Competishun

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

Date: 11/12/2023

Time: 3 hours **Max. Marks:** 300

MFST-3 (23-24)

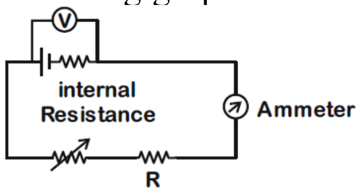
Physics

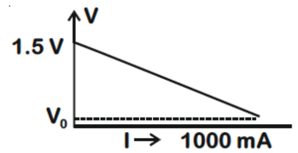
Single Choice Question

Q1 The ratio of surface tensions of mercury and water is given to be 7.5 while the ratio of 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 :

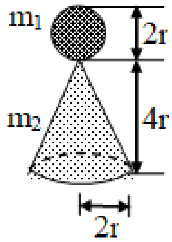
a) The emf of the battery is 1.5 V and its internal resistance is 1.5 Ω

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

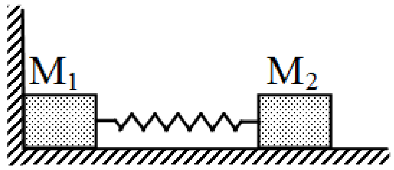
d) The potential difference across the battery is 1.5 V when it sends a current of 1000 mA

Q3 A cone and sphere is shown in figure. Density of material of cone is $\frac{1}{12}$ times that of sphere. The position of C.M. on the line of symmetry is -



a) 4r   b) 3r   c) 2r   d) 5r

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 – 0.2 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

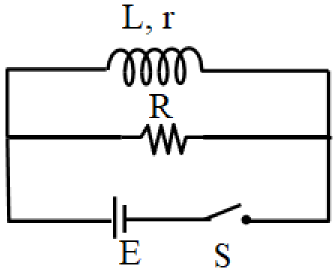
Q6 A projectile is fired with velocity u making an angle θ with the horizontal. What is the angular momentum of the projectile at the highest point about the starting point? (Given the mass of the projectile is m)

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

Q7 A uniform heavy rod of weight 10 kg ms^{-2}, cross-sectional area 100 cm^2 and length 20 cm is hanging from a fixed support. Young modulus of the material of the rod is 2 × 10^{11} Nm^{-2}. Neglecting the lateral contraction, find the elongation of rod due to its own weight.

a) 2 × 10^{-9} m   b) 5 × 10^{-8} m   c) 4 × 10^{-8} m   d) 5 × 10^{-10}m

Q8 For the circuit shown in the figure, initially the switch is closed for a long time so that 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] :

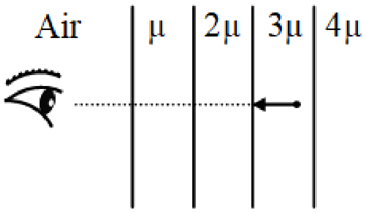


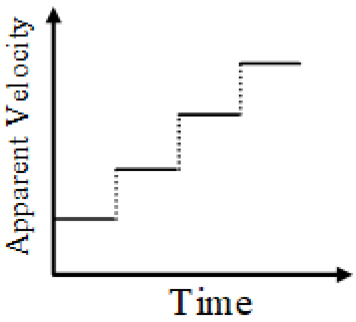
a) zero b) $\frac{E^2}{2(R+r)}$ c) $\frac{E^2 L}{2(R+r)}$ d) $\frac{E^2 R}{2r(R+r)}$

Q9 YDSE is carried out with two thin sheets of thickness 10.5 μm each and refractive indices μ_1 = 1.5 and μ_2 = 1.4 covering the slits S_1 and S_2 respectively. If white light of range 4000 Å to 7800 Å is used then which wavelength will form minima exactly at the centre O of the screen-

a) 4200 Å only b) 7000 Å only c) 5250 Å only d) 4200 Å and 7000Å

Q10 A particle is moving with a real velocity V m/s along the straight line shown. An observer at the end of the same line is viewing the particle. Which of the following graphs most appropriately represent the velocity of the particle as seen by the observer ? All the medium boundaries are in the state of rest.



a)


