Competishun

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

Date: 07/01/2024

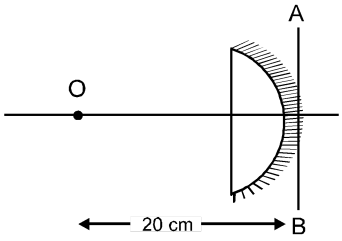
Time: 3 hours **Max. Marks:** 300

MFST-11 (23-24) & UT-2_MT-3

Physics

Single Choice Question

Q1 A point object is placed at a distance of 20 cm from a thin plane convex lens of focal length 15 cm (n = 1.5). Now the curved surface is silvered. The image will be formed at :



a) 60 cm left of AB **b)** 30 cm left of AB

c) $\frac{20}{7}$ cm left of AB **d)** 60 cm right of AB

Q2 The following data are given for a crown glass prism ;
refractive index for blue light $n_b = 1.521$
refractive index for red light $n_r = 1.510$
refractive index for yellow light $n_y = 1.550$
Dispersive power of a parallel glass slab made of the same material is :

a) 0.01 **b)** 0.02 **c)** 0.03 **d)** 0

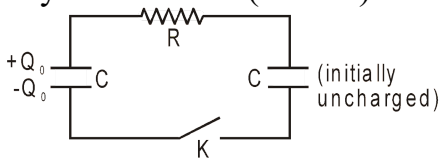
Q3 Two coaxial dipoles of dipole moments P_1 & P_2 are separated by a distance ' r '. The magnitude of electric force on P_1 due to P_2 is: ($k = 1/4\pi\epsilon_0$)

a) $\frac{2kP_1P_2}{r^3}$ **b)** $\frac{2kP_1P_2}{r^2}$ **c)** $\frac{6kP_1P_2}{r^4}$ **d)** zero

Q4 Two racing cars of masses m_1 and m_2 are moving in circles of radii r and 2r respectively and their angular speeds are equal. The ratio of the time taken by cars to complete one revolution is :

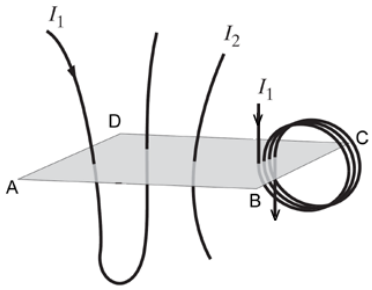
a) $m_1 : m_2$ **b)** 1 : 2 **c)** 1 : 1 **d)** $m_1 : 2m_2$

Q5 The shown circuit comprises of two identical capacitors of capacitance C Farad and resistor of resistance R Ω. The key K is initially open. At time t = 0 the charge on left capacitor is Q_0 Coloumbs and the right capacitor is uncharged as shown. The key K is closed at time t = 0. Then the magnitude of current in amperes through the resistor at any later time t (in sec.) is :



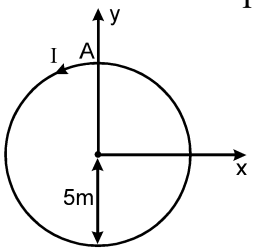
a) $\frac{Q_0}{RC}e^{\frac{-t}{RC}}$ **b)** $\frac{Q_0}{RC}e^{\frac{-2t}{RC}}$ **c)** $\frac{Q_0}{2RC}e^{\frac{-2t}{RC}}$ **d)** $\frac{Q_0}{2RC}e^{\frac{-t}{RC}}$

Q6 Three distinct current carrying wires intersect a finite rectangular plane ABCD . The current in left wire and the loop is I_1. The direction of current in left most wire and right most loop is downwards as shown in figure. The current I_2 through middle wire is adjusted so that the path integral of the total magnetic field along the perimeter of the rectangle is zero, that is, $\oint_{ABCDA}\vec{B}.\vec{d\ell}=0$. Then the current I2 is -



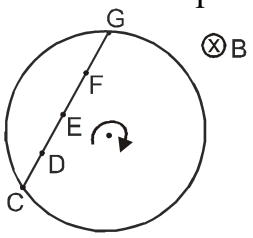
a) 2 I_1 and upwards **b)** 2 I_1 and downwards
c) 4 I_1 and upwards **d)** 3 I_1 and downwards

Q7 A ring of radius 5 m is lying in the x-y plane and is carrying current of 1 A in anti-clockwise sense. If a uniform magnetic field $\vec{B}=3\hat{i}+4\hat{j}$ is switched on, then the co-ordinates of point about which the loop will lift up is:



a) (3, 4) **b)** (4, 3) **c)** (3, 0) **d)** (0, 3)

Q8 A conducting disc rotates about its axis (passing through centre and perpendicular to the plane of disc) in a uniform magnetic field B and magnetic field is perpendicular to plane of disc. There are certain points marked on a chord joining two points C and G on the periphery of the disc. Point E is the midpoint of the chord. Points D and F are the midpoints of segments CE and EG respectively. The emf induced is maximum between the points:(Do not consider the emf due to centrifugal forces)

