Competishun

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

Date: 23/12/2024

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

UTS-1_MT-12 (24-25)

Physics

Single Choice Question

Q1 A tuning fork A of unknown frequency produces 5 beats/s with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats/s. What is the frequency of fork A ?

a) 342 Hz **b)** 345 Hz **c)** 335 Hz **d)** 338 Hz

Q2 The length of an elastic string is 5 metre when the longitudinal tension is 4 N and 6 metre when the tension is 5 N. If the length of the string (in metre) is "2X" when the longitudinal tension is 9 N is (assume Hooke's law is valid) then the value of X will be :

a) 3 **b)** 4 **c)** 5 **d)** 7

Q3 Heavy stable nuclei tend to have higher $\frac{N}{Z}$ ratio, this is because

a) Nuclear forces between neutrons are weaker than that between protons

b) Neutron's mass is more than that of proton

c) Neutrons decay into protons through beta decay

d) To overcome the long range repulsive effect of electrostatic forces of protons

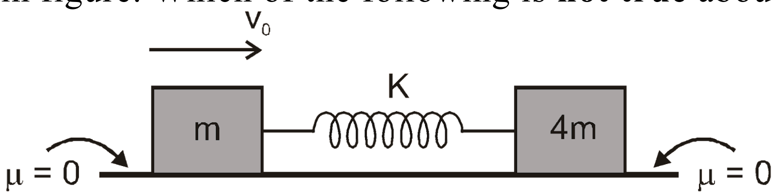
Q4 An isolated parallel plate capacitor has circular plates of radius 4cm. If the gap is filled with a partially conducting material having some dielectric constant and conductivity $5 \times 10^{-14}\ \Omega^{-1}\ m^{-1}$. When the capacitor is charged to a surface density of $15\ \mu C/cm^2$ the initial current between the plates is $1\mu A$. If total joule heating produced is 7500 J, the separation of the capacitor plates is :

a) 4 mm **b)** 5 mm **c)** 3 mm **d)** 6 mm

Q5 In the motorcycle stunt called "the well of death" the track is a vertical cylindrical surface of 18 m radius. Take the motorcycle to be a point mass and $\mu = 0.8$. The minimum angular speed of the motorcycle to prevent him from sliding down should be:

a) 6/5 rad/s **b)** 5/6 rad/s **c)** 25/3 rad/s **d)** none of these

Q6 Two blocks of masses m and 4m lie on a smooth horizontal surface connected with a spring in its natural length. Mass m is given velocity v_0 through an impulse as shown in figure. Which of the following is **not true** about subsequent motion ?



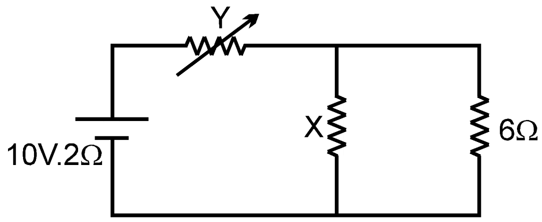
a) Kinetic energy is maximum in ground frame and centre of mass (CM) frame simultaneously.

b) Value of maximum and minimum kinetic energy is same in CM and ground frame.

c) Minimum kinetic energy is zero in CM frame about non-zero in ground frame

d) Maximum and minimum kinetic energy of m in ground frame is, respectively, 1/2 mv_0^2 and zero.

Q7 In the figure shown the thermal power generated in ' y ' is maximum when y = 4 Ω. Then X is:



a) 2 Ω **b)** 3 Ω **c)** 1 Ω **d)** 6 Ω

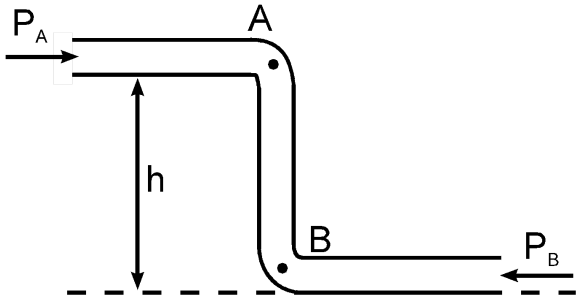
Q8 A long straight solid cylinder of radius r = 1 mm carries uniformly distributed current I = 4π A. If the axis of cylinder is perpendicular to uniform magnetic field B0 = $7\pi \times 10^{-4}$ Tesla, then minimum magnitude value of magnetic field at a finite distance from cylinder will be :

a) $8\pi \times 10^{-4}$ T **b)** $\pi \times 10^{-4}$ T **c)** $15\pi \times 10^{-4}$ T **d)** Zero

