JEE MAINS MODEL PAPER – 2017

No. of Questions: 90 **Maximum Marks: 360** **Time: 3 hours**

MATHEMATICS

1. If $f(x + y) = f(x) + f(y)\ \forall\ x, y \in R$ and $f(1) = \frac{1}{2014}$ then $f(2014) =$

1) 2014 2) $\frac{1}{2014}$ 3) 4028 4) 1

2. The value of the expression $\sum_{k=1}^{6}\left[\sin\left(\frac{2k\Pi}{7}\right) - i\cos\left(\frac{2k\Pi}{7}\right)\right]$ equals

1) 0 2) i 3) $-i$ 4) 1

3. Suppose that f (x) is a quadratic expression which is positive for all real x.

If g(x) = f (x) + f'(x) + f''(x), then for any real x (where f'(x) and f''(x) represent 1^{st} and 2^{nd} derivatives respectively)

1) g (x) < 0 2) g (x) > 0 3) g (x) = 0 4) g (x) ≥ 0

4. If $A = [a_{ij}]_{4\times4}$, such that

$a_{ij} = \begin{cases} 2, \text{ when } i = j \\ 0, \text{ when } i \neq j \end{cases}$, then $\frac{\det(\text{adj}(\text{adj } A))}{7}\Big\}$ is (where { . } represents fractional part function)

1) $\frac{1}{7}$ 2) $\frac{2}{7}$ 3) $\frac{3}{7}$ 4) $\frac{4}{7}$

5. The number of values of k for which the system of equations $(k + 1)x + 8y = 4k$, $kx + (k + 3)y = 3k - 1$ has infinitely many solutions, is/ are

1) 0 2) 1 3) 2 4) infinite

6. The letters of the word COCHIN are permuted and all the permutations are arranged in an alphabetical order as in an English dictionary. The number of words that appear before the word COCHIN is

1) 360 2) 192 3) 96 4) 48

7. In the binomial expansion of $(a - b)^n$, $n \geq 5$, the sum of 5^{th} and 6^{th} terms is zero, then a/b equals

1) $\frac{n-5}{6}$ 2) $\frac{n-4}{5}$ 3) $\frac{5}{n-4}$ 4) $\frac{6}{n-5}$

8. If $a, a_1, a_2, \ldots, a_{2n}, b$ are in AP, and $a, g_1, g_2, g_3, \ldots, g_{2n}, b$ are in GP and h is the HM of a, b then

$\frac{a_1 + a_{2n}}{g_1 g_{2n}} + \frac{a_2 + a_{2n-1}}{g_2 g_{2n-1}} + \ldots + \frac{a_n + a_{n+1}}{g_n g_{n+1}}$ is equal to

1) $\frac{h}{n}$ 2) $\frac{2n}{h}$ 3) $\frac{h}{2n}$ 4) $\frac{2n}{h+n}$

9. The 15^{th} term of the series $2\frac{1}{2} + 1\frac{7}{13} + 1\frac{1}{9} + \frac{20}{23} + \ldots$ is

1) $\frac{10}{39}$ 2) $\frac{10}{21}$ 3) $\frac{10}{23}$ 4) $\frac{15}{29}$

10. If $f(x) \lim_{n\to\infty} \frac{\{e^x\}^n - 1}{\{e^x\}^n + 1}$ where $\{ . \}$ represents fractional part function, then

1) f(x) is discontinuous function

2) f(x) is an even function

3) f(x) is continuous but non – differentiable function

4) f(x) is not defied for all real numbers

11. If the function f(x) defined as $f(x) = \begin{cases} (\sin x + \cos x)^{\text{cosec } x}, & -\frac{\Pi}{2} < x < 0 \\ a, & x = 0 \\ \frac{e^{1/x} + e^{2/x} + e^{3/x}}{ae^{-2+1/x} + be^{-1+3/x}}, & 0 < x < \frac{\Pi}{2} \end{cases}$ is continuous at x = 0,

then the value of a & b respectively

1) e, 1 2) 4, e^{-1} 3) 4, e 4) 1, e

12. Consider the curve $5x^5 - 10x^3 + x + 2y + 6 = 0$ let P (0, –3). The normal at P meets the curve again at Q (x_1, y_1) and R (x_2, y_2) where $x_1 > x_2$ then the equation of tangent at Q (x_1, y_1) is

1) $2x - y - 3 = 0$ 2) $2x + y - 1 = 0$ 3) $x - y - 2 = 0$ 4) $x + y = 0$

13. $f(x) = 20 - 24x - 15x^2 - 2x^3$ has

1) two local maxima and one local minima

2) two local minima and one local maxima

3) one local maxima and one local minima

4) two local maxima and two local minima

14. $\int \frac{\cos 5x + 5\cos 3x + 10\cos x}{\cos 6x + 6\cos 4x + 15\cos 2x + 10}\, dx =$

1) $\ln\left|\tan\left(\frac{x}{2} - \frac{\Pi}{4}\right)\right| + c$ 2) $\ln\left|\tan\left(\frac{x}{2} + \frac{\Pi}{4}\right)\right| + c$

3) $\frac{1}{2}\ln\left|\tan\left(\frac{x}{2} - \frac{\Pi}{4}\right)\right| + c$ 4) $\frac{1}{2}\ln\left|\tan\left(\frac{x}{2} + \frac{\Pi}{4}\right)\right| + c$

15. If $f : D \to R$ be such that $f(x) = \sqrt{\sin(\cos x)} + \log(-2\cos^2 x + 3\cos x - 1)$ then,

$\int_{x_1}^{x_2} \left[\cos x - \frac{1}{2}\right] dx$ = ... ([.] denotes G.I.F) also

1) 0 2) –1 3) 1 4) $\frac{1}{2}$

16. The area of the region in the XY plane defined by the inequalities $x - 2y^2 \geq 0$, $1 - x - |y| \geq 0$ is

1) $\frac{1}{2}$ 2) $\frac{1}{3}$ 3) $\frac{1}{4}$ 4) $\frac{7}{12}$

17. If real value of 'm' for which the substitution $y = u^m$ will transform the differential equation $2x^4 y \frac{dy}{dx} + y^4 = 4x^6$ into a homogeneous equation then the value of m is

1) 3 2) 4 3) 2 4) 5

18. If $P\left(\left(1+\frac{\alpha}{\sqrt{2}}\right), 2+\left(\frac{\alpha}{\sqrt{2}}\right)\right)$ be any point on a line, then the range of values of α for which the point P lies between the parallel lines $x + 2y = 1$ and $2x + 4y = 15$ is

1) $-\frac{4\sqrt{2}}{3} < \alpha < \frac{5\sqrt{2}}{6}$ 2) $0 < \alpha < \frac{5\sqrt{2}}{6}$

3) $-\frac{4\sqrt{2}}{3} < \alpha < 0$ 4) None of these

19. A line meets the coordinate axes in A and B. A circle is circumscribed about the triangle OAB (O be the origin). If m and n are the distances of the tangent to the circle at the origin from the points A and B respectively, the diameter of the circle is

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

20. Let PQ and RS be tangents at the extremities of the diameter PR of a circle of radius r. If PS and RQ intersect at a point X on the circumference of the circle, then 2r equals

1) $\sqrt{PQ.RS}$ 2) $\frac{PQ + RS}{2}$

3) $\frac{2PQ.RS}{PQ + RS}$ 4) $\frac{\sqrt{PQ^2 + RS^2}}{2}$

21. Consider a circle with its centre lying on the focus of the parabola $y^2 = 2px$, such that it touches the directrix of the parabola. Then a point of intersection of the circle and the parabola is

1) $\left(\frac{p}{2}, p\right)$ 2) $\left(\frac{p}{2}, -2p\right)$ 3) $\left(-\frac{p}{2}, p\right)$ 4) $\left(-\frac{p}{2}, -p\right)$

22. Let F_1, F_2 are the foci of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ and F_3, F_4 are the foci of its conjugate hyperbola. If e_H and e_C are their eccentricities respectively then statement which holds true

1) Their equation of asymptotes are different

2) $e_H > e_C$

3) Area of the quadrilateral formed by their foci is 50 sq. units

4) Their auxiliary circle will have the same equation

23. The distance from of a point (2, 4, −1) from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$

1) 6 units 2) 7 units

3) 8 units 4) 9 units

24. The line passing through the points (5, 1, a) and (3, b, 1) crosses the YZ-plane at the point $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$. Then,

