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Aakash
Medical | IIT-JEE | Foundations
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KCET-2020 (Code-A1)

PHYSICS

Subject	No. Of Questions	Max. Marks	Maximum Time For Answering
Physics	60	60	70 Minutes

Choose the correct answer:

1. The value of acceleration due to gravity at a height of 10 km from the surface of earth is x. At what depth inside the earth is the value of the acceleration due to gravity has the same value x ?

   (A) 5 km (B) 20 km

   (C) 10 km (D) 15 km

Sol. Answer: (B)

$$x = g\left(1-\frac{2h}{R}\right) = g\left(1-\frac{d}{R}\right)$$

$$\Rightarrow 2h = d$$

$$\Rightarrow d = 2h = 20km$$

2. Young's modulus of a perfect rigid body is

   (A) Zero

   (B) Unity

   (C) Infinity

   (D) Between Zero and Unity

Sol. Answer: (C)

Young's modulus of a perfect rigid body is infinity.

3. A wheel starting from rest gains an angular velocity of 10 rad/s after uniformly accelerated for 5 sec. The total angle through which it has turned is

   (A) 25 rad

   (B) 100 rad

   (C) 25 π rad

   (D) 50 π rad about a vertical axis

Sol. Answer: (A)

$$10 = 0 + \alpha \times 5 \Rightarrow \alpha = 2 \text{ rad/S}^2$$

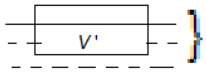
$$\theta = 0 + \frac{1}{2}\alpha(5)^2 = \frac{1}{2}\times 2 \times 5 = 25 \text{ rad}$$

4. Iceberg floats in water with part of it submerged. What is the fraction of the volume of iceberg submerged if the density of ice is $\rho_i = 0.917 \text{ g cm}^{-3}$?

   (A) 0.917 (B) 1

   (C) 0.458 (D) 0

So.. Answer: (A)



$$\rho_i = 0.917 \text{ g/cm}^3$$

$V\rho_i g = V'.\rho g$

$$\Rightarrow \frac{V'}{V} = \frac{\rho_i}{\rho} = 0.917$$

5. A sphere, a cube and a thin circular plate all of same material and same mass initially heated to same high temperature are allowed to cool down under similar conditions. Then the

   (A) Plate will cool the fastest and cube the slowest.

   (B) Sphere will cool the fastest and cube the slowest.

   (C) Plate will cool the fastest and sphere the slowest.

   (D) Cube will cool the fastest and plate the slowest.

Sol. Answer: (C)

For given mass and material thin plate has maximum surface area and sphere has minimum. So plate will cool fastest and sphere the slowest.

6. In an adiabatic expansion of an ideal gas the product of pressure and volume.

(A) Decreases

(B) Increases

(C) Remains constant

(D) At first increases and then decreases

Sol. Answer: (A)

PV^{r} =constant

$$\Rightarrow P.V=\frac{k}{V^{\gamma-1}}$$

In explanation, V keeps on increasing.

So $\frac{1}{V^{\gamma-1}}$ keeps on decreasing.

7. A certain amount of heat energy is supplied to a monoatomic ideal gas which expands at constant pressure. What fraction of the heat energy is converted into work?

(A) 1 (B) $\frac{2}{3}$

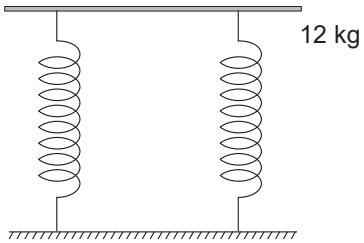
(C) $\frac{2}{5}$ (D) $\frac{5}{7}$

Sol. Answer: (C)

Monoatomic gas $\Rightarrow \gamma=\frac{5}{3}$

$$\frac{\Delta W}{\Delta Q}=1-\frac{\Delta U}{\Delta Q}=1-\frac{C_V}{C_P}=1-\frac{1}{\gamma}=1-\frac{3}{5}=\frac{2}{5}$$

8. A tray of mass 12 kg is supported by two identical springs as shown in figure. When the tray is pressed down slightly and then released. It executes SHM with a time period of 1.5 s. The spring constant of each spring is



(A) 50 Nm^{-1} (B) 0

(C) 105 Nm^{-1} (D) ∞

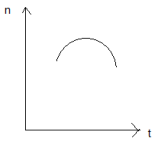
Sol. Answer: (C)

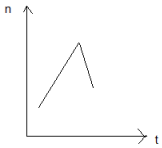
$T=1.5$ s springs are in parallel $\Rightarrow k_{eq}=2k$

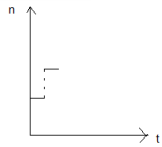
$$2\pi\sqrt{\frac{12}{2k}}=1.5\Rightarrow\frac{6}{k}=\left(\frac{3}{4\pi}\right)^2=\frac{9}{16\pi^2}\Rightarrow k=\frac{32\pi^2}{3}$$

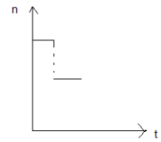
$$\Rightarrow k=105\ \text{Nm}^{-1}$$

9. A train whistling at constant frequency 'n' is moving towards a station at a constant speed V. The train goes past a stationary observer on the station. The frequency 'n' of the sound as heard by the observer is plotted as a function of time 't'. Identify the correct curve

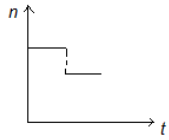
(A) 

(B) 

(C) 

(D) 

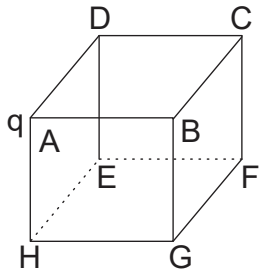
Sol. Answer: (D)



Train is moving at constant speed.

Frequencies heard will be constant (not variable)

10. A point charge 'q' is placed at the corner of a cube of side 'a' as shown in the figure. What is the electric flux through the face ABCD?



