

(d) $\tau_1 = \tau_2 = \tau_3 = \tau_4$ and $U_1 = U_3 > U_2 = U_4$

15. A small ring P is threaded on a smooth wire bent in the form of a circle of radius a and center O. The wire is rotating with constant angular speed ω about a vertical diameter XY, while the ring remains at rest relative to the wire at a distance $\dfrac{a}{2}$ from XY. Then ω^2 is equal to
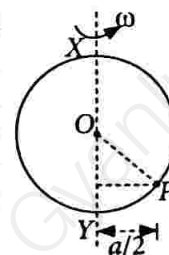

(a) $\dfrac{2g}{a}$

(b) $\dfrac{g}{2a}$

(c) $\dfrac{2g}{a\sqrt{3}}$

(d) $\dfrac{g\sqrt{3}}{2a}$

16. A particle of mas m is moving along the x-axis with speed v when it collides with a particle of mass $2m$ initially at rest. After the collision, the first particle has come to rest and the second particle has split into two equal-mass pieces that are shown in figure. Which of the following statements correctly describes the speeds of the two places? ($\theta > 0$)

Before collision   After collision
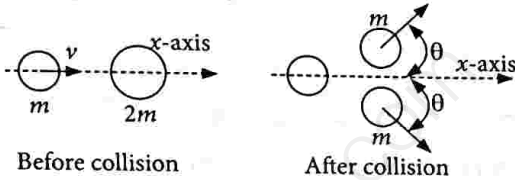
(a) Each piece moves with speed v.
(b) Each piece moves with speed $v/2$.
(c) One of the pieces moves with speed $v/2$, the other moves with speed greater than $v/2$.
(d) Each piece moves with speed greater than $v/2$.

17. In the arrangement as shown, $m_B = 3m$, density of liquid is ρ and density of block B is 2ρ. The system is released from rest so that block B moves up when in liquid and moves down when out of liquid with the same acceleration. Find the mass of block A.
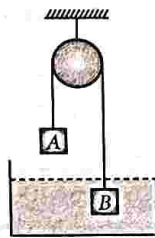
(a) $\dfrac{7}{4}m$ (b) $2m$ (c) $\dfrac{9}{2}m$ (d) $\dfrac{9}{4}m$

18. A satellite is revolving in a circular equatorial orbit of radius $R = 2 \times 10^4$ km from east to west. Calculate the interval after which it will appear at the same equatorial town. Given that the radius of the earth = 6400 km and g (acceleration due to gravity) = 10 m s^{-2}.
(a) 5 h 30 min   (b) 5 h 48 min
(c) 5 h 37 min   (d) 4 h 30 min

19. A simple LR circuit is connected to a battery at time $t = 0$. The energy stored in the inductor reaches half its maximum value at time
(a) $\dfrac{R}{L}\ln\left[\dfrac{\sqrt{2}}{\sqrt{2}-1}\right]$ (b) $\dfrac{L}{R}\ln\left[\dfrac{\sqrt{2}-1}{\sqrt{2}}\right]$
(c) $\dfrac{L}{R}\ln\left[\dfrac{\sqrt{2}}{\sqrt{2}-1}\right]$ (d) $\dfrac{R}{L}\ln\left[\dfrac{\sqrt{2}-1}{\sqrt{2}}\right]$

20. The time of vibration of a dip needle vibrating in the vertical plane in the magnetic meridian is 3 s. When the same magnetic needle is made to vibrate in the horizontal plane, the time period of vibration is $3\sqrt{2}$ s. The angle of dip is
(a) 30°   (b) 45°   (c) 60°   (d) 90°

## Section-B (Numerical Value Type)
Attempt any 5 questions out of 10

21. Two forces equal to P and $2P$ newton act on a particle.

If the first force be doubled and the second force be increased by 20 newton, the direction of the resultant is unaltered. Then the value of P (in N) is _____.

22. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns, giving the output power at 230 V. If the current in the primary of the transformer is 5 A, and its efficiency is 90%, the output current would be _____ A.

23. The equivalent capacitance between A and B in the circuit given below, is _____ μF.
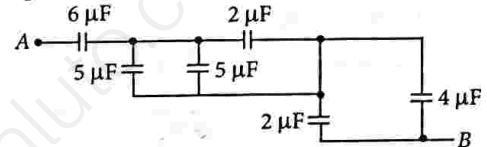

24. A circular disc of radius R is removed from a bigger circular disc of radius $2R$ such that the circumferences of the discs coincide. The centre of mass of the new disc is $\dfrac{1}{n}R$ from the centre of the bigger disc, where the value of n is _____.

