Rankers Academy JEE

Best Educational ERP/LMS Solution

Competishun

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

Date: 01/01/2024

**Time:** 3 hours

**Max. Marks:** 300

> **MFST-9 (23-24)**

Physics

Single Choice Question

Q1 A photodetector is made of a semiconductor having a forbidden energy gap $E_g = 0.7$ eV. What is the maximum wavelength detected by it?

a) 1768 Å b) 1768 μm c) 1768 nm d) 7000 Å

Q2 An ideal gas (1 mol, monoatomic) is in the initial state P (see diagram) on an isothermal A at temperature T_0. It is brought under a constant volume $(2V_0)$ process to Q which lies on an adiabatic B intersecting the isothermal A at (P_0, V_0, T_0). The change in the internal energy of the gas during the process is (in terms of T_0) $(2^{2/3} = 1.587)$
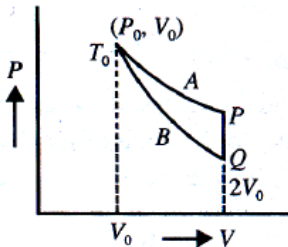

a) $2.3\ T_0$ b) $-4.6\ T_0$ c) $-2.3\ T_0$ d) $4.6\ T_0$

Q3 Twenty-two grams of CO_2 at 27°C is mixed with 16 g of O_2 at 37°C. The temperature of the mixture is

a) 32°C b) 27°C c) 37°C d) 30.5°C

Q4 A large number of droplets, each of radius a, coalesce to form a bigger drop of radius b. Assume that the energy released in the process is converted into the kinetic energy of the drop. The velocity of the drop is (σ = surface intension, ρ = density)

a) $\left[\dfrac{\sigma}{\rho}\left(\dfrac{1}{a}-\dfrac{1}{b}\right)\right]^{1/2}$ b) $\left[\dfrac{2\sigma}{\rho}\left(\dfrac{1}{a}-\dfrac{1}{b}\right)\right]^{1/2}$ c) $\left[\dfrac{3\sigma}{\rho}\left(\dfrac{1}{a}-\dfrac{1}{b}\right)\right]^{1/2}$ d) $\left[\dfrac{6\sigma}{\rho}\left(\dfrac{1}{a}-\dfrac{1}{b}\right)\right]^{1/2}$

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Q5 In the following figure, the velocities are in ground frame and the cylinder is performing pure rolling on the plank, velocity of point 'A' would be
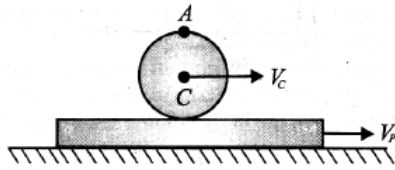
a) $2V_C$

b) $2\,V_C + V_P$

c) $2V_C - V_P$

d) $2\,(V_C - V_P)$

Q6 A yo-yo is placed on a rough horizontal surface and a constant force F, which is less than its weight, pulls it vertically. Due to this
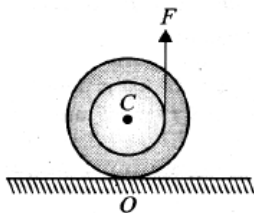

a) friction force acts toward left, so it will move towards left

b) friction force acts toward right so it will move towards right

c) it will move towards left no friction force acts towards left

d) it will move towards right so friction force acts towards right

Q7 A man of mass M stands one end of a plank of length L which lies at rest on a fricionless surface. The man walks to other end of the plank. If the mass of the plank is $\dfrac{M}{3}$, then the distance that the man moves relative to ground is

a) $\dfrac{3L}{4}$

b) $\dfrac{L}{4}$

c) $\dfrac{4L}{5}$

d) $\dfrac{L}{3}$

Q8 A ball of mass m is released from A inside a smooth wedge of mass m as shown in the figure. What is the speed of the wedge when the ball reaches point B ?
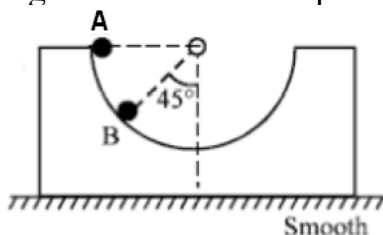

a) $\left(\dfrac{gR}{3\sqrt{2}}\right)^{1/2}$

b) $\sqrt{2gR}$

c) $\left(\dfrac{5gR}{2\sqrt{3}}\right)^{1/2}$

d) $\sqrt{\dfrac{3}{2}gR}$

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Q9 A bob of mass M is suspended by a massless string of length L. The horizontal velocity V at position A is just sufficient to make it reach the point B. The angle θ at which the speed of the bob is half of that at A, satisfies Figure :
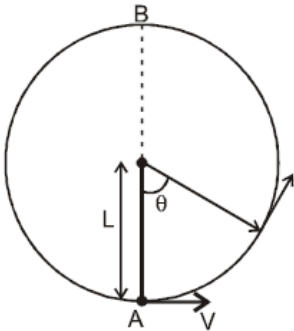

