

Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 13/01/2025

Time: 3 hours

Max. Marks: 300

UTS-1-MT-18 (24-25)

Physics

Single Choice Question

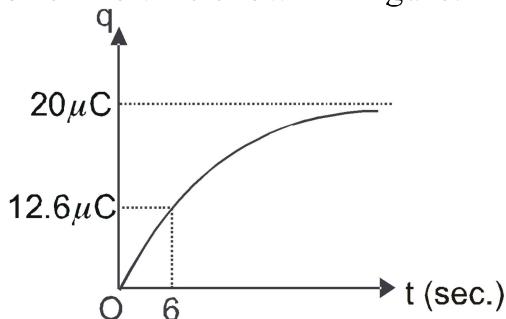
- Q1** A physical quantity P is given as

$$P = \frac{a^2 b^3}{c \sqrt{d}}$$

The percentage error in the measurement of a, b, c and d are 1%, 2%, 3% and 4% respectively. The percentage error in the measurement of quantity P will be

- a) 9 b) 7 c) 13 d) 15

- Q2** Charge q versus t graph for a capacitor, initially uncharged is charged with a battery of emf 5V as shown in figure. The resistance R of the circuit is



- a)** $2\text{M}\Omega$ **b)** $6\text{M}\Omega$ **c)** $3\text{M}\Omega$ **d)** $1.5\text{M}\Omega$

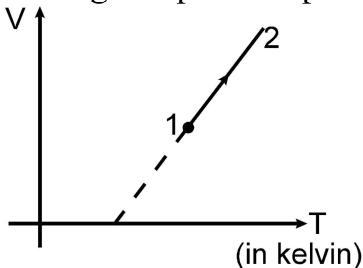
- Q3** A particle can move along the x-axis under the influence of a single conservative force. The potential energy of the particle is given by $U = (5x^2 - 20x + 2)$ J. Where x is the co-ordinate of the particle expressed in meter. If the particle is released from rest at $x = -3$ m. Find the maximum x -coordinate of the particle.

- a) 3 b) 12 c) 9 d) 7

Q4 If electrostatic potential at point (x,y) is given by $V = -\left(\frac{3x+4y}{\sqrt{\pi\varepsilon_0}}\right)$ volts, then the electrostatic energy stored (in Joule) in spherical volume of radius 30 cm centered at $(0,0,1)$ will be

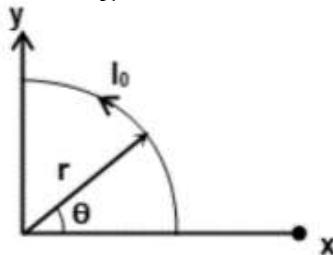
- a) 0.45 b) 0.90 c) 0.60 d) 0.80

Q5 V-T diagram for a process of a given mass of ideal gas is as shown in the figure. During the process pressure of gas.



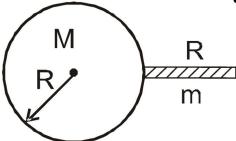
- a) first increases then decreases b) continuously decreases
c) continuously increases d) first decreases then increases.

Q6 A wire carrying current I_0 is in shape of a curve which is represented in polar co-ordinate system as $r = b + \frac{c}{\pi}\theta$ ($0 \leq \theta \leq \frac{\pi}{2}$), where b and c are positive constant. The magnetic field at the origin due to wire is



- a) $\frac{\mu_0 I_0}{4c} \ln\left(1 + \frac{c}{2b}\right)$ b) $\frac{\mu_0 I_0}{4c} \ln\left(1 + \frac{c}{b}\right)$ c) $\frac{\mu_0 I_0}{4c} \ln\left(1 + \frac{2c}{b}\right)$ d) $\frac{\mu_0 I_0}{4c} \ln\left(1 + \frac{b}{c}\right)$

Q7 A uniform thin rod of mass m and length R is placed normally on surface of earth as shown. The mass of earth is M and its radius is R . Then the magnitude of gravitational force exerted by earth on the rod is



- a) $\frac{GMm}{2R^2}$ b) $\frac{GMm}{4R^2}$ c) $\frac{4GMm}{9R^2}$ d) $\frac{GMm}{8R^2}$

- Q8** Large number (N) of coherent waves superimpose at a point in the medium represented by-

$$y_1 = a \sin(kx - \omega t)$$

$$y_2 = a \sin(kx - \omega t + \phi)$$

$$y_3 = a \sin(kx - \omega t + 2\phi)$$

.....

$$y_N = a \sin(kx - \omega t + N\phi)$$

where ϕ is very small. Then amplitude of resultant wave is-

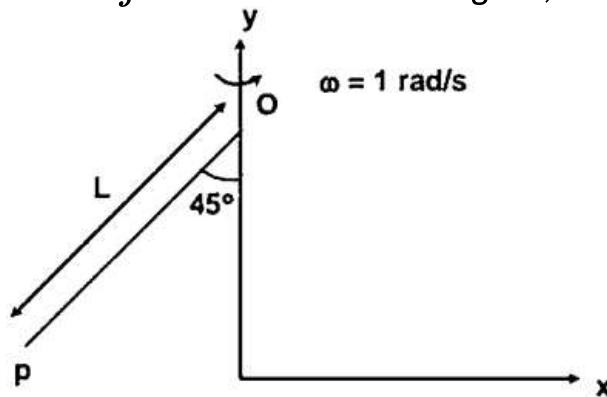
a) zero

b) Na

c) $(a/\phi) \sin(N\phi/2)$

d) $2(a/\phi) \sin(N\phi/2)$

- Q9** A conducting rod OP of length $L = 1\text{m}$ is made to rotate about fixed axes along y -axes passing through its one end O as shown. If uniform magnetic field $\vec{B} = 4\hat{j}$ tesla exist in the region, then induced emf across the ends of rod is



a) 2 volt

b) 4 volt

c) 1 volt

d) 6 volt

- Q10** When a polaroid sheet is rotated between two crossed polaroids then the transmitted light intensity will be maximum for a rotation of :