1) a = 6, b = 4 2) a = 2, b = 8

3) a = 4, b = 6 4) a = 8, b = 2

25. Let $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ be three non-zero vectors such that $\vec{c}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$. If the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\Pi}{6}$, then the value of $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}^2$ is

1) $\frac{3}{4}\left(a_1^2 + a_2^2 + a_3^2\right)\left(b_1^2 + b_2^2 + b_3^2\right)$ 2) $\frac{1}{4}\left(a_1^2 + a_2^2 + a_3^2\right)\left(b_1^2 + b_2^2 + b_3^2\right)$

3) 1 4) 0

26. In an experiment with 15 observations on x, the following results were available $\sum x^2 = 2830$, $\sum x = 170$. One observation that where 20 was found to be wrong and was replaced by the correct value 30. Then the corrected variance is

1) 188.66 2) 177.33 3) 8.33 4) 78.00

27. The probability that atleast one of the events A and B occurs is 0.6. If A and B occur simultaneously with probability 0.2 then $P(\overline{A}) + P(\overline{B}) =$

1) 0.4 2) 0.8 3) 1.2 4) 0.2

28. If $2^{\sqrt{\sin^2 x - 2\sin x + 5}} \frac{1}{4^{\sin 2y}} \le 1$, then the ordered pair (x, y) is equal to (m, n ∈ I)

1) $x = (4n + 1)\frac{\Pi}{2}$, $y = (2m + 1)\frac{\Pi}{2}$ 2) $x = 2n\Pi$, $y = 2m\Pi$

3) $x = (2n + 1)\frac{\Pi}{2}$, $y = (2m + 1)\frac{\Pi}{2}$ 4) x = np, y = mp

29. A person walking along a straight road towards a hill observes at two points of distance $12\sqrt{3}$ kms, the angles of elevation of the top of the hill be 45° and 60°. The height of the hill is

1) $\left(\frac{3}{2}\right)$ kms 2) $18(\sqrt{3} - 1)$

3) $\frac{(\sqrt{3} + 1)}{2}$ kms 4) $18(\sqrt{3} + 1)$

30. If p : It rains today, q : I go to school, r : I shall meet any friends and s : I shall go for a movie, then which of the following is the proposition : If it does not rain or if I do not go to school, then I shall meet my friend and go for a movie.

1) $\sim(p \wedge q) \Rightarrow (r \wedge s)$ 2) $\sim(p \wedge \sim q) \Rightarrow (r \wedge s)$

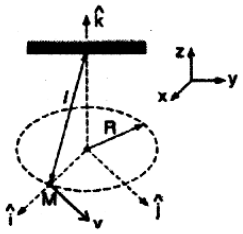
3) $\sim(p \wedge q) \Rightarrow (r \vee s)$ 4) None of these

PHYSICS

31. Time period of a simple pendulum is $T = 2\Pi\sqrt{\frac{L}{g}}$. Measured value of 'L' is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 sec using a wrist watch of 1 sec resolution. What is the percentage error in the determination of 'g'?

1) 4 2) 2 3) 3 4) 6

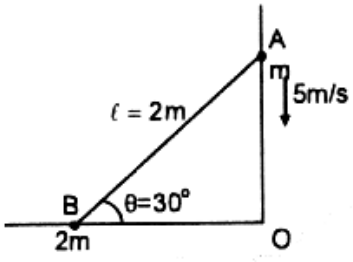
32. A conical pendulum consists of a mass 'M' suspended from a string of length 'l'. The mass executes a circle of radius 'R' in a horizontal plane with speed 'v'. At time 't', the mass is at position $R\hat{i}$ and has velocity $v\hat{j}$. At time 't', the angular momentum vector of the mass 'M' about the point from which the string suspended is



1) $Mv R\hat{k}$ 2) $Mvl\hat{k}$

3) $Mvl\left[\frac{\sqrt{l^2 - R^2}}{l}\hat{i} + \frac{R}{l}\hat{k}\right]$ 4) $-Mvl\left[\frac{\sqrt{l^2 - R^2}}{l}\hat{i} + \frac{R}{l}\hat{k}\right]$

33. Two particles A and B of mass m and 2 m are connected by a light rigid rod of length l. The particles are free to slide on frictionless L – shaped horizontal frame as shown in the figure. A moves with a constant velocity of 5 m/s. Then at the instant shown



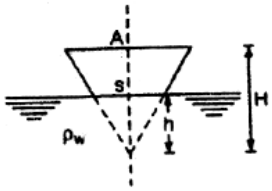
1) speed of B is $\frac{5}{\sqrt{3}}$ m/s

2) the magnitude of rate of change of θ is $\frac{13}{\sqrt{13}}$ rad / sec

3) speed of B is $\frac{10}{\sqrt{3}}$ m/s

4) the magnitude of rate of change of θ is $\frac{10}{\sqrt{3}}$ rad / sec

34. A cone made of a material of relative density $\left(s = \frac{27}{64}\right)$ and height 4m floats with its apex downward in water. The time period of vertical oscillation if it is slightly displaced from the equilibrium position is(nearly) ($g = 10\ m/s^2$)

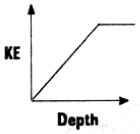


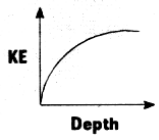
1) 1 sec 2) 2 sec 3) 3 sec 4) 0.5 sec

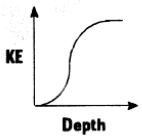
35. Two satellites A and B go around the earth in circular orbits at heights R_A and R_B, respectively, from the surface of earth. Assume the earth to be a uniform sphere of radius R_E. The ratio of the magnitudes of the velocity, v_A / v_B of the satellites is

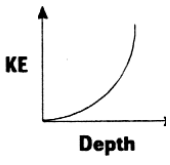
1) $\sqrt{\frac{R_B}{R_A}}$ 2) $\sqrt{\frac{R_B + R_E}{R_A + R_E}}$ 3) $\frac{R_B + R_E}{R_A + R_E}$ 4) $\left(\frac{R_A}{R_B}\right)^2$

36. Which of the diagrams in figure correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart it a terminal velocity?

1) 

2) 

3) 

4) 

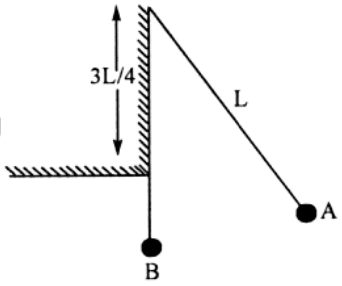
37. A one litre glass flask contains some mercury. It is found that at different temperatures, the volume of air inside the flask remains the same. What is the volume of mercury in this flask, if coefficient of linear expansion of glass is 9×10^{-6}/°C and coefficient of volume expansion of mercury is 1.8×10^{-4} / °C?

1) 50 cc 2) 100 cc 3) 150 cc 4) 200 cc

38. A diatomic ideal gas is heated at constant volume until the pressure is doubled and again heated at constant pressure until its volume is doubled. The average molar heat capacity for the whole process is:

1) $\frac{13R}{6}$ 2) $\frac{19R}{6}$ 3) $\frac{23R}{6}$ 4) $\frac{17R}{6}$

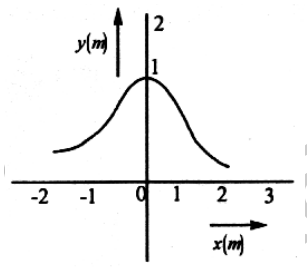
39. A pendulum of length L has time period T for small oscillations. An obstacle is placed directly beneath the pivot so that only the lowest one quarter of the string can follow the pendulum bob when it swings in the left of its resting position as shown in the figure. Time taken by the bob to return the position A if it was released from that position, is



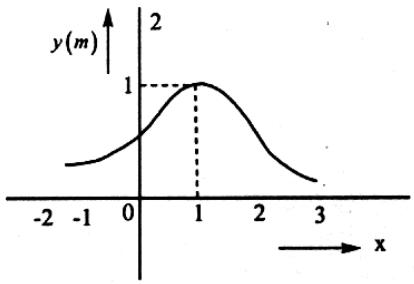
1) T 2) $\frac{T}{2}$ 3) $\frac{3T}{4}$ 4) $\frac{T}{4}$

40. A Periodic wave is given by the equation $y = f(x, t) = \frac{1}{(x - 2t)^2 + 1}$ where position 'x' is in meter and time 't' is in sec. The correct wave profile at the instant t = 1s will be given by which of the following graphs? (Consider Best Approximation graph).