a) $\theta = \dfrac{\pi}{4}$

b) $\dfrac{\pi}{4} < \theta < \dfrac{\pi}{2}$

c) $\dfrac{\pi}{2} < \theta < \dfrac{3\pi}{4}$

d) $\dfrac{3\pi}{4} < \theta < \pi$

Q10 Two wires of the same material and radii r and 2r respectively are welded together end to end. The combination is used as a sonometer wire and kept under tension T. The welded point is midway between the two bridges. When stationary waves are set up in the composite wire, the joint is a node. Then the ratio of the number of loops formed in the thinner to thicker wire is

a) 2 : 3   **b)** 1 : 2   **c)** 2 : 1   **d)** 5 : 4

Q11 The distance between the objective lens and the eye lens of an astronomical telescope when adjusted for parallel light is 100 cm. The measured value of the magnification is 19. The focal lengths of the lenses are

a) 85 cm and 15 cm   **b)** 82 cm and 18 cm

c) 95 cm and 5 cm   **d)** 50 cm and 50 cm

Q12 Two capacitors of capacitances 2C and C are connected in series with an inductor of inductance L. Initially capacitors have charge such that $V_B - V_A = 4V_0$ and $V_C - V_D = V_0$. Initial current in the circuit is zero. The maximum current that will flow in the circuit is
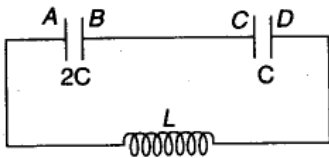

a) $2V_0\sqrt{\dfrac{3C}{2L}}$

b) $V_0\sqrt{\dfrac{3C}{2L}}$

c) $2V_0\sqrt{\dfrac{3C}{L}}$

d) $2V_0\sqrt{\dfrac{C}{L}}$

Q13 Capacitors C_1 and C_2 ($C_1 > C_2$) are connected to a battery, first individually, then in series. If q_1, q_2 and q_3 are the charges stored on them, then

a) $q_1 = q_2 = q_3$ **b)** $q_1 = q_2 < q_3$ **c)** $q_1 > q_2 = q_3$ **d)** $q_1 > q_2 > q_3$

Q14 A brass wire 2m long at 27ºC is held taut with negligible tension between two rigid supports. If the wire is cooled to a temperature of –33ºC, the tension developed in the wire, its diameter being 2 mm, will be (coefficient of linear expansion brass = $2.0 \times 10^{-5}C^{-1}$ and Young's modulus of brass = $0.91 \times 10^{11}Pa$)

a) 3400 N   **b)** 3.4 kN   **c)** 0.34 kN   **d)** 6800 N

Q15 A hollow metallic tube of length L and closed at one end produces resonance with a tuning fork of frequency n. The entire tube is then heated carefully, so that at equilibrium temperature its length changes by l. If the change in velocity V of sound is v, the resonance will now be produced by a tuning fork whose frequency is

a) $\dfrac{(V+v)}{4(L+l)}$

b) $\dfrac{(V-v)}{4(L-l)}$

c) $\dfrac{(V+v)}{4(L-l)}$

d) $\dfrac{(V-v)}{4(L+l)}$

Q16 A sphere starts rolling down an inclined plane of inclination . The speed of its centre when it has covered a distance l :

a) $\sqrt{2gl\sin\theta}$

b) $\sqrt{\dfrac{5}{7}gl\sin\theta}$

c) $\sqrt{\dfrac{10}{7}gl\sin\theta}$

d) $\sqrt{\dfrac{15}{7}gl\sin\theta}$

Q17 A stationary swimmer S inside a liquid of refractive index μ_1 is at a distance d from a fixed point P inside a liquid. A rectangular block of width t and refractive index μ_2 ($\mu_2 < \mu_1$) is now placed between S and P. Now S will observed P to be at a distance

a) $d - t\left[\dfrac{\mu_1}{\mu_2} - 1\right]$

b) $d - t\left[1 - \dfrac{\mu_2}{\mu_1}\right]$

c) $d + t\left[1 - \dfrac{\mu_2}{\mu_1}\right]$

d) $d + t\left[\dfrac{\mu_1}{\mu_2} - 1\right]$

Q18 A volume V of a viscous liquid flows per unit time due to a pressure head ΔP along a pipe of diameter d and length l. Instead of this pipe, a set of four pipes each of diameter d/2 and length $2l$ is connected to the same pressure head ΔP. Now the volume of liquid flowing per unit time is:

a) V/16

b) V/8

c) V/4

d) V

Q19 In the given AC circuit, when switch S is at position 1, the source emf leads currents by $\pi/6$. Now, if the switch is at position 2, then
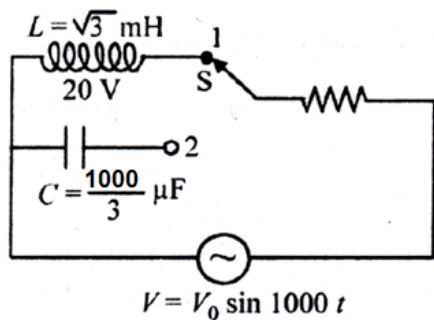
a) current leads source emf by $\pi/4$

b) current leads source emf by $\pi/3$

c) source emf leads current by $\pi/4$

d) source emf leads current by $\pi/3$

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Q20 Figure shows the overhead view of two small identical balls connected with each other by a massless rigid rod. The balls and rod combination is kept on a smooth horizontal surface.