(A) 0 (B) $\frac{q}{24\varepsilon_0}$

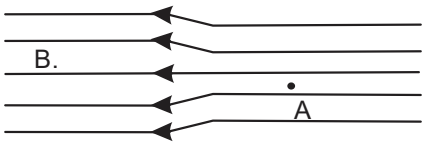
(C) $\frac{q}{6\varepsilon_0}$ (D) $\frac{q}{72\varepsilon_0}$

Sol. Answer: (A)

Flux through face ABCD = 0 as

$\angle\left(\vec{E}.\overrightarrow{dA}\right) = 90^0$ at each and every area element of face ABCD.

11. The electric field lines on the left have twice the separation on those on the right as shown in figure. If the magnitude of the field at A is $40\ \text{Vm}^{-1}$, what is the force on $20\ \mu C$ charge kept at B?



(A) $4\times10^{-4}\ \text{Vm}^{-1}$ (B) $8\times10^{-4}\ \text{Vm}^{-1}$

(C) $16\times10^{-4}\ \text{Vm}^{-1}$ (D) $1\times10^{-4}\ \text{Vm}^{-1}$

Sol. Answer: (A)

$E_A = 40\ \text{V/m} \Rightarrow E_B = \frac{E_A}{2} = 20\ \text{V/m}$

$\Rightarrow F_B = (20\mu c)\times 20\ \text{V/m} = 400\mu\text{N} = 4\times10^{-4}N$

(Unit in options given is wrong)

12. An infinitely long thin straight wire has uniform charge density of $\frac{1}{4}\times10^{-2}\ \text{Cm}^{-1}$. What is the magnitude of electric field at a distance 20 cm from the axis of the wire?

(A) $1.12\times10^{8}\ \text{NC}^{-1}$ (B) $4.5\times10^{8}\ \text{NC}^{-1}$

(C) $2.25\times10^{8}\ \text{NC}^{-1}$ (D) $9\times10^{8}\ \text{NC}^{-1}$

Sol. Answer: (C)

$\lambda = \frac{1}{4}\times10^{-2}\ \text{cm}^{-1}, r = 20\ \text{cm} = \frac{1}{5}\ \text{m}$

$$\Rightarrow E = \frac{\lambda}{2\pi\varepsilon_0 r} = \frac{\frac{1}{4}\times10^{-2}\times18\times10^{9}}{1\times\frac{1}{5}} = \frac{5\times9}{2}\times10^{7}\ \text{V/m}$$

$= 22.5\times10^{7}\ \text{V/m} = 2.25\times10^{8}\ \text{V/m}$

13. A dipole of dipole moment 'P' and moment of inertia I is placed in a uniform electric field $\vec{E}$. If it is displaced slightly from its stable equilibrium position, the period of oscillation of dipole is

(A) $\sqrt{\frac{PE}{I}}$

(B) $2\pi\sqrt{\frac{I}{PE}}$

(C) $\frac{1}{2\pi}\sqrt{\frac{PE}{I}}$

(D) $\pi\sqrt{\frac{I}{PE}}$

Sol. Answer: (B)

$T = 2\pi\sqrt{\frac{I}{PE}}$

14. The difference between equivalent capacitances of two identical capacitors connected in parallel to that in series is $6\ \mu\text{F}$. The value of capacitance of each capacitor is

(A) 2 μF (B) 3 μF

(C) 4 μF (D) 6 μF

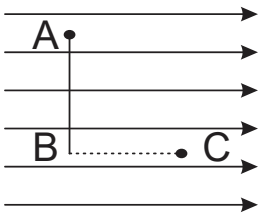
Sol. Answer: (C)

Identical capacitors,

$C,C \Rightarrow C_P = 2\ C\ \&\ C_S = \frac{C}{2}$

$\Rightarrow 2C - \frac{C}{2} = 6 \Rightarrow \frac{3C}{2} = 6 \Rightarrow C = 4\mu F$

15. Figure shows three points A, B and C in a region of uniform electric field $\vec{E}$. The line AB is perpendicular and BC is parallel to the field lines. Then which of the following holds good? (V_A, V_B and V_C represent the electric potential at points A, B and C respectively)



(A) $V_A = V_B = V_C$ (B) $V_A = V_B > V_C$

(C) $V_A = V_B < V_C$ (D) $V_A > V_B = V_C$

Sol. Answer: (B)

$V_A = V_B$ and $V_C < (V_A = V_B)$

16. When a soap bubble is charged?

(A) Its radius increases.

(B) Its radius decreases.

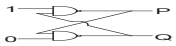
(C) The radius remain the same.

(D) Its radius may increase or decrease.

Sol. Answer: (A)

When a soap bubble is charged its radius increases as there will be repulsion between similar kind of charge present on surface of bubble.

17. A hot filament liberates an electron with zero initial velocity. The anode potential is 1200 V. The speed of the electron when it strikes the anode is

(A) 

(B) 2.5×10^{6} ms^{-1}

(C) 2.1×10^{7} ms^{-1}

(D) 2.5×10^{8} ms^{-1}

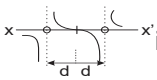
Sol. Answer: (C)

$$\frac{1}{2}mv^2 = qv \Rightarrow v = \sqrt{\frac{2qv}{m}} = \sqrt{\frac{2\times1.6\times10^{-19}\times1200}{9.1\times10^{-31}}}$$

$$\Rightarrow v = \sqrt{\frac{32\times12}{9}\times10^{13}}$$

$$= 10^{6}\times\sqrt{\frac{32\times40}{3}} = 8\times10^{6}\times\sqrt{\frac{20}{3}}$$

$$v = 8\times2.53\times10^{6} = 2.1\times10^{7}\ \text{ms}^{-1}$$

18. A metal rod of length 10 cm and a rectangular cross – section of 

is connected to a battery across opposite faces. The resistance will be

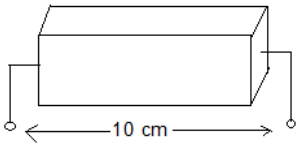
(A) Maximum when the battery is connected across $1\text{ cm}\times\frac{1}{2}$ cm faces.

(B) Maximum when the battery is connected across $1\text{ cm}\times\frac{1}{2}$ cm faces.

(C) Maximum when the battery is connected across $10\text{ cm}\times1\text{ cm}$ faces.

(D) Same irrespective of the three faces.