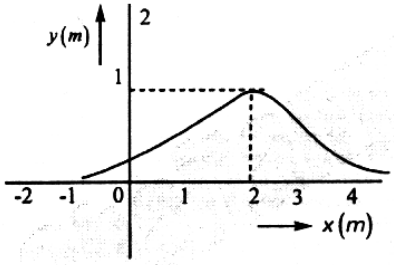
1)



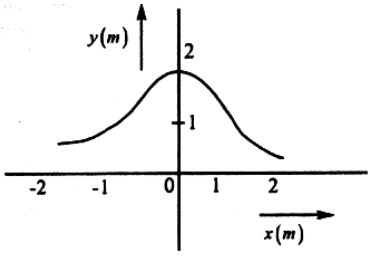
2)



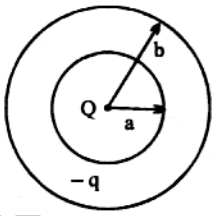
3)



4)



41. A spherical shell with an inner radius 'a' and an outer radius 'b' is made of conducting material. A point charge +Q is placed at the centre of the spherical shell and a total charge −q is placed on the shell. Charge −q is distributed on the surfaces as



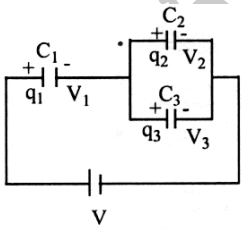
1) −Q on the inner surface, −q on outer surface

2) −Q on the inner surface, −q +Q on the outer surface

3) +Q on the inner surface, −q −Q on the outer surface

4) The charge −q is spread uniformly between the inner and outer surface

42. In the circuit as shown in figure if all the symbols have their usual meanings, then identify the correct statement



1) $q_2 = q_3$; $V_2 = V_3$

2) $q_1 = q_2 + q_3$; $V_2 = V_3$

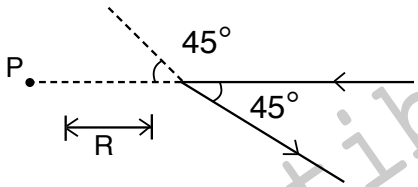
3) $q_1 = q_2 + q_3$; $V = V_1 + V_2 + V_3$

4) $q_1 + q_2 + q_3 = 0$; $V_2 = V_3 = V - V_1$

43. In a chemical reaction platinum is used as a catalyst. Since platinum is a very rare metal to increase the available surface area small spheres of platinum are used for the reaction. The catalyst action happens due to the phenomenon of adsorption. The reactant molecules are absorbed on the surface where they may react with each other easily. Assuming that the surface of these spheres is very smooth even at molecular level, what is the number of degrees of freedom with respect to translation for a adsorbed hydrogen molecule [Take appropriate assumptions]

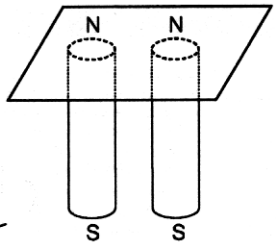
1) 10 2) 2 3) 23 4) 5

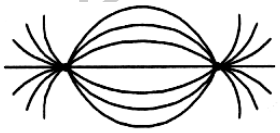
44. A long straight wire, carrying current I is bent at its midpoint to form an angle of 45°. Induction of magnetic field at point P, distant R from point of bending is equal to:

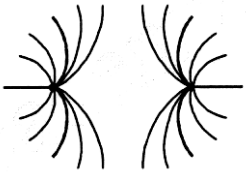


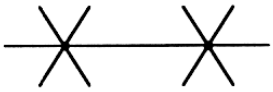
1) $\frac{(\sqrt{2}-1)\mu_0 I}{4\pi R}$ 2) $\frac{(\sqrt{2}+1)\mu_0 I}{4\pi R}$ 3) $\frac{(\sqrt{2}-1)\mu_0 I}{4\sqrt{2}\pi R}$ 4) $\frac{(\sqrt{2}+1)\mu_0 I}{4\sqrt{2}\pi R}$

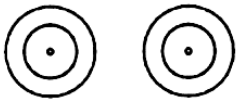
45. Two long, identical bar magnets are placed under a horizontal piece of paper, as shown in figure. The paper is covered with iron filings. When the two north poles are a small distance apart and touching the paper, the iron filings move into a pattern that shows the magnetic lines of forces. Which of the following best illustrates the pattern that results?



1) 

2) 

3) 

4) 

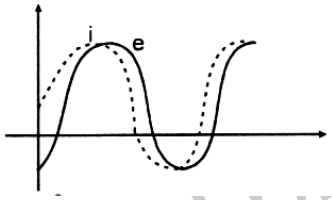
46. When an AC source of emf e = E0 sin(100t) is connected across a circuit, the phase difference between the emf e and the current i in the circuit is observed to be $\frac{\pi}{4}$, as shown in the diagram. If the circuit consists possibly only of R-C or R-L or L-C series, find the relationship between the two elements.

1) R = 1 kΩ , C = 10 μ F

2) R = 1 kΩ , L = 10 H

3) R = 1 kΩ , C = 1 μ F

4) R = 1 kΩ , L = 1 H



47. The energy contained in a small volume through which an electromagnetic wave is passing oscillates with:

1) zero frequency

2) the frequency of the wave

3) half of the frequency of the wave

4) double of the frequency of wave

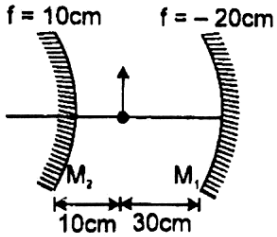
48. In the figure shown find the total magnification after two successive reflections first on M_1 & then on M_2

1) +1

2) −2

3) +2

4) −1



49. A slit of width d is placed in front of a lens of focal length 0.5m and is illuminated with light of wave length 5.89×10^{-7}m. The first diffraction minima on either side of the central diffraction maximum are separated by 2×10^{-3}m. The width d of the slit is (in m)

1) 2.045×10^{-4} 2) 2.105×10^{-4}

3) 2.945×10^{-4} 4) 0.125×10^{-4}

50. A photon collides with a stationary hydrogen atom in ground state and is completely absorbed (Perfectly inelastic collision). Energy of the colliding photon is 10.2 eV. After a micro second, another photon collides with the same hydrogen atom perfectly inelastically with an energy of 15 eV. What will be observed by the detector ?(Neglect kinetic energy attained by hydrogen atom during the process)

1) Two photons of energy 1.2 eV

2) Two photons of energy 1.4 eV.

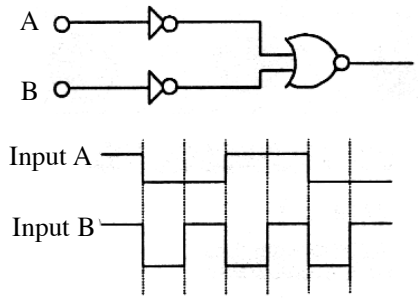
3) One photon of energy 10.2 eV and one electron of kinetic energy 1.4 eV.

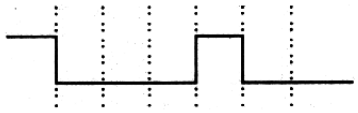
4) One electron having kinetic energy nearly 11.6 eV.

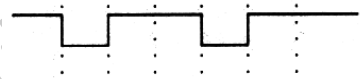
51. An unstable element is produced in nuclear reaction at a constant rate R. Its disintegration constant is λ. Find number of nuclei after time 't' if initially it was Zero

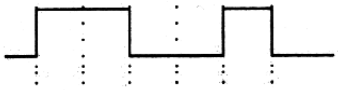
1) $\frac{R}{\lambda} e^{-\lambda t}$ 2) $\frac{R}{\lambda}(1 - e^{-\lambda t})$ 3) $\frac{R}{\lambda}(1 + e^{-\lambda t})$ 4) $\frac{Rt}{\lambda}$

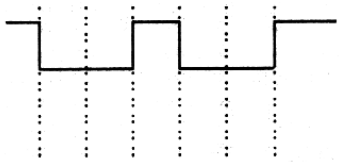
52. The logic circuit shown below has the input waveforms A and B as shown. Pick out the correct output waveform.