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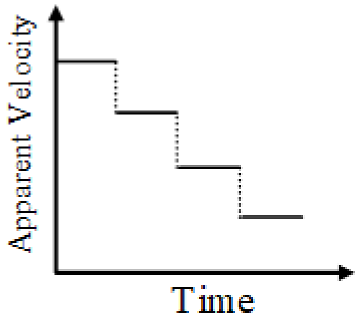
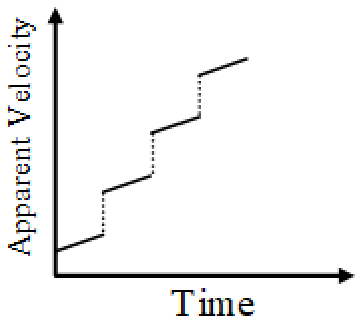
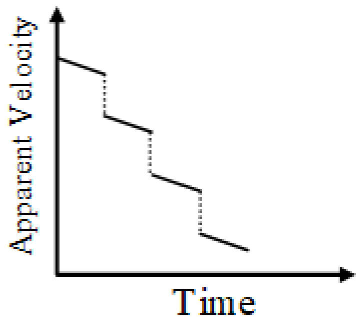
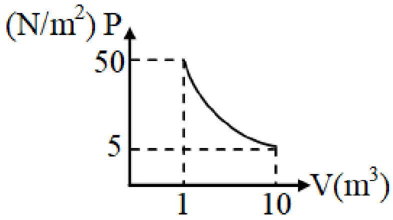


c)


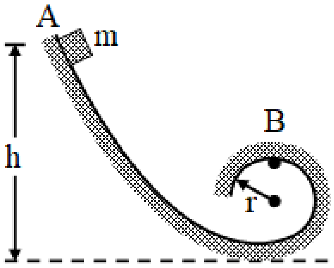
d)


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



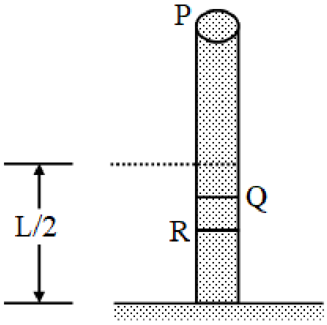
a) 11.5 J b) 115 J c) 1150 J d) 1.15 J

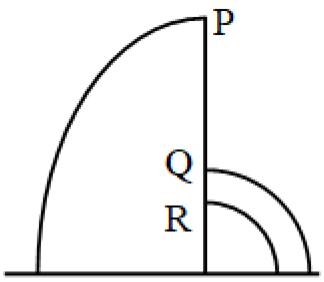
Q12 A mass m starting from A reaches B of a frictionless track. On reaching B it pushes the track with a force equal to x times its weight, then applicable relation is

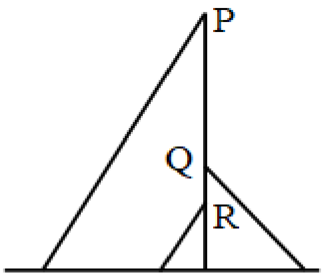


a) $h = \frac{(x+5)}{2} r$ **b)** $h = \frac{x}{2} r$ **c)** $h = r$ **d)** $h = \left(\frac{x+1}{2}\right) r$

Q13 A rod of mass M and length L falls when it is made to stand on a smooth floor. The trajectories of the points P, Q and R as shown in the figure given below are :



a)


b)


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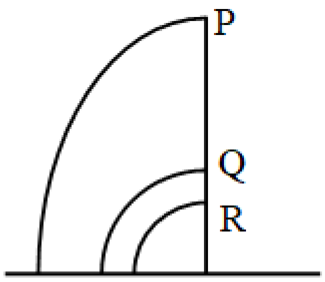
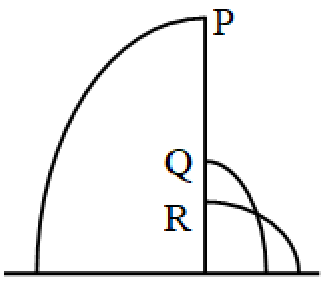
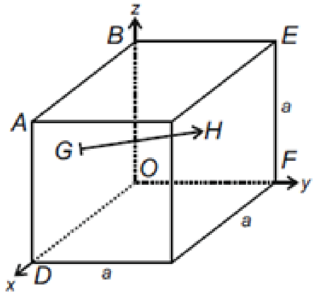


