Competishun

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

Date: 21/11/2024

Time: 3 hours **Max. Marks:** 30

UTS-1_MT-3 (24-25)

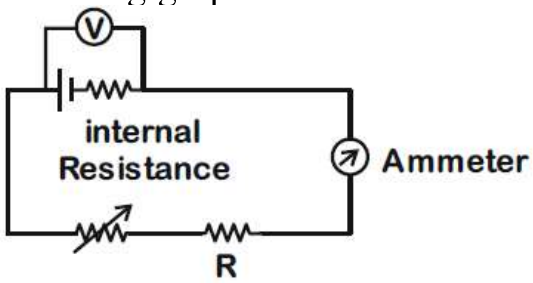
Physics

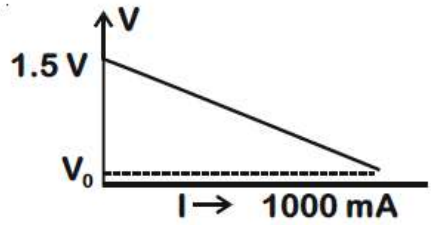
Single Choice Question

Q1 The ratio of surface tensions of mercury and water is given to be 7.5 while the ratio o their densities is 13.6. Their contact angles, with glass, are close to 135° and 0°, respectively. It is observed that mercury gets depressed by an amount h in a capillary tube of radius r_1, while water rises by the same amount h in a capillary tube of radius r_2. The ratio, (r_1/r_2), is then close to :

a) 4/5 **b)** 2/3 **c)** 3/5 **d)** 2/5

Q2 To verify Ohm's law, a student connects the voltmeter across the battery as, shown in the figure. The measured voltage is plotted as a function of the current, and the following graph is obtained :





If V_0 is almost zero, identify the correct statement :

a) The emf of the battery is 1.5 V and its internal resistance is 1.5 Ω

b) The emf of the battery is 1.5 V and the value of R is 1.5 Ω

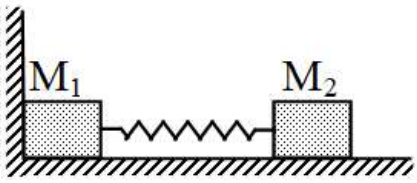
c) The value of the resistance R is 1.5 Ω

d) The potential difference across the battery is 1.5 V when it sends a current of 1000 mA

Q3 In a typical combustion engine the workdone by a gas molecule is given by $W = \alpha^2 \beta e^{\frac{-\beta x^2}{kT}}$, where x is the displacement, k is the Boltzmann constant and T is the temperature. If α and β are constants, dimension of α will be :

a) $\left[M^2LT^{-2}\right]$ **b)** $\left[M^0LT^0\right]$ **c)** $\left[MLT^{-1}\right]$ **d)** $\left[MLT^{-2}\right]$

Q4 Two masses M_1 and M_2 are connected with each other with the help of a massless spring of 'spring-constant' k. Mass M_1 is fixed to a wall and the system is at rest on the frictionless floor. M_2 is displaced by distance x and released. Velocity of CM of the system when M_1 is detached from wall is given by-



a) $\frac{(kM_1)^{1/2}x}{M_1+M_2}$ **b)** $\frac{x(kM_2)^{+1/2}}{M_1+M_2}$ **c)** $\frac{M_2^{1/2}kx}{M_1+M_2}$ **d)** $\frac{(M_1k)^{-1/2}x}{M_1-M_2}$

Q5 When a monochromatic point source of light is at a distance of 40 cm from a photo-cell, the stopping potential and the saturated photoelectric current are 2.0 V and 400 μA, respectively. If the same source is kept at a distance of 10 cm from the photo-cell, then :

a) the stopping potential will be still 2.0 V

b) the stopping potential will become 8.0 V

c) the stopping potential will become 0.5 V

d) the saturated photo-electric current will become 100 μA

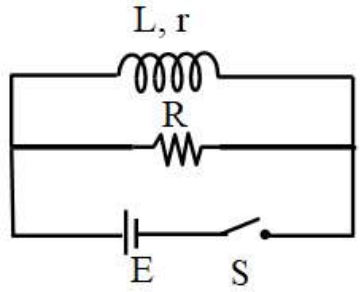
Q6 A projectile is fired with velocity u making an angle θ with the horizontal. What is th angular momentum of the projectile at the highest point about the starting point? (Given the mass of the projectile is m)

a) $\frac{mu\cos\theta}{2g}$ **b)** $\frac{mu^2\sin^2\theta\cos\theta}{2g}$ **c)** $\frac{mu^3\cos^2\theta}{2g}$ **d)** $\frac{mu^3\sin^2\theta\cos\theta}{2g}$

Q7 A proton, an electron and a helium nucleus, have the same energy. They are in circula orbits in a plane due to magnetic field perpendicular to the plane. Let r_p,r_e and r_{He} be their respective radii, then,