1) 

2) 

3) 

4) 

53. Which one of the following is incorrect statement in the transmission of electromagnetic waves?

1) Ground wave propagation is for high frequency transmission.

2) Sky wave is facilitated by ionospheric layers.

3) Space wave is of high frequency and is suitable for line of sight communication.

4) Space wave is used for satellite communication.

54. The pitch of a screw gauge is 0.5 mm and there are 50 divisions on circular scale when there is nothing between two ends of screw gauge 45^{th} division of circular scale is coinciding with screw gauge and in this situation zero of main scale is not visible. When wire is placed between the two ends, the linear scale reads 2 divisions and 20^{th} division of circular scale coincides with reference line. For this situation mark the correct statement

1) Least count of Instrument is 0.01 mm

2) Zero correction for the Instrument is + 0.45 mm

3) Thickness of wire is 1.65 mm

4) All the above

55. A 3.6 m long vertical pipe is filled completely with a liquid. A small hole is drilled at the base of the pipe due to which liquid starts leaking out slowly. This pipe resonates with a tuning fork. The first two resonances occur when height of water column from base is 3.22 m and 2.34 m respectively. The area of cross–section of pipe is

1) $25\ \pi\ cm^2$ 2) $100\ \pi\ cm^2$

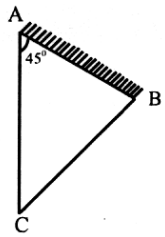
3) $200\ \pi\ cm^2$ 4) $400\ \pi\ cm^2$

56. A galvanometer with resistance 100Ω gives full scale deflection with a current of 10 mA. The value of shunt, in order to convert it into an ammeter of 10 ampere range, will be

1) –10 Ω 2) 1 Ω 3) 0.1 Ω 4) 0.01 Ω

57. One face AB of a prism of prism angle 45° is silvered. An incident ray on face AC retraces its initial path.

Find the range of refractive index of the prism for which it is possible:



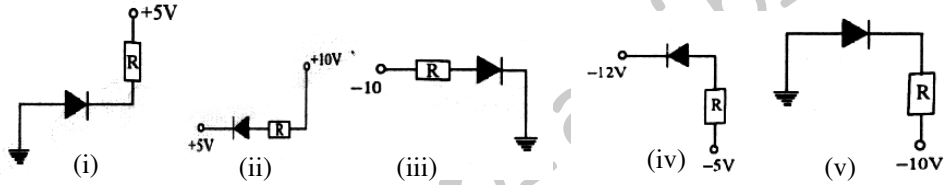
1) $\sqrt{2} > \mu > 1$

2) $\sqrt{3} > \mu > \sqrt{2}$

3) $2 > \mu > \sqrt{2}$

4) Range can't be defined

58. In the given, which of the diodes are forward biased?

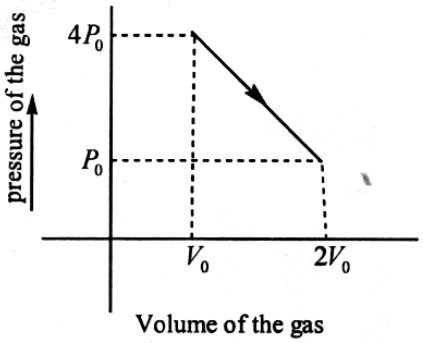


1) (i), (ii), (iii) 2) (ii), (iv), (v) 3) (i), (iii), (iv) 4) (ii), (iii), (iv)

59. For a transistor $x = \frac{1}{\alpha}$, $y = \frac{1}{\beta}$. α, β are the current gains in common base and common emitter configurations. Then

1) x + y = 1 2) x − y = 1 3) 2x = 1 − y 4) x + y = 0

60. 1 mole of monoatomic gas undergoes polytropic process and it's P – V diagram as shown in the figure, then maximum Absolute temperature attained by the gas during that process is (R is the universal gas constant)



1) $\frac{4P_0V_0}{R}$ 2) $\frac{49P_0V_0}{12R}$ 3) $\frac{49P_0V_0}{6R}$ 4) $\frac{2P_0V_0}{R}$

CHEMISTRY

61. 15 cc of gaseous hydrocarbon required 45 cc of oxygen for complete combustion. If 30 cc of CO_2 is formed, the formula of the gaseous compound is

1) C_3H_6 2) C_2H_2 3) C_4H_{10} 4) C_2H_4

62. For 2 different gases at different temperatures, the relation for rms velocity is $\frac{C_1}{C_2} = \sqrt{\frac{T_1}{T_2} \times \frac{M_1}{M_1}}$.

Then if rms velocity of 32 grams of O_2 at 27°C and 3 atm pressure is 10 mt/s and kinetic energy is 900 cal. At 27° and 6 atm pressure kinetic energy of 2 grams of H_2 is x × 100 cal. Value of 'x' is

1) 3 2) 6 3) 9 4) 12

63. The accelerating potential that required to produce an electron beam with an effective wave length of 0.090 A° is

1) 18.6 eV 2) 18.6 k eV 3) 18.6 m eV 4) 18.6 M Ev

64. In which of the following molecules/ ions BF_3, NO_2^-, NH_2^- and H_2O, the central atom is SP_2 hybridized?

1) BF_3 and NO_2^- 2) NO_2^- and NH_2^- 3) NH_2^- and H_2O 4) NO_2^- and H_2O

65. For the complete combustion of ethanol $C_2H_5OH(l) + 3\ O_2(g) \longrightarrow 2\ CO_2(g) + 3\ H_2O(l)$ the amount of heat produced as measured in bomb calorimeter is 1364.47 kJ mol^{-1} at 25°C Assuming ideality, the enthalpy of combustion, (ΔCH) for the reaction will be (R = 8.314 kJ^{-1} mol^{-1}).

1) −1366.95 kJ mol^{-1} 2) −1361.95 kJ mol^{-1}

3) −1460.50 kJ mol^{-1} 4) −1350.50 kJ mol^{-1}

66. Two moles of a liquid A(p° = 100 torr) and 3 moles of liquid B(p° = 150 torr) form a solution having vapour pressure of 120 torr. Based upon this observation one can conclude:

1) Interactions between like molecules > those between unlike molecules

2) Interactions between like molecules < those between unlike molecules

3) Interactions between like molecules = those between unlike molecules

4) $\Delta_{S\text{mixing}} = 0$

67. $A(g) + 3\ B(g) \rightleftharpoons 4\ C(g)$ Initial conc. of A is equal to that of B. The equilibrium conc. of A and C are equal. Kc is equal to

1) 0.08 2) 8 3) $\frac{1}{8}$ 4) 80

68. In a galvanic cell, the salt - bridge

1) Does not participate chemically in the cell reaction

2) Stops the diffusion of ions from one electrode to another

3) Is necessary for the occurrence of the cell reaction

4) Ensures mixing of the two electrolytic solutions

69. Decomposition of NH_3 on gold surface follows zero order kinetics. If rate constant K is 5×10^{-4} M – s^{-1}, rate of formation of N_2 will be

1) 10^{-3} M – s^{-1} 2) 2.5×10^{-4} M – s^{-1}

3) 5×10^{-4} M – s^{-1} 4) Zero

70. Based on Langmuir adsorption isotherm, the intercept in the graph $\left(\frac{m}{x} \text{ versus } \frac{1}{p}\right)$ is equal to

1) $\frac{1}{a}$ 2) $\frac{b}{a}$ 3) $\frac{a}{b}$ 4) $\frac{1}{\text{slope}}$

71. The successive four ionization energy values of an element are 191; 578; 872 and 5972 K.cals/ mole. The formula of its chloride is (symbol of the element is M)

1) MCl 2) MCl_2 3) MCl_3 4) MCl_4

72. Which one of the following method is used for the purification of silver metal containing lead as impurity?

1) Cupellation 2) Poling 3) Liquation 4) Distillation

73. Pure de-mineralised (de- ionised) water free from all soluble mineral salts is obtained by passing hard water though

1) Cation exchange resin which removes dissolved cations

2) Anion exchange resin which removes dissolved anions

3) Both (1) and (2)

4) None of the above

74. Among the given oxides, the one which will react with both acids and bases, is

1) Na_2O 2) MgO 3) BeO 4) BaO

75. Which is correct match?

1) Mg + very dil.$HNO_3 \longrightarrow$ NO 2) Zn + dil.$HNO_3 \longrightarrow H_2$

3) Sn + dil.$HNO_3 \longrightarrow N_2O$ 4) Pb + dil.$HNO_3 \longrightarrow$ NO

76. The number of P–P bonds and oxidation state of phosphorous in hypophosphoric acid are respectively

1) 0, +3 2) 0, +5 3) 1, +5 4) 1, +4

77. Which arrangement of electrons leads to anti-ferromagnetism?

1) ↑↑↑↑ 2) ↑↓↑↓ 3) Both (1) and (2) 4) None of these

78. The decreasing order of magnetic moments is

1) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

2) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

3) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

4) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

79. Which of the following types of octahedral complexes will exhibit geometrical isomerism (M stands for a metal, and a and b are achiral ligands)?