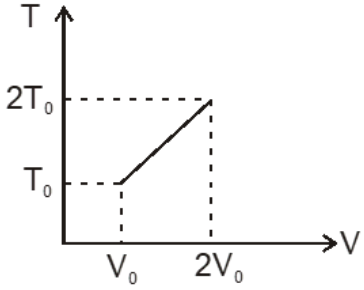


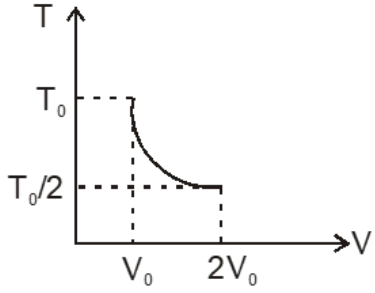
a) C and D **b)** C and E **c)** C and G **d)** D and F

Q9 A monoatomic ideal gas undergoes a process given by $2dU + 3dW = 0$, then the process is:

a) isobaric **b)** adiabatic **c)** isothermal **d)** none of these

Q10 For two thermodynamic process temperature and volume diagram are given. In first process, it is a straight line having initial and final coordinates as (V_0, T_0) and $(2V_0, 2T_0)$, where as in second process it is a rectangular hyperbola having initial and final coordinates (V_0, T_0) and $(2V_0, T_0/2)$. Then ratio of work done in the two processes must be



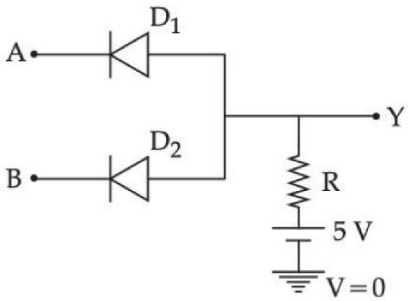


a) 1 : 2 **b)** 2 : 1 **c)** 1 : 1 **d)** None of these

Q11 A photon is incident upon a hydrogen atom ejects an electron with a kinetic energy 10.7 eV. If the ejected electron was in the first excited state. Energy of photon incident nearly will be :

a) 14.5 eV **b)** 20.9 eV **c)** 24.3 eV **d)** 14.1 eV

Q12 In the circuit, the logical value of A = 1 or B = 1 when potential at A or B is 5V and the logical value of A = 0 or B = 0 when potential at A or B is 0 V. The truth table of the given circuit will be :



a)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

b)

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

c)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

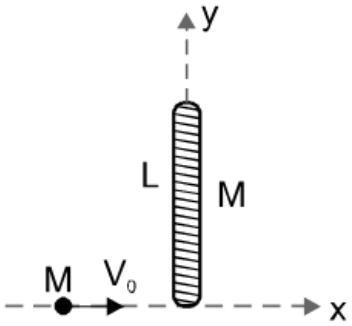
d)

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

Q13 A heavy nucleus having mass number 200 gets disintegrated into two small fragments of mass number 80 and 120. If binding energy per nucleon for parent atom is 6.5 M eV and for daughter nuclei is 7 MeV and 8 MeV respectively, then the energy released in the decay will be :

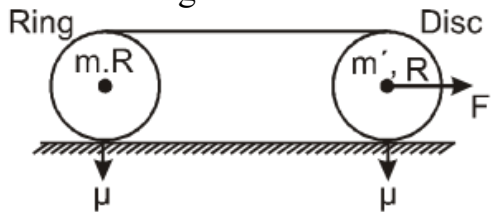
a) 200 MeV **b)** − 220 MeV **c)** 220 MeV **d)** 180 MeV

Q14 A uniform rod of length L and mass M rests on horizontal frictionless table. A particle of equal mass M is moving along the 'x' axis at a speed V_0. At time t = 0 the particle strikes one end of the rod and sticks to it. Consider (particle + rod) as combined system. The position $\vec{R}_{cm}$ of centre of mass of system as a function of time is :



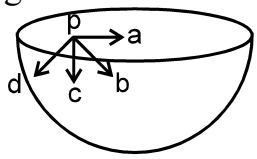
a) $\frac{V_0}{2}t\,\hat{i}+\frac{L}{4}\hat{j}$ **b)** $\frac{V_0}{2}t\,\hat{i}+\frac{L}{2}\hat{j}$ **c)** $V_0t\,\hat{i}+\frac{L}{2}\hat{j}$ **d)** $V_0t\,\hat{i}+\frac{L}{4}\hat{j}$

Q15 A disc and a ring having different masses and same radius are connected with an ideal string as shown in the figure. Both are placed on rough surface of coefficient of friction μ. A force F is applied on the centre of disc horizontally. Assume that initially both the bodies were at rest and they would be rolling without slipping when they start moving. Then frictional force acting on the ring is.



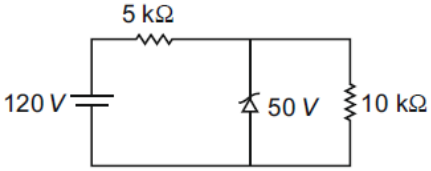
a) $\frac{2F}{3}$ **b)** $\frac{F}{3}$ **c)** zero **d)** None of these

Q16 Figure show a hemispherical shell having uniform mass density. The direction of gravitational field intensity at point P will be along:



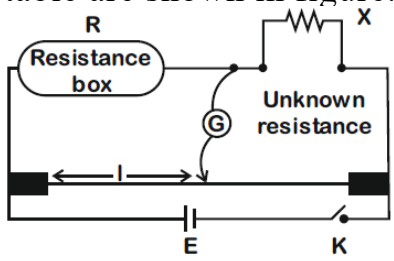
a) a **b)** b **c)** c **d)** d

Q17 For the circuit shown below, the current through the Zener diode is:



a) Zero **b)** 9 mA **c)** 14 mA **d)** 5 mA

Q18 In a meter bridge experiment, the circuit diagram and the corresponding observation table are shown in figure.