Q9 A conducting wire of length L fixed at both ends is vibrating in its fundamental mode with angular frequency ω and maximum amplitude A. There exists a uniform and constant magnetic field of induction B perpendicular to the plane of oscillations of the wire. The maximum emf induced in the wire is:

a) $\frac{BA\omega L}{\pi}$ **b)** $\frac{2BA\omega L}{\pi}$ **c)** $\frac{BA\omega L}{2\pi}$ **d)** $\frac{BA\omega L\pi}{2}$

Q10 Figure shows an ideal fluid flowing through a uniform cross-sectional tube in the vertical tube with liquid velocities v_A & v_B and pressure P_A & P_B. Knowing that tube offers no resistance to fluid flow then which of the following is true.



a) $P_B > P_A$ **b)** $P_B < P_A$ **c)** $P_A = P_B$ **d)** none of these

Q11 Two moles of an ideal gas expands with temperature according to the relation $V = KT^{2/3}$, where V is volume, T is absolute temperature and K is a constant. The work done by the gas as the gas temperature increases by 30ºC is

a) 10 R **b)** 20 R **c)** 30 R **d)** 40 R

Q12 Two stars of mass m and 2m separated by distance r are moving in circular path about their centre of mass due to mutual gravitation force. The angular velocity of any star will be :

a) $\sqrt{\frac{Gm}{r^3}}$ **b)** $\sqrt{\frac{2Gm}{r^3}}$ **c)** $\sqrt{\frac{3Gm}{r^3}}$ **d)** $\sqrt{\frac{Gm}{2r^3}}$

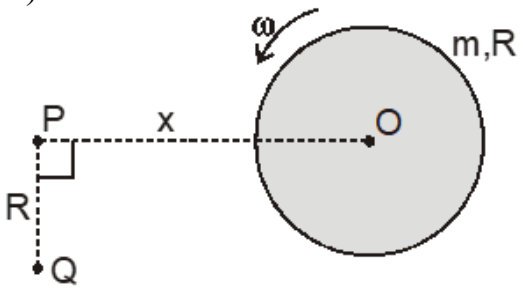
Q13 If the kinetic energy of a free electron doubles, its de-Broglie wavelength changes by the factor :

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

Q14 If an electromagnetic wave propagating through vacuum is described by $E = E_0 \sin(kx - \omega t)$; $B = B_0 \sin(kx - \omega t)$,

a) $E_0 k = B_0 \omega$ **b)** $E_0 B_0 = \omega k$ **c)** $E_0 \omega = B_0 k$ **d)** $E_0 B_0 = \omega / k$

Q15 A uniform disc of mass m and radius R is undergoing fixed axis rotation about its own axis and centre O of disc remains stationary. The angular speed of disc is ω. Then the magnitude of angular momentum of disc about shown point Q is : (OP = x and PQ = R)

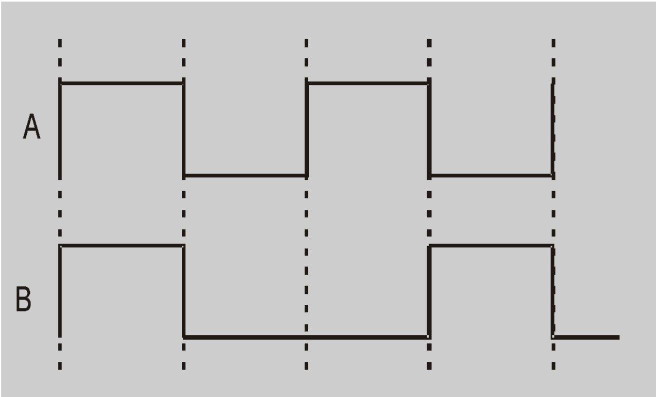


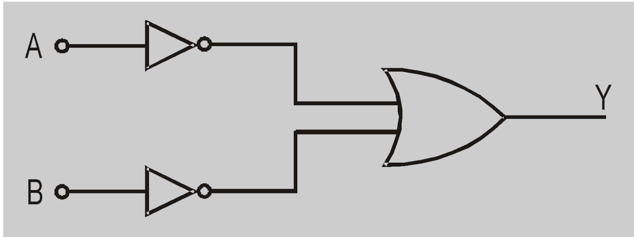
a) $m\frac{(x^2+2R^2)}{2}\omega$ **b)** $m\frac{(x^2+R^2)}{2}\omega$ **c)** $\frac{mx^2}{2}\omega$ **d)** $\frac{mR^2}{2}\omega$

Q16 A ball projected vertical upwards with velocity 10 m/s returns back on ground with 8 m/s. If air drag is constant then maximum height reached by ball, is

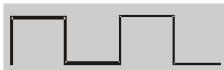
a) 4.1 m **b)** 5 m **c)** 3.0 m **d)** 3.6 m

Q17 In a given circuit as shown the two inputs waveform A and B applied simultaneously.





