



JEE MAIN PATTERN
TEST PAPER-01 | 01-01-2019

Time: 3 Hours

SCORE-1

Maximum Marks : 360

PAPER -1

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

1. This booklet contains **16** printed pages.
2. The Test Booklet consists of **90** questions. The maximum marks are 360.
3. There are three parts in the question paper A, B, C consisting of Physics, Mathematics and Chemistry having 30 questions in each part of equal weightage. Each question is allotted **4** (four) marks for correct response.
4. Candidates will be awarded marks as stated above in instruction No. 3 for correct response of each question. $\frac{1}{4}$ (**one-fourth**) marks of the total marks allotted to the question (i.e. 1 mark) will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 4 above.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination room/hall.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall.
However, the candidates are allowed to take away this Test Booklet with them.
9. Do not fold or make any stray mark on the Answer Sheet

Name of the Candidate

I have read all the instructions and shall abide by them.

Signature of the Candidate

Form Number

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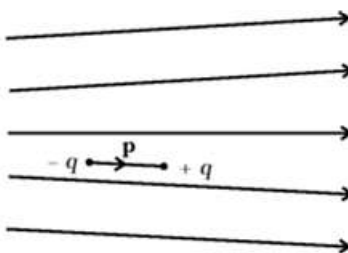
I have verified all the information filled in by the Candidate.

Signature of the invigilator

CHOOSE WISE TO RISE

PART-A : PHYSICS

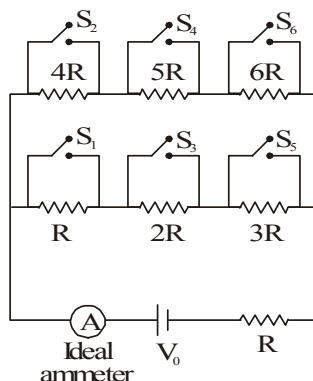
1. Figure shows electric field lines in which an electric dipole \mathbf{p} is placed as shown. Which of the following statements is correct?

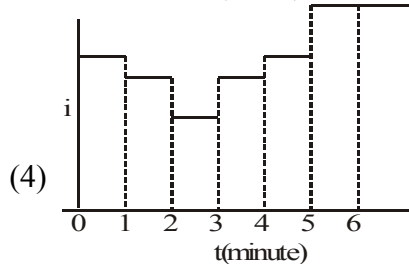
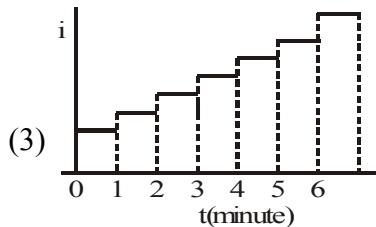
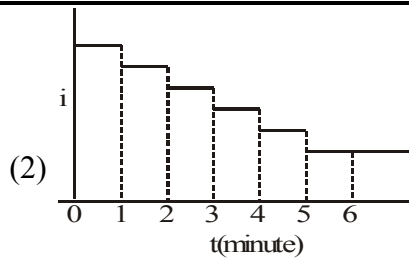
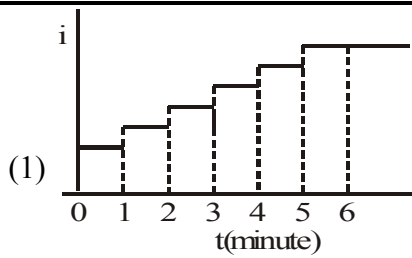


- (1) The dipole will not experience any force.
 (2) The dipole will experience a force towards right.
 (3) The dipole will experience a force towards left.
 (4) The dipole will experience a force upwards.
2. The radionuclide ${}_{6}^{11}\text{C}$ decays by β^+ emission.
 Given that $m({}_{6}^{11}\text{C}) = 11.011434 \text{ u}$
 $m({}_{5}^{11}\text{B}) = 11.009305 \text{ u}$
 $m_e = 0.000548 \text{ u}$, $1\text{u} = 931.5 \text{ MeV}/c^2$
 The Q-value of this decay process is :-
 (1) 0.962 MeV (2) $0.962 \times 10^3 \text{ MeV}$ (3) 0.962 eV (4) Zero
3. Two planks A and B of mass 20 kg have length 4 m and 2 m respectively float on water. A has a man of mass 60 kg and B has a boy of mass 20 kg both standing at the middle. Initially the boy and the man were 9 m away. The man starts pulling the boy with a cord. Assuming the center of each plank to be its centre of mass and water offering no resistance. Find the distance moved by man before the planks meet.