Sol. Answer: (A)



Resistance will be maximum. When the battery is connected across

$\Rightarrow 1\text{ cm}\times\frac{1}{2}$ cm faces

19. A car has a fresh storage battery of e.m.f 12 V and internal resistance $2\times10^{-2}\Omega$. If the starter motor draws a current of 80 A. Then the terminal voltage when the starter is on is

(A) 12 V (B) 8.4 V

(C) 10.4 V (D) 9.3 V

Sol. Answer: (C)

$E = 12$ volt,, r = $2\times10^{-2}\Omega$

V = E - Ir

$=12 - 80\times2\times10^{-2} = 12 - 1.6 = 10.4V$

20. A potentiometer has a uniform wire of length 5m. A battery of emf 10 V and negligible internal resistance is connected between its ends. A secondary cell connected to the circuit gives balancing length at 200 cm. The emf of the secondary cell is

(A) 4 V (B) 6 V

(C) 2 V (D) 8 V

Sol. Answer: (A)

$$\phi = \frac{10}{500} = \frac{1}{50}V/cm$$

$$\Rightarrow E = \phi\ell = \frac{1}{50}\times200V$$

$$\Rightarrow E = 4V$$

21. The colour code for a carbon resistor of resistance of $0.28\ \text{k}\Omega\pm10\%$ is

(A) Red, Grey, Brown, Silver

(B) Red, Green, Brown, Silver

(C) Red, Grey, Silver, Silver

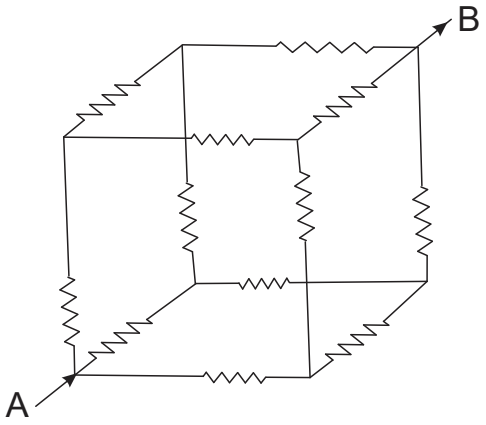
(D) Red, Green, Silver

Sol. Answer: (A)

$\Rightarrow 0.28\ \text{k}\Omega\pm10\% = 280\Omega\pm10\% = 28\times10^{1}\pm10\%$

$\Rightarrow$ Red, Grey, Brown, Silver

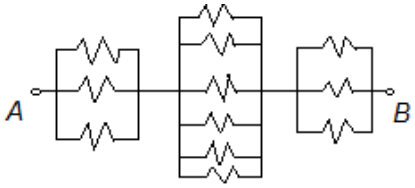
22. Each resistance in the given cubical network has resistance of $1\,\Omega$ and equivalent resistance between A and B is



(A) $\frac{5}{6}\Omega$ (B) $\frac{6}{5}\Omega$

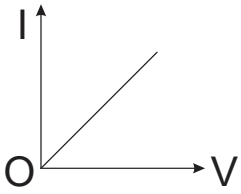
(C) $\frac{5}{12}\Omega$ (D) $\frac{12}{5}\Omega$

Sol. Answer: (A)



$$\Rightarrow R_{AB} = \frac{1}{3}+\frac{1}{6}+\frac{1}{3} = \frac{5}{6}\Omega$$

23. I – V characteristic of a copper wire of length L and area of cross – section A is shown in figure. The slope of the curve becomes



(A) More if experiment is performed at higher temperature

(B) More if a wire of steel of same dimension is used.

(C) Less if the area of the wire is increased.

(D) Less if the length of the wire is increased.

Sol. Answer: (D)

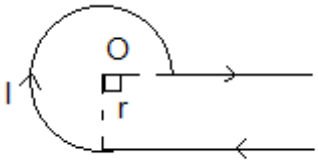
At higher temperature resistance increases. So slope of curve must decreases

Resistance of steel wire is more so slope of curve will be less.

Area $\uparrow \Rightarrow$ Resistance $\downarrow \Rightarrow$ slope $\uparrow$

Length $\uparrow \Rightarrow$ Resistance $\uparrow \Rightarrow$ slope $\downarrow$

24. In the given figure, the magnetic field at 'O'



(A) $\frac{3}{4}\frac{\mu_0 I}{r}+\frac{\mu_0 I}{4\pi r}$ (B) $\frac{3}{10}\frac{\mu_0 I}{r}-\frac{\mu_0 I}{4\pi r}$

(C) $\frac{3}{8}\frac{\mu_0 I}{r}+\frac{\mu_0 I}{4\pi r}$ (D) $\frac{3}{8}\frac{\mu_0 I}{r}-\frac{\mu_0 I}{4\pi r}$

Sol. Answer: (C)

$$B = \frac{\mu_0}{4\pi}\frac{I}{r}(1+0)\otimes+\frac{\mu_0}{4\pi}.\frac{I}{r}\left(\frac{3\pi}{2}\right)\otimes+0$$

$$B = \frac{\mu_0 I}{4\pi r}+\frac{3}{8}\frac{\mu_0 I}{r}$$

25. The magnetic field at the origin due to a current element $i\vec{dl}$ placed at a point with vector position $\vec{r}$ is

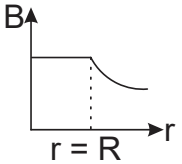
(A) $\frac{\mu_0 i}{4\pi}\frac{\vec{dl}\times\vec{r}}{r^3}$ (B) $\frac{\mu_0 i}{4\pi}\frac{\vec{r}\times\vec{dl}}{r^3}$

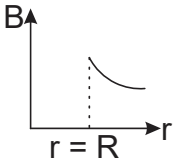
(C) $\frac{\mu_0 i}{4\pi}\frac{\vec{dl}\times\vec{r}}{r^2}$ (D) $\frac{\mu_0 i}{4\pi}\frac{\vec{r}\times\vec{dl}}{r^2}$

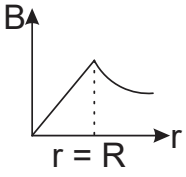
Sol. Answer: (B)

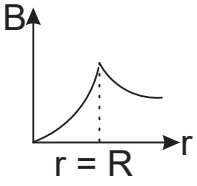
$$\overrightarrow{dB} = \frac{\mu_0}{4\pi}\frac{\left(i\overrightarrow{d\ell}\right)\times\left(-\vec{r}\right)}{r^3} = \frac{\mu_0}{4\pi}.i\frac{\vec{r}\times\overrightarrow{d\ell}}{r^3}$$