25. A bandwidth of 5 MHz is available for AM transmission. If the maximum audio signal frequency used for modulating the carrier is not to exceed 5 kHz, the number of stations that can be broadcasted within this band simultaneously without interfering with each other is _____.

26. A machine gun fires a bullet of mass 40 g with a speed of 1200 m s^{-1}. The person holding the gun can exert a maximum force of 144 N on it. The number of bullets that can be fired from the gun per second is _____.

27. An electric bulb is designed to consume 55 W when operated at 110 V. It is connected to a 220 V, 50 Hz line through a choke coil in series. The bulb will get correct voltage when the inductance of the coil (in H) is _____.

28. The energy per unit length ratio inside the solid long wire having current density J is given by $\dfrac{\pi\mu_0 J^2 r^4}{x}$ where the value of x is _____.
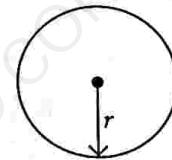
29. Two trains 120 m and 80 m in length are running in opposite directions with velocity 42 km h^{-1} and 30 km h^{-1}. They will completely cross each other in time _____ s.

30. The pan attached to a spring balance has a mass of 1 kg. A weight of 2 kg when placed on the pan stretches the spring by 10 cm. The frequency with which the

empty pan will oscillate is $\frac{x}{\pi}$ Hz, where the value of x is _____.

CHEMISTRY
Section-A (Multiple Choice Questions)

31. Which of the following combinations will produce H_2 gas?
(a) Cu metal and conc. HNO_3
(b) Zn metal and $NaOH_{(aq)}$
(c) Au metal and $NaCN_{(aq)}$ in the presence of air
(d) Fe metal and conc. HNO_3

32. Consider the following reactions :

(i) Glucose + ROH $\xrightarrow{\text{Dry HCl}}$ Acetal
$\xrightarrow[\text{(CH}_3\text{CO)}_2\text{O}]{x \text{ eq. of}}$ acetyl derivative

(ii) Glucose $\xrightarrow{\text{Ni/H}_2}$ A $\xrightarrow[\text{(CH}_3\text{CO)}_2\text{O}]{y \text{ eq. of}}$ acetyl derivative

(iii) Glucose $\xrightarrow[\text{(CH}_3\text{CO)}_2\text{O}]{z \text{ eq. of}}$ acetyl derivative

'x', 'y' and 'z' in these reactions are respectively
(a) 5, 4 and 5
(b) 4, 6 and 5
(c) 4, 5 and 5
(d) 5, 6 and 5

33. Positive deviation from ideal behaviour takes place because of
(a) molecular interaction between atoms and $PV/nRT > 1$
(b) molecular interaction between atoms and $PV/nRT < 1$
(c) finite size of atoms and $PV/nRT > 1$
(d) finite size of atoms and $PV/nRT < 1$.

**34.** The major product of the following reaction is

(a)
(b)
(c)
(d)
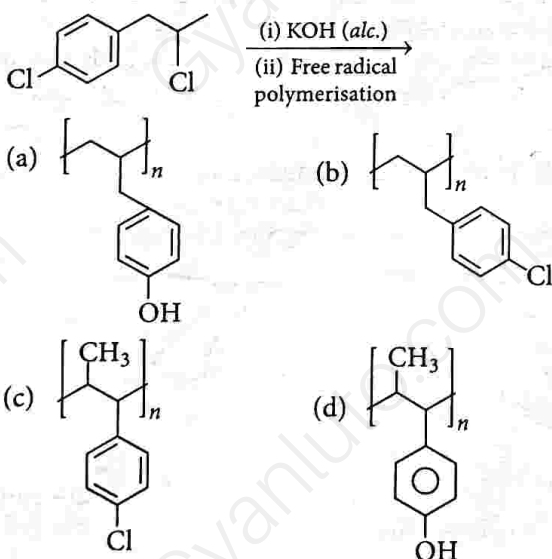
35. Consider the reactions given below. On the basis of these reactions, find out which of the algebraic relations given in options (a) to (d) is correct?
(i) $C_{(g)} + 4H_{(g)} \rightarrow CH_{4(g)}$; $\Delta_r H = x$ kJ mol^{-1}