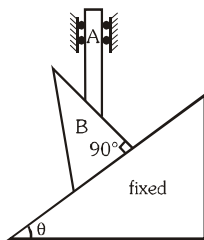


- (1) 1.5 m (2) 2.0 m (3) 2.5 m (4) 3.0 m
4. Say switches S_1, S_2 and so on upto S_6 are closed, one after other in order (first S_1 , then S_2) at regular intervals of 1minute starting from $t = 0$. The graph of current versus time is best represented as



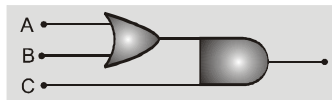


5. The rod A slides vertically down on block B which slides down on a fixed inclined plane making an angle θ with horizontal. The angles are shown. If a_A and a_B are the accelerations of A and B respectively, then $\frac{a_B}{a_A}$ is



- (1) $\sin \theta$ (2) $\cos \theta$ (3) $\tan \theta$ (4) $\cot \theta$

6. To get an output $Y = 1$ from the circuit shown below the input must be



- | | A | B | C |
|-----|----------|----------|----------|
| (1) | 0 | 1 | 0 |
| (2) | 0 | 0 | 1 |
| (3) | 1 | 0 | 1 |
| (4) | 1 | 0 | 0 |

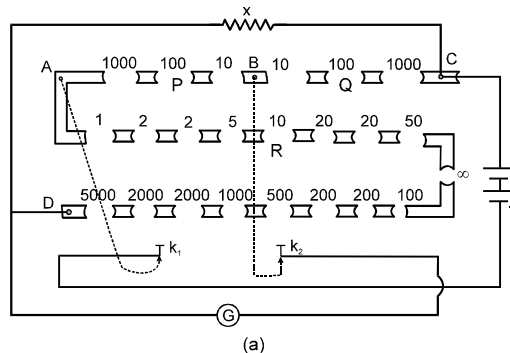
7. A 16 cm long image of an object is formed by a convex lens on a screen. On moving the lens towards the screen, without changing the positions of the object and the screen, a 9 cm long image is formed again on the screen. The size of the object is

- (1) 9 cm (2) 11 cm (3) 12 cm (4) 13 cm.

8. A stone of mass 100 gm is thrown from ground with a speed of $40\sqrt{2}$ m/s and at angle of 45° with horizontal at $t = 0$. The average power delivered by gravity between $t = 1$ s and $t = 3$ s is :-

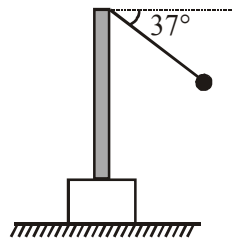
- (1) - 20 W (2) - 12.5 W (3) - 40 W (4) - 25 W

9. In the given post office box, the selected resistances P and Q are 1000Ω and 10Ω respectively when the value of R is selected as 311Ω then 315Ω then galvanometer deflects in same direction. If now 318Ω is selected it deflects in the opposite direction to the previous deflection. Then :



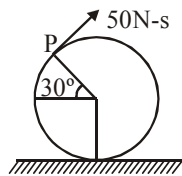
- (1) the unknown resistance may lie between 3.11Ω and 3.15Ω .
- (2) the unknown resistance may lie between 3.15Ω and 3.18Ω .
- (3) unknown resistance is greater than 3.18Ω .
- (4) if the deflection with 318Ω is also in the same direction to that of 315Ω then it is sure that the unknown resistance lies between 3.15Ω and 3.18Ω

10. A point like ball of mass 1kg is tied to the end of a string, which is attached to the top of a thin vertical rod. The rod is fixed to the middle of the block of mass 2kg lying at rest on a horizontal plane. The pendulum is displaced to a horizontal position and released from rest. If the block does not slip during the oscillation of pendulum, the value of friction force between block and horizontal surface when string makes angle 37° with horizontal is :-



- (1) $\frac{25g}{36}$
- (2) $\frac{36g}{25}$
- (3) $\frac{3g}{2}$
- (4) $\frac{2g}{3}$

11. A solid ball of radius 0.2m and mass 1kg lying at rest on a smooth horizontal surface is given an instantaneous impulse of $50\text{N}\cdot\text{s}$ at point P as shown. The number of rotations made by the ball about its diameter before hitting the ground is

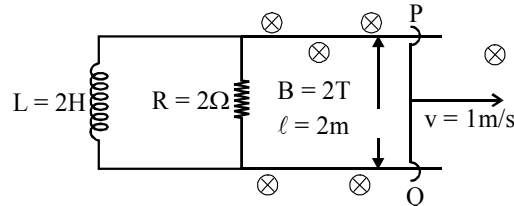


- (1) $\frac{625\sqrt{3}}{2\pi}$
- (2) $\frac{2500\sqrt{3}}{2\pi}$
- (3) $\frac{3125\sqrt{3}}{2\pi}$
- (4) $\frac{1250\sqrt{3}}{2\pi}$