A force F is applied horizontally on ball A in a direction perpendicular to the rod. The immediate acceleration of the ball A and B are respectively.
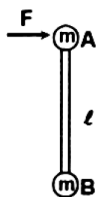

a) F/m, F/m   b) F/2m, F/2m   c) F/m, 0   d) F/2m, 0

Numerical

Q21 A stone is dropped from the top of a building. When it crosses a point 5 m below the top, another stone starts to fall from a point 25 m below the top. Both stones reach the bottom of building simultaneously. The height (in m) of the building is :

**Q22** In the circuit shown below, maximum zener diode current will be _____mA
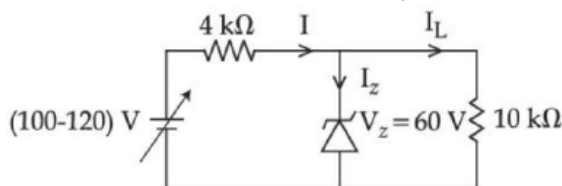
Q23 A symmetric lamina of mass M consists of a square shape with a semicircular section over each of the edge of the square as shown in the figure. The side of the square is 2a. The moment of inertia of the lamina about an axis through its center of mass and perpendicular to the plane is $1.6\ Ma^2$. The moment of inertia of the lamina about the tangent AB in the plane of lamina is (in Ma^2)
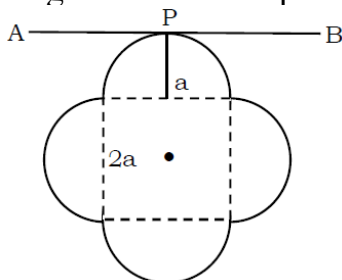
**Q24** Two small spheres each of mass 10 mg are suspended from a point by threads 0.5 m long. They are equally charged and repel each other to a distance of 0.20 m. The charge on each of the sphere is $\frac{a}{21} \times 10^{-8} C$. The value of 'a' will be _____. [Given g = 10 ms^{-2}]

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Q25 The diagram shows an iron-cored transformer assumed to be 100% efficient. The ratio of the secondary turns to the primary turns is 1 : 20. A 240V ac supply is connected to the primary coil and a 6.0Ω resistor is connected to the secondary coil. What is the current in the primary coil? (in A)
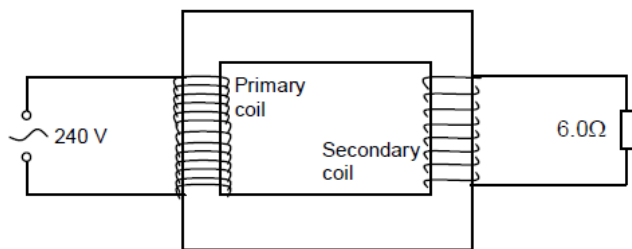
Q26 The batteries, one of emf 18 volt and internal resistance 2ΩW and other of emf 12 volt and internal resistance 1Ω, are connected as shown. The voltmeter V will record a reading of (in V)
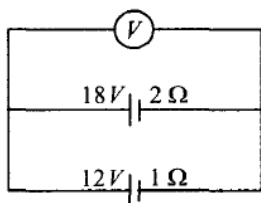
Q27 A glass tube of 1.0 m length is filled with water; the water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency 500 Hz is brought at the upper end of the tube and the velocity of sound is 330 m/s, then the total number of resonances obtained will be

Q28 There is an air filled 1pF parallel plate capacitor. When the plate separation is doubled and the space is filled with wax, the capacitance increases to 2pF. The dielectric constant of wax is :

Q29 Ge and Si diodes conduct at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of V0 changes by (in V)
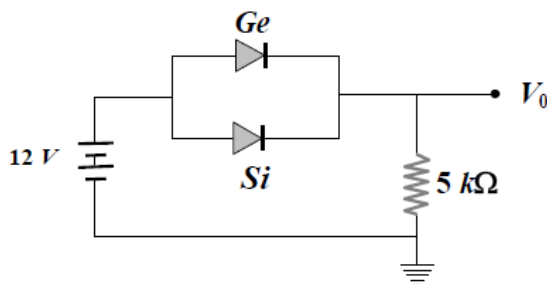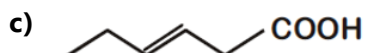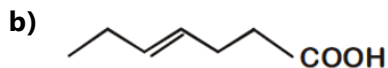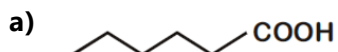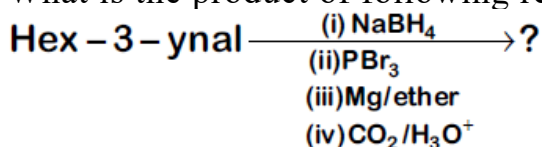