26. A long cylindrical wire of radius R carries uniform current I flowing through it. The variation of magnetic field with distance 'r' from the axis of the wire is shown by

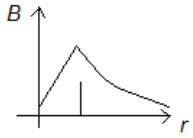
(A) 

(B) 

(C) 

(D) 

Sol. Answer: (C)



$B \propto$ r (inside wire)

$B \propto \frac{1}{r}$ (outside wire)

27. A cyclotron is used to accelerate protons $\left({}_1^1\text{H}\right)$, Deuterons $\left({}_1^2\text{H}\right)$ and α - particles $\left({}_2^4\text{He}\right)$. While exiting under similar conditions, the minimum K.E. is gained by

(A) α - particle (B) proton

(C) deuteron (D) same for all

Sol. Answer: (C)

Radius of cyclotron will be fixed.

$$\Rightarrow R = \frac{\sqrt{2mk}}{qB} \Rightarrow K = \frac{q^2B^2R^2}{2m}$$

$$K_P : K_D : K_\alpha = \frac{1^2}{1} : \frac{1^2}{2} : \frac{2^2}{4} = 1 : \frac{1}{2} : 1$$

$\Rightarrow$ Minimum K.E = Deuteron

28. A paramagnetic sample shows a net magnetization of 8 Am^{-1} when placed in an external magnetic field of 0.6 T at a temperature of 4 K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16 K. The magnetization will be

(A) $\frac{32}{3}$ Am^{-1} (B) $\frac{2}{3}$ Am^{-1}

(C) 6 Am^{-1} (D) 2.4 Am^{-1}

Sol. Answer: (B)

$I = x_m H$ and $x_m \propto \frac{1}{T} \Rightarrow \frac{I_1}{I_2} = \frac{T_2}{T_1} \times \frac{H_1}{H_2}$

$$\Rightarrow \frac{8}{I_2} = \frac{16}{4} \times \frac{0.6}{0.2} = 4 \times 3 = 12$$

$$\Rightarrow I_2 = \frac{8}{12} = \frac{2}{3} Am^{-1}$$

29. The ratio of magnetic field at the centre of a current carrying circular coil to its magnetic moment is 'x'. If the current and the radius both are doubled. The new ratio will become

(A) $2x$ (B) $4x$

(C) $\frac{x}{4}$ (D) $\frac{x}{8}$

Sol. Answer: (D)

$$B = \frac{\mu_0}{4\pi} \cdot \frac{2\pi I}{r}$$

$$M = IA = I\pi r^2$$

$$x = \frac{B}{M} = \frac{\frac{\mu_0}{4\pi} \cdot \frac{2\pi I}{r}}{I\pi r^2} = \frac{\mu_0}{2\pi} \cdot \frac{1}{r^3} \Rightarrow \frac{x'}{x} = \frac{\left(\frac{1}{2}\right)^3}{(1)^3}$$

$$= \frac{1}{8} \Rightarrow x' = \frac{x}{8}$$

30. In a permanent magnet at room temperature

(A) Magnetic moment of each molecule is zero.

(B) The individual molecule have non-zero magnetic moment which are all perfectly aligned.

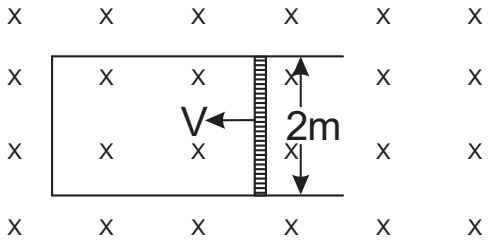
(C) Domains are partially aligned.

(D) Domains are all perfectly aligned.

Sol. Answer: (C)

In a permanent magnet domain are partially aligned at room temperature.

31. A rod of length 2 m slides with a speed of 5 ms^{-1} on a rectangular conducting frame as shown in figure. There exists a uniform magnetic field of 0.04 T perpendicular to the plane of the figure. If the resistance of the rod is 3Ω. The current through the rod is



(A) 75 mA (B) 133 mA

(C) 0.75 A (D) 1.33 A

Sol. Answer: (B)

$e = Bv\ell = 0.04 \times 5 \times 2 = 0.4$ volt

$\Rightarrow i = \frac{e}{R} = \frac{0.4}{3} = 0.133A = 133$ mA

32. The current in a coil of inductance 0.2 H changes from 5 A to 2 A in 0.5 sec. The magnitude of the average induced emf in the coil is

(A) 0.6 V (B) 1.2 V

(C) 30 V (D) 0.3 V

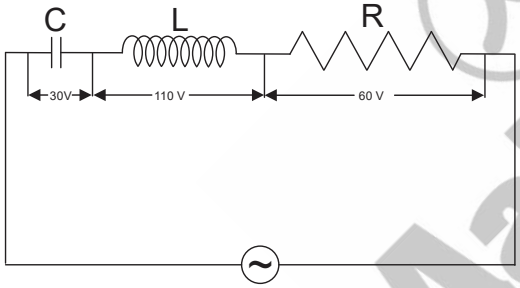
Sol.. Answer: (B)

$\Delta t = 0.5s \Rightarrow \Delta I = 3A$

$\left|e_{avg}\right| = 1.\frac{\Delta I}{\Delta t}$

$\Rightarrow \left|e_{avg}\right| = 0.2 \times \frac{3}{0.5} = 1.2$ volt

33. In the given circuit the peak voltages across C, L and R are 30 V, 110 V and 60 V respectively. The rms value of the applied voltage is



(A) 100 V (B) 200 V

(C) 70.7 V (D) 141 V

Sol. Answer: (C)

$V_{0C} = 30V, V_{OL} = 110V, V_{OR} = 60V$

$\Rightarrow V_O = \sqrt{V_{OR}^2 + \left(V_{OC} - V_{OL}\right)^2} = \sqrt{60^2 + 80^2}$

$= 100\ V$

$\Rightarrow V_{O(rms)} = \frac{100}{\sqrt{2}} = 70.7$ volt

34. The power factor of R – L circuit is $\frac{1}{\sqrt{3}}$. If the inductive reactance is $2\ \Omega$. The value of resistance is