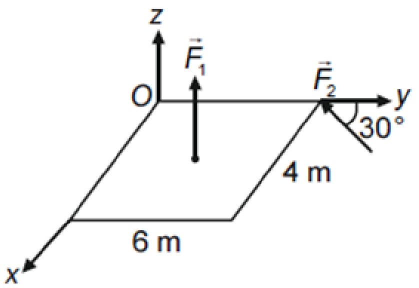
d)


Q14 In the cube of side 'a' shown in the figure, the vector from the central point of the face ABOD to the central point of the face BEFO will be



a) $\frac{1}{2}a(\hat{j}-\hat{i})$ b) $\frac{1}{2}a(\hat{i}-\hat{k})$ c) $\frac{1}{2}a(\hat{j}-\hat{k})$ d) $\frac{1}{2}a(\hat{k}-\hat{j})$

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) $(3\hat{i}-2\hat{j}-3\hat{k})F$

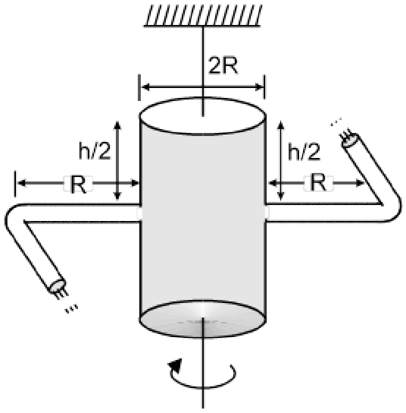
Q16 A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60° with ground level. But he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is

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

Q17 If first and second frequencies in transition to 'K' orbital are related by the relation $v_1 = kv_2$, then the first frequency in the transition to second orbital will not be equal to :

a) $v_1\left(\frac{1}{k}-1\right)$ b) $(1-k)\,v_2$ c) $v_2 - v_1$ d) $k^2\, v_2$

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:

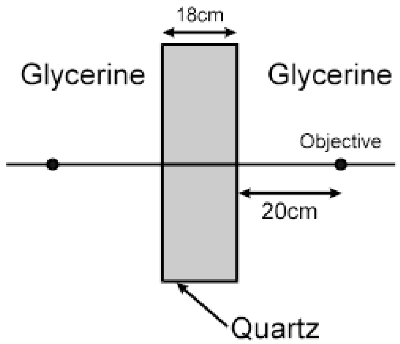


a) $4\,a\,g\,h\,\rho\,R$ **b)** $8\,a\,g\,h\,\rho\,R$ **c)** $2\,a\,g\,h\,\rho\,R$ **d)** none of these

Q19 Motion of a particle in x-y plane is described by a set of following equations $x = 4\sin\left(\frac{\pi}{2} - \omega t\right)$ m and $y = 4\sin(\omega t)$ m. The path of particle will be –

a) circular **b)** helical **c)** parabolic **d)** elliptical

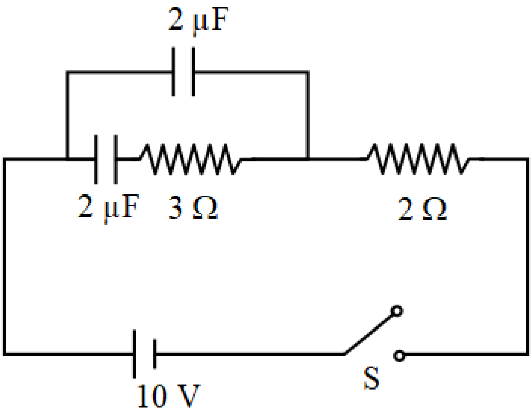
Q20 Given that, velocity of light in quartz = 1.5×10^8 m/s and velocity of light in glycerine = $(9/4) \times 10^8$ m/s Now a slab made of quartz is placed in glycerine as shown. What is the shift produced by slab?



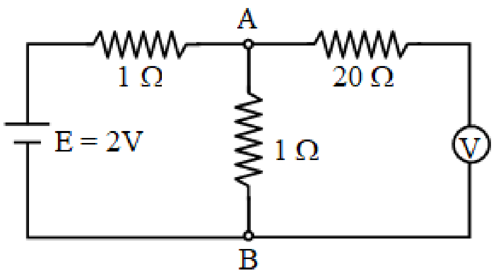
a) 6 cm **b)** 3.55 cm **c)** 9 cm **d)** 2 cm

Numerical

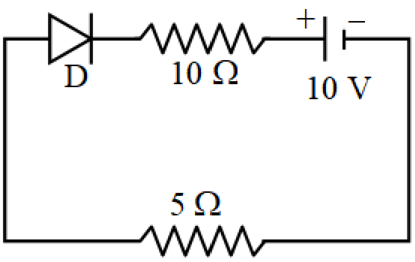
Q21 Current through the battery, at instant when the switch S is closed is (see Figure.) [Give answer in Amp.]