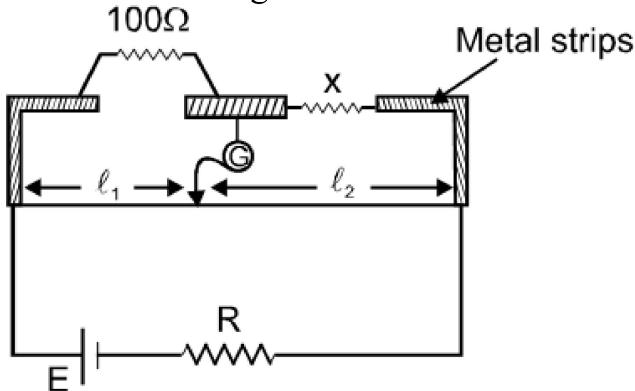
a) 60°

b) 30°

c) 90°

d) 45°

Q11 In a practical Meter bridge circuit as shown, when another resistance of 50Ω is connected parallel with unknown resistance 'x' then ratio $\frac{\ell'_1}{\ell'_2}$ become 3, where ℓ'_1 is new balance length. AB is a uniform wire. Then value of 'x' must be :

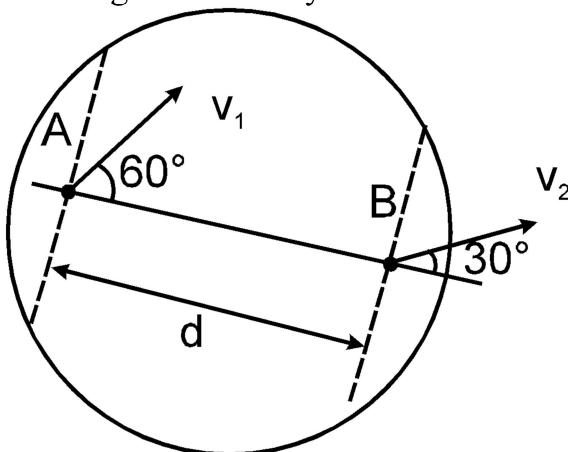


- a) 100Ω b) 200Ω c) 50Ω d) 400Ω

Q12 If photoelectrons emitted by a metal on irradiating it by a light of wave length λ cannot move away farther than a distance 'd' in presence of a retarding electric field E , find threshold wavelength of the metal

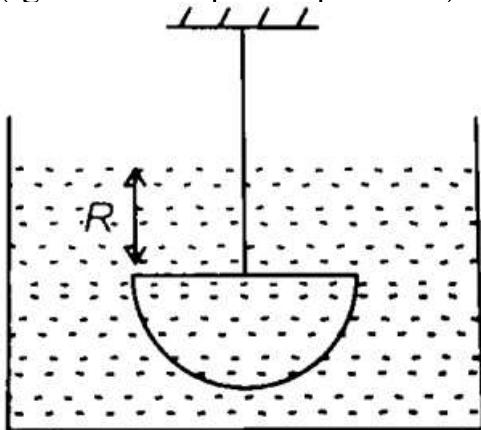
- a) $\lambda c / eEd$ b) $\lambda + \frac{hc}{eEd}$ c) $\lambda - \frac{hc}{eEd}$ d) $\left[\frac{1}{\lambda} - \frac{eEd}{hc} \right]^{-1}$

Q13 Two points A & B on a disc have velocities v_1 & v_2 at some moment. Their directions make angles 60° and 30° respectively with the line of separation as shown in figure. The angular velocity of disc is :

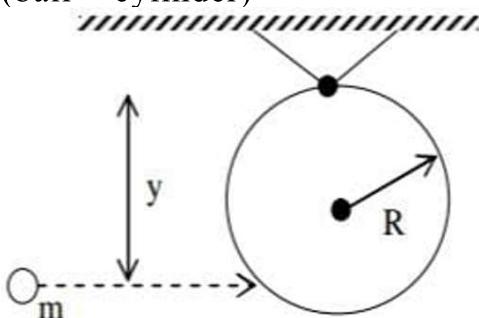


- a) $\frac{\sqrt{3}v_1}{d}$ b) $\frac{v_2}{\sqrt{3}d}$ c) $\frac{v_2 - v_1}{d}$ d) $\frac{v_2}{d}$

- Q14** A solid hemisphere of radius R immersed into a liquid of density ρ . If the hemisphere is at a depth R , then force exerted by liquid on the flat surface of the hemisphere, is (ignore atmospheric pressure)