(ii) $C\,(\text{graphite}, s) + 2H_{2(g)} \rightarrow CH_{4(g)}$; $\Delta_r H = y$ kJ mol^{-1}
(a) $x = y$
(b) $x = 2y$
(c) $x > y$
(d) $x < y$

36. Which of the following does not affect the rate of reaction?
(a) Amount of reactants taken
(b) Physical state of reactants
(c) ΔH of reaction
(d) Size of the vessel
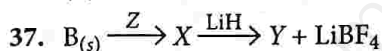
37. $B_{(s)} \xrightarrow{Z} X \xrightarrow{\text{LiH}} Y + LiBF_4$
Which of the statement is true for the above sequence of reactions?
(a) Z is hydrogen.
(b) Y is $LiBH_4$.
(c) Z and Y are F_2 and B_2H_6 respectively.
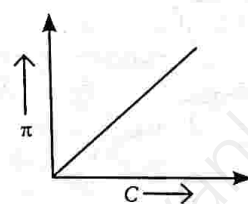(d) Z is potassium hydroxide.

38. Fe_3O_4 contains the magnetic dipoles of cations oriented as
(a) ↑↓↑↓
(b) ↓↓↑↓↓
(c) ↑↑↑↑↑
(d) ↑↑↑↓↓↓

39. $ClCH_2COOH$ is heated with fuming HNO_3 in the presence of $AgNO_3$ in Carius tube. After filtration and washing the precipitate, the substance obtained is
(a) $AgNO_3$
(b) $AgCl$
(c) Ag_2SO_4
(d) $ClCH_2COOAg$

40. A graph showing variation of osmotic pressure (π) versus molar concentration (C) of an aqueous solution at temperature (T) is given as :
The slope of the line represents
(a) solution constant R
(b) absolute temperature T
(c) RT
(d) degree of ionisation of solute.

41. Which compound would give 5-keto-2-methyl-hexanal upon ozonolysis?

(a)
(b)
(c)
(d)
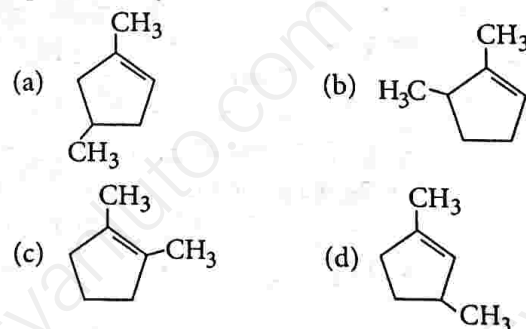
42. What is the standard cell potential (in V) of the cell in which following reaction takes place?
$Fe^{2+}_{(aq)} + Ag^{+}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Ag_{(s)}$
(Given that :
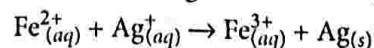
$E^{\circ}_{Ag^+/Ag} = x$ V ; $E^{\circ}_{Fe^{2+}/Fe} = y$ V ; $E^{\circ}_{Fe^{3+}/Fe} = z$ V)

(a) $x - z$
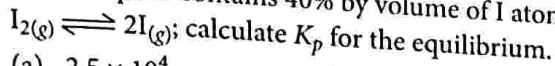(b) $x - y$
(c) $x + 2y - 3z$
(d) $x + y - z$

43. At a certain temperature and total pressure of 10^5 Pa, iodine vapour contains 40% by volume of I atoms. $I_{2(g)} \rightleftharpoons 2I_{(g)}$; calculate K_p for the equilibrium.
    (a) 2.5×10^4
    (b) 2.67×10^4
    (c) 2.7×10^4
    (d) 2.67×10^{-4}

44. In the reaction $2N_2O_5 \longrightarrow 4NO_2 + O_2$, the rate is expressed as

    (i) $-\dfrac{d[N_2O_5]}{dt} = k_1[N_2O_5]$

    (ii) $\dfrac{d[NO_2]}{dt} = k_2[N_2O_5]$

    (iii) $\dfrac{d[O_2]}{dt} = k_3[N_2O_5]$

    Relation between k_1, k_2 and k_3 is
    (a) $2k_1 = 4k_2 = k_3$
    (b) $2k_1 = k_2 = 4k_3$
    (c) $2k_1 = k_2 = 2k_3$
    (d) $k_1 = 4k_2 = 2k_3$

45. Which one of the following substances has the highest proton affinity?
    (a) H_2O
    (b) H_2S
    (c) NH_3
    (d) PH_3

46. **Assertion :** Milk is an example of water in oil type emulsion.