Q22 In the given circuit, the voltmeter and the electric cell are ideal. Find the reading (in V) of the voltmeter :



Q23 In the adjoining circuit the given diode D is ideal. The potential difference across the 5 ohm resistance is :



Q24 The first resonance length observed by a student is 20.3 cm and second resonance length is 62.7 cm. The end correction is (Give answer in cm) : (Round off to the Nearest Integer)

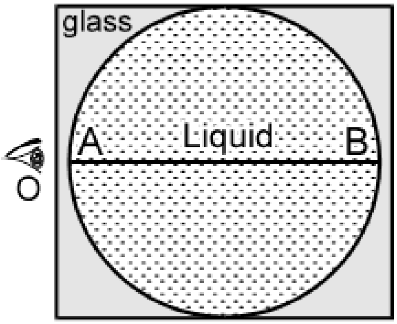
Q25 Light of intensity $32 w/m^2$ is incident on a polarizer whose transmission axis is vertical. Other two polarizer also placed in front of first such that first and last are crossed. Of intensity of emergent light is $3 w/m^2$, then the angle (in degree) between the transmission axis of second and third polarizer will be-

Q26 A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary winding of the transformer is 5 A and its efficiency is 90%, the output current (in A) would be:

Q27 A string of length 1 m and mass 5 g is fixed at both ends. The tension in the string is 8.0 N. The string is set into vibration using an external vibrator of frequency 100 Hz. The separation (in cm) between successive nodes on the string is close to

Q28 A body is projected at t = 0 with a velocity 10 ms^{-1} at an angle of 60° with the horizontal. The radius of curvature of its trajectory at t = 1 s is R. Neglecting air resistance and taking acceleration due to gravity $g = 10\ ms^{-2}$, the value of R (in m) is (Round off to the Nearest Integer)

Q29 The observer 'O' sees the distance AB as infinitely large. If refractive index of liquid is μ_1 and that of glass is μ_2, then $\frac{\mu_1}{\mu_2}$ is :

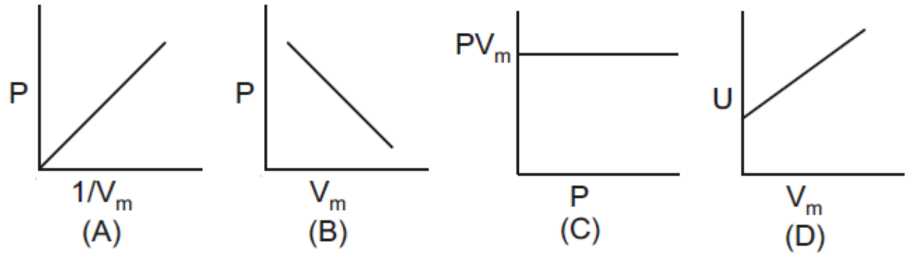


Q30 A stone of mass m, tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually, keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is given by $T = Ar^{-n}$, where A is a constant, r is the instantaneous radius of the circle, and n is _______.

Chemistry

Single Choice Question

Q31 The combination of plots which does not represent isothermal expansion of an ideal gas is

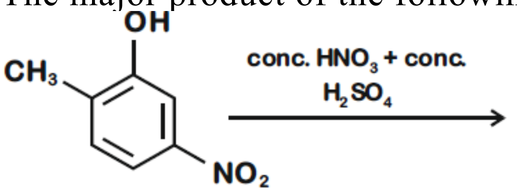


a) (A) and (C) **b)** (A) and (D) **c)** (B) and (C) **d)** (B) and (D)

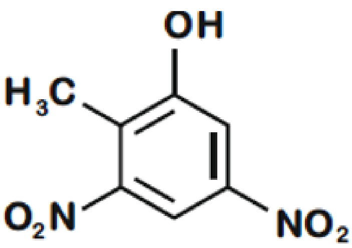
Q32 Λ_m° for NaCl, HCl and NaA are 126.4, 425.9 and 100.5 S $cm^2 mol^{-1}$, respectively. If the conductivity of 0.001 M HA is 5×10^{-5} S cm^{-1}, degree of dissociation of HA is