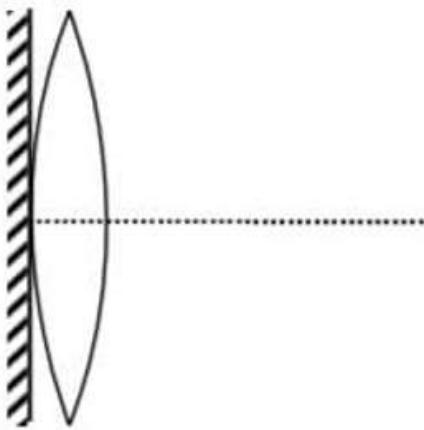


- a) $\frac{4}{3}\pi R^3 \rho g$ b) $\pi R^3 \rho g$ c) $2\pi R^3 \rho g$ d) $\frac{5}{3}\pi R^3 \rho g$
- Q15** A small ball of mass m hits the cylinder which is hinged at top and free to rotate in vertical plane as shown in figure. Mass of cylinder is M . Liner momentum of system (ball + cylinder)



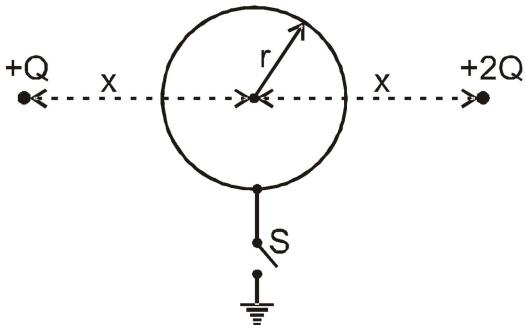
- a) Remains conserved if $y = R$
 b) Remains conserved if $y = \frac{3}{2}R$
 c) Remains conserved if $y = \frac{7}{5}R$
 d) Cannot be conserved for any value of y .

- Q16** A thin convex lens of focal length 'f' is put on a plane mirror as shown in the figure. When an object is kept at a distance 'a' from the lens mirror combination, its image is formed at a distance $\frac{a}{3}$ in front of the combination. The value of 'a' is



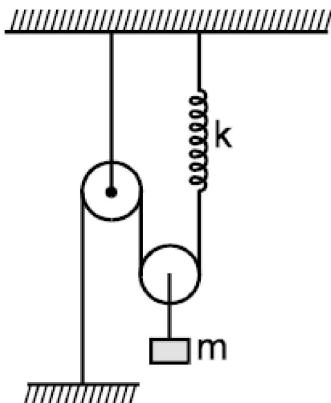
- a) $3f$ b) $\frac{3}{2}f$ c) f d) $2f$

- Q17** Two particles having positive charges $+Q$ and $+2Q$ are fixed at equal distance x from centre of an conducting sphere having zero net charge and radius r as shown. Initially the switch S is open. After the switch S is closed, the net charge flowing out of sphere is



- a) $\frac{Qr}{x}$ b) $-\frac{Qr}{x}$ c) $\frac{3Qr}{x}$ d) $-\frac{3Qr}{x}$

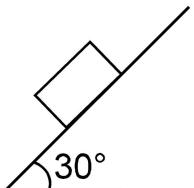
- Q18** Mass m shown in figure is in equilibrium. If it is displaced further by x and released find its acceleration just after it is released. Take pulleys to be light & smooth and strings light.



- a) $\frac{4kx}{5m}$ b) $\frac{2kx}{5m}$ c) $\frac{4kx}{m}$ d) none of these
- Q19** An inductance coil has a reactance of 100Ω . When an AC signal of frequency 1000 Hz is applied to the coil, the applied voltage leads the current by 45° . The self-inductance of the coil is :
- a) $6.7 \times 10^{-7} \text{ H}$ b) $5.5 \times 10^{-5} \text{ H}$ c) $1.1 \times 10^{-1} \text{ H}$ d) $1.1 \times 10^{-2} \text{ H}$
- Q20** The time taken by an object to slide down 45° rough inclined plane is n times as it takes to slide down a perfectly smooth 45° incline plane. The coefficient of kinetic friction between the object and the incline plane is
- a) $\sqrt{\frac{1}{1-n^2}}$ b) $\sqrt{1-\frac{1}{n^2}}$ c) $1+\frac{1}{n^2}$ d) $1-\frac{1}{n^2}$

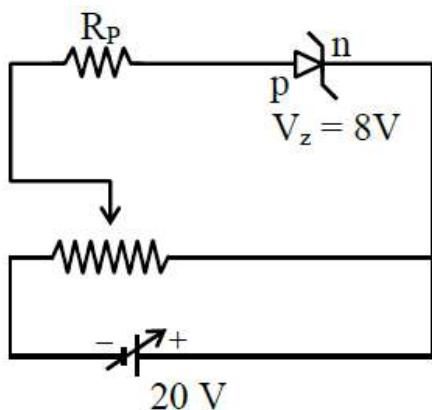
Numerical

- Q21** A cubical block (of side 2m) of mass 20 kg slides on inclined plane lubricated with the oil of viscosity $\eta = 10^{-1} \text{ poise}$ with constant velocity of 10 m/sec . ($g = 10 \text{ m/sec}^2$) find out the thickness of layer of liquid (in mm). ($10^{-1} \text{ poise} = 10^{-2} \text{ Nsm}^2$)



- Q22** A boat has to cross a river as soon as possible. In doing so it takes 4 sec less than if it travels by shortest path. Let the width of the river is ' d '. Velocity of river water is 8 m/s and boat can travel in still water with a velocity of 17 m/s . Find the value of $\frac{d}{170}$

- Q23** A zener diode having zener voltage 8 V and power dissipation rating of 0.5 W is connected across a potential divider arranged with maximum potential drop across zener diode is as shown in the diagram. The value of protective resistance R_p is Ω .