    Reason : Emulsions contain liquid dispersed in solid.
    (a) If both assertion and reason are true and reason is the correct explanation of assertion.
    (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
    (c) If assertion is true but reason is false.
    (d) Both assertion and reason are false.

47. Ordinary hydrogen at room temperature is a mixture of
    (a) 75% of o-hydrogen + 25% of p-hydrogen.
    (b) 25% of o-hydrogen + 75% of p-hydrogen.
    (c) 50% of o-hydrogen + 50% of p-hydrogen.
    (d) 1% of o-hydrogen + 99% of p-hydrogen.

48. Match column-I with column-II and select the correct option from the given codes :

Column-I		Column-II	
(A)	Mercury	(i)	Vapour phase refining
(B)	Copper	(ii)	Distillation refining
(C)	Silicon	(iii)	Electrolytic refining
(D)	Nickel	(iv)	Zone refining

    (a) (A)-(ii), (B)-(iv), (C)-(iii),(D)-(i)
    (b) (A)-(i), (B)-(iv), (C)-(ii), (D)-(iii)
    (c) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
    (d) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

49. Beryllium and aluminium exhibit many properties which are similar. But, the two elements differ in
    (a) exhibiting maximum covalency in compounds
    (b) forming polymeric hydrides
    (c) forming covalent halides
    (d) exhibiting amphoteric nature in their oxides.

50. Holme's signal uses
    (a) only calcium carbide
    (b) only calcium phosphide
    (c) mixture of calcium carbide and calcium phosphide
    (d) mixture of calcium carbide and aluminium carbide.

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

51. The value of x in SO_x when oxide of sulphur acts as a primary pollutant is _____.

52. Considering that $\Delta_o > P$, the magnetic moment (in B.M.) of $[Ru(H_2O)_6]^{2+}$ would be _____.

53. The mass of bromine that will completely react with 5.0 g of pent-1-ene is _____ $\times 10^{-2}$ g. (Atomic mass of Br = 80 g/mol)

54. Total number of isomers (including stereoisomers) obtained on monochlorination of methylcyclohexane is _____.

55. The number of sp^3 hybridised carbon atoms in an acyclic neutral compound with molecular formula C_4H_5N is _____.

56. A sample of 4.5 mg of an unknown monohydric alcohol, R–OH was added to methylmagnesium iodide. A gas is evolved and is collected and its volume measured to be 3.1 mL. The molecular weight of the unknown alcohol is _____ g/mol.

57. The atomic number of untripentium is ABC. The sum of A and C is _____.

58. $CH_3CH_2CHO + CH_3CH_2CHO \xrightarrow[\Delta]{NaOH} A \xrightarrow{\Delta} B$
    In product B, what is the total number of carbon and hydrogen atoms?

59. The lattice energy of NaCl is 788 kJ mol^{-1}, the amount of energy required (in kJ) to separate 1000 g of solid NaCl into its gaseous ions is _____.

60. An electron is moving with kinetic energy of

4.55×10^{-25} J. Its wavelength is _____ $\times 10^{-7}$ m.

[Given : mass of an electron = 9.1×10^{-31} kg and $h = 6.6 \times 10^{-34}$ kg m^2 s^{-1}]

MATHEMATICS
Section-A (Multiple Choice Questions)

61. $\int \dfrac{\sec x}{\sqrt{\{\sin(2x+\alpha)+\sin\alpha\}}}dx$ equals

(a) $\sqrt{2}[(\tan x + \tan\alpha)\sec\alpha]^{1/2}+C$

(b) $-\sqrt{2}[(\cot x - \cot\alpha)\sec\alpha]^{1/2}+C$

(c) $\sqrt{2}[(\cot x - \cot\alpha)\sec x]^{1/2}+C$

(d) $-\sqrt{2}[(\tan x + \tan\alpha)\sec\alpha]^{1/2}+C$

62. The equation of the parabola whose focus is (3, 2) and vertex is (1, 2), is

(a) $x^2 + 4x - 8y + 12 = 0$

(b) $x^2 - 4x - 8y + 12 = 0$

(c) $y^2 - 8x - 4y + 12 = 0$

(d) $y^2 + 4y - 8x + 12 = 0$

63. Let $\vec{u} = \hat{i}+\hat{j}, \vec{v} = \hat{i}-\hat{j}$ and $\vec{w} = \hat{i}+3\hat{j}+5\hat{k}$. If $\hat{n}$ is a unit vector such that $\vec{u}\cdot\hat{n}=0$ and $\vec{v}\cdot\hat{n}=0$, then projection of $\vec{w}$ on $\hat{n}$ is

(a) 1   (b) 3   (c) 5   (d) 0

64. Find the C.V. of the following data :

Size (in m)	10-15	15-20	20-25	25-30	30-35	35-40
No. of items	2	8	20	35	20	15

(a) 20.24   (b) 21.89

(c) 23.10   (d) 19.20

65. A box has 100 pens of which 10 are defective. What is the probability that out of a sample of 5 pens drawn one by one with replacement at most one is defective?