Sl. No	R (Ω)	l (cm)
1.	1000	60
2.	100	13
3.	10	1.5
4.	1	1.0

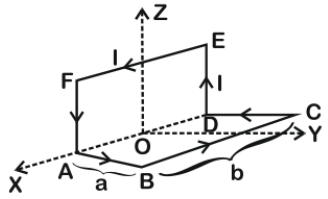
Which of the readings is inconsistent ?

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

Q19 A capillary tube made of glass of radius 0.15 mm is dipped vertically in a beaker filled with methylene iodide (surface tension = 0.05 Nm^{-1}, density = 667 kg m^{-3}) which rises to height h in the tube. It is observed that the two tangents drawn from liquid-glass interfaces (from opp. sides of the capillary) make an angle of 60° with one another. Then h is close to (g = 10 ms^{-2})

a) 0.049 m **b)** 0.087 m **c)** 0.137 m **d)** 0.172 m

Q20 A wire carrying current I is bent in the shape ABCDEFA as shown, where rectangle ABCDA and ADEFA are perpendicular to each other. If the sides of the rectangles are of lengths a and b, then the magnitude and direction of magnetic moment of the loop ABCDEFA is



a) abl, along $\left(\frac{\hat{j}}{\sqrt{5}}+\frac{2\hat{k}}{\sqrt{5}}\right)$

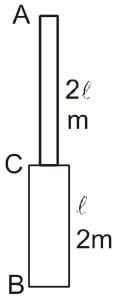
b) $\sqrt{2}$ abl, along $\left(\frac{\hat{j}}{\sqrt{2}}+\frac{\hat{k}}{\sqrt{2}}\right)$

c) abl, along $\left(\frac{\hat{j}}{\sqrt{2}}+\frac{\hat{k}}{\sqrt{2}}\right)$

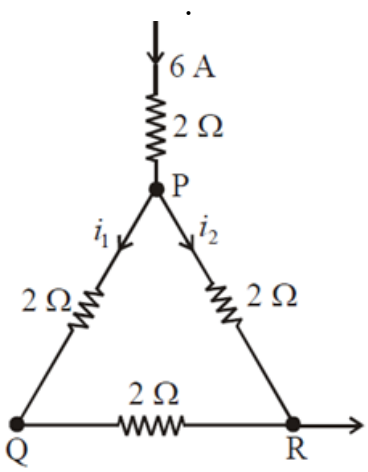
d) $\sqrt{2}$ abl, along $\left(\frac{\hat{j}}{\sqrt{5}}+\frac{2\hat{k}}{\sqrt{5}}\right)$

Numerical

Q21 A composite rod is made of two rods: one of mass m, length 2ℓ and another of mass 2m and length ℓ as shown. When the rod is suspended from A and allowed small oscillation in vertical plane, time period is T. Find the distance (in centimeter) of the point of suspension on other side from the junction so that time period is still the same. Take ℓ = 60 cm.

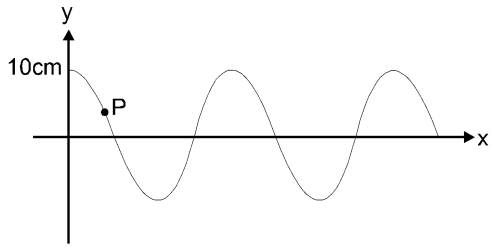


Q22 A current of 6 A enters one corner P of an equilateral triangle PQR having 3 wires of resistance 2 Ω each and leaves by the corner R. The currents il in ampere is



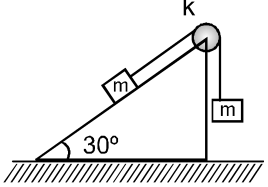
Q23 A ball will a speed of 9 m/s collides with another identical ball at rest. After the collision, the direction of each ball makes an angle of 30° with the original direction. The ratio of velocities of the balls after collision is x : y, where x is _____.

Q24 A transverse sinusoidal wave moves along a string in the positive x-direction at a speed of 10 cm/s. The wavelength of the wave is 0.5 m and its amplitude is 10 cm. At a particular time t, the snap-shot of the wave is shown in figure. The speed of point P is $x\sqrt{2}\pi$ cm/s when its displacement is $\frac{10}{\sqrt{2}}$ cm, then the value of x is :



Q25 A position dependent force $F=\frac{1}{2}|x-4|$ is acting along x-axis, where x is in meter and F is in Newton. Find the work done (in joule) by the force in moving a particle from origin to x = 8 m rectilinearly along x-axes.

Q26 Two blocks of equal mass 'm' are connected by massless string and pulley as shown in figure. Now the blocks are left to move. Then the force exerted by pulley on the clamp is $\frac{3\sqrt{3}Mg}{k}$. Find the value k ?