- Q24** For the circuit shown, the value of current at time $t = 3.2$ s will be ____ A.

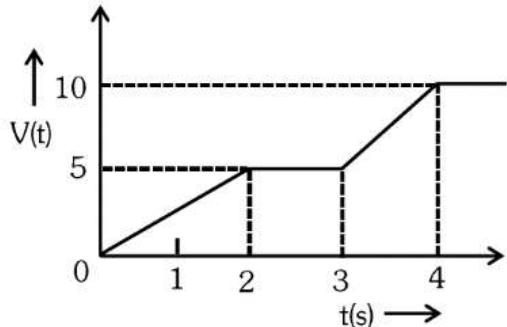


Figure 1

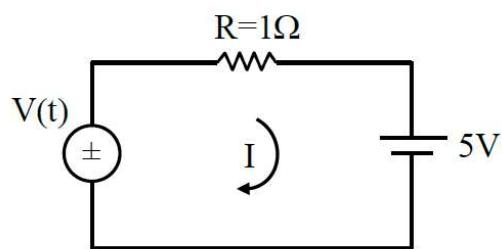


Figure-2

[Voltage distribution $V(t)$ is shown by Fig. (i) and the circuit is shown in fig. (2)]

- Q25** A bi convex lens of focal length 10 cm is cut in two identical parts along a plane perpendicular to the principal axis. The power of each lens after cut is _____ D.

Chemistry

Single Choice Question

Q26 Given below are two statements:

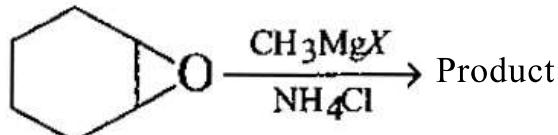
Statement I: SbCl₅ is more covalent than SbCl₃

Statement II: The higher oxides of halogens also tend to be more stable than the lower ones.

In the light of the above statements, choose the most appropriate answer from the options given below

- a) Both statement I and Statement II are correct
- b) Both statement I and Statement II are incorrect
- c) Statement I is correct but Statement II is incorrect
- d) Statement I is incorrect but Statement II is correct

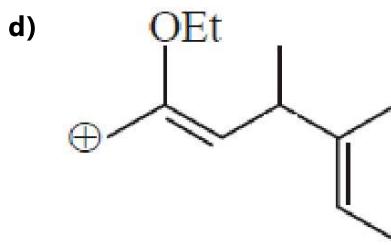
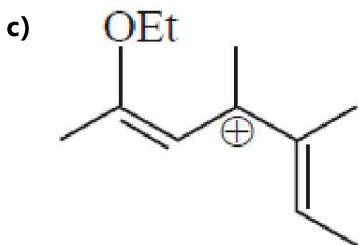
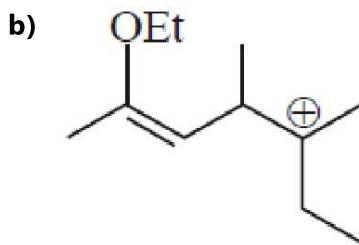
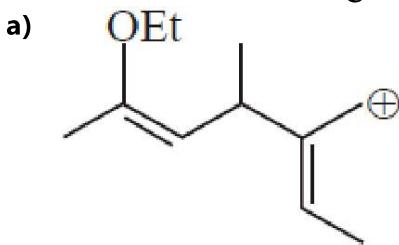
Q27



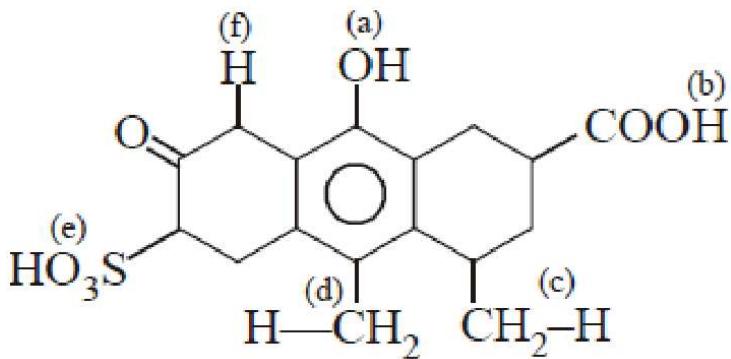
What is the product?

- a) Enantiomer
- b) Diastereoisomer
- c) Meso
- d) Achiral

Q28 Which of the following is most stable carbocation.

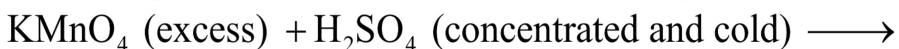


Q29 Arrange the following in increasing order of acid strength.