The resultant wave form Y is-

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

Q18 A 12 V battery connected to a coil of resistance 6 Ω through a switch, drives a constant current in the circuit. The switch is opened in 1 ms. The emf induced across the coil is 20 V. The inductance of the coil is :

a) 5 mH **b)** 12 mH **c)** 8 mH **d)** 10 mH

Q19 If $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}$ & $\vec{B} = 3\hat{i} - 2\hat{j} + \hat{k}$, then the area of parallelogram formed with $\vec{A}$ and $\vec{B}$ as the sides of the parallelogram is:

a) $\sqrt{3}$ **b)** $8\sqrt{3}$ **c)** 64 **d)** 0

Q20 The potential energy of a particle of mass m free to move along x-axis is given by $U = \frac{1}{2}kx^2$ for $x < 0$ and $U = 0$ for $x \geq 0$ (x denotes the x-coordinate of the particle and k is a positive constant). If the total mechanical energy of the particle is E, then its speed at $x = -\sqrt{\frac{2E}{k}}$ is:

a) zero **b)** $\sqrt{\frac{2E}{m}}$ **c)** $\sqrt{\frac{E}{m}}$ **d)** $\sqrt{\frac{E}{2m}}$

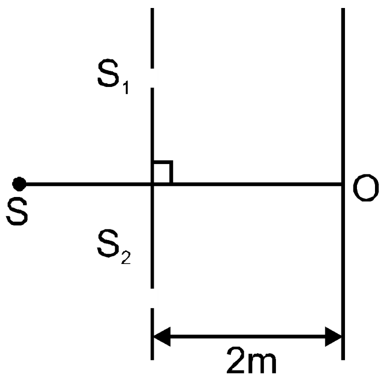
Numerical

Q21 The electric field in a region is given $\vec{E} = \left(\frac{3}{5}E_0\hat{i} + \frac{4}{5}E_0\hat{j}\right)\frac{N}{C}$. The ratio of flux of reported field through the rectangular surface of area 0.2 m^2 (parallel to y – z plane) to that of the surface of area of 0.3 m^2 (parallel to x – z plane) is a : 2, where a = _______.
[Here $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z axes respectively]

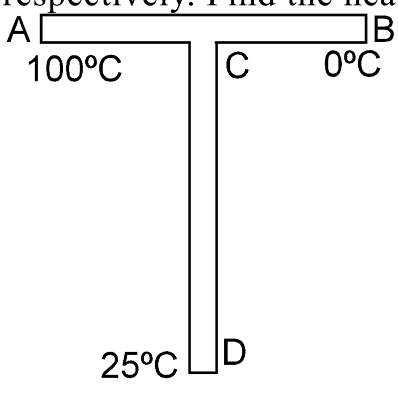
Q22 The same size images are formed by a convex lens when the object is placed at 20cm or at 10cm from the lens. The focal length of convex lens is ______ cm.

Q23 A person standing on the bank of a river wants to cross the river in minimum possible time. Find the distance (in km) travelled by the person with respect to ground when he reaches the opposite bank of the river.
Width of river = 1km
Speed of river flow = 10 m/sec
Swimming capacity of man in still water = $\frac{10}{\sqrt{3}}$ m/sec

Q24 A point source 'S' which is symmetrically placed (as shown in figure) emits light rays of wavelength 4000 Å and 6000 Å. If distance between slits S_1 and S_2 is 1mm then least (non–zero) distance of point on screen from 'O' at which both the wavelengths produces maxima together is $\frac{6X}{10}$ mm then calculate 'X' :



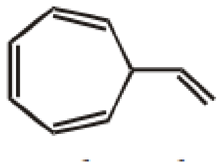
Q25 A rod CD of thermal resistance 5.0 K/W is joined at the middle of an identical rod AB as shown in figure. The ends A, B and D are maintained at 100°C, 0°C and 25°C respectively. Find the heat current in CD (in watt).