Q30 The surface of water in a water tank of cross section area 750 cm^2 on the top of a house is h(m). above the tap level. The speed of water coming out through the tap of cross section area 500 mm^2 is 30 cm/s. At that instant, $\frac{dh}{dt}$ is x × 10^{-3} m/s. The value of x will be_____.

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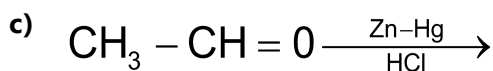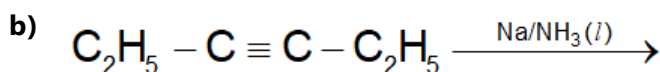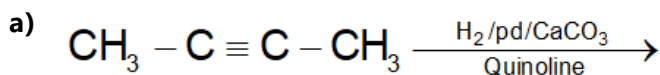
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Chemistry

Single Choice Question

Q31 0.1 M of $KMnO_4$ (in acidic medium) can not oxidise completely (Assume the volume of reactant is same as of the $KMnO_4$ solution)

a) 0.25 M $H_2C_2O_4$ b) 0.5 M $FeSO_4$ c) $\frac{M}{6}FeC_2O_4$ d) 0.6 M $K_2Cr_2O_7$

Q32 Pick out the complex compound in which the central metal atom obeys EAN rule strictly

a) $K_4[Fe(CN)_6]$ b) $K_3[Fe(CN)_6]$ c) $[Cr(H_2O)_6]Cl_3$ d) $[Cu(NH_3)_4]SO_4$

Q33 In a 1 L container following equilibrium is establlished with equal moles of $NO_2(g)$ & $N_2O_4(g)$ $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, at equlibrium $M_{avg.} = \frac{184}{3}$, then ratio of K_C & total initial moles is.

a) 3   b) $\frac{3}{2}$ c) $\frac{27}{4}$ d) 6

Q34 The lithium ion (Li^+) and hydride ion (H^-) are isoelectronic ions. Which statement about this systems is true ?

a) Chemical properties of these ions are identical since they are isoelectronic.

b) Li^+ is a stronger reducing agent than H^-.

c) More energy is needed to ionize H^- than Li^+

d) Radius of H^- is larger than that of Li^+

Q35 The enthalipies of decomposition of methane (CH_4) (g) and ethane (C_2H_6)(g) are 400 and 670 kJ. mol^{-1}, respectively . The ΔH_{C-C} in $kJmol^{-1}$ is

a) 270   b) 70   c) 200   d) 240 ml

Q36 Select the correct option regarding the bond strength of $C^{14}O^{16}$, $C^{12}O^{16}$, $C^{14}O^{18}$.

a) $C^{14}O^{18} > C^{14}O^{16} > C^{12}O^{16}$ b) $C^{14}O^{18} < C^{14}O^{16} < C^{12}O^{16}$

c) $C^{14}O^{18} > C^{14}O^{16} < C^{12}O^{16}$ d) $C^{14}O^{18} < C^{14}O^{16} > C^{12}O^{16}$

Q37 The incorrect statement among the following is:

a) beryllium oxide is amphoteric in nature

b) solubility of sulphates of second group elements decreases down the group

c) reducing power of hydride of alkali metal decreases down the group

d) Berylium has diagonal relationship with alumunium

Q38 What is the molar solubility of $Mn(OH)_2$ in a buffer solution containing equal amount of NH_4^+ and $NH_3(aq)$.

Given that $- (K_{sp})_{Mn(OH)_2} = 4.5 \times 10^{14}$
$(K_b)_{NH_3} = 1.8 \times 10^{-5}$

a) 1.35×10^{-3} b) 1.38×10^{-4} c) 2.38×10^{-4} d) 3.2×10^{-4}

Q39 What is the product of following reaction?

$$Hex-3-ynal \xrightarrow[\substack{(ii)PBr_3 \\ (iii)Mg/ether \\ (iv)CO_2/H_3O^+}]{(i)\ NaBH_4} \ ?$$

a) COOH

b) COOH

c) COOH

d) COOH

Q40 Out of the followings in which reaction(s) **polar** product is obtained ?