(A) $2\ \Omega$ (B) $\sqrt{2}\ \Omega$

(C) $0.5\ \Omega$ (D) $\frac{1}{\sqrt{2}}\ \Omega$

Sol. Answer: (B)

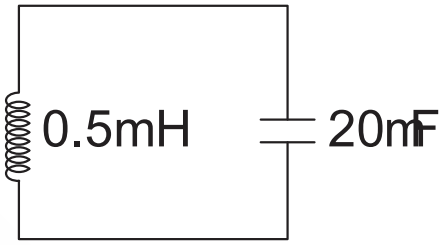
$\cos\phi = \frac{R}{z} = \frac{1}{\sqrt{3}} \Rightarrow R\sqrt{3} = Z,\ X_L = 2\Omega$

$\Rightarrow 3R^2 = Z^2 = R^2 + X_L^2 \Rightarrow 2R^2 = 2^2$

$\Rightarrow \sqrt{2}R = 2$

$\Rightarrow R = \sqrt{2}\Omega$

35. In the given circuit, the resonant frequency is



(A) 15.92 Hz (B) 159.2 Hz

(C) 1592 Hz (D) 15910 Hz

Sol. Answer: (C)

$f = \frac{1}{2\pi\sqrt{0.5 \times 10^{-3} \times 20 \times 10^{-6}}}$

$= \frac{1}{2\pi\sqrt{10^{-8}}}$

$f = \frac{10000}{2\pi} Hz = \frac{5000}{\pi} Hz = 1592\ Hz$

36. A light beam of intensity 20 W/cm^2 is incident normally on a perfectly reflecting surface of sides $25\ \text{cm} \times 15\ \text{cm}$. The momentum imparted to the surface by the light per second is

(A) 2×10^{-5} kg ms^{-1} (B) 1×10^{-5} kg ms^{-1}

(C) 5×10^{-5} kg ms^{-1} (D) 1.2×10^{-5} kg ms^{-1}

Sol. Answer: (C)

$I = 20$ W/cm^2 $A = 25\ \text{cm} \times 15\ \text{cm}$

Momentum per second = Force

= Pressure X Area

$= 2\left(\frac{I}{C}\right) \times A = 2 \times \frac{20 \times 10^4}{3 \times 10^8} \times 25 \times 15 \times 10^{-4}$

$= \frac{40}{3} \times 10^{-8} \times 25 \times 15 = 200 \times 25 \times 10^{-8} N$

$= 5 \times 10^{-5} N = 5 \times 10^{-5}$ kgm s^{-2}

(Unit given in options is wrong)

37. An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus, the image

(A) Moves away from the lens with an uniform speed 5 m/s .

(B) Moves away from the lens with an uniform acceleration.

(C) Moves away from the lens with a non – uniform acceleration.

(D) Moves towards the lens with a non – uniform acceleration.

Sol. Answer: (C)

$$\frac{1}{f}=\frac{1}{v}-\frac{1}{u}\Rightarrow 0=-\frac{1}{v^2}.\frac{dv}{dt}+\frac{1}{v^2}\frac{du}{dt}$$

$\Rightarrow$ Speed of image $=\left(\frac{f}{f+u}\right)^2$ (Speed of object)

$$\Rightarrow V_I=\frac{f^2}{(f+u)^2}v_o\Rightarrow \frac{dV_I}{dt}=V_o t^2-2(f+u)^{-3}.\left(O+\frac{du}{dt}\right)$$

$$\frac{dV_I}{dt}=-\frac{2v_o f^2}{(f+u)^3}.\frac{du}{dt}=-\frac{2V_0^2 f^2}{(f+u)^3}$$

$\Rightarrow$ non uniform acceleration.

38. The refracting angle of a prism is A and refractive index of material of prism is cot $\frac{A}{2}$. The angle of minimum deviation is

(A) 180^0 - 3A (B) 180^0+2A

(C) 90^0 - A (D) 180^0 - 2A

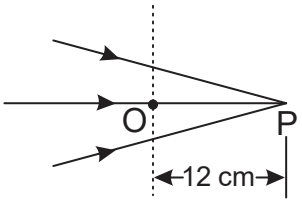
Sol. Answer: (D)

$$\mu=\frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}\Rightarrow\frac{\cos\left(\frac{A}{2}\right)}{\sin\left(\frac{A}{2}\right)}\times\sin\left(\frac{A}{2}\right)=\sin\left(\frac{A+\delta_m}{2}\right)$$

$$\Rightarrow\sin\left(90^0-\frac{A}{2}\right)=\sin\left(\frac{A+\delta_m}{2}\right)\Rightarrow 90^0-\frac{A}{2}=\frac{A+\delta_m}{2}$$

$$\Rightarrow 180^0-A=A+\delta_m\Rightarrow\delta_m=180^0-2A$$

39. The following figure shows a beam of light converging at point P. When a concave lens of focal length 16 cm is introduced in the path of the beam at a place shown by dotted line such that OP becomes the axis of the lens, the beam converges at a distance x from the lens. The value of x will be equal to



(A) 12 cm (B) 24 cm

(C) 36 cm (D) 48 cm

Sol. Answer: (D)

$u=+12$ cm, $f=-16$ cm, $v=?$

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}\Rightarrow\frac{1}{v}-\frac{1}{12}=-\frac{1}{16}$$

$$\Rightarrow\frac{1}{v}-\frac{1}{12}=\frac{1}{16}$$

$$\Rightarrow\frac{1}{v}=\frac{4-3}{48}=\frac{1}{48}\Rightarrow v=48\text{ cm}$$

40. Three polaroid sheets P_1,P_2 and P_3 are kept parallel to each other such that the angle between pass axes of P_1 and P_2 is 45^0 and that between P_2 and P_3 is 45^0. If unpolarised beam of light of intensity 128 Wm^{-2} is incident on P_1. What is the intensity of light coming out of P_3?