1) $[Ma_6]$ 2) $[Ma_5b]$ 3) $[M(aa)_3]$ 4) $[Ma_4b_2]$

80. The BOD values of four samples of water A, B, C and D are 156 ppm, 120 ppm, 20 ppm and 5 ppm respectively. The most polluted and least polluted water samples are

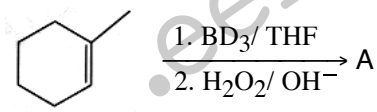
1) A & B 2) B & C 3) A & D 4) C & D

81. An organic compound present in aqueous medium is less soluble in any organic solvent. It is separated by

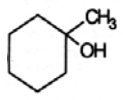
1) Continuous extraction 2) Distillation

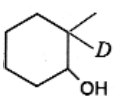
3) Chromatography 4) Sublimation

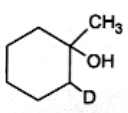
82.

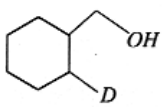


Then 'A' is

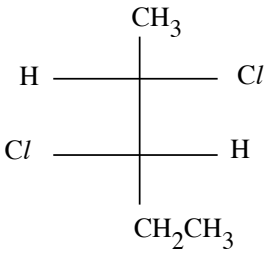
1) 

2) 

3) 

4) 

83. What is the configuration of the following compound



1) 2S, 3R 2) 2R, 3S 3) 2S, 3S 4) 3R, 3R

84. Tert-butyl bromide on treatment with sodium methoxide yields

1) sodium tertiary butoxide 2) methyl tertiary butyl ether

3) tert-butyl alcohol 4) isobutylene

85. $CH_2 = CH - CH = \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} - CH_3 \xrightarrow{+HBr} \underset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle Br}{\overset{\displaystyle |}{CH_3 - CH}}}} - CH = \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} - CH_3 + \underset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle Br}{\overset{\displaystyle |}{CH_3 - CH}}}} = CH - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle Br}{\overset{\displaystyle |}{C}}}} - CH_3$

(I) (II)

Correct statement about the above reaction is

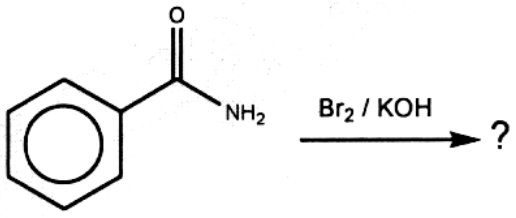
1) 'I' is kinetic controlled product

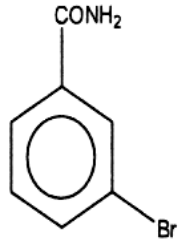
2) 'II' is thermodynamic controlled product

3) 'I' is major product at low temperature

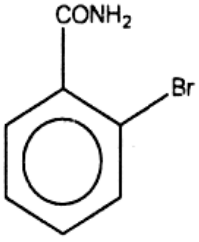
4) 'II' is major product at low temperature

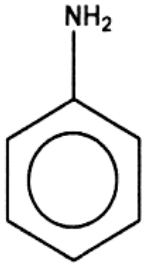
86.



1) 

2) 

3) 

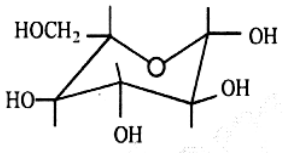
4) 

87. Tri ethylaluminium and titanium tetrachloride mixture is used to manufacture

1) Polyacrylonitrile 2) High density polythene

3) Teflon 4) Terylene

88. Number of methoxy groups present in the product 'P' is



$\xrightarrow{CH_3OH/\ H^+}$ Product (P)

1) 1 2) 4 3) 5 4) 6

89. The following is a cationic detergent

1) Sodium laurylsulphate

2) sodium dodecylbenzene sulphonate

3) cetyltrimethyl ammonium bromide

4) sodium stearate

90. In the dry heating test, a white crystalline salt produces crackling noise and also brownish fumes. The residue after heating is seen to be yellow-brown in colour. When a glowing splinter is held in the fumes it is relighted. The fumes consist of :

1) bromine only 2) nitrogen dioxide only

3) mixture of O_2 and Br_2. 4) A mixture of nitrogen dioxide and oxygen

KEY

1-4; 2-2; 3-2; 4-1; 5-2; 6-3; 7-2; 8-2; 9-1; 10-2; 11-1; 12-1; 13-3; 14-4; 15-1; 16-4; 17-1; 18-1; 19-2; 20-1; 21-1; 22-3; 23-2; 24-1; 25-2; 26-4; 27-3; 28-1; 29-4; 30-1; 31-3; 32-3; 33-1; 34-2; 35-2; 36-2; 37-3; 38-2; 39-3; 40-3; 41-2; 42-2; 43-2; 44-1; 45-2; 46-1; 47-4; 48-3; 49-3; 50-3; 51-2; 52-1; 53-1; 54-4; 55-2; 56-3; 57-1; 58-2; 59-2; 60-2; 61-4; 62-3; 63-2; 64-1; 65-1; 66-2; 67-2; 68-1; 69-3; 70-2; 71-3; 72-1; 73-3; 74-3; 75-4; 76-4; 77-2; 78-4; 79-4; 80-3; 81-1; 82-2; 83-3; 84-4; 85-4; 86-4; 87-2; 88-1; 89-3; 90-4.

EXPLANATIONS

1. $f\ (2014) = (2014)\ f\ (1) = 1$

2. $\sum_{k=1}^{n} \left(\sin \frac{2k\pi}{n+1} \mp \frac{2k\pi}{n+1}\right) = \pm i$

3. $g(x) = ax^2 + (b + 2a)x + (b + 2a + c)$

Discriminant of g (x) is $(b^2 - 4ac) - 4a^2 < 0$ is $b^2 - 4ac < 0$ since $f\ (x) > 0 \forall x$

4. From given data $|A| = 2^4$

$\Rightarrow |\text{adj (adj A)}| = (2^4)^9 = 2^{36}$

$\Rightarrow \left\{\frac{\det (\text{adj}) (\text{adj A})}{7}\right\}$

$= \left\{\frac{2^{36}}{7}\right\} = \left\{\frac{(7+1)^{12}}{7}\right\} = \frac{1}{7}$

5. infinitely many solutions 1

6. The letter of word COCHIN in alphabetic order are C, C, H, I, N, O.

Fixing first letter C and keeping C at second place, rest 4 can be arranged in 4! ways. Similarly the words starting with CH, CI, CN are 4! in each case. Then fixing first two letters as CO next four places when filled in alphabetic order give the word COCHIN. Number of words coming before COCHIN are $4 \times 4! = 4 \times 24 = 96$

7. $T_5 = (-1)^4 \cdot {}^nC_4 (a)^{n-4} \cdot (b)^4$ and $T_6 = (-1)^5 \cdot {}^nC_5 (a)^{n-5} \cdot (b)^5$