Q27 On an inclined plane of inclination 30°, a ball is thrown at an angle of 60° with the horizontal from the foot of the incline with a velocity of 10 $\sqrt{3}$ ms^{-1}. If g = 10 ms^{-2}, then the time in which ball will hit the inclined plane is -

Q28 A uniform chain of 6 m length is placed on a table such that a part of its length is hanging over the edge of the table. The system is at rest. The co-efficient of static friction between the chain and the surface of the table is 0.5, the maximum length of the chain hanging from the table is _____m.

Q29 The displacement current of 4.425 μA is developed in the space between the plates of parallel plate capacitor when voltage is changing at a rate of 10^6 Vs^{-1}. The area of each plate of the capacitor is 40 cm^2. The distance between each plate of the capacitor is $x \times 10^{-3}$ m. The value of x is,
(Permittivity of free space, $E_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2})

Q30 Two identical conducting spheres with negligible volume have 2.1 nC and –0.1 nC charges, respectively. They are brought into contact and then separated by a distance of 0.5 m. The electrostatic force acting between the spheres is_____$\times 10^{-9}$ N.
$\left[\text{Given : } 4\pi\varepsilon_0 = \frac{1}{9\times10^9}\text{ SI unit}\right]$

Chemistry

Single Choice Question

Q31 Consider the following changes :
$M(s) \rightarrow M(g)$ .....(i)
$M(s) \rightarrow M^{2+}(g) + 2e^-$. .....(ii)
$M(g) \rightarrow M^{+}(g) + e^-$. .....(iii)
$M+(g) \rightarrow M^{2+}(g) + e^-$. .....(iv)
$M(g) \rightarrow M^{2+}(g) + 2e^-$. .....(v)
The second ionization energyof M could be calculated from the enrgy values associated with :

a) 1 + 3 + 4 **b)** 2 – 1 + 3 **c)** 1 + 5 **d)** 5 – 3.

Q32 In which of the following molecules number of lone paris and bond pairs on central atom are not equal ?

a) H_2O **b)** I_3^- **c)** O_2F_2 **d)** SCl_2

Q33 A hypothetical reaction :
$A_2 + B_2 \longrightarrow 2AB$ Follows mechanism as given below :

$A_2 \underset{}{\overset{k_c}{\rightleftharpoons}} A + A$ .....(fast)

$A + B_2 \overset{k_1}{\rightleftharpoons} AB + B$ .....(slow)

$A + B_2 \overset{k_2}{\rightleftharpoons} AB$ .....(fast)

The order of overall reaction is :

a) 2.5 **b)** 1 **c)** 3/2 **d)** Zero

Q34 In which of the following reactions, the equilibrium remains unaffected on addition of small amount of argon at constant volume.

a) $H_2 + I_2 \rightleftharpoons 2HI(g)$

b) $PCI_5(g) \rightleftharpoons PCI_3(g) + Cl_2(g)$

c) $N_2 + 3H_2 \rightleftharpoons 2NH_3(g)$

d) The equilibrium will be remain unaffected in all the three cases.

Q35 Which of the followings is/are correct :
(i) α-D-glucose and β-D-glucose are anomer of each other.
(ii) D-Galactose is C-4 epimer of D-glucose.
(iii) Sucrose is a reducing sugar.
(iv) Cellulose is natural polymer of β-D-glucopyranose

a) i, ii, iii, iv **b)** i, ii, iii **c)** i, ii, iv **d)** ii, iii, iv

Q36 Which of the following will have three stereoisomeric forms?
(i) $[Cr(NO_3)_3(NH_3)_3]$ (ii) $K_3[Co(C_2O_4)_3]$ (iii) $K_3[CoCI_2(C_2O_4)_2]$ (iv) $[CoBrCI(en)_2]$

a) (iii) and (iv) **b)** (i), (iii) and (iv) **c)** (iv) only **d)** All four

Q37 Sulphide ions reacts with sodium nitropruside giving a coloured solution. In the reaction, the oxidation state of iron :

a) Changes from +2 to +4 **b)** Changes from +3 to +2

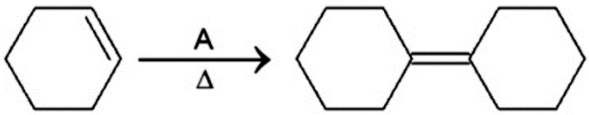
c) Changes from +2 to +3 **d)** Does not change

Q38 Three faradays of electricity are passed through molten Al_2O_3, aqueous solution of $CuSO_4$ and molten NaCl taken in different electrolytic cells. The amount of Al,Cu and Na deposited at the cathodes will be in the ratio of

a) 1 mole : 2 mole : 3 mole **b)** 3 mole : 2 mole : 1mole

c) 1 mole : 1.5 mole : 3 mole **d)** 1.5 mole : 2 mole : 3 mole

Q39



A can be

a) Conc. H_2SO_4 **b)** Alc. KOH **c)** Et_3N **d)** t–BuOK

Q40 A 0.001 molal solution of a complex $[MA_8]$ in water has the freezing point of –0.0054°C. Assuming100% ionization of the complex salt and K_f for H_2O = 1.86 km^{-1}, write the correct representation for the complex

a) $[MA_8]$ **b)** $[MA_7]A$ **c)** $[MA_6]A_2$ **d)** $[MA_5]A_3$

Q41 The thermal stability of the hydrides of group 15 follows the order:

a) $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$ **b)** $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$

c) $PH_3 > NH_3 > AsH_3 > SbH_3 < BiH_3$ **d)** $AsH_3 < PH_3 > SbH_3 > BiH_3 > NH_3$