(A) 128 Wm^{-2} (B) 0

(C) 16 Wm^{-2} (D) 64 Wm^{-2}

Sol. Answer: (C)

$$\frac{I_0}{8}=\frac{128}{8}=16\text{ Wm}^{-2}$$

41. Two poles are separated by a distance of 3.14 m. The resolving power of human eye is 1 minute of an arc. The maximum distance from which he can identify the two poles distinctly is

(A) 10.8 km (B) 5.4 km

(C) 188 m (D) 376 m

Sol. Answer: (A)

$$\theta=\frac{d}{D}\Rightarrow D=\frac{d}{\theta}=\frac{3.14}{\frac{1}{60}\times\frac{\pi}{180}}=60\times180\text{ m}$$

$\Rightarrow D=10800$ m=10.8 km

42. In Young's Double Slit Experiment, the distance between the slits and the screen is 1.2 m and the distance between the two slits is 2.4 mm. If a thin transparent mica sheet of thickness 1 μm and R.I. 1.5 is introduced between one of the interfering beams, the shift in the position of central bright fringe is

(A) 2 mm (B) 0.5 mm

(C) 0.125 mm (D) 0.25 mm

Sol. Answer: (D)

$D = 1.2$ m, d=2.4 mm, t = 1μm, $\mu = 1.5$

$$\text{shift} = \frac{(\mu-1)tD}{d} = \frac{0.5\times10^{-6}\times1.2}{2.4\times10^{-3}} = \frac{0.6}{2.4}\times10^{-3}\ \text{m}$$

$$= \frac{1}{4}\times10^{-3}\ \text{m} = 0.25\ \text{mm}$$

43. The de – Broglie wavelength associated with electron of hydrogen atom in this ground state is

(A) 0.3 $\overset{0}{A}$ (B) 3.3 $\overset{0}{A}$

(C) 6.26 $\overset{0}{A}$ (D) 10 $\overset{0}{A}$

Sol. Answer: (B)

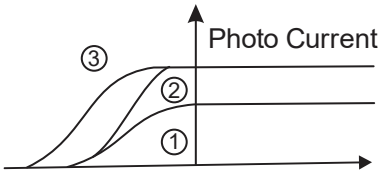
$$v = \frac{Ze^2}{2nh\varepsilon_0} = \frac{e^2}{2h\varepsilon_0} = \frac{(1.6)^2\times10^{-38}}{2\times6.625\times10^{-34}\times8.854\times10^{-12}}$$

$$v = \frac{1.28\times10^{8}}{6.625\times8.854} = 2.18\times10^{6}\ \text{m/s}$$

$$\Rightarrow \lambda = \frac{h}{mv} = \frac{6.625\times10^{-34}}{9.1\times10^{-31}\times2.18\times10^{6}} = \frac{6.625\times10^{-9}}{9.1\times2.18}\ \text{m}$$

$$\Rightarrow \lambda = \frac{66.25}{9.1\times2.18}\overset{0}{A} = 3.3\overset{0}{A}$$

44. The following graph represents the variation of photo current with anode potential for a metal surface. Here I_1, I_2 and I_3 represents intensities and $\gamma_1, \gamma_2, \gamma_3$ represent frequency for curves 1,2 and 3 respectively, then



(A) $\gamma_1 = \gamma_2$ and $I_1 \neq I_2$ (B) $\gamma_1 = \gamma_3$ and $I_1 = I_3$

(C) $\gamma_1 = \gamma_2$ and $I_1 = I_2$ (D) $\gamma_2 = \gamma_3$ and $I_1 = I_3$

Sol. Answer: (A)

$\gamma_1 = \gamma_2$ as stopping potentials are same for both.

$I_2 = I_3$ as saturation current is same for both

45. The period of revolution of an electron revolving in nth orbit of H – atom is proportional to

(A) n^2 (B) $\frac{1}{n}$

(C) n^3 (D) Independent of n

Sol. Answer: (C)

$$T = \frac{2\pi r}{v} = 2\pi\frac{n^2h^2\varepsilon_0}{\pi mZe^2}\left(\frac{Ze^2}{2nh\varepsilon_0}\right)^{-1} = \frac{n^2h^2\varepsilon_0.2nh\varepsilon_0}{\pi mZe^2.Ze^2}$$

$\Rightarrow T \propto n^3$

46. Angular momentum of an electron in hydrogen atom is $\frac{3h}{2\pi}$ (h is Planck's constant). The K.E. of the electron is

(A) 4.35 eV (B) 1.51 eV

(C) 3.4 eV (D) 6.8 eV

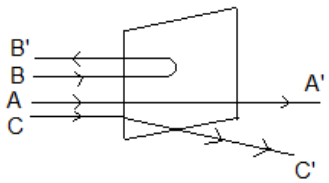
Sol. Answer: (B)

$$mvr = 3\left(\frac{h}{2\pi}\right) \Rightarrow n = 3 \Rightarrow T.E = -\frac{13.6}{3^2}eV$$

$$= -1.51\ eV$$

K.E = $|T.E| = 1.51$ eV

47. A beam of fast moving alpha particles were directed towards a thin film of gold. The parts A, B and C of the transmitted and reflected beams corresponding to the incident parts A, B and C of the beam are shown in the adjoining diagram. The number of alpha particles in



(A) B' will be minimum and in C' maximum.

(B) A' will be maximum and in C' minimum.

(C) A' will be minimum and in B' maximum

(D) C' will be minimum and in B' maximum

Sol. Answer: (no option is correct)

48. Two protons are kept at a separation of 10 nm. Let F_n and F_e be the nuclear force and the electromagnetic force between them

(A) $F_e = F_n$

(B) $F_e >> F_n$

(C) $F_e << F_n$

(D) F_e and F_n differ only slightly

Sol. Answer: (B)

10 nm = $10^{-8} m$

Range of nuclear force is $10^{-15} m$. If distance is more than $10^{-15} m$ then F_n is not functional (or it is negligible)

$\Rightarrow F_n << F_e$

49. During a β-decay

(A) An atomic electron is ejected.

(B) An electron which is already present within the nucleus is ejected.

(C) A neutron in the nucleus decays emitting an electron.

(D) A proton in the nucleus decays emitting an electron.

Sol. Answer: (C)

During $\beta - decay$, a neutron in the nucleus decays emitting an electron.