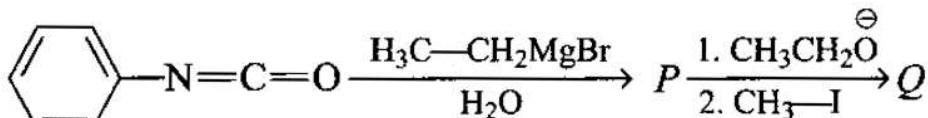
- a) c < f < d < a < b < e
 b) f < d < c < b < e < a
 c) f < c < d < b < e < a
 d) c < d < f < a < b < e

Q30 The final products obtained for the following reaction is :



- a) Mn₂O₇ b) MnO c) Mn₃O₄ d) MnO₃⁺

Q31



Find out P and Q :

- a) P is $\text{Ph}-\overset{\text{OH}}{\underset{|}{\text{N}}}=\text{C}-\text{CH}_2\text{CH}_3$ and Q is $\text{Ph}-\overset{\text{O}-\text{CH}_3}{\underset{|}{\text{N}}}=\text{C}-\text{CH}_2\text{CH}_3$

- b) P is $\text{Ph}-\overset{\text{O}}{\underset{||}{\text{NH}}}-\text{C}-\text{CH}_2\text{CH}_3$ and Q is $\text{Ph}-\overset{\text{O}}{\underset{||}{\text{N}}}-\text{C}-\text{CH}_2\text{CH}_3$

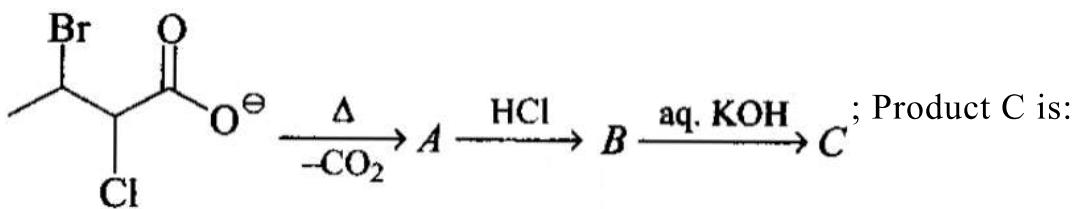
- c) P is $\text{Ph}-\overset{\text{O}}{\underset{||}{\text{NH}}}-\text{C}-\text{CH}_2\text{CH}_3$ and Q is $\text{Ph}-\overset{\text{OCH}_3}{\underset{|}{\text{N}}}=\text{C}-\text{CH}_2\text{CH}_3$

- d) P and Q both are same

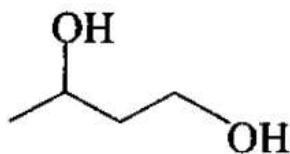
Q32 Which of the following is correct statement ?

- a) Starch is a polymer of α -glucose
 b) Amylose is a component of cellulose
 c) Proteins are composed of only one type of amino acid
 d) Cyclic structure of fructose, is hemiacetal with furanose structure.

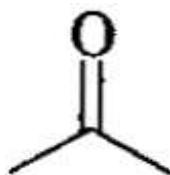
Q33



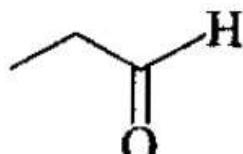
a)



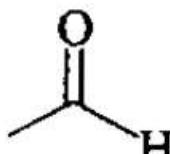
b)



c)

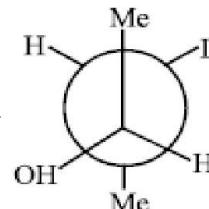


d)

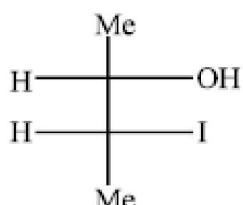


Q34

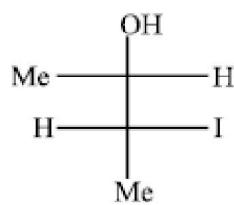
Which of the following is the diastereoisomers of the compound



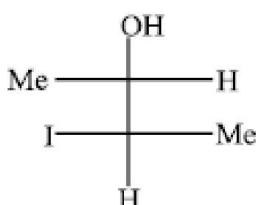
a)



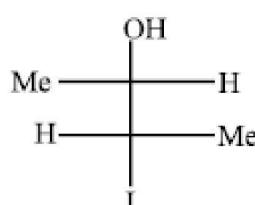
b)



c)



d)



Q35 The impure 6 g of NaCl is dissolved in water and then treated with excess of silver nitrate solution. The weight of precipitate of silver chloride is found to be 14 g. The % purity of NaCl solution would be :

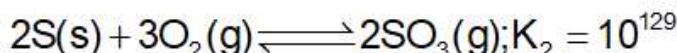
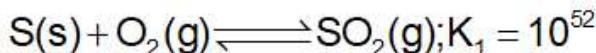
a) 95%

b) 85%

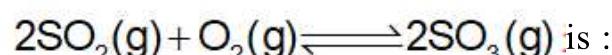
c) 75%

d) 65%

Q36 For the following reactions, equilibrium constants are given :



The equilibrium constant for the reaction,

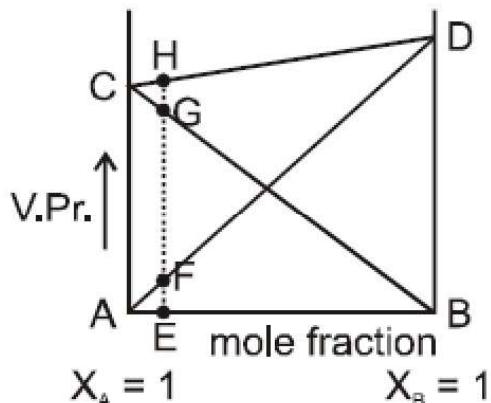


is :

a) 10^{154} b) 10^{25} c) 10^{77} d) 10^{181}

- Q37** Which reaction involves a change in the electron–pair geometry for the underlined element?
- $\underline{\text{B}}\text{F}_3 + \text{F}^- \longrightarrow \underline{\text{B}}\text{F}_4^-$
 - $2 \underline{\text{S}}\text{O}_2 + \text{O}_2 \longrightarrow 2 \underline{\text{S}}\text{O}_3$
 - $\underline{\text{N}}\text{H}_3 + \text{H}^+ \longrightarrow \underline{\text{N}}\text{H}_4^+$
 - $\text{H}_2\underline{\text{O}} + \text{H}^+ \longrightarrow \text{H}_3\underline{\text{O}}^+$

- Q38** Based on the given diagram, which of the following statements regarding the homogenous solutions of two volatile liquids are correct?