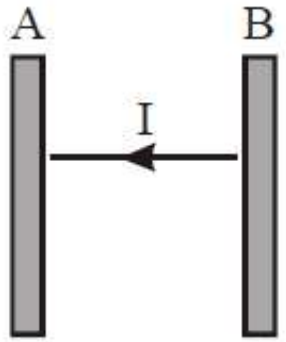
a) $r_e < r_p < r_{He}$ **b)** $r_e > r_p > r_{He}$ **c)** $r_e < r_p = r_{He}$ **d)** $r_e > r_p = r_{He}$

Q8 For the circuit shown in the figure, initially the switch is closed for a long time so tha steady state has been reached. Then at t = 0, the switch is opened, due to which current in the circuit decays to zero. the heat generated in the inductor is [L = self inductance of inductor, r = resistance of inductor] :



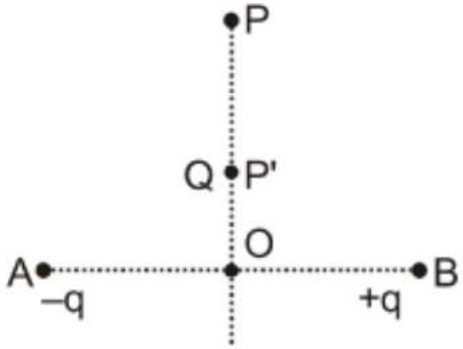
a) zero **b)** $\frac{E^2}{2(R+r)}$ **c)** $\frac{E^2L}{2r(R+r)}$ **d)** $\frac{E^2R}{2r(R+r)}$

Q9 A parallel beam of light of intensity I is incident normally on a plane surface A which absorbs 50% of the incident light. The reflected light falls on B which is perfect reflector, the light reflected by B is again partly reflected and partly absorbed and this process continues. For all absorption by A, asborption coefficient is 0.5. The pressure experienced by A due to light is :-



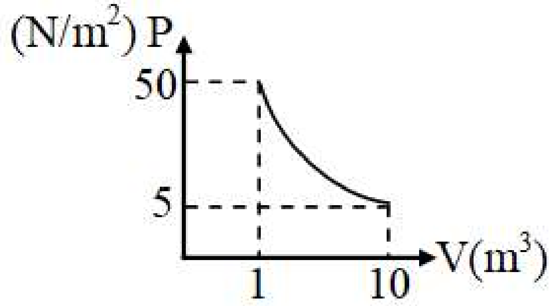
a) $\frac{1.5I}{c}$ **b)** $\frac{I}{c}$ **c)** $\frac{3I}{2c}$ **d)** $\frac{3I}{c}$

Q10 Charges –q and +q located at A and B, respectively, constitute an electric dipole. Distance AB = 2a, O is the midpoint of the dipole and OP is perpendicular to AB. A charge Q is placed at P where OP = y and y >> 2a. The charge Q experiences an electrostatic force F. If Q is now moved along the equatorial line to P' such that the $OP' = \left(\frac{y}{3}\right)$, force on Q will be close to $\left(\frac{y}{3} \gg 2a\right)$



a) 27 F **b)** 3 F **c)** $\frac{F}{3}$ **d)** 9 F

Q11 P-V curve of thermodynamic process is given in diagram for a gas. Find work done in this process-

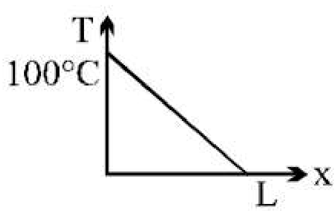


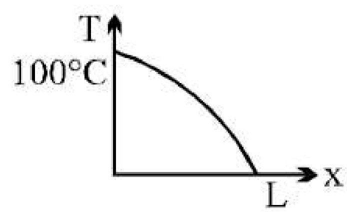
a) 11.5 J b) 115 J c) 1150 J d) 1.15 J

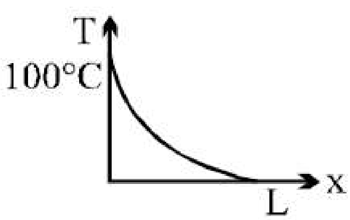
Q12 A capacitor C is fully charged with voltage V_0. After disconnecting the voltage source, it is connected in parallel with another uncharged capacitor of capacitance $\frac{C}{2}$. The energy loss in the process after the charge is distributed between the two capacitors is

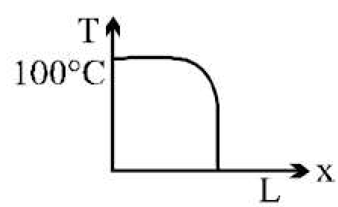
a) $\frac{1}{2}CV_0^2$ b) $\frac{1}{3}CV_0^2$ c) $\frac{1}{4}CV_0^2$ d) $\frac{1}{6}CV_0^2$

Q13 A rod of length L and uniform cross-sectional area has varying thermal conductivity which changes linearly from 2 K at end A to K at the other end B. The ends A and B of the rod are maintained at constant temperature 100ºC and 0ºC, respectively. At steady state, the graph of temperature : T = T(x) where x = distance from end A will be

a)


b)