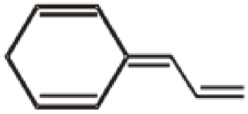


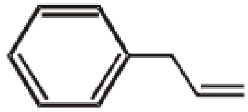
Chemistry

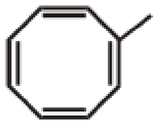
Single Choice Question

Q26 Which of the following has the lowest heat of combustion ?

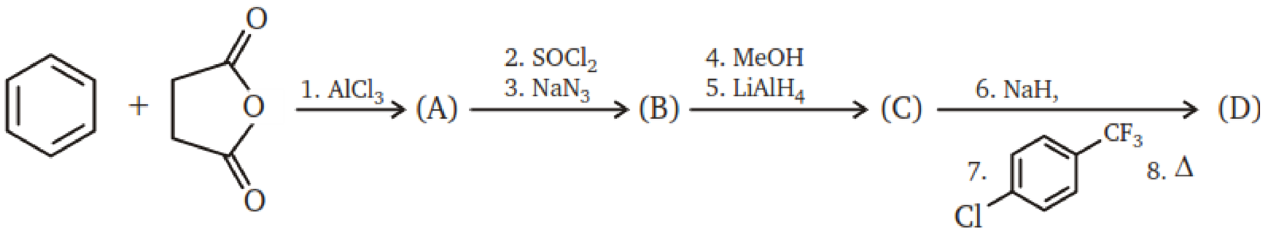
a) 

b) 

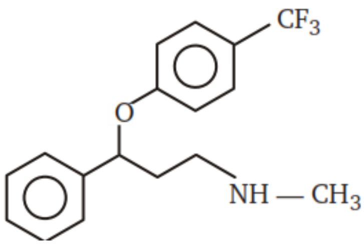
c) 

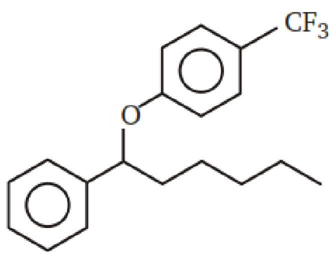
d) 

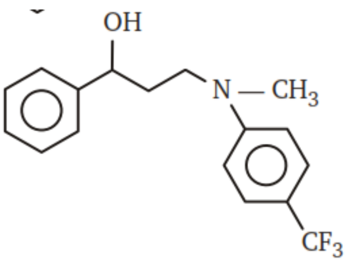
Q27

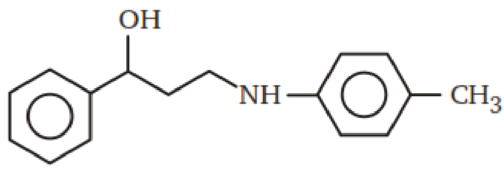


Product (D) in above sequnce is :

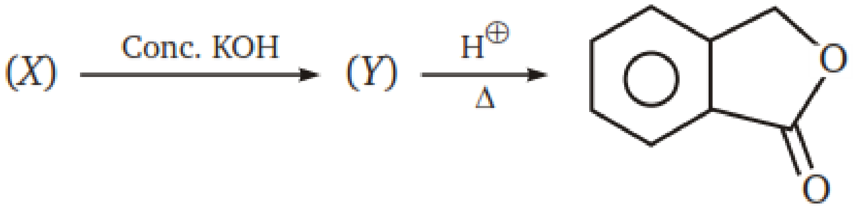
a) 

b) 

c) 

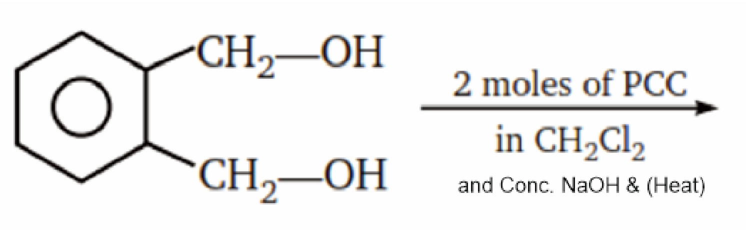
d) 

Q28

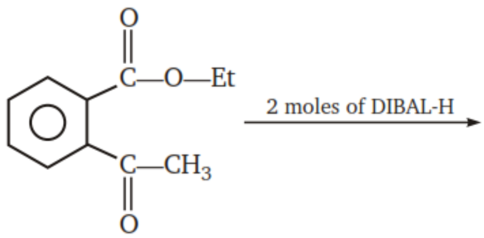


Identify reaction in which Compound X will be formed

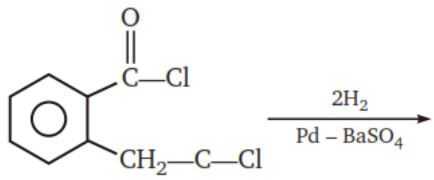
a)