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

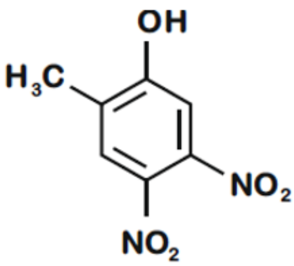
Q33 The major product of the following reaction is:



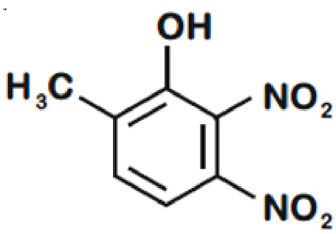
a)



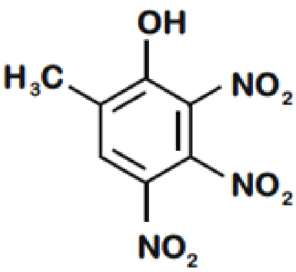
b)



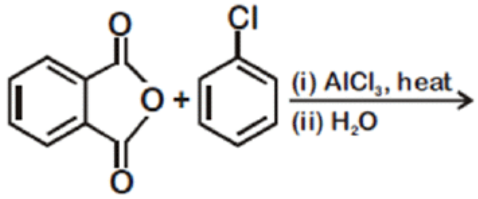
c)

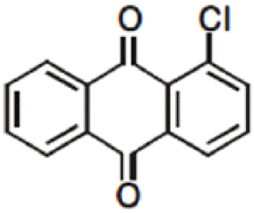


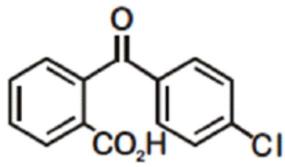
d)

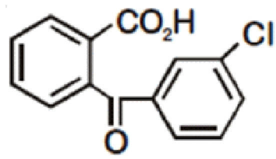


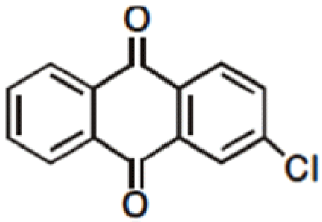
Q34 The major product of the following reaction is:



a) 

b) 

c) 

d) 

Q35 The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L^{-1}) in solution is

a) 16×10^{-4} b) 4×10^{-4} c) 6×10^{-2} d) 4×10^{-2}

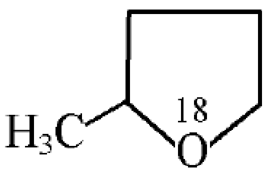
Q36 Consider the species CH_4, NH_4^+ and BH_4^-. Choose the correct option with respect to the there species:

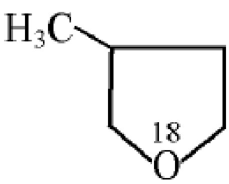
a) They are isoelectronic and only two have tetrahedral structures
b) They are isoelectronic and all have tetrahedral structures
c) Only two are isoelectronic and all have tetrahedral structures
d) Only two are isoelectronic and only two have tetrahedral structures

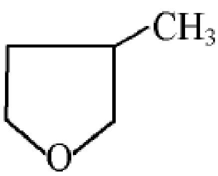
Q37 Dehydration product of 1,4-diol given below will be :

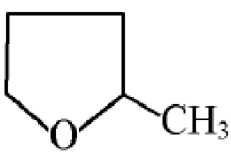
$$\underset{\displaystyle OH}{CH_3\overset{|}{C}H}CH_2CH_2\underset{\displaystyle \overset{18}{}OH}{CH_2} \xrightarrow{H_3PO_4}$$

(OH on C-2 and OH on C-5; the lower OH labelled 18)

a) 

b) 

c) 

d) 

Q38 An alkali is titrated against an acid with methyl orange as indicator, which of the following is a correct combination?

a) **Base** → Weak, **Acid** → Strong, **End point** → Yellow to pinkish red

b) **Base** → Strong, **Acid** →Strong, **End point** → Pink to colourless

c) **Base** → Weak, **Acid** →Strong, **End point** → Colourless to pink

d) **Base** → Strong, **Acid** →Strong, **End point** → Pinkish red to yellow

Q39 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)** $[Co(en)(NH_3)_2Cl_2]Cl$

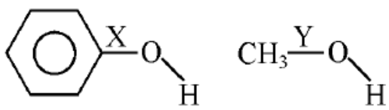
Q40 What would happen when a solution of potassium chromate is treated with an excess of dilute HNO_3 ?