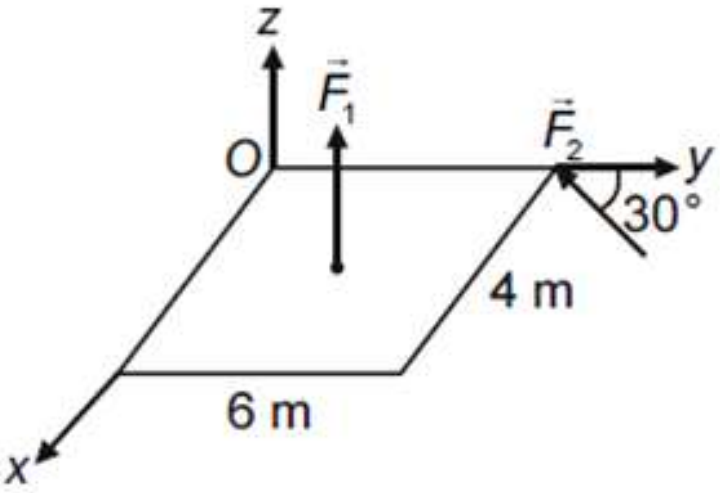
c)


d)


Q14 Identical charges –q each are placed at the eight corners of a cube of side b. Find the electrostatic potential energy of a charge +q placed at the centre of the cube

a) $\frac{-q^2}{\sqrt{3}\pi\varepsilon_0 b}$ b) $\frac{-2q^2}{\sqrt{3}\pi\varepsilon_0 b}$ c) $\frac{-3q^2}{\sqrt{3}\pi\varepsilon_0 b}$ d) $\frac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$

Q15 A slab is subjected to two forces $\overrightarrow{F_1}$ and $\overrightarrow{F_2}$ of same magnitude F as shown in the figure. Force $\overrightarrow{F_2}$ is in XY-plane while force F1 acts along z-axis at the point $(2\overrightarrow{i} + 2\overrightarrow{j})$. The moment of these forces about point O will be



a) $(3\hat{i}-2\hat{j}+3\hat{k})F$ **b)** $(3\hat{i}+2\hat{j}-3\hat{k})F$ **c)** $(3\hat{i}+2\hat{j}+3\hat{k})F$ **d)** $(3\hat{i}-2\hat{j}-3\hat{k})F$

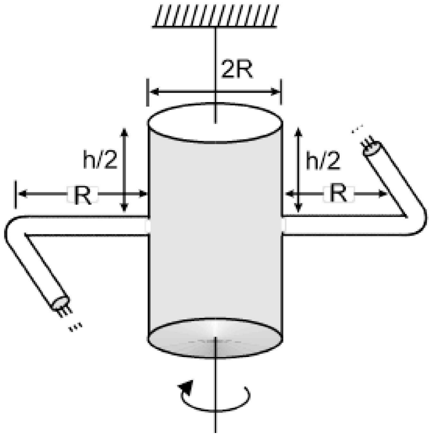
Q16 A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60° with ground level. But he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is

a) $\frac{2v}{\sqrt{3}}$ **b)** $\frac{\sqrt{3}}{2}v$ **c)** $\frac{v}{2}$ **d)** v

Q17 Earthquakes generate sound waves inside the earth. Unlike a gas, the earth can experience both transverse (S) and longitudinal (P) sound waves. Typically the speed of S wave is about 4.0 km s^{-1}, and that of P wave is 8.0 km s^{-1}. A seismograph records P and S waves from an earthquake. The first P wave arrives 4 min before the first S wave. Assuming the waves travel in straight line, the distance at which the earthquake occurs is.

a) 1920 km **b)** 960 km **c)** 480 km **d)** 240 km

Q18 A cylindrical container of radius ' R ' and height ' h ' is completely filled with a liquid Two horizontal L shaped pipes of small cross-section area ' a ' are connected to the cylinder as shown in the figure. Now the two pipes are opened and fluid starts coming out of the pipes horizontally in opposite directions. Then the torque due to ejected liquid on the system is:

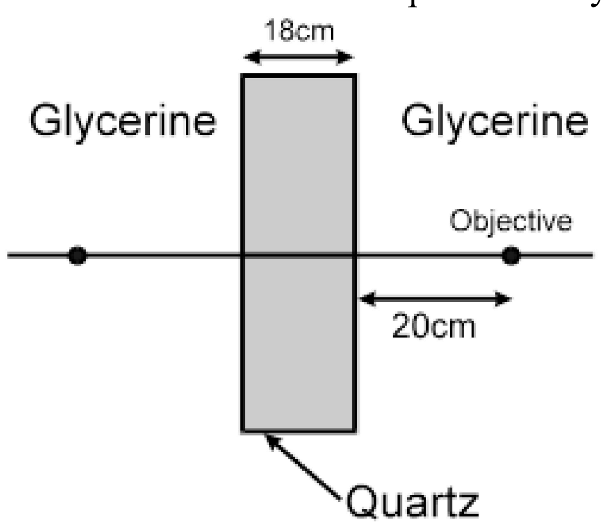


a) $4\ a\ g\ h\ \rho\ R$ **b)** $8\ a\ g\ h\ \rho\ R$ **c)** $2\ a\ g\ h\ \rho\ R$ **d)** none of these