Given $T_5 + T_6 = 0$

$$\Rightarrow \frac{n!}{4!\,(n-4)!} \cdot \frac{a^n}{a^4} b^4 - \frac{n!}{5!\,(n-5)!} \cdot \frac{a^n}{a^5} b^5 = 0$$

$$\Rightarrow \frac{a}{b} = \frac{n-4}{5}$$

8. $ab = g_1 g_{2n} = g_2 g_{2n-1} = \ldots\ldots = g_n g_{n-1}$

and $h = \frac{2ab}{a+b}$ and $\frac{a_1 + a_{2n}}{g_1 g_{2n}}$

$$= \frac{a+b}{ab} = \frac{2}{h}$$

9. Reciprocals of given sequence are

$$\frac{8}{20}, \frac{13}{20}, \frac{18}{20}, \frac{23}{20}, \ldots.$$

Whose 15^{th} term is $\frac{78}{20} = \frac{39}{10}$

10. As $0 < \{e^x\} < 1$

$$\therefore \lim_{n\to\infty} \frac{\{e^x\}^n - 1}{\{e^x\}^n + 1} = -1$$

$\Rightarrow f(x) = -1 \forall x \in R$

11. We have

$$\lim_{x\to 0^-} f(x) = \lim_{h\to 0^+} (\sin(-h) + \cos(-h)^{\operatorname{cosec}(-h)}$$

$$= \lim_{h\to 0^+} (\cosh - \sinh)^{-\operatorname{cosec} h}$$

$$\lim_{h\to 0^+} (1 + (\cosh - \sinh - 1))$$

$$\frac{1}{(\cosh - \sinh - 1)} \cdot \frac{(\cosh - \sinh - 1)}{(-\sinh)}$$

$$= \lim_{h\to 0^+} e^{\frac{\cosh - \sinh - 1}{-\sinh}} = e$$

$$= \lim_{h\to 0+} e^{\frac{\cosh - \sinh - 1}{-\sinh}} = e$$

Now we have

$$\lim_{x\to 0^+} f(x) = \lim_{h\to 0^+} \frac{e^{1/h} + e^{2/h} + e^{3/h}}{ae^{-2+1/h} + be^{-1+3/h}}$$

$$= \lim_{h\to 0^+} \frac{e^{2/h} + e^{-1/h} + 1}{(ae^{-2})e^{-2/h} + (be^{-1})} = \frac{e}{b}$$

If 'f' is continuous at x = 0, then

$e = a = \frac{e}{b}$ gives a = e and b = 1

12. Normal at (0, –3) is 2x – y – 3 = 0

Solving with the given equation

x = 0, 1, –1; y = –3, –1, –5

i.e (0, –3), (1, –1) ,(–1, –5)

since $x_1 > x_2$ we have Q = (1,–1);

R = (–1, –5) equation of tangent at Q is 2x – y – 3 = 0

13. Use derivative of f(x) =0

14. $\cos 6x + 6\cos 4x + 15\cos 2x + 10 = \cos 6x + \cos 4x + 5(\cos 4x + \cos 2x) + 10(\cos 2x + 1)$

$= 2\cos x(\cos 5x + 5\cos 3x + 10\cos x)$

$\Rightarrow \frac{1}{2}\int \sec x\,dx = \frac{1}{2}\ln(\sec x + \tan x) + c$

$= \frac{1}{2}\ln\left(\frac{1+\sin x}{\cos x}\right) + c$

$= \frac{1}{2}\ln\tan\left(\frac{x}{2} + \frac{\pi}{4}\right) + c$

15. Domain of sin (cos x) is $\left(n\pi - \frac{\pi}{2}, n\pi + \frac{\pi}{2}\right)$

Also log $(-2\cos^2 x + 3\cos x - 1)$ exist only if $-2\cos^2 x + 3\cos x - 1 > 0 - \cos x \in \left(\frac{1}{2}, 1\right)$

$\therefore \frac{1}{2} < \cos x < 1, 0 < \cos x - \frac{1}{2} < \frac{1}{2}$

$\Rightarrow \left[\cos x - \frac{1}{2}\right] = 0 \int_{x1}^{x2} 0\,dx = 0$

16. Area $= 2\int_0^{1/2} \sqrt{\frac{x}{2}}\,dx + \frac{1}{4} = \frac{7}{12}$

17. $y = u^m \Rightarrow \frac{dy}{dx}\ mu^{m-1}\frac{du}{dx}$

Substituting the value of y and $\frac{dy}{dx}$ in

We have $2x^4 u^m mu^{m-1}\frac{du}{dx} + u^{4m} = 4x^6$

$\Rightarrow \frac{du}{dx} = \frac{4x^6 - u^{4m}}{2mx^4u^{2m-1}}$

For homogeneous $4m = 6 \Rightarrow m = 3/2$

And $2m - 1 = \Rightarrow m = \frac{3}{2}$

18. $\therefore P\left(1 + \frac{\alpha}{\sqrt{2}}, 2 + \frac{\alpha}{\sqrt{2}}\right)$ lies between the parallel lines $x + 2y = 1$ and $2x + 4y = 15$, then

$$\frac{\left(1 + \frac{\alpha}{\sqrt{2}}\right) + 2\left(2 + \frac{\alpha}{\sqrt{2}}\right) - 1}{2\left(1 + \frac{\alpha}{\sqrt{2}}\right) + 4\left(2 + \frac{\alpha}{\sqrt{2}}\right) - 15} < 0$$

$$\Rightarrow \frac{4 + \frac{3\alpha}{\sqrt{2}}}{-5 + \frac{-6\alpha}{\sqrt{2}}} < 0 \Rightarrow \frac{\left(\alpha + \frac{4\sqrt{2}}{3}\right)}{\left(\alpha - \frac{5\sqrt{2}}{6}\right)} < 0$$

$$\therefore -\frac{4\sqrt{2}}{3} < \alpha < \frac{5\sqrt{2}}{6}$$

19. Let line is $\frac{x}{a} + \frac{y}{b} = 1$

$\therefore$ A (a, 0) and B (0, b)

Equation of circle since AB is diameters is $(x - a)(x - 0) + (y - 0)(y - b) = 0$

$\Rightarrow x^2 + y^2 - ax - by = 0$

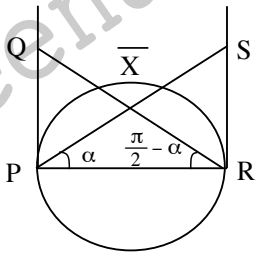
Tangent at (0, 0) is $ax + by = 0$

$$\therefore AM = m = \frac{a^2}{\sqrt{a^2 + b^2}}$$

$$\text{and } BN = n = b\,\frac{b^2}{\sqrt{a^2 + b^2}}$$

$\Rightarrow m + n = \sqrt{(a^2 + b^2)}$ = diameter of circle

20. From figure



$$\tan\alpha = \frac{RS}{PR} = \frac{RS}{2r} \text{ ..... (i)}$$

$$\tan\left(\frac{\pi}{2} - \alpha\right) = \frac{PQ}{PR} = \frac{PQ}{2r} \text{ ..... (ii)}$$

Multiplying Eqs. (i) and (ii),

$\tan\alpha \cot\alpha = \frac{RS.PQ}{(2r)^2}$

$\therefore\ 2r = \sqrt{(RS)\,(PQ)}$

21. Focus of the parabola is $\left(\frac{p}{2}, 0\right)$, since the circle touches directrix $x = -\frac{p}{2}$ of the parabola,

the radius of the circle $= \frac{p}{2} + \frac{p}{2} = p.$

P equation of the circle is $\left(x - \frac{p}{2}\right)^2 + y^2 = p^2$

$\Rightarrow x^2 + y^2 - px - \frac{3p^2}{4} = 0$

this circle meets the parabola y2 = 2px at points whose abscissae are given by

$x^2 + 2px - px - \frac{3p^2}{4} = 0$

P $x = \frac{p}{2},\ x = -\frac{3p}{4}$ But $x = -\frac{3p}{4}$ is not possible on parabola, $y^2 = 2px$.