(a) $\left(\dfrac{9}{10}\right)^5$

(b) $\dfrac{1}{2}\left(\dfrac{9}{10}\right)^4$

(c) $\dfrac{1}{2}\left(\dfrac{9}{10}\right)^5$

(d) $\left(\dfrac{9}{10}\right)^5+\dfrac{1}{2}\left(\dfrac{9}{10}\right)^4$

66. All the values of complex number z satisfying $|z^2+z+1|=1$ satisfy which of the following inequality?

(a) $\left|z+\dfrac{1}{2}\right|\le\dfrac{1}{2}$ for all $z \in S$

(b) $|z| \ge 2$ for all $z \in S$

(c) $\left|z+\dfrac{1}{2}\right|\ge\dfrac{1}{2}$ for all $z \in S$

(d) None of these

67. If $A(\theta) = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 \end{bmatrix}$, then $A(\theta)^3$ will be a null matrix if and only if

(a) $\theta = (2k+1)\pi/3, k \in I$

(b) $\theta = (4k-1)\pi/3, k \in I$

(c) $\theta = (3k-1)\pi/4, k \in I$

(d) None of these

68. If $C_0, C_1, C_2, ..., C_n$ are binomial coefficients in the expansion of $(1+x)^n$, then value of $C_1 + C_4 + C_7 + ...$ equals

(a) $\dfrac{1}{3}\left(2^n + \sqrt{3}\sin\dfrac{n\pi}{3}\right)$

(b) $\dfrac{1}{3}\left(2^n - \cos\dfrac{n\pi}{3}+\sqrt{3}\sin\dfrac{n\pi}{3}\right)$

(c) $\dfrac{1}{3}\left(2^n - \sqrt{3}\sin\dfrac{n\pi}{3}\right)$

(d) $\dfrac{1}{3}\left(2^n - \cos\dfrac{n\pi}{3}-\sqrt{3}\sin\dfrac{n\pi}{3}\right)$

69. The number of bijective functions $f: \{1, 3, 5, 7, ..., 99\} \to \{2, 4, 6, 8, ..., 100\}$, such that $f(3) \ge f(9) \ge f(15) \ge f(21) \ge ... \ge f(99)$, is

(a) $^{50}P_{17}$ (b) $^{50}P_{33}$

(c) $33! \times 17!$ (d) $\dfrac{50!}{2}$

70. Let $g(x) = \begin{cases} -2\sin x, & \text{if } x \le -\dfrac{\pi}{2} \\ A\sin x + B, & \text{if } -\dfrac{\pi}{2} < x < \dfrac{\pi}{2} \\ \cos x, & \text{if } x \ge \dfrac{\pi}{2} \end{cases}$. Then

(a) g is discontinuous for all A and B

(b) g is continuous for all $A = -1$ and $B = 1$

(c) g is continuous for all $A = 1$ and $B = -1$

(d) g is continuous for all real values of A, B.

71. The solution of the differential equation $\dfrac{dy}{dx} = \dfrac{4x^3y^4+3x^2y}{x^3-2x^4y^3}$ when $y(1)=1$ is given by $cy^{\alpha/3} = x^\alpha(xy^\alpha+1)$ then

(a) $\alpha = 3, c = 2$

(b) $\alpha = 4, y = \dfrac{x^\alpha(xy^\alpha+1)}{3}$

(c) $c = 2, \alpha = 2$ (d) $\alpha = 2, c = 0$

72. Let $x > 0, y > 0, z > 0$ are respectively the $2^{nd}, 3^{rd}, 4^{th}$ terms

of a G.P. and $\Delta = \begin{vmatrix} x^k & x^{k+1} & x^{k+2} \\ y^k & y^{k+1} & y^{k+2} \\ z^k & z^{k+1} & z^{k+2} \end{vmatrix} = (r-1)^2 \left(1 - \frac{1}{r^2}\right)$

(where r is the common ratio), then $k =$
   (a) -1 (b) 1
   (c) 0   (d) 2

73. Which of the following statements is "exclusive or" statement?
   (a) To enter in a country, you need a passport or a voter registration card.
   (b) The school is closed if it is a holiday or a Sunday.
   (c) Two lines intersect at a point or are parallel.
   (d) Candidate who has cleared P-TET or C-TET is eligible for teaching.