Q19 If the terminal speed of a sphere of gold (density = 19.5 kgm^{-3}) is 0.2 ms^{-1} in a viscous liquid (density = 1.5 kgm^{-3}) find the terminal speed of a sphere of silver (density 10.5 kgm^{-3}) of the same size in the same liquid

a) 0.2 ms^{-1} **b)** 0.4 ms^{-1} **c)** 0.133 ms^{-1} **d)** 0.1 ms^{-1}

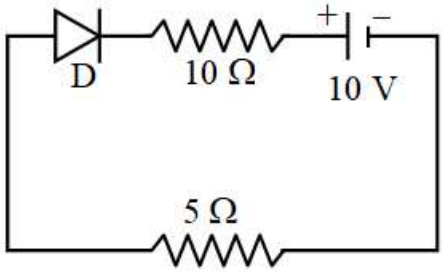
Q20 Given that, velocity of light in quartz = 1.5×10^8 m/s and velocity of light in glycerine = $(9/4) \times 10^8$ m/s Now a slab made of quartz is placed in glycerine as shown. What is the shift produced by slab?



a) 6 cm **b)** 3.55 cm **c)** 9 cm **d)** 2 cm

Numerical

Q21 In the adjoining circuit the given diode D is ideal. The potential difference across the 5 ohm resistance is :



Q22 Light of intensity $32 w/m^2$ is incident on a polarizer whose transmission axis is vertical. Other two polarizer also placed in front of first such that first and last are crossed. Of intensity of emergent light is $3 w/m^2$, then the angle (in degree) between the transmission axis of second and third polarizer will be (Angle should be Higher)

Q23 A stone of mass m, tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually, keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is given by $T = Ar^{-n}$, where A is a constant, r is the instantaneous radius of the circle, and n is _____.

Q24 A person pushes a box on a rough horizontal platform surface. He applies a force of 200 N over a distance of 15 m. Thereafter, he gets progressively tired and his applied force reduces linearly with distance to 100 N. The total distance through which the box has been moved is 30 m. What is the work done by the person during the total movement of the box? (in joules)

Q25 A container is divided into two chambers by a partition. The volume of first chamber is 4.5 litre and second chamber is 5.5 litre. The first chamber contain 3.0 moles of gas at pressure 2.0 atm and second chamber contain 4.0 moles of gas at pressure 3.0 atm. After the partition is removed and the mixture attains equilibrium, then, the common equilibrium pressure existing in the mixture is $x \times 10^{-1}$ atm. Value of x is

Chemistry

Single Choice Question

Q26 The quantum number of four electrons are given below:

(I) $n = 4, l = 2, m_l = -2, m_s = -\frac{1}{2}$

(II) $n = 3, l = 2, m_l = 1, m_s = +\frac{1}{2}$

(III) $n = 4, l = 1, m_l = 0, m_s = +\frac{1}{2}$

(IV) $n = 3, l = 1, m_l = 1, m_s = -\frac{1}{2}$

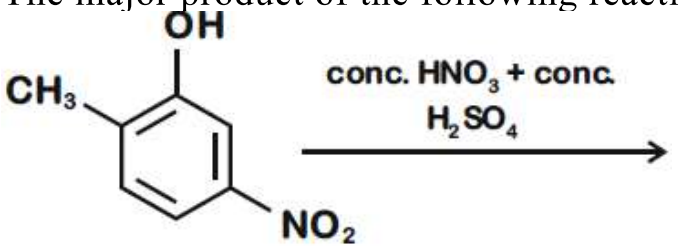
The correct order of their increasing energies will be:

a) IV < II < III < I **b)** I < III < II < IV **c)** IV < III < II < I **d)** I < II < III < IV

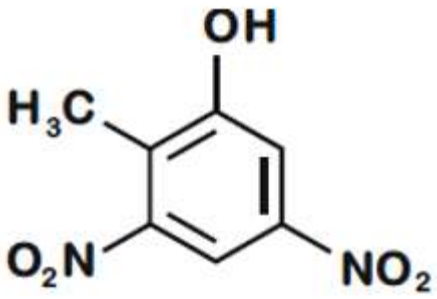
Q27 Λ_m° for NaCl, HCl and NaA are 126.4, 425.9 and 100.5 S cm^2mol^{-1}, respectively. If the conductivity of 0.001 M HA is 5×10^{-5} S cm^{-1}, degree of dissociation of HA is

a) 0.25 **b)** 0.125 **c)** 0.50 **d)** 0.75

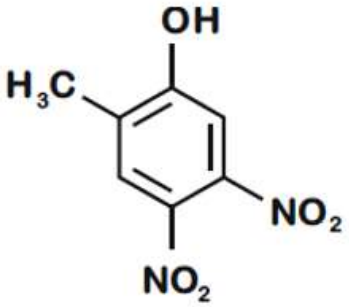
Q28 The major product of the following reaction is:



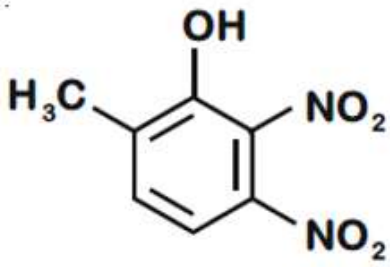
a)



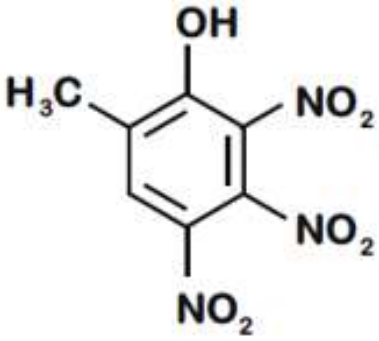
b)



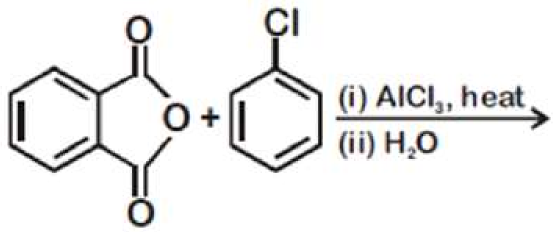
c)

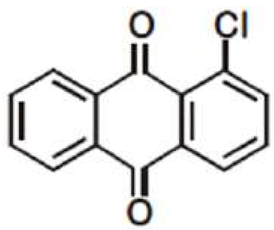


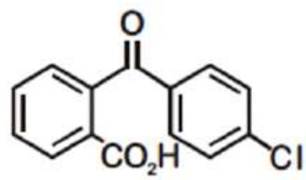
d)

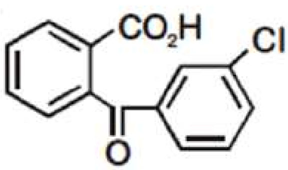


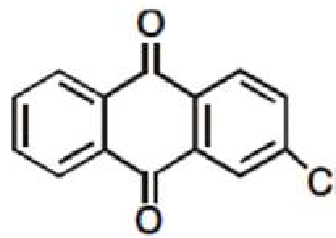
Q29 The major product of the following reaction is:



a) 

b) 

c) 

d) 

Q30 **Assertion :** Electron affinity values of the 3rd period elements on extreme right of the periodic table except noble gases are generally more than the 2nd period element of the same group.
Reason : Due to smaller atomic size of the 2nd period element, its electron density increases which oppose the addition of electron.

a) If both assertion and reason are true and reason is the correct explanation of assertion

b) If both assertion and reason are true but reason is not the correct explanation of assertion

c) If Assertion is true but reason is false.

d) If both assertion and reason are false.

Q31 Given below are two statements :one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : In $T\ell I_3$, isomorphous to CsI_3, the metal is present in +1 oxidation state.

Reason R : $T\ell$ metal has fourteen f electrons in the electronic configuration.

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

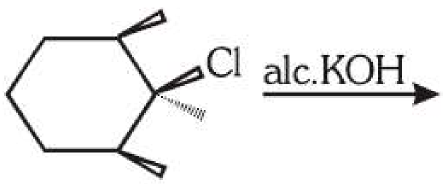
a) **A** is correct but **R** is not correct

b) Both **A** and **R** are correct and **R** is the correct explanation of **A**.

c) **A** is not correct but **R** is correct

d) Both **A** and **R** are correct but **R** is NOT the correct explanation of **A**.

Q32



Give total number of elimination products including stereoisomers.

a) 3 b) 5 c) 7 d) 9

Q33 **AX** **BX_2** **CX_3**
I **II** **III**
(All are sparingly soluble salts)
K_{sp} of all these are equal, which salt is most soluble in water.

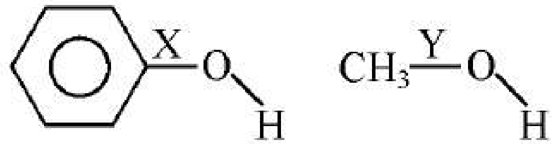
a) I
b) II
c) III
d) All are equally soluble

Q34 Which of the following does not have optical isomers?

a) $[Co(en)_3]Cl_3$
b) $[Co(NH_3)_3Cl_3]$
c) $[Co(en)_2Cl_2]Cl$
d) $[Co(en)(NH_3)_2Cl_2]Cl$

Q35 What would happen when a solution of potassium chromate is treated with an excess of dilute HNO_3 ?

a) $Cr_2O_7^{2-}$ and H_2O are formed
b) CrO_4^{2-} is reduced to +3 state of Cr
c) CrO_4^{2-} is oxidised to +7 state of Cr
d) Cr^{3+} and $Cr_2O_7^{2-}$ are formed

Q36 

Which is true about C–O bond lengths?

a) x = y
b) x > y
c) x < y
d) cannot be predicted

Q37 Which of the following reactions will yield 2,2-dibromopropane ?