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

Q41 

Which is true about C–O bond lengths?

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

Q42 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) $CH_3 - C = CH_2 + HBr \longrightarrow$

Q43 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

Q44 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

Q45 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

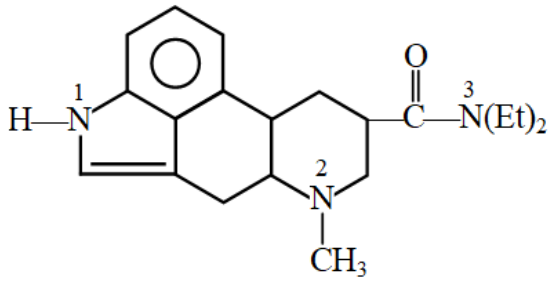
c) Its bond order is two and it is paramagnetic

d) Its bond order is one and it is diamagnetic

Q46 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

Q47 Which nitrogen atom in LSD is most basic?



a) 1 **b)** 3 **c)** 2 **d)** All are equally basic

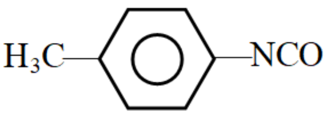
Q48 The addition of Br_2 to Z-2 butene gives :

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%)

Q49 The reaction of $CHCl_3$ and alcoholic KOH with p-toluidine gives :

a)


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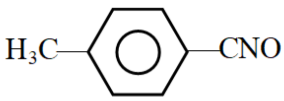

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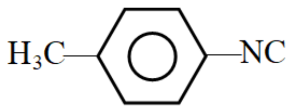
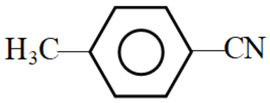


d)


Q50 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

Q51 The equilibrium constant Kc at 298 K for the reaction $A + B \rightleftharpoons C + D$ is 100. Starting with an equimolar solution with concentrations of A, B, C and D all equal to 1M, the equilibrium concentration of D is_____ (Nearest integer)

Q52 For silver, $C_p(JK^{-1}\ mol^{-1}) = 23 + 0.01T$. If the temperature (T) of 3 moles of silver is raised from 300 K to 1000 K at 1 atm pressure, what will be the value of ΔH (in kJ) report your answer in terms of nearest integer.

Q53 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 :

Q54 $A(g) + 3B(g) \rightleftharpoons 4C(g)$, initial concentration of A is equal to that of B. The equilibrium concentrations of A and C are equal. K_c of the reaction will be :

Q55 The mass of CO_2 obtained when 60 g of calcium carbonate is treated with excess of hydrochloric acid is : (Nearest integer)

Q56 Consider the cell Ag|AgBr(s)| Br^- || Cl^- | AgCl(s)| Ag at 25°C. The solubility product constants of AgBr & AgCl are respectively 5×10^{-13} & 1×10^{-10} . For what ratio of the concentrations of Br^- & Cl^- ions would the e.m.f. of the cell be zero ? Report as $1000 \times$ your answer.

Q57 Sodium oxide reacts with water to produce sodium hydroxide. 20.0 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is ____ $\times 10^{-1}$ M. (Nearest integer)
[Atomic mass : Na = 23.0, O = 16.0, H = 1.0]

Q58 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, $[Al(OH)_4]^-$

Q59 If $H_2 + 1/2\ O_2 \longrightarrow H_2O$, $\quad \Delta H = -68$ kcal
$K + H_2O + \text{water} \longrightarrow KOH\ (aq) + 1/2\ H_2$,
$\Delta H = -48$ kcal
$KOH + \text{water} \longrightarrow KOH\ (aq)$, $\Delta H = -14$ kcal
Find the heat of formation of KOH. If your answer is –X kcal then what will be the value of X/10.