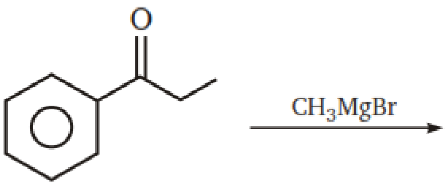
b)



c)

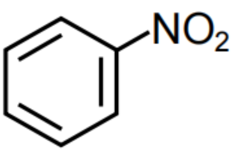


d)

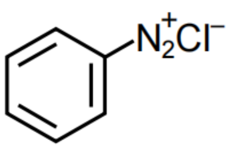


Q29 Which of the following compounds will be suitable for Kjeldahl's method for nitrogen estimation?

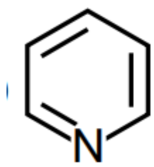
a)



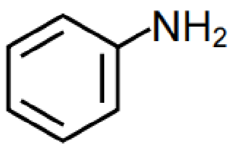
b)



c)



d)



Q30 In which of reactions final product is NOT a ketone :

a) $CH_3-C\equiv C-H \xrightarrow{NaNH_2} (A) \xrightarrow{CH_3-I} (B) \xrightarrow[H_2SO_4]{HgSO_4} (C)$

b) $H-C\equiv C-H \xrightarrow{NaNH_2} (C) \xrightarrow{CH_3-CH_2-I} (D) \xrightarrow[NaBH_4,\,H^-]{Hg(OAc)_2,\,H_2O} (E)$

c) $R-\overset{\overset{O}{\|}}{C}-OH \xrightarrow{NaOH} (A) \xrightarrow{CH_3-I} (B)$

d) $\text{1-butyne} \xrightarrow{NaNH_2} (A) \xrightarrow{CH_3-I} (B) \xrightarrow{(1)\ BH_3\cdot THF,\ (2)\ H_2O_2/HO^{\ominus}} (C)$

Q31 Phosphoric acid (H_3PO_4) prepared in a two step process.

(1) $P_4 + 5O_2 \longrightarrow P_4O_{10}$

(2) $P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$

We allow 62 g of phosphorus to react with excess oxygen which form P_4O_{10} in 85% yield. In the step (2) reaction 90% yield of H_3PO_4 is obtained. Produced mass of H_3PO_4 is:

a) 37.485 g **b)** 149.949 g **c)** 125.47 g **d)** 564.48 g

Q32 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

Q33 A 0.05 L sample of 0.2 M aqueous hydrochloric acid is added to 0.05 L of 0.2 M aqueous ammonia in a calorimeter. Heat capacity of entire calorimeter system is $480\,J/K$. The temperature increase is 1.09 K . Calculate $\Delta_r H^\circ$ in kJ/mol for the following reaction :

$$HCl(aq.) + NH_3(aq.) \longrightarrow NH_4Cl(aq.)$$

a) -52.32 **b)** -61.1 **c)** -55.8 **d)** -58.2

Q34 Maltose on treatment with dilute HCl gives

a) D-Galactose **b)** D-Glucose and D-Fructose **c)** D-Glucose **d)** D-Fructose

Q35 The number of 2-centre-2-electron and 3-centre-2-electron bonds in B_2H_6 respectively are:

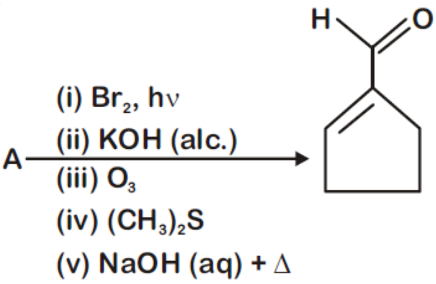
a) 4 and 2 **b)** 2 and 2 **c)** 2 and 4 **d)** 2 and 1

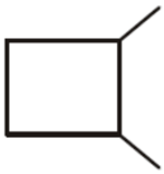
Q36 A flask containing 0.5 atm pressure of $A_2(g)$, some solid AB added into flask which undergoes dissociation according to $2AB(s) \rightleftharpoons A_2(g) + B_2(g) \quad K_p = 0.06\,atm^2$