a) $CH_3 - C \equiv CH + 2HBr \longrightarrow$
b) $CH_3CH = CHBr + HBr \longrightarrow$
c) $CH \equiv CH + 2HBr \longrightarrow$
d) $CH_3 - C = CH_2 + HBr \longrightarrow$

Q38 Determine which of the following reactions at constant pressure represent surrounding that do work on the system environment

I. $4NH_3(g) + 7O_3(g) \longrightarrow 4NO_2(g) + 6H_2O(g)$
II. $CO(g) + 2H_2(g) \longrightarrow CH_3OH(\ell)$
III. $C(s, graphite) + H_2O(g) \longrightarrow CO(g) + H_2(g)$
IV. $H_2O(s) \longrightarrow H_2O(\ell)$

a) III, IV
b) II and III
c) II, IV
d) I and II, IV

Q39 For the reaction $A(g) + 3B(g) \rightleftharpoons 2C(g)$ at 27°C, 2 moles of A, 4 moles of B and 6 moles of C are present in 2 litre vessel. If K_c for the reaction is 1.2, the reaction will proceed in :

a) forward direction
b) backward direction
c) neither direction
d) none of these

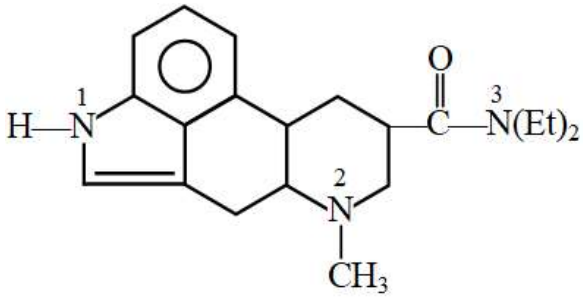
Q40 Which of the following is correctly based on molecular orbital theory for peroxide ion?

a) Its bond order is two and it is diamagnetic
b) Its bond order is one and it is paramagnetic
c) Its bond order is two and it is paramagnetic
d) Its bond order is one and it is diamagnetic

Q41 The half - life of a radioisotope is four hours. If the initial mass of the isotope was 200 g, the mass remaining after 24 hours undecayed is :

a) 1.042 g
b) 2.084 g
c) 3.125 g
d) 4.167 g

Q42 Which nitrogen atom in LSD is most basic?



a) 1 **b)** 3

c) 2 **d)** All are equally basic

Q43 The addition of Br_2 to Z-2 butene gives :

a) (R, R)-2,3-dibromobutane only

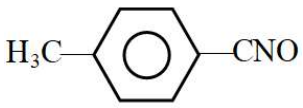
b) (S, S)-2,3-dibromobutane only

c) (R, S)-2,3-dibromobutane only

d) a mixture of (R, R) and (S, S)-2,3-dibromobutanes (50% : 50%)

Q44 The reaction of $CHCl_3$ and alcoholic KOH with p-toluidine gives :

a) 

b) 

c) 

d) 

Q45 A buffer solution contains 100 mL of 0.01 M CH_3COOH and 200 mL of 0.02 M CH_3COONa. 700 mL of water is added. pH before and after dilution are : (pK_a = 4.74 :

a) 5.04, 5.04 **b)** 5.04, 0.504 **c)** 5.04, 1.54 **d)** 5.34, 5.34

Numerical

Q46 A 100 mL solution was made by adding 1.43 g of $Na_2CO_3 \cdot xH_2O$. The normality of the solution is 0.1 N. The value of x is _____.
(The atomic mass of Na is 23 g/mol)

Q47 Two liquids A and B have P_A^0 and P_B^0 in the ratio of 1 : 3 and the ratio of number of moles of A and B in liquid phase are 1 : 3 then mole fraction of 'A' in vapour phase in equilibrium with the solution is equal to, if your answer is X then what will be value of 10X :

Q48 The mass of CO_2 obtained when 60 g of calcium carbonate is treated with excess of hydrochloric acid is : (Nearest integer)

Q49 The number of molecule(s) or ion(s) from the following having non-planar structure is .

NO_3^-, H_2O_2, BF_3, PCl_3, XeF_4, SF_4, XeO_3, PH_4^+, SO_3, $[Al(OH)_4]^-$

Q50 If $H_2 + 1/2\ O_2 \longrightarrow H_2O$, $\Delta H = -68$ kcal

$K + H_2O$ + water $\longrightarrow$ KOH (aq) + $1/2\ H_2$, $\Delta H = -48$ kcal

KOH + water $\longrightarrow$ KOH (aq), $\Delta H = -14$ kcal

Find the heat of formation of KOH. If your answer is –X kcal then what will be the value of X/10.