Q42 For the first-order reaction T_{av} (average life), T_{50} and T_{75} in the increasing order are :

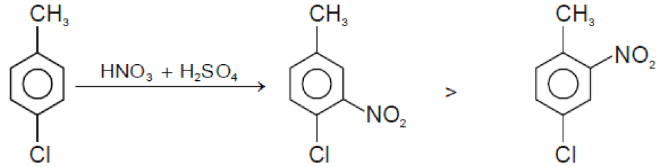
a) $T_{50} < T_{av} < T_{75}$ **b)** $T_{50} < T_{75} < T_{av}$ **c)** $T_{av} < T_{50} < T_{75}$ **d)** $T_{av} = T_{50} < T_{75}$

Q43 How many ml water should be added to 100ml HCl solution (d = 1.5 g/ml) 80% by wt. to make it a solution of 40% by wt. of density = 1 g/ml.

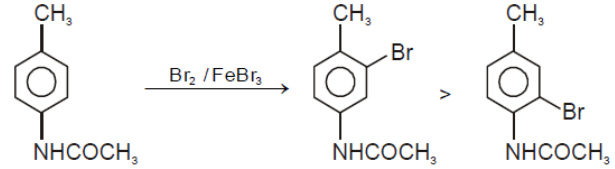
a) 100 ml **b)** 300 ml **c)** 200 ml **d)** none of these

Q44 Select the reaction in which the correct orientation have been mentioned in the major products.

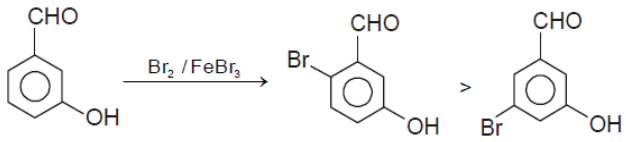
a)



b)



c)



d) All of these are correct

Q45 Aryl halides are less reactive towards nucleophilic substitution reactions as compared to alkyl halides due to

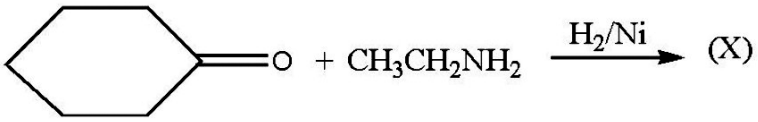
a) The formation of less stable carbocation

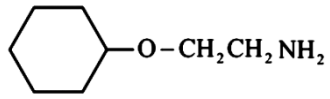
b) Shorter carbon halogen bond than usual

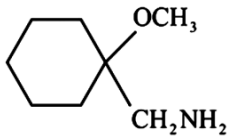
c) sp^2–hybridized carbon attached to the halogen

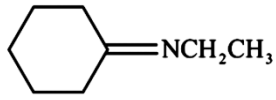
d) All of the above

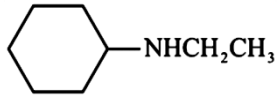
Q46 What is the product (X) in the given reaction?

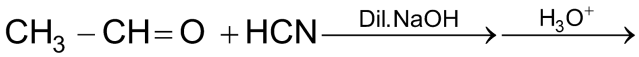


a) 

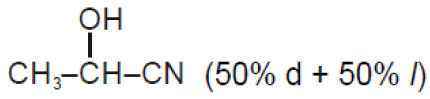
b) 

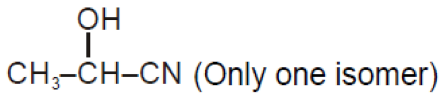
c) 

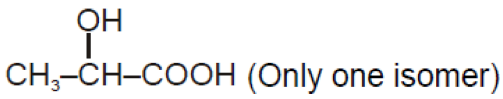
d) 

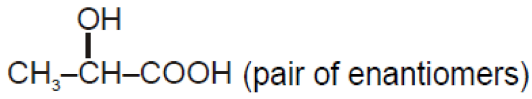
Q47 

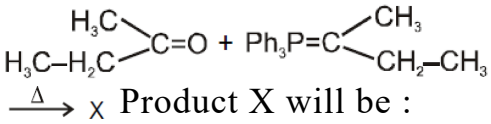
Products are :

a) 

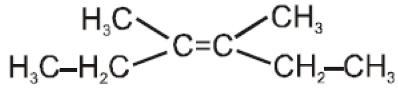
b) 

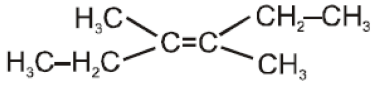
c) 

d) 

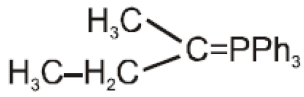
Q48 

Product X will be :

a) 

b) 

c) Both (1) and (2)

d) 

Q49 For the conversion of benzene into m-chlorobenzoic acid, the correct sequence of reagents is :