12. A lens of focal length f projects m times magnified image of an object on a screen. The distance of the screen from the lens is

- (1) $\frac{f}{(m-1)}$ (2) $\frac{f}{(m+1)}$ (3) $f(m-1)$ (4) $f(m+1)$

13. The given figure shows an inductor and resistor fixed on a conducting wire. A movable conducting wire PQ starts moving on the fixed rails from $t = 0$ with constant velocity 1 m/s . The work done by the external force on the wire PQ in 2 seconds is :-

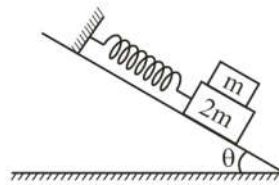


- (1) 16 J (2) 32 J (3) 48 J (4) 64 J

14. The wavelength of K_{α} X-ray produced by an X-ray tube is 0.76 \AA . The atomic number of anticathode material is

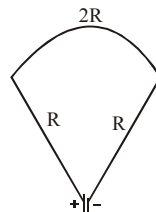
- (1) 82 (2) 41 (c) 20 (d) 10.

15. The coefficient of friction between block of mass m and $2m$ is $\mu = 2 \tan \theta$. There is no friction between block of mass $2m$ and inclined plane. The maximum amplitude of two block system for which there is no relative motion between both the blocks.



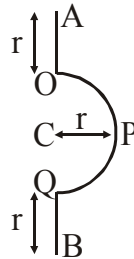
- (1) $\frac{2mg \sin \theta}{k}$ (2) $\frac{3mg \sin \theta}{k}$ (3) $\frac{6mg \sin \theta}{k}$ (4) $\frac{8mg \sin \theta}{k}$

16. Three wires of equal length and of same material are connected to a battery as shown in figure. Which one of the following graphs represents the variation of electric field E in the conductor with distance x measured along the wire and positive terminal of the battery?



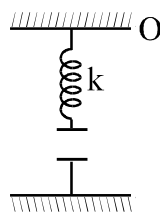
- (1) (2) (3) (4)

17. If the radius of the earth were to shrink by one percent, its mass remaining the same, the value of g on the earth's surface would
 (1) increase by 0.5% (2) increase by 2% (3) decrease by 0.5% (4) decrease by 2%.
18. An inductor of inductance L and resistor of resistance R are joined in series and connected by a source of frequency ω . Power dissipated in the circuit is -
 (1) $\frac{(R^2 + \omega^2 L^2)}{V}$ (2) $\frac{V^2 R}{(R^2 + \omega^2 L^2)}$ (3) $\frac{V}{(R^2 + \omega^2 L^2)}$ (4) $\frac{\sqrt{R^2 + \omega^2 L^2}}{V^2}$
19. Photoelectric effect is observed from a surface for frequency's 3×10^{14} Hz and 2×10^{14} Hz for incident radiations. If maximum kinetic energies are in ratio 2 : 1 then threshold frequency is (h is plank constant)
 (1) $h \times 10^{14}$ Hz (2) $h \times \frac{3}{2} \times 10^{14}$ Hz (3) $h \times \frac{4}{3} \times 10^{14}$ Hz (4) None of these
20. A wire frame AOPQB, lying in the horizontal plane, is free to rotate about a vertical axis passing through centre C of the same circle and \perp to plane of AOPQB. The mass M of the frame is uniformly distributed over its whole length. The moment of inertia of the frame about this axis, is ($OA = QB = r$ and $CP = r$ the radius of semicircular part)



- (1) $Mr^2 \left(\frac{14+3\pi}{3\pi+6} \right)$ (2) $Mr^2 \left(\frac{\pi+r}{\pi+2r} \right)$ (3) $Mr^2 \left(\frac{3}{4} \pi \right)$ (4) $\frac{1}{2} Mr^2$

21. A parallel plate capacitor initially having plate separation d & capacitance C in air is connected by means of a spring of spring constant k to a point O , the plates are assumed to be massless, and the lower plate is also fixed. A charge q now is given to the capacitor. The capacitance of the capacitor (assuming that the spring is non conducting) becomes



- (1) $\frac{C}{\left(1 - \frac{q^2}{Ckd^2} \right)}$ (2) $\frac{C}{\left(1 - \frac{q^2}{2Ckd^2} \right)}$ (3) C (4) none of the above

22. A hydrogen atom is in an excited state of principal quantum number (n) it emits a photon of wavelength (λ), when it returns to the ground state. The value of n is

- (1) $\sqrt{\frac{\lambda R}{\lambda R + 1}}$ (2) $\sqrt{\frac{(\lambda R - 1)}{\lambda R}}$ (3) $\sqrt{\lambda(R - 1)}$ (4) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