Q60 The ratio of sigma and π bonds present in pyrophosphoric acid is _______

Mathematics

Single Choice Question

Q61 Let $P = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 9 & 3 & 1 \end{bmatrix}$ and $Q = [q_{ij}]$ be two 3 × 3 matrices such that $Q - P^5 = I_3$. Then $\frac{q_{21} + q_{31}}{q_{32}}$ is equal to

a) 10 b) 135 c) 9 d) 15

Q62 The maximum value of $f(x) = 3\cos^2 x + 4\sin^2 x + \cos x/2 + \sin x/2$, is -

a) 4 b) $3 + \sqrt{2}$ c) $4 + \sqrt{2}$ d) none of these

Q63 The number of ways, in which 5 girls and 7 boys can be seated at a round table so that no two girls sit together, is –

a) $126(5!)^2$ b) $7(360)^2$ c) 720 d) $7(720)^2$

Q64 Area bounded by the curve $a^2y = x^2(x + a)$ and x-axis is -

a) $\frac{a^2}{3}$ b) $\frac{a^2}{4}$ c) $\frac{a^2}{8}$ d) $\frac{a^2}{12}$

Q65 $2\sin\left(\frac{\pi}{22}\right)\sin\left(\frac{3\pi}{22}\right)\sin\left(\frac{5\pi}{22}\right)\sin\left(\frac{7\pi}{22}\right)\sin\left(\frac{9\pi}{22}\right)$ is equal to :

a) $\frac{3}{16}$ b) $\frac{1}{16}$ c) $\frac{1}{32}$ d) $\frac{9}{32}$

Q66 Let $f : R \to R$ be a function such that $f(x) = \frac{x^2 + 2x + 1}{x^2 + 1}$. Then

a) f(x) is many–one in $(-\infty, -1)$
b) f(x) is many–one in $(1, \infty)$
c) f(x) is one–one in $[1, \infty)$ but not in $(-\infty, \infty)$
d) f(x) is one–one in $(-\infty, \infty)$

Q67 If the ratio of the roots of $ax^2 + 2bx + c = 0$ is same as the ratio of the $px^2 + 2qx + r = 0$, then -

a) $\frac{2b}{ac} = \frac{q^2}{pr}$ b) $\frac{b}{ac} = \frac{q}{pr}$ c) $\frac{b^2}{ac} = \frac{q^2}{pr}$ d) None of these

Q68 Let $\lambda \in R$, the origin and the non-real roots of $2z^2 + 2z + \lambda = 0$ form the three vertices of an equilateral triangle in the Argand plane then λ is

a) 1 b) 2/3 c) 2 d) –1

Q69 If $A \cup B = A \cup C$ and $A \cap B = A \cap C$, then -

a) B = C only when $A \subseteq B$
b) B = C only when $A \subseteq C$
c) B = C
d) None of these

Q70 A parabola has its latus rectum along PQ, where P(x_1, y_1) and Q (x_2, y_2), $y_1 > 0$, $y_2 > 0$ are the end points of the latus rectums of the ellipse $\frac{x^2}{4} + \frac{y^2}{1}$ =1. Coordinates of the focus of the parabola are -

a) (0, – 1/2) **b)** (0, 0) **c)** (0, 1/2) **d)** (0, 1)

Q71 The domain of the function $f(x) = \sin^{-1}\left(\frac{x^2 - 3x + 2}{x^2 + 2x + 7}\right)$ is :

a) $[1, \infty)$ **b)** $(-1, 2]$ **c)** $[-1, \infty)$ **d)** $(-\infty, 2]$

Q72 $\alpha \in \left(0, \frac{\pi}{2}\right)$; then minimum value of $\sqrt{x^2 + x} + \frac{tan^2\alpha}{\sqrt{x^2+x}}$ is

a) 1 **b)** $\sec^2\alpha$ **c)** $2 \tan \alpha$ **d)** none

Q73 If $\int_{\frac{\pi}{2}}^{x} \sqrt{3 - 2sin^2t}\, dt + \int_0^y \cos t\, dt = 0$ then $\left(\frac{dy}{dx}\right)_{\pi,\pi}$ is equal to -

a) $\frac{1}{\sqrt{3}}$ **b)** $\sqrt{3}$ **c)** does not exist **d)** none

Q74 If in triangle ABC,A ≡ (1, 10), circumcentre ≡ (–1/3, 2/3) and orthocentre ≡ (11/3, 4/3), then the coordinates of mid point of side opposite to A is-

a) (1, – 11/3) **b)** (1, 5) **c)** (1, – 3) **d)** (1, 6)