a)
$$CH_3 - C \equiv C - CH_3 \xrightarrow[Quinoline]{H_2/pd/CaCO_3}$$

b)
$$C_2H_5 - C \equiv C - C_2H_5 \xrightarrow{Na/NH_3(l)}$$

c)
$$CH_3 - CH = 0 \xrightarrow[HCl]{Zn-Hg}$$

d)
$$Ph - COOH \xrightarrow[CaO.\Delta]{NaOH}$$

Q41 The correct sequence of correct reagents for the following transformation is :-

a) (i) Fe, HCl (ii) Cl_2, HCl, (iii) $NaNO_2$, HCl, 0°C (iv) H_2O/H^+
b) (i) Fe, HCl (ii) $NaNO_2$, HCl, 0°C (iii) H_2O/H^+ (iv) Cl_2, $FeCl_3$
c) (i) Cl_2, $FeCl_3$ (ii) Fe, HCl (iii) $NaNO_2$, HCl, 0°C (iv) H_2O/H^+
d) (i) Cl_2, $FeCl_3$ (ii) $NaNO_2$, HCl, 0°C (iii) Fe, HCl (iv) H_2O/H^+
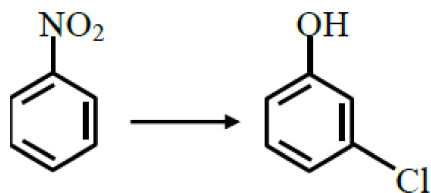
Q42 Which is correct order for heat of hydrogenation of the following molecules?

(A)

(B)

(C)

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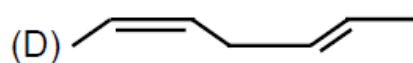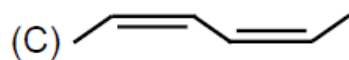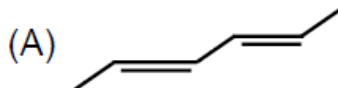
a) D > C > B > A   b) A > B > C > D   c) D > B > A > C   d) C > D > B > A

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Q43 Choose the correct option for the following reactions.

$$B \xleftarrow[H_2O_2/OH^{\ominus}]{(BH_3)_2} H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2 \xrightarrow[NaBH_4]{Hg(OAc)_2, H_2O} A$$

- **a)** 'A' and 'B' are both Markovnikov addition products.
- **b)** 'A' is Markovnikov product and 'B' is anti–Markovnikov product.
- **c)** 'A' and 'B' are both anti–Markovnikov products.
- **d)** 'B' is Markovnikov and 'A' is anti–Markovnikov product.

Q44 Which of the following names is **wrong** according to IUPAC rules?
- **a)** 4-Chloropentan-2-ol
- **b)** 1-Bromohex-4-yne
- **c)** 3-Hydroxybenzene-1-carbonitrile
- **d)** 3-Bromo-1,1-dimethyl cyclopentane

Q45

The reaction $cis - X \underset{k_b}{\overset{k_f}{\rightleftharpoons}} trans - X$ is first order in both directions. At 25°C, the
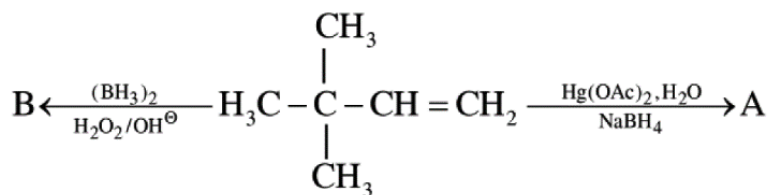
equilibrium constant is 0.10 and the rate constant $k_f = 3 \times 0^{-4}$ S^{-1}. In an experiment starting with the pure cis–form, how long would it take for half of the equilibrium amount of the trans–isomer to be formed ?

- **a)** 150 sec
- **b)** 200 sec
- **c)** 240 sec
- **d)** 210 sec

Q46 Equivalent conductivity of $Fe_2 (SO_4)_3$ is related to molar conductivity by the expression.
- **a)** $\Lambda_{eq} = \Lambda_m$
- **b)** $\Lambda_{eq} = \Lambda_m / 3$
- **c)** $\Lambda_{eq} = 3\Lambda_m$
- **d)** $\Lambda_{eq} = \Lambda_m / 6$

Q47 75% of a first order reaction is completed in 30 minutes. What is the time required for 93.75% of thereaction (in minutes)
- **a)** 45
- **b)** 120
- **c)** 90
- **d)** 60

Q48
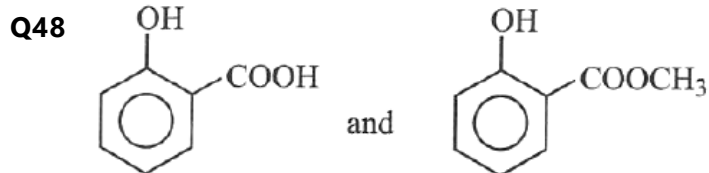
can be differentiated by

- **a)** NaOH
- **b)** Na metal
- **c)** $NaHCO_3$
- **d)** $FeCl_3$

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Q49 A Friedel–Crafts reaction of benzene with chloroform produces

a) $C_6H_5CHCl_2$

b)

$$C_6H_5-\underset{\underset{H}{|}}{\overset{\overset{Cl}{|}}{C}}-C_6H_5$$

c)

$$C_6H_5-\underset{\underset{H}{|}}{\overset{\overset{C_6H_5}{|}}{C}}-C_6H_5$$
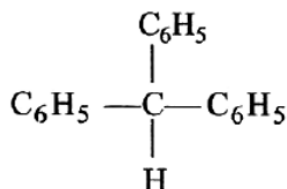
d) All of these