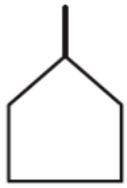
The total pressure (in atm) at equilibrium is :

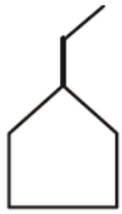
a) 0.70 **b)** 0.6 **c)** 0.10 **d)** None of these

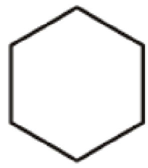
Q37 In the following reaction A is



a) 

b) 

c) 

d) 

Q38 Calculate approximate pH of the resultant solution formed by titration of 25 mL of 0.04 M Na_2CO_3 with 50 mL of 0.025 M HCl . [Given : $pK_{a_1} = 6.4$ and $pK_{a_2} = 10.3$ for H_2CO_3]

a) 5.92 **b)** 6.88 **c)** 6.4 **d)** 5.88

Q39 The bond dissociation energy is highest for

a) Cl_2 **b)** I_2 **c)** Br_2 **d)** F_2

Q40 Match list - I and List - II.

List-I	**List-II**
(a) $R-\overset{O}{\overset{\|\|}{C}}-Cl \rightarrow R-CHO$	(i) $Br_2/NaOH$
(b) $R-CH_2-COOH \rightarrow R-\underset{Cl}{\underset{\|}{CH}}-COOH$	(ii) $H_2/Pd-BaSO_4$
(c) $R-\overset{O}{\overset{\|\|}{C}}-NH_2 \rightarrow R-NH_2$	(iii) Zn(Hg)/Conc.HCl
(d) $R-\overset{O}{\overset{\|\|}{C}}-CH_3 \rightarrow R-CH_2-CH_3$	(iv) Cl_2/Red P, H_2O

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

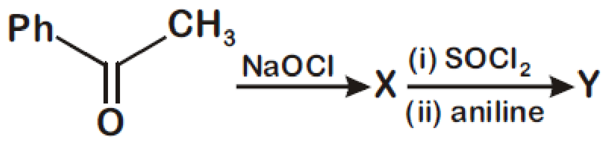
c) (a)–(ii), (b)–(iv), (c)–(i), (d)–(iii) **d)** (a)–(iii), (b)–(i), (c)–(iv), (d)–(ii)

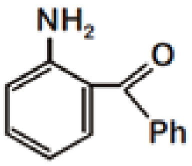
Q41 The calculated magnetic moments (spin only value) for species $[FeCl_4]^{2-}$, $[Co(C_2O_4)_3]^{3-}$ and MnO_4^{2-} respectively are :

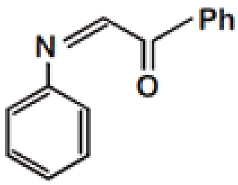
a) 5.82, 0 and 0 BM **b)** 4.90, 0 and 1.73 BM **c)** 5.92, 4.90 and 0 BM

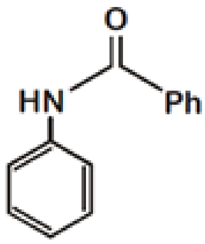
d) 4.90, 0 and 2.83 BM

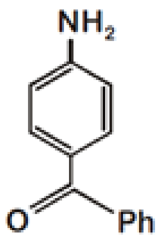
Q42 The major product 'Y' in the following reaction is :



a) 

b) 

c) 

d) 

Q43 The ground state energy of hydrogen atom is –13.6 eV. The energy of second excited state of He^+ ion in eV is :

a) –27.2 b) –6.04 c) –54.4 d) –3.4

Q44 A. Phenyl methanamine
B. N,N-Dimethylaniline
C. N-Methyl aniline
D. Benzenamine
Choose the correct order of basic nature of the above amines.

a) A > C > B > D b) D > C > B > A c) D > B > C > A d) A > B > C > D

Q45 The ionic radius of Na+ ions is 1.02 Å. The ionic radii (in Å) of Mg^{2+} and Al^{3+}, respectively, are-

a) 1.05 and 0.99 b) 0.72 and 0.54 c) 0.85 and 0.99 d) 0.68 and 0.72

Numerical

Q46 If 75% of a first order reaction was completed in 90 minutes, 60% of the same reaction would be completed in approximately (in minutes)_______.
(Take : log 2 = 0.30; log 2.5 = 0.40)

Q47 At 363 K, the vapour pressure of A is 21 kPa and that of B is 18 kPa. One mole of A and 2 moles of B are mixed. Assuming that this solution is ideal, the vapour pressure of the mixture is _________ kPa. (Round of to the Nearest Integer).