22. $e_H = \frac{5}{4}$, $F_1 = (5, 0)$ and $F_2 = (-5, 0)$

$e_C = \frac{5}{3}$, $F_3 = (0, 5)$ and $F_4 = (0, -5)$

Area of $F_1\ F_2\ F_3\ F_4 = 50$

23. $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9} = \lambda\ q(2, 4, -1)$

p $(\lambda - 5, 4\lambda - 3, -9\lambda + 6)$

Direction of the given line (1, 4, –9)

Direction of pq ⊥ lar direction of the line

$(\lambda - 7)1 + (4\lambda - 7)4 + (7 - 9\lambda)(-9)\lambda$

$98\lambda = 98$

$\lambda = 1$

P(–4, 1, –3)

$pq = \sqrt{36 + 9 + 4} = \sqrt{49} = 7$

24. Ratio – $x_1 : x_2 = -5 : 3$

$\left(\frac{-15+15}{-5+3}, \frac{-5b+3}{-2}, \frac{-5+3a}{-2}\right) = \left(0, \frac{17}{2}, \frac{-13}{2}\right)$

$\frac{-5b+3}{-2} = \frac{17}{2}$

$-5b = -20$

$b = 4$

$\frac{-5+3a}{-2} = \frac{13}{-2}$

25. $\left(\vec{a} \times \vec{b}.\vec{c}\right)^2 = |\vec{a}|^2 \, |\vec{b}|^2 \, |\vec{c}|^2 \, \sin^2\theta \cdot \cos^2\phi$

(θ is the angle between $\vec{a}$ and $\vec{b}$, $\phi = 0$)

$= \frac{1}{4}\left(a_1^2 + a_2^2 + a_3^2\right)\left(b_1^2 + b_2^2 + b_3^2\right)$

26. Correct $\sum x = 170 - 20 + 30 = 180$

Correct $\sum x^2 = 2830 - (20)^2 + (30)^2 = 3330$

Correct variance = 78.

27. $P(A \cup B) = 0.6 \Rightarrow P\left(\overline{A \cup B}\right) = 1 - 0.6 = 0.4$

$\therefore P(\bar{A} \cap \bar{B}) = 0.4$ by De Morgan's law

$P(A \cap B) = 0.2 \Rightarrow P\left(\overline{A \cap B}\right) = 1 - 0.2 = 0.8$

$\therefore P(\bar{A} \cup \bar{B}) = 0.8$

$\Rightarrow P(\bar{A}) + P(\bar{B}) - P(\bar{A} \cap \bar{B}) = 0.8$

$\Rightarrow P(\bar{A}) + P(\bar{B}) = 0.8 + P(\bar{A} \cap \bar{B})$

$= 0.8 + 0.4 = 1.2$

28. $\sin^2 x - 2\sin x + 5 = (\sin x - 1)^2 + 4 \geq 4$

$2^{\sqrt{\sin^2 x - 2\sin x + 5}} \geq 2^2 = 4$

and $\sin^2 y \leq 1 \Rightarrow \frac{1}{4^{\sin^2 y}} \geq \frac{1}{4}$

LHS ^{3} 1 and according to question

LHS £ 1, so therefore, LHS = 1

for which

$\sin^2 x - 2 \sin x + 5 = 4$

$(\sin x - 1)^2 = 0$

$\sin x = 1$ P $x = (2n + 1)\frac{\pi}{2}$ and

cosec2y = 1, sin2y = 1 or

cos y = 0

y = (2m + 1)

29. $18\left(\sqrt{3} + 1\right)$

30. Correct result is $(\sim p \vee \sim q) \Rightarrow (r \wedge s)$

So, $\sim (p \wedge q) \Rightarrow (r \wedge s)$.

31. $\frac{\Delta g}{g} = \frac{\Delta L}{L} + 2\frac{\Delta T}{T}$

32. From figure

$\vec{r}\ R\hat{i} - \sqrt{l^2 - R^2}\ \hat{k}$

$\vec{p} = Mv\hat{j}$

$\vec{L} = \vec{r} \times \vec{p}$

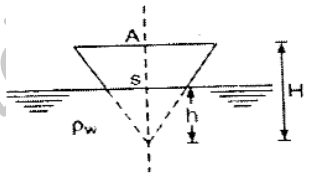
33. $x^2 + y^2 = l^2$

$\frac{dy}{dt} = \frac{x}{y}\frac{dx}{dt}$

$vB = (\tan 30)5 = \frac{5}{\sqrt{3}}$

$\omega = \frac{d\theta}{dt} = \frac{v}{2\cos 30} = \frac{5}{\sqrt{3}}$

34. Let A be the base area of the cone. In floating condition the cone is in equilibrium, i.e.,



Buoyant force = weight

$\frac{1}{3}\left[A\left(\frac{h}{H}\right)^2\right]h\rho_w g = \left(\frac{1}{3}AH\right)\rho_w sg$

or $h = H(s)^{1/3}$

For H = 4 m, $s = \frac{27}{64}$

When the cone is further pushed by x, the restoring force is

$\frac{d^2x}{dt^2} + \left(\frac{4g}{H}\right)x = 0$

On substituting

T . 1.98 s

35. Orbital velocity $V_0 = \sqrt{\frac{GM}{R_E + h}}\ j$

$v_0 \propto \frac{1}{\sqrt{R_E + h}}$

$\frac{v_A}{v_B} = \sqrt{\frac{R_E + h_B}{R_E + h_A}} = \sqrt{\frac{R_E + R_B}{R_E + R_A}}$

36. When an iron sphere falls freely in a lake, its motion is accelerated due to gravity and retarded due to viscous force. The overall effect is increase in velocity and hence increase in KE till the sphere acquires terminal velocity, which is constant. Hence KE of sphere beyond this depth of lake becomes constant. Choice (2) is most appropriate

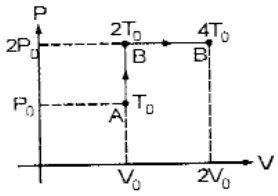
37. It is given that the volume of air in the flask remains the same. This means that the expansion in volume of the vessel is exactly equal to the volume expansion of the mercury.

$\Delta V_G = \Delta V_L$

$V_L = \dfrac{V_G \gamma_G}{\gamma_L}$

$= \dfrac{1000 \times (3 \times 9 \times 10^{-6})}{1.8 \times 10^{-4}} = 150$ cc

38. Let initial pressure, volume, temperature be P_0, V_0, T_0 indicated by state A in P-V diagram. The gas is then inochorically taken to state B ($2P_0$, V_0, $2T_0$) and then taken from state B to state C ($2P_0$, $2V_0$, $4T_0$) isobarically.



Total heat absorbed by 1 mole of gas

$\Delta Q = C_v (2T_0 - T_0) + C_p (4T_0 - 2T_0)$

$= \dfrac{5}{2} RT_0 + \dfrac{7}{2} R \times 2T_0 = \dfrac{19}{2} RT_0$

Total change in temperature from state A to C is

$\Delta T = 3T_0$

$\therefore$ Molar heat capacity

$= \dfrac{\Delta Q}{\Delta T} = \dfrac{\frac{19}{2} RT_0}{3T_0}$

$= \dfrac{19}{6} R$

39. Time taken from A to B $t_1 = \dfrac{T}{4}$

Time taken to move from B to C $t_2 = \dfrac{T}{8}$

Total time to return from A $= 2 (t_1 + t_2) = 2 \left(\dfrac{T}{4} + \dfrac{T}{8} \right) = 2. \dfrac{3T}{8} = \dfrac{3T}{4}$

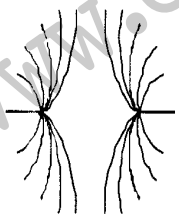
40. Put t = 1sec, $y = e^{-(x-2)^2}$ with centre of symmetry at x = 2

41. From the Gauss law change on the inner surface –Q, outer surface –q + Q

42. $q_1 = q_2 + q_3$; $V_2 = V_3$

43. The molecule can move only on the surface because radial motion is possible

44.



46. $\Delta\varphi = \dfrac{\pi}{4} \Rightarrow X = R$

for RC, $\frac{1}{\omega C} = R$

$\Rightarrow RC = \frac{1}{\omega} = 10^{-2}$

for LR,

$L\omega = R \Rightarrow \omega = \frac{R}{L} 10^2$

47. half of the frequency of the wave

48. for M_1 : V = –60, $m_1 = -2$

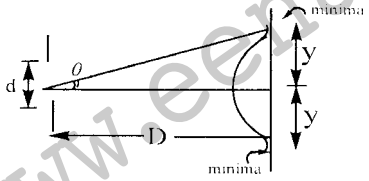
for M_2 : u = + 20. f = 10 ? ? v = 20

? M_2 = – ? M = $M_1 \times M_2$ = +2

49. Given, $2y = 2 \times 10^{-3}$ m

d sinθ = λ for first minima

$\sin\theta \approx \tan\theta = \frac{y}{D}$



So, $d\left(\frac{y}{D}\right) = \lambda$

$d = \frac{\lambda D}{y} = \frac{5.89 \times 10^{-7} \times 0.5}{1 \times 10^{-3}}$

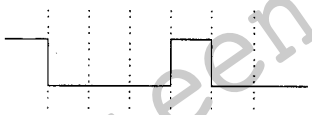
$= 2.945 \times 10^{-4}$ m

50. Total energy received by the atom will be 25.2 eV. 13.6 eV energy is needed to remove the electron from the attraction of the nucleus. Rest of the energy will be almost available in the form of KE of electron

51. $\frac{dN}{dt} = R - \lambda N \Rightarrow \frac{dN}{R - \lambda N} = dt$

solving this equation with initial conditions, we get the desired answer

52.