Q50 The numbers of chiral centers present in glucopyranose and fructofuranose are

a) 4 and 3   **b)** 5 and 4   **c)** 4 in each   **d)** 5 in each

Numerical

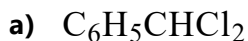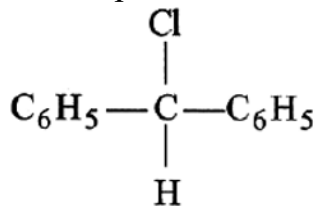**Q51** The modulus of entropy change when 10 moles of an deal gas expand from a volume V to a volume 10V reversibly and isothermally is ....R (Report your answer in terms of nearest integer)

Q52 For how many species the Ostwald dilution law is not applicable.
(i) H_2SO_4 (ii) KOH
(iii) CH_3COOH (iv) $HClO_4$
(v) NaOH   (vi) HI
(vii) NH_4OH (viii) HCOOH
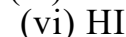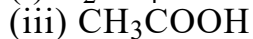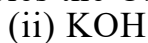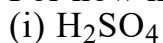
Q53 How many of the following oxides show amphoteric nature?
V_2O_3, V_2O_5, CrO, CrO_3, Cr_2O_3, Mn_2O_7, FeO, Cu_2O, ZnO.
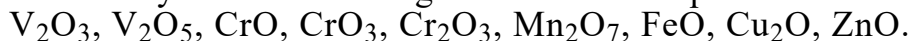
Q54 How many structure isomers of carbonyl compounds (Aldehydes & ketones only) are possible for molecular formula C5H$_{10}$O ?

Q55 Negative charge of the given anion is delocalized at how many carbon atoms?
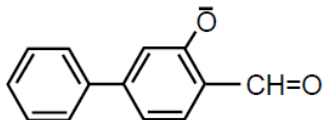
Q56 An aqueous solution of urea has a freezing point of –0.515°C. Predict the osmotic pressure (in atm) of the same solution at 37°C. Assume molarity and molality to be same (Nearest Integer)
(Given : $k_{f(H_2O)} = 1.86$ K kgmol^{-1}

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Q57 For an H-like atom

$$\psi_{(r)} = K_1 r [K_2 r^2 + k_3 r + k_4] \cdot e^{\frac{-Zr}{4a_0}}$$

Find the maximum value of $n + \ell + m$ for
The orbital, if k_1, k_2, k_3, k_4 & a_0 are constants

Q58 Identify number of substitutions those are deactivating but ortho and para directing

$$-\ddot{\underset{..}{F}}: , -CF_3 , -\overset{O}{\underset{\|}{C}}-NH_2 , -CH{=}CH-\overset{O}{\underset{\|}{C}}-H , -CH{=}CH-\overset{O}{\underset{\|}{C}}-OH,$$

$$-\overset{O}{\underset{..}{\underset{\|}{S}}}-C_2H_5 , -\overset{O}{\underset{\underset{\|}{O}}{\underset{\|}{S}}}-C_2H_5 , -\ddot{N}{=}O , -\overset{O}{\underset{\|}{C}}-NH_2$$
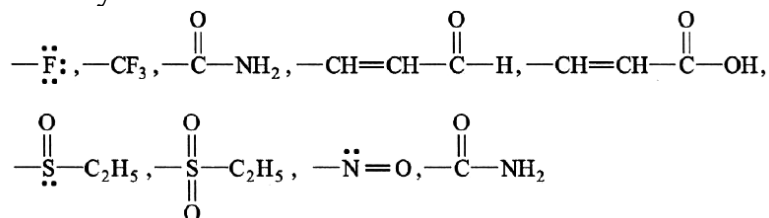
Q59 Total number of vacant orbitals in valency shell of Br when it forms maximum covalent bonds

Q60 How many moles of HIO_4 is required to break down the given molecule here ?

$$
\begin{array}{l}
\text{CH—OCH}_3 \\
\text{H——OH} \\
\text{H——OH} \\
\text{H——} \\
\text{CH}_2\text{OH}
\end{array}
$$

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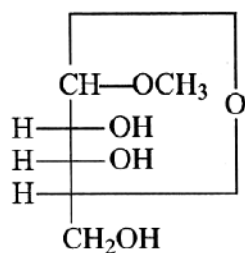
Mathematics