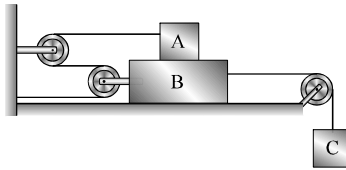
23. The X-ray are not used for radar, because they are

- (1) electromagnetic waves (2) completely absorbed by air
(3) penetrate through the target (4) none

24. A charged particle P leaves the origin with speed $v = v_0$, at some inclination with the x-axis. There is uniform magnetic field B along the x-axis. P strikes a fixed target T on the x-axis for a minimum value of $B = B_0$. P will also strike T if

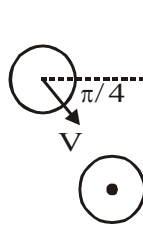
- (1) $B = 2B_0, v = 2v_0$ (2) $B = B_0/2, v = 2v_0$ (3) $B = B_0, v = 2v_0$ (4) None of these.

25. The maximum value of mass of block C so that neither A nor B moves is (Given that mass of A is 100 kg and that of B is 140 kg. Pulleys are smooth and friction coefficient between A and B and between B and horizontal surface is $\mu = 0.3$) $g = 10 \text{ m/s}^2$



- (1) 210 kg (2) 190 kg (3) 185 kg (4) 162 kg

26. In a carom-board game the striker and the coins are identical and of mass m . In a particular hit the coin is hit when it is placed close to the edge of the board as shown in figure such that the coin travels parallel to the edge. If the striker is moving with speed v before the strike, then the net impulse on the striker during collision if it moves perpendicular to the edge after collision is (assume all collisions to be perfectly elastic)



- (1) $mv \sqrt{\frac{5}{2}}$ (2) $2mv$ (3) $\frac{mv\sqrt{3}}{2}$ (4) mv

27. A lens of diameter 5.0 cm and focal length $f = 20.0$ cm was cut along the diameter into two identical halves. In the process, a thin layer of lens ($a = 1.0$ mm) is lost. Then the halves were put together to form a composite lens. A source slit is placed 10 cm from the lens, emitting light of wavelength $\lambda = 600$ nm. Behind the lens, a screen wall located at a distance $b = 80$ cm from lens. Find the fringe width :-

- (1) 0.15 mm (2) 0.3 mm (3) 0.6 mm (4) 1.2 μm

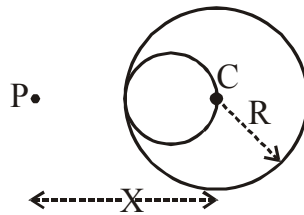
28. A given object taken η times as much time to slide down a 45° rough incline as it takes to slide down a perfectly smooth 45° . The coefficient of kinetic friction between object and incline is given by

- (1) $\mu = \frac{1}{1-\eta^2}$ (2) $\mu = 1 - \frac{1}{\eta^2}$ (3) $\mu = \sqrt{\frac{1}{1-\eta^2}}$ (4) $\mu = \sqrt{1 - \frac{1}{\eta^2}}$

29. Which of the following is/are the limitations of amplitude modulation?

- (1) Clear reception (2) High efficiency
(3) Small operating range (4) Good audio quality

30. A solid dielectric uniformly charged spherical region of radius R has a spherical cavity whose diameter 'R' as shown, total charge of the body is Q . Find the potential at a point P (whose distance is 'x' from the centre C of sphere) :-



- (1) $\frac{Q(7x-4R)}{7\pi\epsilon_0(2x-R)x}$ (2) $\frac{Q(7x-4R)}{14\pi\epsilon_0(2x-R)x}$
(3) $\frac{Q(7x-4R)}{21\pi\epsilon_0(2x-R)x}$ (4) $\frac{Q(7x-4R)}{28\pi\epsilon_0(2x-R)x}$