Mathematics

Single Choice Question

Q51 The value of a for which all extermum of function $f(x)=x^3-3ax^2+3\left(a^2-1\right)x+1$ lie in the interval $(-2,4)$ is

a) $(3,4)$ **b)** $(-1,3)$ **c)** $(-3,-1)$ **d)** None of these

Q52 The function $f(x)=\begin{cases}\left(\frac{4}{3}\right)^{\frac{\tan 4x}{\tan 3x}} ; 0<x<\frac{\pi}{2} \\ b+2 ; x=\frac{\pi}{2} \\ (1+|\cos x|)^{\frac{a}{b}|\tan x|} ; \frac{\pi}{2}<x<\pi\end{cases}$ then the sum $(a+b)$ if f is continuous at; $x=\frac{\pi}{2}$ is

a) -1 **b)** 1 **c)** 2 **d)** -2

Q53 Let $f(x)=\left([a]^2-5[a]+4\right)x^3-\left(6\{a\}^2-5\{a\}+1\right)x-(\tan x)\operatorname{sgn} x$, be an even function for all $x\in R$, then sum of all possible values of a is (where [.] and {.} denote the greatest integer function and fractional part functions respectively)

a) $\frac{17}{6}$ **b)** $\frac{53}{6}$ **c)** $\frac{31}{3}$ **d)** $\frac{35}{3}$

Q54 If $P=\begin{pmatrix}\frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2}\end{pmatrix}$ and $A=\begin{pmatrix}1 & 1 \\ 0 & 1\end{pmatrix}$ and $Q=PAP^T$ then the inverse of $P^TQ^{2023}P$ is

a) $\begin{pmatrix}1 & 2023 \\ 0 & 1\end{pmatrix}$ **b)** $\begin{pmatrix}2023 & 0 \\ 1 & 1\end{pmatrix}$ **c)** $\begin{pmatrix}1 & 0 \\ 1 & -2023\end{pmatrix}$ **d)** $\begin{pmatrix}1 & -2023 \\ 0 & 1\end{pmatrix}$

Q55 The number of numbers between 2000 and 5000 that can be formed with the digits 0,1,2,3,4 (repetition of digits is not allowed) and are multiple of 3 is :

a) 24 **b)** 30 **c)** 36 **d)** 48

Q56 The range of the function $f(x)=\sqrt{\cos^{-1}\left(\sqrt{\log_4 x}\right)-\frac{\pi}{2}+\sin^{-1}\left(\frac{1+x^2}{4x}\right)}$ is equal to

a) $\left(0,\frac{\pi}{2}+\sqrt{\frac{\pi}{2}}\right)$ **b)** $\left[\frac{\pi}{2},\frac{\pi}{2}+\sqrt{\frac{\pi}{2}}\right]$ **c)** $\left[\frac{\pi}{6},\frac{\pi}{2}\right]$ **d)** $\left\{\frac{\pi}{6}\right\}$

Q57 $f(x)$ is differentiable function which satisfies the equation

$f(x)=-\int_0^x f(t)\tan t\,dt+\int_0^x \tan(t-x)dt$ where $x\in(-\pi/2,\pi/2)$, passes through (0, 0), then the maximum value of $f(x)$ is

a) 1 **b)** -1 **c)** 0 **d)** 2

Q58 The shortest distance between the lines $\frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{-1}$ and $\frac{x+3}{2}=\frac{y-6}{1}=\frac{z-5}{3}$ is :

a) $\frac{18}{\sqrt{5}}$ **b)** $\frac{22}{3\sqrt{5}}$ **c)** $\frac{46}{3\sqrt{5}}$ **d)** $6\sqrt{3}$

Q59 Two loaded dice each have the property that 2 or 4 is three times as likely to appear as 1 , 3,5 or 6 on each roll. When two such dice are rolled, the probability of obtaining a total of 7 is

a) $\frac{1}{8}$ **b)** $\frac{1}{7}$ **c)** $\frac{7}{50}$ **d)** $\frac{7}{25}$

Q60 Let the area enclosed by the lines x + y = 2, y = 0, x = 0 and the curve $f(x)=\min\left\{x^2+\frac{3}{4},1+[x]\right\}$ where [x] denotes the greatest integer $\le$ x, be A. Then the value of 12A is ______.

a) 17 **b)** 15 **c)** 9 **d)** 19

Q61 Consider a branch of the hyperbola $x^2-2y^2-2\sqrt{2}x-4\sqrt{2}y-6=0$ with vertex at the point A. Let B be one of the end points of its latus rectum and C be the focus of the hyperbola nearest to the point A, the area of the triangle ABC is :

a) $\sqrt{\frac{3}{2}}$ **b)** $\sqrt{\frac{3}{2}}-1$ **c)** $\sqrt{\frac{3}{2}}+1$ **d)** $\sqrt{\frac{2}{3}}$

Q62 The solution of the differential equation $yy' = x\left(\frac{y^2}{x^2} + \frac{f\left(\frac{y^2}{x^2}\right)}{f'\left(\frac{y^2}{x^2}\right)}\right)$ is

a) $f\left(\frac{y^2}{x^2}\right) = c^2x^2$ **b)** $x^2 f\left(\frac{y^2}{x^2}\right) = c^2y^2$ **c)** $x^2 f\left(\frac{y^2}{x^2}\right) = c$ **d)** $f\left(\frac{y^2}{x^2}\right) = \frac{cy}{x}$