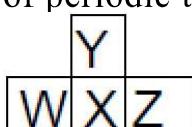


- Plots AD and BC show the Raoult's law is obeyed for the solution in which B is a solvent and A is the solute and as well as for that in which A is solvent and B is solute.
- Plot CD shows that Dalton's law of partial pressure is obeyed by the binary solution of components A and B.
- $\text{EF} + \text{EG} = \text{EH}$; and AC and BD correspond to the vapour pressure of the pure solvents A and B respectively.

Select the correct answer using the options given below :

- Only (a)
- (b) and (c)
- (a) and (c)
- All

- Q39** Consider the following four elements, which are represented according to long form of periodic table.



Here W, Y and Z are left, up and right elements with respect to the element 'X' and 'X' belongs to 16th group and 3rd period. Then according to given information the incorrect statement regarding given elements is:

- Maximum electronegativity: Y
- Maximum catenation property: X
- Maximum electron affinity: Z
- Y exhibits variable covalency

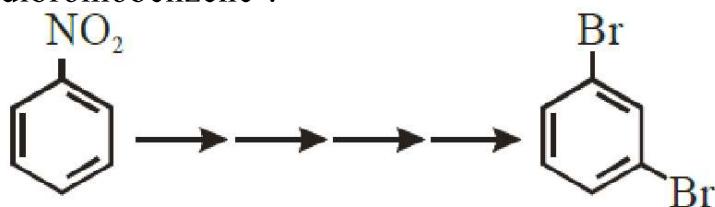
- Q40** Which solution will show maximum elevation in b.pt. :

- 0.1 M KCl
- 0.1M BaCl₂
- 0.1MFeCl₃
- 0.1MFe₂(SO₄)₃

Q41 An acidic buffer is obtained on mixing

- a) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl
- b) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH₃COONa
- c) 100 mL of 0.1 M CH₃COOH and 100 mL of 0.1 M NaOH
- d) 100 mL of 0.1 M CH₃COOH and 200 mL of 0.1 M NaOH

Q42 What is the correct sequence of reagents used for converting nitrobenzene into m-dibromobenzene?



- a) $\text{NaNO}_2 \rightarrow / \text{HCl} \rightarrow / \text{KBr} \rightarrow / \text{H}^+ \rightarrow$
- b) $\text{Br}_2/\text{Fe} \rightarrow / \text{Sn/HCl} \rightarrow / \text{NaNO}_2/\text{HCl} \rightarrow / \text{CuBr}/\text{HBr} \rightarrow$
- c) $\text{Sn/HCl} \rightarrow / \text{KBr} \rightarrow / \text{Br}_2 \rightarrow / \text{H}^+ \rightarrow$
- d) $\text{Sn/HCl} \rightarrow / \text{Br}_2 \rightarrow / \text{NaNO}_2 \rightarrow / \text{NaBr} \rightarrow$

Q43 O-xylene on reductive ozonolysis will give

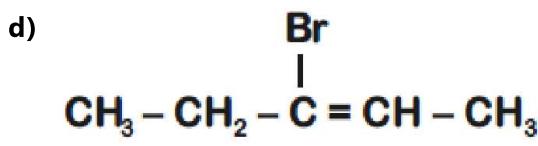
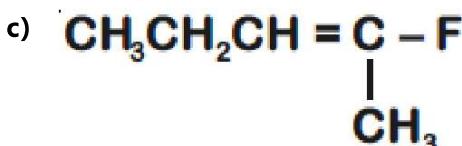
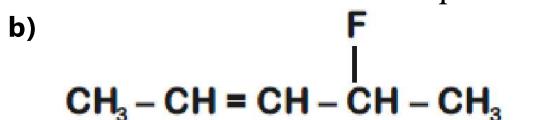
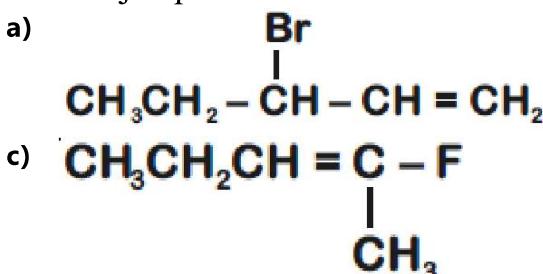
- a) $\begin{array}{c} \text{CHO} \\ | \\ \text{CHO} \end{array}$ & $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{CHO}$
- b) $\begin{array}{c} \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \\ | \\ \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \end{array}$ & $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{CHO}$
- c) $\begin{array}{c} \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \\ | \\ \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \end{array}$ & $\begin{array}{c} \text{CHO} \\ | \\ \text{CHO} \end{array}$
- d) $\begin{array}{c} \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \\ | \\ \text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O} \end{array}$, $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{CHO}$ & $\begin{array}{c} \text{CHO} \\ | \\ \text{CHO} \end{array}$