Single Choice Question

Q61 Let $x = \sin 1°$, then the value of the expression
$$\frac{1}{\cos 0° \cdot \cos 1°} + \frac{1}{\cos 1° \cdot \cos 2°} + \frac{1}{\cos 2° \cdot \cos 3°} + ... + \frac{1}{\cos 44° \cdot \cos 45°}$$ is equal to

a) X

b) $\dfrac{1}{x}$

c) $\dfrac{\sqrt{2}}{x}$

d) $\dfrac{x}{\sqrt{2}}$

Q62 The value of k so that the lines
x + ky + 2 = 0
3x + 2y + 1 = 0
2x + y + 2 = 0 form a triangle is

a) $k \in \left\{\frac{2}{5}, \frac{2}{3}, \frac{3}{4}\right\}$

b) $k \in \left\{\frac{1}{4}, \frac{2}{3}, \frac{3}{4}\right\}$

c) $k \in \left\{\frac{1}{4}, \frac{2}{3}, \frac{1}{2}\right\}$

d) $k \in R - \left\{\frac{1}{4}, \frac{2}{3}, \frac{1}{2}\right\}$

Q63 If $f(x) = x^3 + 2x^2 + 3x + 4$ and g(x) is the inverse of f(x) then g''(4) is equal to

a) $\dfrac{1}{4}$

b) 0

c) $\dfrac{1}{3}$

d) $-\dfrac{4}{27}$

Q64 z_1, z_2, z_3, z_4 are distinct complex numbers representing the vertices of a quadrilateral ABCD taken in order. If $z_1 - z_4 = z_2 - z_3$ and arg $\frac{z_4 - z_1}{z_2 - z_1} = \frac{\pi}{2}$, then the quadrilateral is

a) rectangle

b) rhombus

c) trapezium

d) parallelogram but not rectangle

Q65 A coin is tossed 7 times. Then the probability that at least 4 consecutive heads appear is

a) 3/16

b) 5/32

c) -3/16

d) 1/8

Q66 x_1 and x_2 are the roots of $ax^2 + bx + c = 0$ and $x_1 x_2 < 0$. Roots of $x_1(x - x_2)^2 + x_2(x - x_1)^2 = 0$ are

a) real and of opposite sign

b) negative

c) positive

d) non-real

Q67 If $\lim_{x \to 0}\left(x^{-3}\sin 3x + ax^{-2} + b\right)$ exists and is equal to 0, then

a) a = −3 and b = 9/2

b) a = 3 and b = 9/2

c) a = −3 and b = −9/2

d) a = 3 and b = −9/2

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Q68 The value of $\cos^{-1}\left[\cot\left\{\sin^{-1}\left(\sqrt{\dfrac{2-\sqrt{3}}{4}}\right) + \cos^{-1}\left(\dfrac{\sqrt{12}}{4}\right) + \sec^{-1}(\sqrt{2})\right\}\right]$ is

a) 0
b) $\dfrac{\pi}{4}$
c) $\dfrac{\pi}{3}$
d) $\dfrac{\pi}{2}$

Q69 Let $f(x) = \lim\limits_{n\to\infty} \dfrac{\log(2+x) - x^{2n}\sin x}{1+x^{2n}}$. Then

a) f is continuous at $x = 1$
b) $\lim\limits_{x\to 1^+} f(x) = \log 3$
c) $\lim\limits_{x\to 1^+} f(x) = -\sin 1$
d) $\lim\limits_{x\to 1^-} f(x)$ does not exist

Q70 If $\sum\limits_{i=1}^{5} x_i^2 = 40$ & $\sum\limits_{i=6}^{10} x_j^2 = 20$ and mean of $x_1, x_2, \ldots x_5$, is 1 and mean of $x_6, x_7, \ldots x_{10}$ is 2 then variance of $x_1, x_2, \ldots x_{10}$ is

a) $\dfrac{13}{4}$
b) $\dfrac{15}{4}$
c) $\dfrac{17}{4}$
d) $\dfrac{19}{4}$

Q71 The area of the region whose boundaries are defined by the curves $y = 2\cos x$, $y = 3\tan x$, and the y-axis is

a) $1 + 3\ln\left(\dfrac{2}{\sqrt{3}}\right)$ sq. units
b) $1 + \dfrac{3}{2}\ln 3 - 3\ln 2$ sq. units
c) $1 + \dfrac{3}{2}\ln 3 - \ln 2$ sq. units
d) $\ln 3 - \ln 2$ sq. units

Q72 A relation R is defined on the set of circles such that "$C_1RC_2 \Rightarrow$ circle C_1 and circle C_2 touch each other externally", then relation R is

a) Reflexive and symmetric but not transitive
b) Symmetric only
c) Symmetric and transitive but not reflexive
d) Equivalence