Q75 Let the function $f(x) = \begin{cases} \frac{\log_e(1+5x) - \log_e(1+\alpha x)}{x} & ; if\ x \neq 0 \\ 10 & ; if\ x = 0 \end{cases}$

be continuous at x = 0. The α is equal to :

a) 10 **b)** -10 **c)** 5 **d)** -5

Q76 If $\int \frac{dx}{x^2(x^n+1)^{(n-1)/n}} = -[f(x)]^{1/n} + c$, then f(x) is-

a) $(1 + x^n)$ **b)** $1 + x^{-n}$ **c)** $x^n + x^{-n}$ **d)** none of these

Q77 From each of the four married couples, one of the partner's is selected at random. The probability that those selected are of the same gender is-

a) $\frac{1}{2}$ **b)** $\frac{1}{4}$ **c)** $\frac{1}{8}$ **d)** $\frac{1}{16}$

Q78 The value of c so that for all real x, the vectors $cx\hat{i} - 6\hat{j} + 3\hat{k}, x\hat{i} + 2\hat{j} + 2cx\hat{k}$ make an obtuse angle are

a) $c < 0$ **b)** $0 < c < 4/3$ **c)** $-4/3 < c < 0$ **d)** $c > 0$

Q79 The shortest distance between the lines $\frac{x-4}{4} = \frac{y+2}{5} = \frac{z+3}{3}$ and $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-4}{2}$ is –

a) $3\sqrt{6}$ **b)** $6\sqrt{3}$ **c)** $6\sqrt{2}$ **d)** $2\sqrt{6}$

Q80 Let y = y(x) be the solution of the differential equation, $(x^2 + 1)^2 \frac{dy}{dx} + 2x(x^2 + 1)y = 1$ such that y(0) = 0. If $\sqrt{a}\, y(1) = \frac{\pi}{32}$, then the value of 'a' is

a) $\frac{1}{2}$ **b)** $\frac{1}{4}$ **c)** 1 **d)** $\frac{1}{16}$

Numerical

Q81 $\sum_{r=0}^{10} r\ {}^{10}C_r . 3^r . (-2)^{10-r} =$

Q82 In the expansion of 17^{256} last two digits are-

Q83 $\lim_{x\to\infty} \left(\frac{2x^2+1}{3x^2-1}\right)^{x^2/(x-1)} =$

Q84 The value of a for which the function f(x) = a sin x + (1/3) sin 3x has an extremum at $x = \frac{\pi}{3}$ is-

Q85 If $y(x) = (x^x)^x, x>0$ then $\frac{d^2x}{dy^2} + 20$ at x = 1 is equal to :

Q86 If the surface area of a cube is increasing at a rate of 3.6 cm^2/sec, retaining its shape; then the rate of change of its volume (in cm^3/sec), when the length of a side of the cube is 10 cm, is:

Q87 If α and β be the roots of the equation $x^2 - 2x + 2 = 0$, then the least value of n for which $\left(\frac{\alpha}{\beta}\right)^n = 1$ is :

Q88 The mean and variance of seven observations are 8 and 16, respectively. If 5 of the observations are 2, 4, 10, 12, 14, then the product of the remaining two observations is:

Q89 If one end of a focal chord of the parabola, $y^2 = 16x$ is at (1, 4), then the length of this focal chord is

Q90 The minimum number of elements that must be added to the relation R = {(a, b), (b, c), (b, d)} on the set {a, b, c, d} so that it is an equivalence relation, is __________.

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**D**	**A**	**A**	**B**	**A**	**D**	**D**	**C**	**D**	**A**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**B**	**A**	**D**	**A**	**A**	**C**	**D**	**A**	**A**	**A**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**5**	**1**	**0**	**1**	**60**	**45**	**20**	**3**	**2**	**3**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**D**	**B**	**B**	**B**	**C**	**B**	**A**	**B**	**B**	**A**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**C**	**A**	**D**	**A**	**D**	**C**	**C**	**D**	**C**	**D**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**2**	**62**	**1**	**8**	**26**	**5**	**13**	**6**	**10**	**6**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**A**	**C**	**A**	**D**	**B**	**C**	**C**	**B**	**C**	**C**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**C**	**C**	**B**	**A**	**D**	**B**	**C**	**C**	**A**	**D**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**30**	**81**	**0**	**2**	**16**	**9**	**4**	**48**	**25**	**13**