50. A radio – active element has half – life of 15 years. What is the fraction that will decay in 30 years?

(A) 0.25

(B) 0.5

(C) 0.75

(D) 0.85

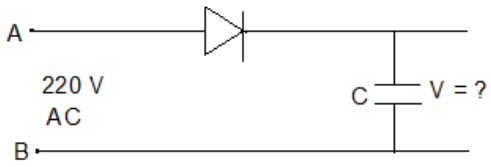
Sol. Answer: (C)

$T_{1/2} = 15$ year

$\Rightarrow N=N_0\left(\frac{1}{2}\right)^2 = \frac{N_0}{4}$ (remaining)

$\Rightarrow \left(\frac{3}{4}\right)^{th}$ fraction decayed

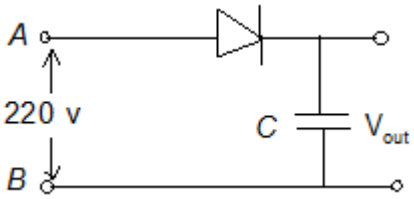
51. A 220 V A.C. supply is connected between points A and B as shown in figure what will be the potential difference V across the capacitor?



(A) 220 V (B) 110 V

(C) 0 (D) $220\sqrt{2}$ V

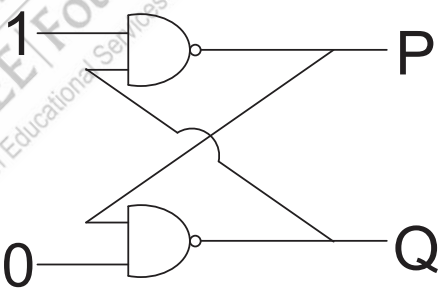
Sol. Answer: (D)



Capacitor gets charged and it will maintain that voltage across its plates. Capacitor will get charged to peak value of applied input voltage.

$\Rightarrow V_{out} = 220\sqrt{2}$ volt

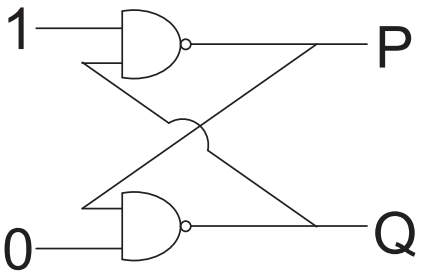
52. In the following circuit what are P and Q:



(A) P=1,Q=0 (B) P=0,Q=1

(C) P=0,Q=0 (D) P=1,Q=1

Sol. Answer: (B)



$P = \overline{IQ} = \overline{I} + \overline{Q} = \overline{Q}$

$Q = \overline{RO} = \overline{O} = I \Rightarrow Q = 1$

$P = \overline{Q} = O$

53. A positive hole in a semiconductor is

(A) An anti – particle of electron.

(B) A vacancy created when an electron leaves a covalent bond.

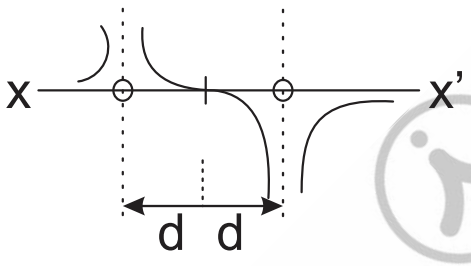
(C) Absence of free electrons.

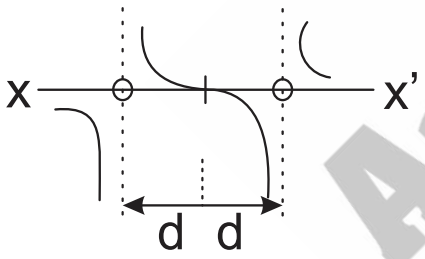
(D) An artificially created particle.

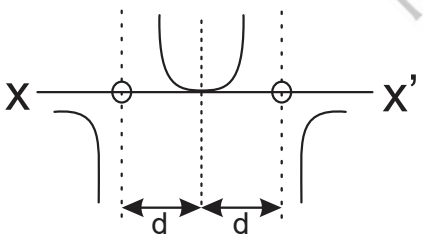
Sol. Answer: (B)

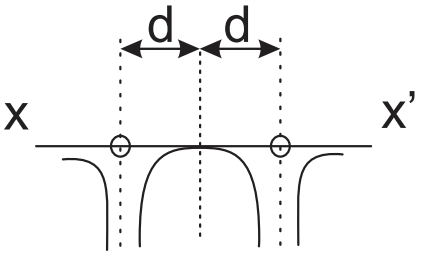
A positive hole in a semiconductor is a vacancy created when an electron leaves a covalent bond.

54. Two long straight parallel wires are a distance 2 d apart. They carry steady equal currents flowing out of the plane of the paper. The variation of magnitude field B along the line xx' is given by

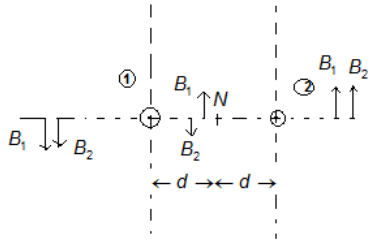
(A)


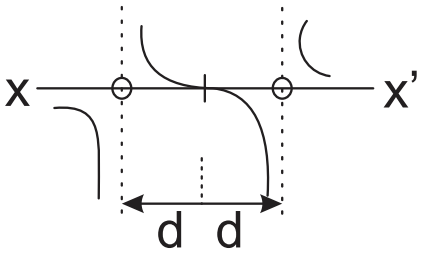
(B)


(C)


(D)


Sol. Answer: (B)





55. A cylindrical wire has a mass (0.3 ± 0.003)g, radius (0.5 ± 0.005)mm, and length (6 ± 0.06)cm. The maximum percentage error in the measurement of its density is

(A) 1

(B) 2

(C) 3

(D) 4

Sol. Answer: (D)

$$\frac{\Delta\rho}{\rho} = \frac{\Delta m}{m} + 2\frac{\Delta r}{r} + \frac{\Delta \ell}{\ell} = \frac{0.003}{0.3} + 2\times\frac{0.005}{0.5} + \frac{0.06}{6}$$

$$= 0.01 + 2\times 0.01 + 0.01 = 0.04 \Rightarrow 4\%$$

56. At a metro station, a girl walks up a stationary escalator in 20 sec. If she remains stationary on the escalator, then the escalator take her up in 30 sec. The time taken by her to walk up on the moving escalator will be

(A) 25 sec (B) 60 sec

(C) 12 sec (D) 10 sec

Sol. Answer: (C)

$v \rightarrow$ speed of girl on stationary escalator.