PART-B : MATHEMATICS

31. If $r, k, p \in W$, then $\sum_{r+k+p=10} {}^{30}C_r \cdot {}^{20}C_k \cdot {}^{10}C_p$ is equal to -
- (1) $\binom{60}{50}$ (2) $\binom{60}{30}$ (3) $\binom{60}{20}$ (4) $\binom{30}{10} \binom{30}{20}$
32. The equation of straight line equally inclined to the axes and equidistant from the point $(1, -2)$ and $(3, 4)$ is -
- (1) $x + y = 1$ (2) $y - x - 1 = 0$ (3) $y - x = 2$ (4) $y - x + 1 = 0$
33. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}$, $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $A^{-1} = \frac{1}{6}(A^2 + cA + d)$ then the values of c and d are respectively -
- (1) $-6, -11$ (2) $6, 11$ (3) $-6, 11$ (4) $6, -11$
34. Solution of the differential equation $xydy = (y + xy^3(1 + \log_e x))dx$ is
- (1) $\frac{-x^2}{y^2} = \frac{2}{3}x^3 \left(\frac{2}{3} + \log_e x \right) + C$ (2) $\frac{x^2}{y^2} = \frac{2}{3}x^3 \left(\frac{2}{3} - \log_e x \right) + C$
- (3) $\frac{x^2}{y} = \frac{2}{3}x^3 \left(\frac{2}{3} + \log_e x \right) + C$ (4) $\frac{-x^2}{y} = \frac{2}{3}x^3 \left(\frac{2}{3} + \log_e x \right) + C$
- (Where C is arbitrary constant)
35. If the equation $2\sin^2 x + \frac{\sin 2x}{2} = k$, has atleast one real solution, then the sum of all integral values of k is
- (1) 2 (2) 3 (3) 5 (4) 6
36. If A & B are two independent events such that $P(A) > 0.5$, $P(B) > 0.5$, $P(A \cap \bar{B}) = \frac{3}{25}$, $P(\bar{A} \cap B) = \frac{8}{25}$, then $P(A \cap B)$ is
- (1) $\frac{12}{25}$ (2) $\frac{14}{25}$ (3) $\frac{18}{25}$ (4) $\frac{24}{25}$
37. If the focal distance of an end of the minor axis of any ellipse (its axes as x and y axis respectively) is k and the distance between the foci is $2h$, then its equation is-
- (1) $\frac{x^2}{k^2} + \frac{y^2}{h^2} = 1$ (2) $\frac{x^2}{k^2} + \frac{y^2}{k^2 - h^2} = 1$ (3) $\frac{x^2}{k^2} - \frac{y^2}{k^2 - h^2} = 1$ (4) $\frac{x^2}{k^2} + \frac{y^2}{k^2 + h^2} = 1$

38. Let H be the set of all houses in a village where each house is faced in one of the directions, East, West, North, South.
Let $R = \{(x, y) | (x, y) \in H \times H \text{ and } x, y \text{ are faced in same direction}\}$. Then the relation 'R' is
(1) non symmetric (2) only reflexive and symmetric
(3) non reflexive (4) an equivalence relation
39. Shortest distance between curves $y^2 = x^3$ and $9x^2 + 9y^2 - 30y + 16 = 0$ is
(1) $\frac{\sqrt{13}}{3}$ (2) $\frac{2}{3}$ (3) $\frac{5}{3}$ (4) $\frac{\sqrt{13}}{3} - 1$
40. If $f(x)$ be a continuously increasing function satisfying the condition that
 $f(x) = \frac{1}{3} \left[f(x+6) + \frac{6}{f(x+7)} \right]$ and $f(x) \geq 0$ for all $x \in \mathbb{R}$. If $\lim_{x \rightarrow \infty} f(x) = \sqrt{m}$ then value of m is
(1) 3 (2) 4 (3) 6 (4) 5
41. $\int e^{x^2} \cdot e^x (2x^2 + x + 1) dx = e^{x^2} (f(x)) + c$
where c is constant of integration. If the minimum value of $f(x)$ is equal to 'm' then find the value of $\left[-\frac{1}{m} \right]$, $[\cdot]$ denotes [GIF] functions
(1) -3 (2) 2 (3) 4 (4) 0
42. If $y = \sin(m \sin^{-1}x)$, then $(1-x^2) y_2 - xy_1 + m^2y$ equals to -
(1) 0 (2) y (3) -y (4) None of these
43. $1 + \sum_{r=0}^{22} \{r(r+2) + 1\} \cdot r! = k!$ then the number of divisors of k is
(1) 4 (2) 6 (3) 8 (4) 10
44. Which of the following is **NOT** true for any two statements p and q ?
(1) $\sim [p \vee (\sim q)] \equiv (\sim p) \wedge q$ (2) $\sim (p \vee q) \equiv (\sim p) \vee (\sim q)$
(3) $q \wedge \sim q$ is a contradiction (4) $\sim (p \wedge (\sim p))$ is a tautology
45. Equation of circle which cuts the circle $x^2 + y^2 + 2x + 4y - 4 = 0$ and the lines $xy - 2x - y + 2 = 0$ orthogonally, is
(1) $x^2 + y^2 - 2x - 4y - 12 = 0$ (2) $x^2 + y^2 - 2x - 4y - 6 = 0$
(3) $x^2 + y^2 - 2x - 4y + 6 = 0$ (4) $x^2 + y^2 - 2x - 4y - 10 = 0$
46. There are 12 points in a plane of which 5 are collinear. Barring these five points no three are collinear. The number of quadrilaterals one can form using these points is
(1) 7C_3 (2) 7P_3 (3) $10 \cdot {}^7C_3$ (4) ${}^{10}C_4 \times 2!$