Q48 Number of amphoteric compound among the following is __________
(A) BeO
(B) BaO
(C) Ga_2O_3
(D) $Sr(OH)_2$
(E) PbO
(F) PbO_2
(G) SnO
(H) SnO_2
(I) NaOH

Q49 Number of grams of bromine that will completely react with 5.0g of pent-1-ene is _______ $\times 10^{-2}$g. (Atomic mass of Br = 80 g/mol) [Nearest Integer) . Write your answer dividing by 16 to the nearest integer.

Q50 A reaction of 0.1 mole of Benzylamine with bromomethane gave 23 g of Benzyl trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are n × 10^{-1}, when n = ________. (Round off to the Nearest Integer).
(Given : Atomic masses : C : 12.0 u, H : 1.0 u,
N : 14.0 u, Br : 80.0 u]

Mathematics

Single Choice Question

Q51 If $y=\frac{x}{\sqrt{a^2-1}}-\frac{2}{\sqrt{a^2-1}}\tan^{-1}\left(\frac{\sin x}{a+\sqrt{a^2-1}+\cos x}\right)$ where $a \in (-\infty, -1) \cup (1, \infty)$ then $y'\left(\frac{\pi}{2}\right)$ equals

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

Q52 The number of ordered quadruples (a_1, a_2, a_3, a_4) of positive odd integers that satisfy $a_1 + a_2 + a_3 + a_4 = 32$ is equal to

a) 286 **b)** 4495 **c)** 680 **d)** 4040

Q53 The coefficient of t^8 in the expansion of $(1 + 2t^2 - t^3)^9$, is

a) 1680 **b)** 2140 **c)** 2520 **d)** 2730

Q54 If $\int \frac{(x-1)(x-2)(x-3)}{(x-4)(x-5)(x-6)}dx = a_1x + a_2\log|x-4| + a_3\log|x-5| + a_4\log|x-6| + C$ then $a_1 + a_2 + a_3 + a_4 =$ (where C is a constant of integration)

a) 5 **b)** 10 **c)** 12 **d)** 8

Q55 Water is dropped at the rate of $2m^3$/sec. into a cone of semi-vertical angle 45°. The rate at which periphery of water surface changes when height of the water in the cone is 2 meter, is

a) 1 m/sec. **b)** 2 m/sec. **c)** 3m/sec. **d)** 4 m/sec.

Q56 The base of a triangle passes through a fixed point (f, g) and its sides are bisected at right angles by the lines $y^2 - 8xy - 9x^2 = 0$. The locus of vertex of triangle is

a) straight line **b)** circle **c)** parabola **d)** ellipse

Q57 Equation of chord AB of circle $x^2 + y^2 = 2$ passing through the point P(2, 2) such that $\frac{PB}{PA} = 3$ is

a) $x = 3y$ **b)** $x = y$ **c)** $y - 2 = \sqrt{3}(x - 2)$ **d)** None of these

Q58 Let α, β, γ are the real roots of the equation $x^3 + ax^2 + bx + c = 0$ ($a, b, c \in R$ and $a \neq 0$). If the system of equations (in u, v and w) given by

$\alpha u + \beta v + \gamma w = 0$

$\beta u + \gamma v + \alpha w = 0$

$\gamma u + \alpha v + \beta w = 0$

has non-trivial solutions, then a^2 equals

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

Q59 Consider two sets A = {1, 2, 3, 4, 5} and B = {1, 2, 3, ..., 9, 10}.
If Tina randomly selects two distinct numbers from set A and Reena randomly selects one number from set B, the probability that Reena's number is greater than the sum of the two number chosen by Tina, is

a) 2/5 **b)** 1/2 **c)** 3/5 **d)** 1/5

Q60 Suppose a parabola $y = x^2 - ax - 1$ intersects the coordinate axes at three points A, B and C respectively. The circumcircle of ΔABC intersects the y-axis again at the point D(0, t). Find the value of *t*.