Q44 Among (a) – (d), the complexes that can display geometrical isomerism are

- (a) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]^+$ (b) $[\text{Pt}(\text{NH}_3)\text{Cl}_5]^-$
 (c) $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$ (d) $[\text{Pt}(\text{NH}_3)_4\text{ClBr}]^{2+}$

- a) (c) and (d) b) (a) and (b) c) (b) and (c) d) (d) and (a)

Q45 The major product obtained from – E₂ elimination of 3-bromo-2-fluoropentane is



Numerical

Q46 If enthalpy of dissociation of CH_4 and C_2H_6 are 320 and 600 calories respectively then bond energy of C–C bond (in cal) is : (report your answer by dividing 10)

Q47 Reaction A + B → C + D follows rate law, $r = k [\text{A}]^{1/2} [\text{B}]^{1/2}$ starting with 1M of A and B each. What is the time taken (in sec.) for concentration of A become 0.1 M, If your answer is X then what will be the value of $\frac{X}{10}$?

[Given $k = 2.303 \times 10^{-2} \text{ sec}^{-1}$].

Q48 If the frequency of violet radiation is $7.5 \times 10^{14} \text{ Hz}$, then the value of wavenumber in m^{-1} for it is $p \times 10^5$. Give the value of p?

Q49 Conductivity of a saturated solution of $\text{Cu}_2[\text{Fe}(\text{CN})_6]$ after subtracting the conductivity of water is $1.28 \times 10^{-5} \Omega^{-1} \text{ cm}^{-1}$. Calculate value of solubility of $\text{Cu}_2[\text{Fe}(\text{CN})_6]$. [$\Lambda_m^\infty (\text{CuSO}_4) = 260 \text{ S cm}^2 \text{ mol}^{-1}$, $\Lambda_m^\infty (\text{K}_2\text{SO}_4) = 300 \text{ S cm}^2 \text{ mol}^{-1}$, $\Lambda_m^\infty (\text{K}_4\text{Fe}(\text{CN})_6) = 720 \text{ S cm}^2 \text{ mol}^{-1}$]

Report your answer as (solubility) $\times (10^5)$

Q50 How many of the following ions would form coloured complexes in water ?
 Cu^{2+} , Zn^{2+} , Ti^{3+} , Ti^{+4} , Cd^{2+} , Mn^{2+}

Mathematics

Single Choice Question

Q51 If A is a symmetric matrix and B is a skew-symmetric matrix such that

$$A + B = \begin{bmatrix} 2 & 3 \\ 5 & -1 \end{bmatrix}, \text{ then } AB \text{ is equal to :}$$

- a) $\begin{bmatrix} 4 & -2 \\ 1 & -4 \end{bmatrix}$ b) $\begin{bmatrix} 4 & -2 \\ -1 & -4 \end{bmatrix}$ c) $\begin{bmatrix} -4 & -2 \\ -1 & 4 \end{bmatrix}$ d) $\begin{bmatrix} -4 & 2 \\ 1 & 4 \end{bmatrix}$

Q52 Let α be the angle between the lines whose direction cosines satisfy the equations $l + m - n = 0$ and $l^2 + m^2 - n^2 = 0$. Then the value of $\sin^4 \alpha + \cos^4 \alpha$ is :

- a) $\frac{3}{4}$ b) $\frac{3}{8}$ c) $\frac{5}{8}$ d) $\frac{1}{2}$

Q53 If $x \in \left(\frac{3\pi}{2}, 2\pi\right)$ then value of the expression $\sin^{-1}(\cos(\cos^{-1}(\cos x) + \sin^{-1}(\sin x)))$ equals

- a) $-\frac{\pi}{2}$ b) $\frac{\pi}{2}$ c) 0 d) None

Q54 The set of all values of λ for which the equation $\cos^2 2x - 2 \sin^4 x - 2 \cos^2 x = \lambda$

- a) $[-2, -1]$ b) $\left[-2, -\frac{3}{2}\right]$ c) $\left[-1, -\frac{1}{2}\right]$ d) $\left[-\frac{3}{2}, -1\right]$

Q55 Let $f(x)$ be a polynomial of degree 3 such that $f(-1) = 10$, $f(1) = -6$, $f(x)$ has a critical point at $x = -1$, and $f'(x)$ has a critical point $x = 1$. Then $f(x)$ has a local minima at $x =$

- a) 2 b) 3 c) 4 d) 6

Q56 Number of solution of equation $|x - 1| = e^x$ is-

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

Q57 Let $f : R \rightarrow R$ be defined as $f(x) = \begin{cases} -\frac{4}{3}x^3 + 2x^2 + 3x, & x > 0 \\ 3xe^x, & x \leq 0 \end{cases}$. Then f is

increasing function in the interval

- a) $(-\frac{1}{2}, 2)$ b) $(0, 2)$ c) $(-1, \frac{3}{2})$ d) $(-3, -1)$

Q58 If the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{\lambda}$ and $\frac{x-2}{1} = \frac{y-4}{4} = \frac{z-5}{5}$ is $\frac{1}{\sqrt{3}}$, then the sum of all possible values of λ is :