74. If $\frac{\cos^4 x}{\theta_1} + \frac{\sin^4 x}{\theta_2} = \frac{1}{\theta_1 + \theta_2}$, then $\frac{\theta_2}{\theta_1}$ equals

   (a) $\cos^2 x$ (b) $\sin^2 x$
   (c) $\tan^2 x$ (d) None of these

75. The area bounded by the curves $y = \ln x$, $y = \ln |x|$, $y = |\ln x|$ and $y = |\ln|x||$ is
   (a) 4 sq. units   (b) 6 sq. units
   (c) 10 sq. units   (d) none of these

76. If $f(x) = \log\left(\frac{1+x}{1-x}\right), -1 < x < 1$, then

   $f\left(\frac{3x + x^3}{1 + 3x^2}\right) - f\left(\frac{2x}{1+x^2}\right)$ is

   (a) $[f(x)]^3$ (b) $[f(x)]^2$
   (c) $-f(x)$ (d) $f(x)$

77. If $D_k = \begin{vmatrix} 1 & 2k & 2k-1 \\ n & n^2+n+1 & n^2 \\ n & n^2+n & n^2+n+1 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 72$,

   then value of n equals
   (a) 4   (b) 6   (c) 7   (d) 8

78. The number of solutions of

   $\sin^{-1}(1 + b + b^2 + ...\infty) + \cos^{-1}\left(a - \frac{a^2}{3} + \frac{a^3}{9} - ...\infty\right)$

   $= \frac{\pi}{2}$ is

   (a) 1   (b) 2   (c) 3   (d) ∞

79. A normal is drawn at a point $A (x, y)$ to a curve, the curve meet the x-axis at B. If AB is a fixed length r, then

which of the following is incorrect?
   (a) The curve passes through $(0, r)$.
   (b) The curve passes through $(r, 0)$.
   (c) Curve itself represents a circle centred at origin.
   (d) None of the above

80. The equation $2\sin^2\left(\frac{x}{2}\right)\cos^2 x = x^2 + \frac{1}{x^2}, 0 \le x \le \frac{\pi}{2}$ has

   (a) no real solution
   (b) one real solution
   (c) more than one real solution
   (d) none of these

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

81. If $x + y = k$ is normal to the parabola $y^2 = 12x$, then k is _____.

82. $\frac{d}{dx}\left(\sin^2\left(\cot^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right)\right)\right)$ equals _____ at $x = 1$.

83. A person is to count 4500 currency notes. Let a_n denote the number of notes he counts in the nth minute. If $a_1 = a_2 = ... = a_{10} = 150$ and $a_{10}, a_{11}, ...$ are in an A.P. with common difference -2, then the time taken by him to count all notes is _____.

84. The degree of the differential equation of the family of ellipse having the same foci, is _____.

85. The radius of the circle in which the sphere $x^2 + y^2 + z^2 + 2x - 2y - 4z - 19 = 0$ is cut by the plane $x + 2y + 2z + 7 = 0$ is _____.

86. The number of functions f, from the set $A = \{x \in N : x^2 - 10x + 9 \le 0\}$ to the set $B = \{x = n^2 : n \in N\}$ such that $f(x) \le (x - 3)^2 + 1$, for every $x \in A$, is _____.

87. If 100 times the 100th term of an A.P. with non-zero common difference equals the 50 times its 50th term, then the 150th term of this A.P. is _____.

88. Let $f(x) = [\cos x + \sin x], 0 < x < 2\pi$, where $[x]$ denotes the greatest integer less than or equal to x. The number of points of discontinuity of $f(x)$, is _____.

89. If the straight lines $x = 1 + s, y = -3 - \lambda s, z = 1 + \lambda s$ and $x = \frac{t}{2}, y = 1 + t, z = 2 - t$, with parameters s and t respectively, are co-planar, then $|\lambda|$ equals _____.

90. The length of the latus rectum of the hyperbola $16x^2 - 25y^2 = 144$ is _____.