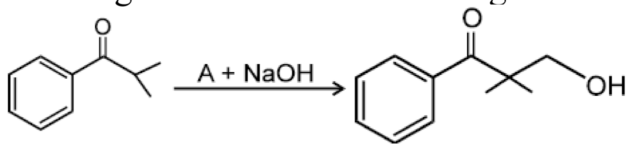
a) (i) C_2H_5Cl, $AlCl_3$ (ii) Cl_2,Fe
(iii) $KMnO_4$, H^+,Δ

b) (i) CO,HCl, $AlCl_3$ (ii) Cl_2,Fe
(iii) $KMnO_4$, H^+,Δ

c) (i) Cl_2, $AlCl_3$ (ii) C_2H_5Cl, $AlCl_3$
(iii) $KMnO_4$, H+, Δ

d) (i) HCOOH, $AlCl_3$ (ii) Cl_2,Fe

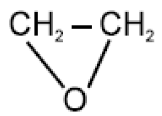
Q50 The reagent ‘A’ for the following reaction would be



a) $CH_3-\overset{O}{\overset{||}{C}}-OC_2H_5$

b) CH_3CHO

c) HCHO

d) 

Numerical

Q51 In Duma's method of estimation of nitrogen, 0.1840 g of an organic compound gave 30 mL of nitrogen collected at 287 K and 758 mm of Hg pressure. The percentage composition of nitrogen in the compound is _____. (Round off to the Nearest Integer). [Given : Aqueous tension at 287 K = 14 mm of Hg]

Q52 The number of orbitals with n = 5, m_1 = + 2 is _______. (Round off to the Nearest Integer).

Q53 Sulphurous acid (H_2SO_3) has $Ka_1 = 1.7 \times 10^{-2}$ and $Ka_2 = 6.4 \times 10^{-8}$. The pH of 0.588 M H_2SO_3 is __________. (Round off to the Nearest Integer)

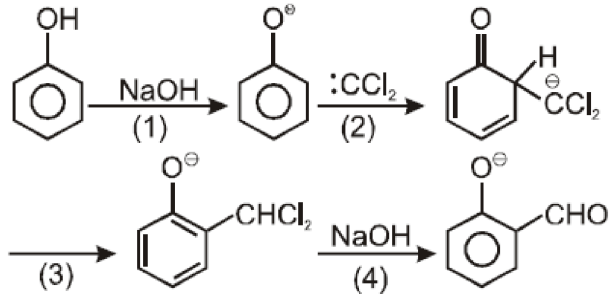
Q54 When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, _________ $\times 10^{-5}$ moles of lead sulphate precipitate out. If your answer is X then what will be the value of $\frac{X}{25}$. (Round off to the Nearest Integer).

Q55 For the reaction A(g) $\rightleftharpoons$ B(g) at 495 K, Δ_rG^o = –9.478 kJ mol^{-1}.
If we start the reaction in a closed container at 495 K with 22 millimoles of A, the amount of B is the equilibrium mixture is ________ millimoles. (Round off to the Nearest Integer).
[R = 8.314 J mol^{-1} K^{-1}; *l*n 10 = 2.303]

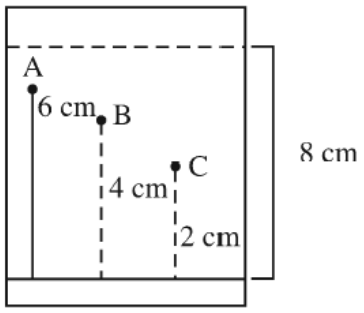
Q56 The standard enthalpies of formation of Al_2O_3 and CaO are –1675 kJ mol^{-1} and –635 $kJmol^{-1}$ respectively.
For the reaction
$3CaO + 2Al \rightarrow 3Ca + Al_2O_3$ the standard reaction enthalpy $\Delta_r H^0$ = _____ kJ.
If your answer is X then what will be the value of $\frac{X}{10}$.
(Round off to the Nearest Integer).

Q57 The number of moles of potassium dichromate ($K_2Cr_2O_7$) required for the complete reaction of 36 mole of cuprous sulphide (Cu_2S) with its acidified solution producing Cu^{2+} ions and $SO_2(g)$ is :

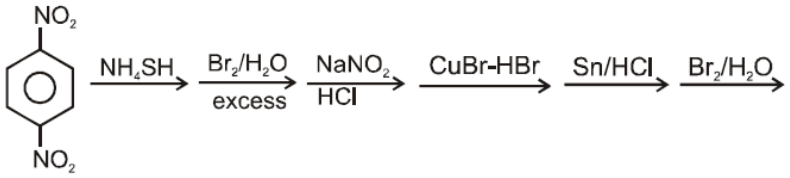
Q58 The rate determing step of following reaction is:



Q59 Three organic compounds A, B and C were allowed to run in thin layer chromatography using hexane and gave the following result (see figure). The R_f, value of the least polar compound is ____ × 10^{-2}



Q60



major end product.
Find the total number of halogen atoms present in the major end product :

Mathematics

Single Choice Question

Q61 Let $f(x) = e^x - x$ and $g(x) = x^2 - x$, $\forall\, x \in R$. Then the set of all $x \in R$, where the function $h(x) = (fog)(x)$ is increasing, is :

a) $\left[-1, \frac{-1}{2}\right] \cup \left[\frac{1}{2}, \infty\right)$ **b)** $[0, \infty)$ **c)** $\left[0, \frac{1}{2}\right] \cup [1, \infty)$ **d)** $\left[\frac{-1}{2}, 0\right] \cup [1, \infty)$