Q73 The point on the line $\dfrac{x-2}{1} = \dfrac{y+3}{-2} = \dfrac{z+5}{-2}$ at a distance of 6 from the point $(2,-3,-5)$ is

a) $(3,-5,-3)$
b) $(4,-7,-9)$
c) $(0,2,-1)$
d) $(-3,5,3)$

Q74 Solution of the differential equation $y(axy + e^x)\,dx - e^x dy = 0$ where $y(0) = 1$ is

a) $y(2 - ax^2) = 2e^x$
b) $ax^2 y - 2e^x = 2y$
c) $ax^2 y + 2 + 2ye^x = 0$
d) $x(2 - ax) = 2y^2$

Q75 The focal distance of a point on the parabola $y^2 = 4x$, which lies above its axis, is 10 units. If coordinates of the point are (h, k), then $h + k$ is equal to

a) 10
b) 12
c) 15
d) 18

Q76 Consider the hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$. Area of the triangle formed by the asymptotes and the tangent drawn to it at $(a, 0)$ is

a) $ab/2$
b) ab
c) $2ab$
d) $4ab$

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Q77 An ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1\,(a > b)$ passes through the point $(-3, 1)$ and its eccentricity is $\sqrt{\dfrac{2}{5}}$. Then length of latus rectum is

a) $\dfrac{8}{5}\sqrt{6}$

b) $\dfrac{9}{5}\sqrt{6}$

c) $\dfrac{8}{3}\sqrt{6}$

d) $\dfrac{9}{5}\sqrt{3}$

Q78 The coefficient of x^{65} in the expansion of $(1 + x)^{131}\,(x^2 - x + 1)^{130}$ is

a) $^{130}C_{65} + ^{129}C_{66}$

b) $^{130}C_{65} + ^{129}C_{55}$

c) $^{130}C_{66} + ^{129}C_{65}$

d) None of these

Q79 The Range of $f(x) = (x + 1)(x + 2)(x + 3)(x + 4) + 5$ for $x \in [-6, 6]$ is

a) $[4, 5045]$

b) $[0, 5045]$

c) $[-20, 5045]$

d) none of these

Q80 $\displaystyle\int \dfrac{\sqrt{x}(2x^2 + 3)\,dx}{(x^2 + 2x^2 + 1)^{3/2}} =$ (where c is arbitrary constant)

a) $\dfrac{2x\sqrt{x}}{\sqrt{x^3 + 2x^2 + 1}} + c$

b) $\dfrac{2\sqrt{x}}{\sqrt{x^3 + 2x^2 + 1}} + c$

c) $\dfrac{2x\sqrt{x}}{(x^3 + 2x^2 + 1)^{3/2}} + c$

d) $\dfrac{2\sqrt{x}}{(x^3 + 2x^2 + 1)^{3/2}} + c$

Numerical

Q81 Let $a + ar_1 + ar_1^2 + \ldots + \infty$ and $a + ar_2 + ar_2^2 + \ldots + \infty$ be two infinite series of positive numbers with the same first term. The sum of the first series is r_1 and the sum of the second series is r_2. Then the value of $(r_1 + r_2)$ is.

Q82 $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ x & 2 & y \end{bmatrix}$ is an orthogonal matrix, then the value of $-x - y$ is

Q83 A boy has 3 library tickets and 8 books of his interest in the library including mathematics part-I and mathematics part-II. Of these 8, he does not want to borrow mathematics part II, unless mathematics part I is also borrowed. Then number of ways of borrowing the three books are.

Q84 The extremities of the diagonal of rectangle are $(-4, 4)$ and $(6, -1)$. A circle cirumscribes the rectangle and cuts intercept of length AB on they y-axis. The length of AB is

Q85 Let three matrices $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$; $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$ the

$t_r(A) + t_r\left(\dfrac{ABC}{2}\right) + t_r\left(\dfrac{A(BC)^2}{4}\right) + t_r\left(\dfrac{A(BC)^3}{8}\right) + \ldots\ldots = $

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Q86 For a certain curve y = f (x) satisfying $\dfrac{d^2y}{dx^2} = 6x - 4, f(x)$ has a local minimum value 5 when x = 1. Then global maximum value of f(x), if $0 \le x \le 2$, is

Q87 If $\vec{a}, \vec{b}, \vec{c}$ be the unit vectors then $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$ does not exceed.

Q88 If $I = \dfrac{1}{x - \sin x} \displaystyle\int_0^x \dfrac{t^2 dt}{\sqrt{a + t}}$ and $\lim\limits_{x \to 0} I = 1$, then a is equal to

Q89 For a cubic function y = f(x), f''(x) = 4x at each point (x, y) on it and it crosses the x-axis at (−2, 0) at an angle of 45° with positive direction of the x-axis. Then the value of (-f(1)) is _____.

Q90 Find the absolute value of parameter t for which the area of the triangle whose vertices are A (−1,1,2); B (1,2,3) and C (t, 1,1) is minimum.

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Answer Key

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

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