53. Ground wave propagation is for high frequency transmission.

54. Pitch = 0.5 mm

Least count = $\frac{0.5}{50}$ mm = 0.01 mm

Zero correction = +45 × 0.01 = +0.45 nm

Thickness of wire = 2 × 0.5 mm + 20 × 0.01 mm + 0.45 = 1.65 mm

Hence all are correct

55. $f\frac{(2n+1)v}{4(l+e)}\ l_1 + e = \frac{v}{4f}$

$l_2 + e = \frac{3v}{4f} \Rightarrow \frac{l_2 + e}{l_1 + e} = 3$

$l_2 = (3.6 - 2.34)$ m and

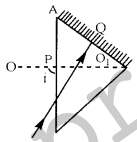
$l_1 = (3.6 - 3.22)$m $\Rightarrow$ e = 0.06 m = 0.6r

pr = 0.1 m A = 100 p cm^2

56. $I_A = \left(1 + \frac{R_G}{R_S}\right) I_G$

57. OO1 $\perp$er PA

$\angle AQP = 90°$ (ray retraces its path)



$\angle APQ = 45°$

For $\angle APQ$ to be 45°, incident ray should make angle of incidence greater than 45° and less than 90° . (1)

$(\sin i) = \mu \sin r$

$= \mu \sin 45° = \mu / \sqrt{2}$

For *i* 45°, $\frac{1}{\sqrt{2}} = \frac{\mu}{\sqrt{2}}$, or $\mu = 1.0$

For *i* 90°1 = $\frac{\mu}{\sqrt{2}}$ or, $\mu = \sqrt{2}$

Range is, $\sqrt{2} > \mu > 1$

58. p-n junction is forward biased if p-side is connected to higher potential and n-side to lower potential.

59. $\alpha = \frac{\beta}{\beta + 1} \quad \beta = \frac{\alpha}{1 - \alpha}$

60. $\frac{P - P_0}{V - 2V_0} = \frac{4P_0 - P_0}{V_0 - 2V_0}$

$P - P_0 = \frac{-3P_0}{V_0}[V - 2V_0]$

$P - P_0 = \frac{-3P_0}{V_0} V + 6P_0$

$P = \frac{-3P_0}{V_0} V + 7P_0$

$T = \frac{1}{R}\left[\frac{-3P_0}{V_0} V^2 + 7P_0 V\right]$

For maximum temperature

$\frac{dT}{dv} = 0 \quad V = \frac{7V_0}{6}$

$T_{max} = \frac{49P_0V_0}{12R}$

61. $C_2H_4 + 3\,O_2 \rightarrow 2\,CO_2 + 2\,H_2O$

1 vol — 3 vol — 2 vol

62. At same temperature kinetic energy for 1 mole of any gass is same

63. $\lambda = \frac{h}{\sqrt{2mE}}$, $E = QV$

64. BF_3 – sp^2

NO_2^- – sp^2

65. $C_2H_5OH_{(2)} + 3\,O_2(g) \rightarrow 2\,CO_2(g) + 3\,H_2O(l)$

Amount of heat produced in bomb calorimeter

$\Delta U = -1364.47$ KJ mol^{-1}

$\therefore \Delta H = \Delta U + \Delta nRT$

$\Delta n = 2 - 3 = -1$

$T = 25°C = 298$ K

$$\therefore \Delta H = -1364.47 + \left[\frac{-1 \times 8.314 \times 298}{1000}\right]$$

$\Delta H = -1364.47 - 2.477$

$= -1366.947$ KJ mol^{-1}

66. Total $P = P_A^0 X_A + P_B^0 X_B$

$$= 100 \times \frac{2}{5} + 150 \times \frac{3}{5} = 130$$

torr the observed vapour pressure is smaller than that calculated from Raoult's law (negative deviation).

Hence, interaction A – B > A – A or B – B

67. $A + 3B \rightleftharpoons 4C$

1– x 1– 3x 4x

0.8 0.4 0.8

$$1 - x = 4x \Rightarrow x = \frac{1}{5} = 0.2$$

$$K_c = \frac{(0.8)^4}{(0.8)(0.4)^3} = 8$$

68. In a galvanic cell, for example

$$Zn \left| Zn^{2+}(C_1) \right| \left| Cu^{2+}(C_2) \right| Cu$$

$\ominus$ $\oplus$

Two half-cells are joined by salt - bridge. It does not take part in chemical reaction.

69. $2\,NH_3 \rightleftharpoons N_2 + 3H_2$

70. $\frac{x}{m} = \frac{ap}{1 + bp}$

$\frac{m}{x} = \frac{1 + bp}{ap}$

$\frac{m}{x} = \frac{1}{a}.\frac{1}{p} + \frac{b}{a}$

$Y = mx + C$

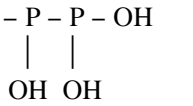
71. MCl_3

72. Cupellation is used to remove easily xidisable impurities. Pb is oxidized to volatile PbO and separated.

73. Cation exchange resin which removes dissolved cations, Anion exchange resin which removes dissolved anions

74. Amphoteric metals liberate H_2 with Acid HCl, or alkali, NaOH

75. $Pb + dil.HNO_3 \rightarrow NO$

76. 

P – P

bonds = 1 O.S = +4

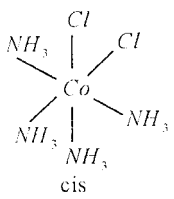
77. Antiferromagnetic passes complementary dipoles alignment giving net dipole moment equal to zero.

78. $[MnCl]^{2-}$ unpaired electrons – 5

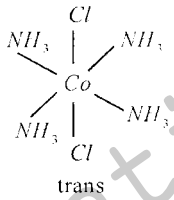
$[CoCl_4]^{2-}$ unpaired electrons – 3

$[Fe(CN)6]^{4-}$ unpaired electrons – 0

79. Octahedral complexes of formula in which the two ligands b may $[Ma_4\ b_2]$ be oriented cis or trans to each other e.g



cis



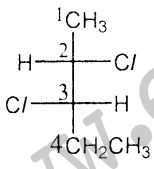
trans

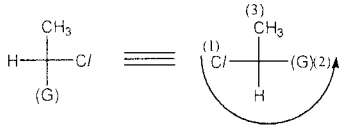
Geometrical isomers (cis &trans) of $[Co(NH_3)_4Cl_2]^+$

80. COD ∝ Pollution

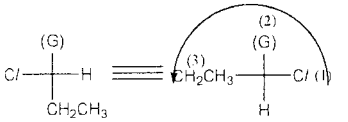
81. Continuous extraction

82. Hydroboration – oxidation.

83. 



'2S' configuration



'3S' configuration

84. Ter-alkyl halides would undergo elimination to produce alkenes.

$$CH_2 = CH - CH = C(CH_3)_2 \xrightarrow{+H^+} CH_3 - \overset{\oplus}{C}H - CH = C(CH_3)_2 \longleftrightarrow \downarrow Br^-$$

less stable intermediate

$$CH_3 - \overset{\oplus}{C}H = CH - C(CH_3)_2 \xrightarrow{Br^-}$$

More stable

$$CH_3 - \underset{\displaystyle Br}{\underset{|}{C}}H - CH = C(CH_3)_2 \qquad CH_3 - CH = CH - \underset{\displaystyle Br}{\underset{|}{C}}(CH_3)_2$$

More stable product less stable product

85. Product from more stable intermediate is called kinetic controlled and it is the major product at low temperature. More stable product is called thermodynamic controlled product and it is the major product at high temperature.

86. Hoffman reaction.

87. High density polythene

88. 1- methoxy group

89. cetyltrimethyl ammonium bromide

90. A mixture of nitrogen dioxide and oxygen

(ఈ నమూనా ప్రశ్నపత్రాన్ని శ్రీచైతన్య విద్యాసంస్థలకు చెందిన నిపుణులు రూపొందించారు)