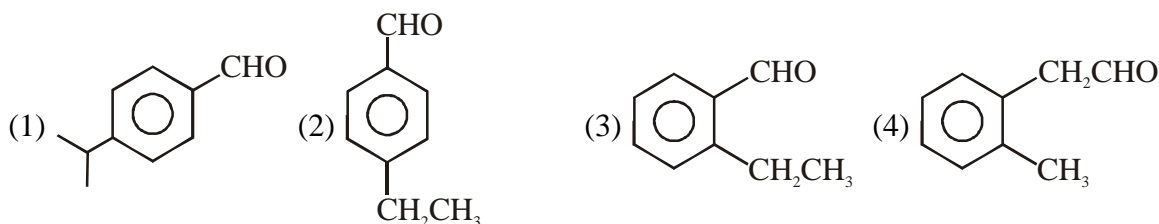
47. Let $f : \left[-1, -\frac{1}{2}\right] \rightarrow [-1, 1]$ is defined by $f(x) = 4x^3 - 3x$, then $f^{-1}(x) =$
- (1) $\cos\left(\frac{1}{3}\cos^{-1}x\right)$ (2) $\cos(3\cos^{-1}x)$
- (3) $\sin\left(\frac{1}{3}\sin^{-1}x\right)$ (4) $\cos\left(\frac{2\pi}{3} + \frac{1}{3}\cos^{-1}x\right)$
48. If $x + y + 1 = 0$ is a common tangent to the $y^2 = 4x$ and $x^2 = \lambda y$ then λ is equal to
- (1) 1 (2) 2 (3) 3 (4) 4
49. Let $f(x)$ is continuous & differentiable function $\forall x \in \mathbb{R}$, such that $f(1) = 2$, $f(4) = 8$ and $f'(x) \leq 2 \forall x \in \mathbb{R}$ then $f(2)$ is equal to
- (1) 4 (2) 3 (3) 2 (4) 1
50. The shortest distance between the skew lines $\frac{x+3}{-4} = \frac{y-6}{3} = \frac{z}{2}$ and $\frac{x+2}{-4} = \frac{y}{1} = \frac{z-7}{1}$ is equal to
- (1) 1 (2) 3 (3) 9 (4) 27
51. The area bounded by $y = x^2$, $y = [x + 1]$, $0 \leq x \leq 2$ and y-axis, where $[.]$ represents greatest integer function is equal to -
- (1) $\frac{2}{3}$ (2) $\frac{4\sqrt{2}}{3} - 1$ (3) $\frac{4\sqrt{3}}{5} - 1$ (4) $\frac{3\sqrt{3}}{4} - 1$
52. If variable chord of hyperbola $x^2 - y^2 = 9$ touches the parabola $y^2 = 12x$ and locus of middle point of these chords is $x^3 + \lambda_1xy^2 + \lambda_2y^2 = 0$, then $\lambda_1 + \lambda_2$ equals
- (1) -3 (2) -2 (3) 3 (4) 2
53. In a complex plane the points A and B are at $z_1 = 5 - 2i$ and $z_2 = 1 + i$. If P(z) moves such that $|z - z_1| = 2|z - z_2|$, then the maximum area of ΔPAB is
- (1) $\frac{1}{3}$ (2) $\frac{25}{3}$ (3) $\frac{50}{3}$ (4) 5
54. The value of 'a' for which the equation $x^3 + ax + 1 = 0$ and $x^4 + ax^2 + 1 = 0$ have common root is
- (1) -2 (2) 0 (3) 2 (4) none