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

Q61 If $\frac{dy}{dx} = \left(e^y - x\right)^{-1}$ where y (0) = 0, then y is expressed explicitly as

a) $\frac{1}{2}\ln\left(1+x^2\right)$ **b)** $\ln\left(1+x^2\right)$ **c)** $\ln\left(x+\sqrt{1+x^2}\right)$ **d)** $\ln\left(x+\sqrt{1-x^2}\right)$

Q62 The area enclosed by the curve $y \le \sqrt{4-x^2}, y \ge \sqrt{2}\sin\left(\frac{\pi x}{2\sqrt{2}}\right)$ and the x-axis is divided by y–axis in the ratio $\frac{a\pi^2}{2\pi + b\pi^2 - 8}$, then a + b is

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

Q63 If $U_n = \int_0^{\pi/2} x^n \sin x \, dx$ then the value $U_{10} + 90U_8$ is

a) $10(\pi/2)^9$ **b)** $9(\pi/2)^9$ **c)** $9(\pi/2)^8 + (\pi/2)^9$ **d)** None of these

Q64 If $0 < \theta \le \pi$ and $\sin\frac{\theta}{2} = \sqrt{1+\sin\theta} - \sqrt{1-\sin\theta}$, then possible values of $\tan\theta$, is

a) $\frac{4}{3}$ **b)** 0 **c)** $\frac{-3}{4}$ **d)** $\frac{-4}{3}$

Q65 The sum of first four terms of a geometric progression (G.P.) is $\frac{65}{12}$ and the sum of their respective reciprocals is $\frac{65}{18}$. If the product of first three terms of the G.P. is 1, and the third term is α, then 2α is ___ .

a) 5 **b)** 4 **c)** 3 **d)** 8

Q66 If f(x) = f(a – x), g(x) = g(a – x) and 3h(x) – 4h(a – x) = 5 and $\int_0^a f(x)g(x)h(x)dx = k\int_0^a f(x)g(x)dx$ then the value of k is

a) 5 **b)** –5 **c)** 4 **d)** –4

Q67 If the expression $(1 + ir)^3$ is of the form of s(1 + i) for some real 's' where 'r' is also real and $i = \sqrt{-1}$, then sum of the values of 'r' is

a) 5 **b)** 3 **c)** 12 **d)** 8

Q68 If mean and standard deviation of 5 observations x_1, x_2, x_3, x_4, x_5 are 10 and 3, respectively, then the variance of 6 observations $x_1, x_2, ..., x_5$ and –50 is equal to :

a) 586.5 **b)** 582.5 **c)** 509.5 **d)** 507.5

Q69 Let $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ be two vectors. If a vector perpendicular to both the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ has the magnitude 12 then one such vector is :

a) $4(-2\hat{i} - 2\hat{j} + \hat{k})$ **b)** $4(2\hat{i} + 2\hat{j} - \hat{k})$ **c)** $4(2\hat{i} + 2\hat{j} + \hat{k})$ **d)** $4(2\hat{i} - 2\hat{j} - \hat{k})$

Q70 The solution set of inequality $(\cot^{-1}x)(\tan^{-1}x) + \left(2 - \frac{\pi}{2}\right)\cot^{-1}x - 3\tan^{-1}x - 3\left(2 - \frac{\pi}{2}\right) > 0$, is

a) $x \in (\tan 2, \tan 3)$ **b)** $x \in (\cot 3, \cot 2)$ **c)** $x \in (-\infty, \tan 2) \cup (\tan 3, \infty)$

d) $x \in (-\infty, \cot 3) \cup (\cot 2, \infty)$

Numerical

Q71 $f(x) = \log_4\left(\frac{2x^2 - 3x + a}{2x^2 + 3x + 3}\right)$ has range $[\alpha, \beta]$ such that $\alpha + \beta = 0$, then find 'a'.

Q72 Let α and β be roots of $x^2 - 6(t^2 - 2t + 2)x - 2 = 0$ with $\alpha > \beta$. If $a_n = \alpha^n - \beta^n$ for $n \geq 1$, then find the minimum value of $\frac{a_{100} - 2a_{98}}{a_{99}}$ (where $t \in R$)

Q73 Let S denote the sum of the series $\frac{3}{2^3} + \frac{4}{2^4 \cdot 3} + \frac{5}{2^6 \cdot 3} + \frac{6}{2^7 \cdot 5} + \frac{7}{2^7 \cdot 15} + ...\infty$, then the value of S^{-1} is

Q74 If the value $\lim_{x \to \infty} x\{(x^2 + 2x)^{1/2} - (x^3 + 3x^2 + x)^{1/3}\} = L$; then $6L =$

Q75 Let $P(x) = \frac{5}{3} - 6x - 9x^2$ and $Q(y) = -4y^2 + 4y + \frac{13}{2}$. If there exist unique pair of real numbers (x, y) such that P(x) Q(y) = 20, then find the value of (6x + 10y).

Answer Key

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