- a) 16 b) 6 c) 12 d) 15

- Q59** The number of rational points on the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is -
a) ∞ **b)** 4 **c)** 0 **d)** 2
- Q60** If $f(x)$ is an even function and satisfies the relation $x^2 f(x) - 2f\left(\frac{1}{x}\right) = g(x)$ where $g(x)$ is an odd function then $f(5)$ equals
a) 0 **b)** $\frac{50}{75}$ **c)** $\frac{49}{75}$ **d)** None of these
- Q61** $\lim_{x \rightarrow 0} \frac{(2^{\sin x} - 1)[\ln(1 + \sin 2x)]}{x \tan^{-1} x}$ is equal to
a) $\ln 2$ **b)** $2 \ln 2$ **c)** $(\ln 2)^2$ **d)** 0
- Q62** The sum of the factor of $8!$ which are odd and are of the form $(3m + 2)$ where $m \in \mathbb{N}$, is
a) 35 **b)** 45 **c)** 40 **d)** 42
- Q63** $\int \frac{\sec x \cdot \cosec x}{2 \cot x - \sec x \cosec x} dx$ is equal to-
a) $\frac{1}{2} \ln |\sec 2x + \tan 2x| + C$ **b)** $\ln |\sec x + \cosec x| + C$
c) $\ln |\sec x + \tan x| + C$ **d)** $\frac{1}{2} \ln |\sec x + \cosec x| + C$
- Q64** If $I_n = \int_0^{\pi/2} x^n \sin x dx$, then $I_{10} + 90 I_8$ is
a) $10 (\pi/2)^6$ **b)** $10 (\pi/2)^9$ **c)** $10 (\pi/2)^8$ **d)** $10 (\pi/2)^7$
- Q65** The solution of $\frac{x^3 dx + yx^2 dy}{\sqrt{x^2 + y^2}} = ydx - xdy$ is:
a) $\sqrt{x^2 + y^2} = Cx$
b) $\sqrt{x^2 + y^2} + y/x = C$
c) $\sqrt{x^2 + y^2} + y/x^2 = C$
d) $(x^2 + y^2)^2 + xy^2 = C$
- Q66** $\frac{z_3 - z_1}{z_3 - z_2} = i$, then the points represented by z_1, z_2 and z_3
a) Are collinear **b)** forms equilateral triangle
c) form isosceles right angled triangle **d)** forms obtuse angled triangle
- Q67** A letter is known to have come from either TATANAGAR or CALCUTTA. On the envelope, just two consecutive letters TA are visible. The probability that the letter has come from CALCUTTA is
a) $4/11$ **b)** $1/3$ **c)** $5/12$ **d)** None of these

- Q68** Let $f: R \rightarrow R$ satisfy the equation $f(x + y) = f(x) \cdot f(y)$ for all $x, y \in R$ and $f(x) \neq 0$ for any $x \in R$. If the function f is differentiable at $x = 0$ and $f'(0) = 3$, then $\lim_{h \rightarrow 0} \frac{1}{h}(f(h) - 1)$ is equal to _____.
a) 5 **b)** 4 **c)** 3 **d)** 2

- Q69** Let \mathbb{N} be the set of all integers,

$$A = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x - 2)^2 + y^2 \leq 4\},$$

$$B = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x^2 + y^2 \leq 4\} \text{ and}$$

$$C = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x - 2)^2 + (y - 2)^2 \leq 4\}$$

If the total number of relations from $A \cap B$ to $A \cap C$ is 2^p , then the value of p is :

- a)** 25 **b)** 24 **c)** 20 **d)** 30

- Q70** If for some $x \in R$, the frequency distribution of the marks obtained by 20 students in a test is :

Marks	2	3	5	7
Frequency	$(x+1)^2$	$2x-5$	x^2-3x	x

Then the mean of the marks is :

- a)** 3.2 **b)** 3.0 **c)** 2.5 **d)** 2.8

Numerical

- Q71** The number of ordered pairs (r, k) for which $6 \cdot {}^{35}C_r = (k^2 - 3) \cdot {}^{36}C_{r+1}$, where k is an integer, is

- Q72** If the sum of the first 40 terms of the series, $3 + 4 + 8 + 9 + 13 + 14 + 18 + 19 + \dots$ is $(102)m$, then m is equal to

- Q73** Let α and β be two real roots of the equation $(k+1)\tan^2 x - \sqrt{2} \cdot \lambda \tan x = (1-k)$, where $k \neq -1$ and λ are real numbers. If $\tan^2(\alpha + \beta) = 50$, then a value of λ is :

- Q74** Let $P(a_1, b_1)$ and $Q(a_2, b_2)$ be two distinct points on a circle with center $C(\sqrt{2}, \sqrt{3})$. Let O be the origin and OC be perpendicular to both CP and CQ . If the area of the triangle OPC is $\frac{\sqrt{35}}{2}$, then $a_1^2 + a_2^2 + b_1^2 + b_2^2$ is equal to _____.
 $\frac{\sqrt{35}}{2}$

- Q75** If $y(\alpha) = \sqrt{2 \left(\frac{\tan \alpha + \cot \alpha}{1 + \tan^2 \alpha} \right) + \frac{1}{\sin^2 \alpha}}$, $\alpha \in \left(\frac{3\pi}{4}, \pi \right)$ then $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$ is

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	D	D	A	B	A	A	D	C	D
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	D	B	B	D	C	C	D	D
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	4	3	192	1	5	A	A	C	D	A
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	B	A	C	D	A	B	A	D	D	D
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	B	B	D	A	C	12	10	25	2	3
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	B	C	B	D	B	D	C	A	A	A
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	B	C	A	B	B	C	A	C	A	D
Que.	71	72	73	74	75					
Ans.	4	20	10	24	4					