55. For the system of equations
 $ax + by + cz = q - r,$
 $bx + cy + az = r - p,$
 $cx + ay + bz = p - q,$ which of the following is always **FALSE** ?
 (1) consistent if $p = q = r$
 (2) consistent if $a = b = c$ and p, q, r are distinct
 (3) consistent if a, b, c are distinct and $a + b + c \neq 0$
 (4) consistent if $a = b = c$
56. If $f(x) = (e^{(x-1)})^2 (x-1)^2$, then which of following is **CORRECT** ?
 (1) $f(x)$ has an extremum at $x = \pm 1$ (2) $f'(1) = 0$
 (3) $f''(1) < 0$ (4) $f''(0) > 0$
57. If $f(x) = \int_1^x \frac{\ln t}{1+t} dt$, then which of the following is **TRUE** ?
 (1) $f\left(\frac{1}{x}\right) = -\int_1^x \frac{\ln t}{t(1+t)} dt$ (2) $f\left(\frac{1}{x}\right) = \int_1^x \frac{\ln t}{t(1+t)} dt$
 (3) $f(x) + f\left(\frac{1}{x}\right) = 0$ (4) $f(x) + f\left(\frac{1}{x}\right) = (\ln x)^2$
58. If $\vec{x}, \vec{y}, \vec{z}$ are unit vectors such that $\vec{x} + \vec{y} + \vec{z} = \vec{a}$, $(\vec{x} \times \vec{y}) \times \vec{z} = \vec{b}$, $\vec{a} \cdot \vec{x} = \frac{3}{2}$, $\vec{a} \cdot \vec{y} = \frac{7}{4}$ and $|\vec{a}| = 2$, then which of the following is **FALSE** ?
 (1) \vec{y} is perpendicular to \vec{z}
 (2) \vec{y} is perpendicular to \vec{b}
 (3) angle between \vec{x}, \vec{y} is acute
 (4) angle between \vec{x}, \vec{z} is obtuse
59. If a tower stands at the centre of a square park ABCD. Angle of elevation of the top of the tower from A is α and angle of elevation of the top of tower from mid point of side of square is β then
 (1) $2\sin^2\alpha\cos^2\beta + \cos^2\alpha\sin^2\beta = 1$
 (2) $2\sin^2\alpha\cos^2\beta - \cos^2\alpha\sin^2\beta = 2$
 (3) $2\sin^2\alpha\cos^2\beta - \cos^2\alpha\sin^2\beta = 0$
 (4) $\sin^2\alpha\cos^2\beta - 2\cos^2\alpha\sin^2\beta = 0$
60. Ratio of variances of first n positive multiples of 5 and first n positive multiples of 10 will be:
 (1) 1 : 2 (2) 1 : 1 (3) 1 : 4 (4) 1 : 5

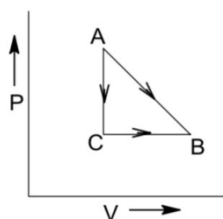
PART-C : CHEMISTRY

- 61.** In which of the following species the bonds are non-directional?
 (1) NCl_3 (2) RbCl (3) BeCl_2 (4) BCl_3
- 62.** 20 ml of $\frac{M}{10}$ NH_4OH solution is mixed with 16 ml of $\frac{M}{10}$ HCl solution. The pH of the resulting solution is: (pK_b of $\text{NH}_4\text{OH} = 4.74$)
 (1) 9.26 (2) 6.85 (3) 4.74 (4) 8.66
- 63.** Which of the following reaction involves $\text{S}_{\text{N}}2$ mechanism?
 (1) $\text{CH}_3\text{-CH}_2\text{-OH} \xrightarrow[443\text{K}]{\text{H}_2\text{SO}_4}$ (2) $\text{C}_2\text{H}_5\text{ONa} + (\text{CH}_3)_3\text{C-Cl} \longrightarrow$
 (3) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{CH}_2\text{CH-CH}_2\text{-OEt} \end{array} \xrightarrow[\text{HI}]{\text{conc.}}$ (4) $\text{CH}_3\text{CHO} + \text{NaBH}_4 \longrightarrow$
- 64.** Which of the following molecule exhibit $\text{P}_\pi\text{-P}_\pi$ bonding:
 (1) XeO_4 (2) SO_2 (3) SO_3 (4) Both (2) and (3)
- 65.** Major product(P) of given reaction will not give ?
 $\text{Cumene} \xrightarrow[\text{(ii) H}^\oplus/\text{H}_2\text{O}]{\text{(i) O}_2/h\nu} \text{Acetone} + (\text{P})$
 (1) 1% FeCl_3 test (2) Na Metal test
 (3) Iodoform test (4) Libermann nitroso test
- 66.** The half life of a substance following 1st order kinetics is 20 minutes. What is the approximate time interval ($t_2 - t_1$) : (where the time t_2 = when $\frac{2}{3}$ of it has reacted and t_1 = when $\frac{1}{3}$ of it has reacted) :
 (1) 14 min (2) 20 min (3) 28 min (4) 17 min
- 67.** Which of the following compound does not contain Mg:
 (1) Dolomite (2) Haematite (3) Carnallite (4) Magnesite
- 68.** Which of the following reaction can't produce aldehyde functional group?
 (1) Stephen's reduction (2) Rosenmund reaction
 (3) Clemmensen reduction (4) Gatterman Koch synthesis

69. Which among the following statement for molar heat capacity of ideal gas is incorrect:
- (1) is zero for an adiabatic process
 - (2) Is infinite for an isothermal process
 - (3) Depends only on the atomicity of the gas for a process in which either volume or pressure is constant
 - (4) is equal to the product of the molecular weight and specific heat capacity for any process
70. Amphoteric nature shown by the oxides of element:
- (1) Be and Al
 - (2) Pb and Zn
 - (3) Sn and Pb
 - (4) All of these
71. An organic compound with the molecular formula $C_9H_{10}O$ forms 2, 4-DNP derivative, reduces tollen's reagent and undergoes cannizzaro reaction. On vigorous oxidation, it gives dicarboxylic acid which is used in glyptal polymer. Then compound is :



72. Consider the modes of transformations of a gas from state 'A' to state 'B' as shown in the following P - V diagram. Which one of the following is true?