Q62 If $f(x) = \sqrt{\frac{1+\sin^{-1}x}{1-\tan^{-1}x}}$; then $f'(0)$ is equal to :

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

Q63 From a pack of 52 well shuflled cards, cards are drawn one by one without replacement. If 4^{th} drawn card is found to be ace, then what is the probability, that there are no more aces left in the pack is :-

a) $\frac{1}{{}^{48}C_3 + 3\,{}^{49}C_2 + 1}$ **b)** $\frac{1}{{}^{48}C_3 + {}^{49}C_2 + 1}$ **c)** $\frac{1}{3\,{}^{48}C_3 + {}^{49}C_2 + 1}$ **d)** $\frac{1}{{}^{52}C_4 + 1}$

Q64 Let $A = \begin{bmatrix} 2 & b & 1 \\ b & b^2+1 & b \\ 1 & b & 2 \end{bmatrix}$ where $b > 0$. Then find minimum value of $\frac{|A|}{b}$ is

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

Q65 Let $\vec{a} = 3\hat{i} + 2\hat{j} + x\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, for some real x. Then $|\vec{a} \times \vec{b}| = r$ is possible if :

a) $3\sqrt{\frac{3}{2}} < r < 5\sqrt{\frac{3}{2}}$ **b)** $\sqrt{\frac{3}{2}} < r \le 3\sqrt{\frac{3}{2}}$ **c)** $0 < r \le \sqrt{\frac{3}{2}}$ **d)** $r \ge 5\sqrt{\frac{3}{2}}$

Q66 if $a^2 + b^2 + c^2 = 0$ and matrix $A = \begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix}$ and if $|adj(adjA)| = 32\lambda$ $a^8b^8c^8$, $(a, b, c \neq 0)$, then $\lambda =$

a) 8 **b)** 16 **c)** 32 **d)** 4

Q67 If $2a + 2b + 3c = \frac{1}{5}$ and $a, b, c \in R^+$, then maximum value of term independent of x in the expansion of $(abx^{1/2} + cx^{-1/3})^{25}$ is -

a) ${}^{25}C_{10}$ **b)** ${}^{25}C_{10}(35)^{25}$ **c)** ${}^{25}C_{15}\left(\frac{1}{35}\right)^{35}$ **d)** None of these

Q68 If α, β are the roots of equation $x^2 - 2x + 5 = 0$, then equation, whose roots are : $\alpha^3 + \alpha^2 - \alpha + 22$, $\beta^3 + 4\beta^2 - 7\beta + 35$ is :

a) $x^2 - 57x + 770 = 0$ **b)** $x^2 - 12x + 35 = 0$

c) $x^2 - 2x + 5 = 0$ **d)** $x^2 - 11x + 25 = 0$

Q69 If the equation $4y^3 - 8a^2yx^2 - 3ay^2x + 8x^3 = 0$ represent three straight lines, two of them are perpendicular then sum of all possible values of a is equal to :

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

Q70 Let $f(-1, \infty) \to R$ be defined by $f(0) = 1$ and $f(x) = \frac{1}{x}\log_e(1+x), x \neq 0$. Then the function f

a) decreases in $(-1, 0)$ and increases in $(0,\infty)$

b) increases in $(-1, \infty)$

c) increases in $(-1, 0)$ and decreases in $(0,\infty)$

d) decreases in $(-1, \infty)$

Q71 Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$

$265\left(\lim_{h\to 0}\frac{h^4 + 3h^2}{(f(1-h) - f(1))\sin 5h}\right) =$

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

Q72 Given that for a, b, c, d $\in$ R, if a sec (200°) – c tan (200°) = d and b sec (200°) + d tan (200°) = c, then find the value of $\left(\frac{a^2 + b^2 + c^2 + d^2}{bd - ac}\right)\sin 20°$.

a) 2 **b)** 1 **c)** 0 **d)** None of these

Q73 Let f(x) = min. $(x+1, \sqrt{1-x})$ for all $x \leq 1$. Then the area bounded by y = f(x) and the x-axis is :-

a) $\frac{7}{3}$ sq. units **b)** $\frac{1}{6}$ sq. units **c)** $\frac{11}{6}$ sq. units **d)** $\frac{7}{6}$ sq. units

Q74 Evaluate $\int \frac{\left(\sqrt[3]{x + \sqrt{2-x^2}}\right)\left(\sqrt[6]{1 - x\sqrt{2-x^2}}\right)}{\sqrt[3]{1-x^2}} dx ; x \in (0,1)$:

a) $2^{\frac{1}{6}}x + C$ **b)** $2^{\frac{1}{12}}x + C$ **c)** $2^{\frac{1}{3}}x + C$ **d)** None of these

Q75 The general solution of differential equation, $\sin 2x\left(\frac{dy}{dx} - \sqrt{\tan x}\right) - y = 0$ is

a) $y\sqrt{\cot x} = \tan x + C$ **b)** $y\sqrt{\cot x} = x + C$ **c)** $y\sqrt{\tan x} = \cot x + C$ **d)** $y\sqrt{\tan x} = x + C$