Q63 Let $x_1, x_2, x_3, \ldots\ldots, x_{20}$ be in geometric progression with $x_1 = 3$ and the common ratio $\frac{1}{2}$. A new data is constructed replacing each x_i by $(x_i - i)^2$. If $\bar{x}$ is the mean of new data, then the greatest integer less than or equal to $\bar{x}$ is _____ .

a) 142 **b)** 143 **c)** 141 **d)** 140

Q64 *Let $\vec{a} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 3\hat{k}$. If $\vec{b}$ is a vector such that $\vec{a} = \vec{b} \times \vec{c}$ and $|\vec{b}|^2 = 50$, then $|72 - |\vec{b} + \vec{c}|^2|$ is equal to.*

a) 66 **b)** 60 **c)** 67 **d)** 70

Q65 The integral $\int \frac{(2x-1)\cos\sqrt{(2x-1)^2+5}}{\sqrt{4x^2-4x+6}}dx$ is equal to

(where c is a constant of integration)

a) $\frac{1}{2}\sin\sqrt{(2x-1)^2+5} + c$ **b)** $\frac{1}{2}\cos\sqrt{(2x+1)^2+5} + c$

c) $\frac{1}{2}\cos\sqrt{(2x-1)^2+5} + c$ **d)** $\frac{1}{2}\sin\sqrt{(2x+1)^2+5} + c$

Q66 $\lim\limits_{x\to\frac{1}{\sqrt{2}}} \frac{\sin\left(\cos^{-1}x\right) - x}{1 - \tan\left(\cos^{-1}x\right)}$ is equal to :

a) $\sqrt{2}$ **b)** $-\sqrt{2}$ **c)** $\frac{1}{\sqrt{2}}$ **d)** $-\frac{1}{\sqrt{2}}$

Q67 The length of the latus rectum of a parabola, whose vertex and focus are on the positive x–axis at a distance R and S (>R) respectively from the origin, is :

a) 4(S + R) **b)** 2(S - R) **c)** 4(S - R) **d)** 2(S + R)

Q68 Let the circumcentre of a triangle with vertices A(a, 3), B(b, 5) and C(a, b), ab > 0 be P(1, 1). If the line AP intersects the line BC at the point Q(k_1, k_2), then $k_1 + k_2$ is equal to :

a) 2 **b)** $\frac{4}{7}$ **c)** $\frac{2}{7}$ **d)** 4

Q69 If $\sin\theta+\cos\theta=\frac{1}{2}$, then $16\left(\sin(2\theta)+\cos(4\theta)+\sin(6\theta)\right)$ is equal to :

a) 23 **b)** -27 **c)** -23 **d)** 27

Q70 If the system of equations
$x + y + z = 2$
$2x + 4y - z = 6$
$3x + 2y + \lambda z = \mu$
has infinitely many solutions, then :

a) $2\lambda - \mu = 5$ **b)** $\lambda - 2\mu = -5$ **c)** $\lambda + 2\mu = 14$ **d)** $2\lambda + \mu = 14$

Numerical

Q71 Let $p,q,r \in R^+$ and $27pqr \geq (p+q+r)^3$ and $3p+4q+5r=12$, then the value of $8p+4q-7r=$

Q72 Two equal chords AB an AC of the circle $x^2+y^2-6x-8y-24=0$ are drawn from the point $A(\sqrt{33}+3,0)$. Another chord PQ is drawn intersecting AB and AC at points R and S respectively. Given that $AR=SC=7$ and $RB=AS=3$, then the value of PR/QS is

Q73 If $(2021)^{3762}$ is divided by 17 then the remainder is_____

Q74 Let C be the set of all complex numbers. Let
$S_1=\{z\in C\,|\,|z-3-2i|^2=8\}$,
$S_2=\{z\in C\,|\,Re(z)\geq 5\}$ and
$S_3=\{z\in C\,|\,|z-\bar{z}|\geq 8\}$.
Then the number of elements in $S_1\cap S_2\cap S_3$ is equal to:

Q75 For a natural number n, let $a_n = 19^n - 12^n$. Then, the value of $\frac{31\alpha_9-\alpha_{10}}{57\alpha_8}$ is

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**D**	**A**	**B**	**B**	**A**	**D**	**C**	**C**	**D**	**A**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**B**	**D**	**B**	**D**	**A**	**C**	**A**	**A**	**D**	**A**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**0**	**60**	**3**	**5250**	**25**	**A**	**B**	**B**	**B**	**A**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**D**	**A**	**C**	**B**	**A**	**C**	**A**	**D**	**A**	**D**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**C**	**C**	**D**	**C**	**D**	**10**	**1**	**26**	**6**	**10**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**B**	**A**	**D**	**D**	**B**	**D**	**C**	**A**	**C**	**A**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**B**	**A**	**A**	**A**	**A**	**D**	**C**	**B**	**C**	**D**
Que.	71	72	73	74	75					
Ans.	**5**	**1**	**4**	**1**	**4**					