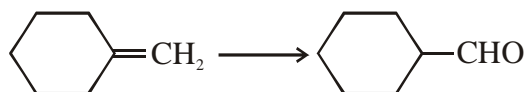
- (1) $\Delta H = q$ along $A \rightarrow C$
 - (2) ΔS is same along both $A \rightarrow B$ and $A \rightarrow C \rightarrow B$
 - (3) W is same along both $A \rightarrow B$ and $A \rightarrow C \rightarrow B$
 - (4) $W_{AB} = W_{BC}$
73. Which of the following represent the correct order of electron gain enthalpy:
- (1) $O > S > Se$
 - (2) $S > Se > O$
 - (3) $Se > S > O$
 - (4) $Se > O > S$
74. Which of the following reaction will produce 3 gm hydrogen gas?
- (1) 94 gm phenol with 23 gm sodium
 - (2) Excess of propyne with 78 gm K
 - (3) Excess of tert-butanol with 27gm Al
 - (4) All of these

- 81.** Which of the following is not an application of adsorption?
- (1) Removal of moisture using anhydrous CaCl_2
 - (2) Use of gas masks to purify the air for breathing
 - (3) Concentration of low grade sulphide ores using pine oil and frothing agent
 - (4) Chromatographic technique is used in purification of organic compounds

- 82.** Aluminium is obtained by
- (i) electrolytic reduction of AlN
 - (ii) reduction with carbon of Al_2O_3
 - (iii) electrolytic reduction of Al_2O_3 with Na_3AlF_6 and CaF_2
 - (iv) Heating cryolite and alumina

Which of the following code is correct about the extraction of Al:

- (1) (iii) (2) (i), (ii) and (iii) (3) (ii), (iii) and (iv) (4) (iii) and (iv)
- 83.** Which of the following is most appropriate for given conversion ?



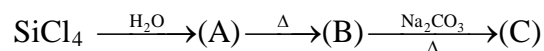
- (1) (i) O_3 (ii) $\text{Zn-H}_2\text{O}$
 - (2) (i) $\text{HBr/H}_2\text{O}_2$ (ii) NaOH (iii) $\text{CrO}_3, \text{H}_2\text{SO}_4$
 - (3) (i) $\text{BH}_3\text{-THF}$ (ii) $\text{H}_2\text{O}_2/\text{NaOH}$ (iii) NBS
 - (4) (i) $\text{HCl/H}_2\text{O}_2$ (ii) H_2O (iii) PCC
- 84.** Among the seven crystal systems, how many systems have body-centred unit cell as a possible variation?
- (1) 3 (2) 4 (3) 5 (4) 6

- 85.** Boric acid on strong heating gives:
- (1) B_2O_3 (2) $\text{Ca}_2\text{B}_6\text{O}_{11}$ (3) B_3H_8 (4) B_4H_{10}

- 86.** Carbohydrate which on reaction with dil. HNO_3 gives a optically inactive product.
- (1) D-Altrose (2) D-Mannose (3) D-Glucose (4) D-Galactose

- 87.** A fixed weight of Ca is converted into CaCO_3 and then completely neutralised by 500 ml decimolar HCl (no acid left at the end). The calcium chloride formed is converted into plaster of paris. Weight of plaster of paris formed is
- (1) 5gm (2) 4.2 gm (3) 8.8 gm (4) 3.625 g

88. A reaction is given:



The compound A, B and C are respectively:

- (1) $\text{Si}(\text{OH})_4$, H_2SiO_3 , Na_2SiO_3 (2) SiCl_4 , H_2SiO_3 , Na_2SiO_4
 (3) SiO_2 , H_2SiO_3 , Na_2SiO_4 (4) SiO_2 , SiC , Na_2SiO_3

89. Optically active amino acid obtained by hydrolysis of the given compound is :



- (1) Alanine (2) Glycine (3) Leucine (4) Valine

90. A particle A moving with a certain velocity has de Broglie wavelength of 1 Å. If particle B has mass 25% of that A and velocity 75% of that of A, the de Broglie wavelength of B will be approximately:

- (1) 1 Å (2) 5.3 Å (3) 3 Å (4) 0.2 Å