Q76 The set of values of k for which the circle C : $4x^2 + 4y^2 - 12x + 8y + k = 0$ lies inside the fourth quadrant and the point $\left(1, -\frac{1}{3}\right)$ lies on or inside the circle C is :

a) An empty **b)** $\left(6, \frac{95}{9}\right]$ **c)** $\left[\frac{80}{9}, 10\right)$ **d)** $\left(9, \frac{92}{9}\right]$

Q77 The vertex C of a triangle ABC is (4, –1). The equation of altitude AD and Median AE are 2x – 3y + 12 = 0 and 2x + 3y = 0 respectively then slope of side AB is :

a) $-\frac{3}{7}$ **b)** $-\frac{3}{2}$ **c)** $-\frac{9}{11}$ **d)** None of these

Q78 The foci of a hyperbola lie at the vertices of the ellipse $\frac{x^2}{100} + \frac{y^2}{64} = 1$ and its directrixes pass through the foci of the ellipse. The equation of the hyperbola must be :-

a) $\frac{x^2}{100} - \frac{y^2}{64} = 1$ **b)** $\frac{x^2}{40} - \frac{y^2}{60} = 1$ **c)** $\frac{x^2}{60} - \frac{y^2}{40} = 1$ **d)** None of these

Q79 The adjacent side vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$ of a rectangle OACB are $\vec{a}$ and $\vec{b}$ respectively, where O is the origin. If $16|\vec{a} \times \vec{b}| = 3(|\vec{a}| + |\vec{b}|)^2$ and θ be the acute angle between the diagonals OC and AB then the value of tan(θ/2) is :

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

Q80 A batsman can score 0, 1, 2, 3, 4 or 6 runs from a ball. The number of different sequences in which he can score exactly 30 runs in an over of six balls :

a) 4 **b)** 72 **c)** 56 **d)** 71

Numerical

Q81 If $f(x) = \int \frac{5x^8 + 7x^6}{(x^2 + 1 + 2x^7)^2} dx$, $(x \geq 0), f(0) = 0$ and $f(1) = \frac{1}{K}$, then the value of K is

Q82 Let A = {2, 3, 4} and B = {8, 9, 12}. Then the number of elements in the relation R = {((a$_1$, b$_1$), (a$_2$, b$_2$)) ∈ (A × B, A × B) : a$_1$ divides b$_2$ and a$_2$ divides b$_1$} is :

Q83 Let the image of the point P(1, 2, 3) in the line L : $\frac{x-6}{3} = \frac{y-1}{2} = \frac{z-2}{3}$ be Q. let R(α, β, γ) be a point that divides internally the line segment PQ in the ratio 1 : 3. Then the value of 22(α + β + γ) is equal to

Q84 Let $f : R \to R$ satisfy the equation f(x + y) = f (x). f(y) for all x, y ∈ R and f(x) ≠0 for any x ∈ R. If Ihe function f is differentiable at x = 0 and f' (0) = 3, then $\lim_{h \to 0} \frac{1}{h}(f(h) - 1)$ is equal to _____.

Q85 The parabola y = 4 – x^2 has vertex P. It intersects x-axis at A and B. If the parabola is translated from its initial position to a new position by moving its vertex along the line y = x + 4, so that it intersects x–axis at B and C, then abscissa of C will be :

Q86 The numbers $\frac{1}{3}, \frac{1}{3}\log_x y, \frac{1}{3}\log_y z, \frac{1}{7}\log_z x$ are in H.P. If $y = x^r$ and $z = x^s$, then $4(r + s) =$

Q87 If $\sum_{n=0}^{\infty} 2\cot^{-1}\left(\frac{n^2+n+4}{2}\right) = k\pi$, then find the value of k.

Q88 Let $f(x) = \int_0^x e^{x-y} f'(y)dy - \left(x^2 - x + 1\right)e^x$ Find the number of roots of the equation f(x) = 0.

Q89 Complex number z_1 and z_2 satisfy $z + \bar{z} = 2|z - 1|$ and $\arg(z_1 - z_2) = \frac{\pi}{4}$. Then the value of $\text{Im}(z_1 + z_2)$ is: (where z_1 & z_2 are none zero complex number)

Q90 If the mean and variance of the frequency distribution.

x_i	2	4	6	8	10	12	14	16
f_i	4	4	α	15	8	β	4	5

are 9 and 15.08 respectively, then the value of $\alpha^2 + \beta^2 - \alpha\beta$ is _____.

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**C**	**B**	**C**	**C**	**B**	**C**	**A**	**B**	**D**	**B**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**D**	**A**	**C**	**A**	**C**	**C**	**B**	**D**	**B**	**B**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**20**	**2**	**1**	**2**	**8**	**4**	**2**	**2**	**8**	**36**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**D**	**B**	**C**	**D**	**C**	**A**	**D**	**C**	**A**	**C**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**B**	**A**	**C**	**C**	**D**	**D**	**D**	**C**	**B**	**C**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**19**	**3**	**1**	**21**	**20**	**23**	**48**	**2**	**75**	**5**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**C**	**D**	**A**	**C**	**D**	**A**	**C**	**B**	**B**	**D**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**C**	**A**	**D**	**A**	**B**	**D**	**C**	**C**	**D**	**D**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**4**	**36**	**125**	**3**	**25**	**6**	**1**	**1**	**2**	**25**