$u \rightarrow$ speed of escalator

$$\Rightarrow 20 = \frac{\ell}{v} \,\&\, 30 = \frac{\ell}{u} \Rightarrow v = \frac{\ell}{20} \,\&\, u = \frac{\ell}{30}$$

$$\Rightarrow T = \frac{\ell}{u+4} = \frac{\ell}{\frac{\ell}{20} + \frac{\ell}{30}} = \frac{20\times 30}{50} = \frac{60}{5} = 12 \text{ s}$$

57. Rain is falling vertically with a speed of . $12\ ms^{-1}$. A woman rides a bicycles with a speed of $12\ ms^{-1}$ in east to west direction. What is the direction in which she should hold her umbrella?

(A) 30^0 towards East

(B) 45^0 towards East

(C) 30^0 towards West

(D) 45^0 towards West

Sol. Answer: (D)

$\tan\theta = \frac{12}{12} = 1 \Rightarrow \theta = 45^0$ towards west.

58. One end of a string of length 'ℓ' is connected to a particle of mass 'm' and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed 'v', the net force on the particle (directed towards the Centre is: (T is the tension in the string)

(A) T (B) T - $\frac{mv^2}{\ell}$

(C) T + $\frac{mv^2}{\ell}$ (D) 0

Sol. Answer: (A)

Net force on the particle is only tension due to string T.

59. A body is initially at rest. It undergoes one – dimensional motion with constant acceleration. The power delivered to it at time 't' is proportional to

(A) $t^{1/2}$ (B) t

(C) $t^{3/2}$ (D) t^2

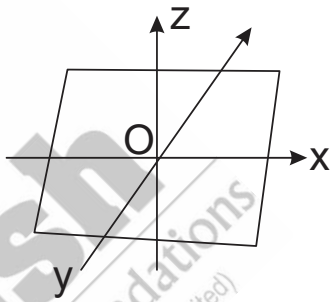
Sol. Answer: (B)

$\frac{dv}{dt} = k \Rightarrow v = k\ t$

$F = m\frac{dv}{dt} = mk$

$\Rightarrow P = F.V = mk.kt = mk^2t = P \propto t^1$

60. A thin uniform rectangular plate of mass 2 kg is placed in X – Y plane as shown in figure. The moment of inertia about x – axis is I_x=0.2 kg m^2 and the moment of inertia about y – axis is I_y=0.3 kg m^2. The radius of gyration of the plate about the axis passing through O and perpendicular to the plane of the plate is



(A) 50 cm (B) 5 cm

(C) 38.7 cm (D) 31.6 cm

Sol. Answer: (A)

$I_z = I_X + I_Y = 0.2 + 0.3 = 0.5$ kg m^2

$\Rightarrow 2 \times Z^2 = 0.5 \Rightarrow Z = \frac{1}{2}m = 50$ cm

❑ ❑ ❑

31/07/2020

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KCET-2020 (Code-C2)

CHEMISTRY

Subject	No. Of Questions	Max. Marks	Maximum Time For Answering
Chemistry	60	60	70 Minutes

Choose the correct answer:

01. Which of the following halide shows highest reactivity towards S_NI reaction?

(A) $CH_3-CH_2-CH_2-CH_2I$

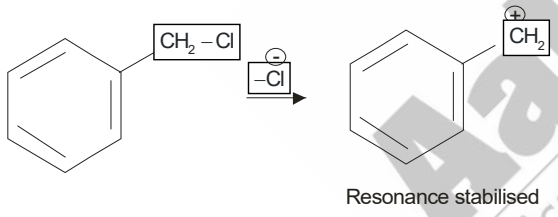
(B) $C_6H_5CH_2Cl$

(C) C_6H_5Cl

(D) CH_3-CH_2Cl

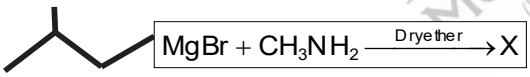
Sol. Answer (B)

Alkyl halide which produces more stable carbocation is more reactive towards S_N1



Resonance stabilised

02. In the reaction:

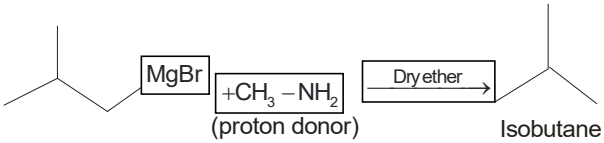


The number of possible isomers for the organic compound X is

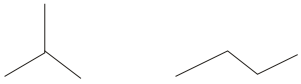
(A) 3 (B) 4

(C) 2 (D) 5

Sol. Answer (C)



Isomers:



03. Prolonged exposure of chloroform in humans may cause damage to liver. It is due to the formation of the following compound:

(A) CH_2Cl_2 (B) CCl_4

(C) Cl_2 (D) $COCl_2$

Sol. Answer (D)

$$CHCl_3 + \frac{1}{2}O_2 \xrightarrow{light} COCl_2 + HCl$$

04. The steps involved in the conversion of propan-2-ol to propan –l-ol are in the order

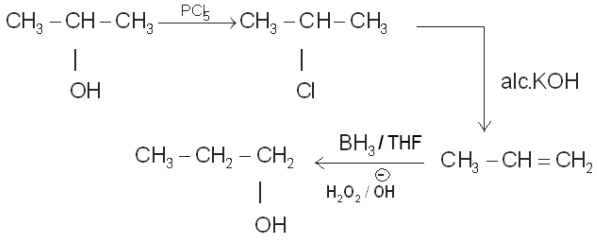
(A) heating with PCl_5 heating with alc. KOH, hydroboration oxidation

(B) dehydration, addition of HBr, heating with aq. KOH

(C) dehydration, addition of HBr in presence of peroxide, heating with alc. KOH

(D) heating with PCl_5, heating with alc. KOH, acid catalysed addition of water

Sol. Answer (A)



05. Which of the following on heating gives ether as major product?

P :$C_6H_5CH_2Br + CH_3ONa$

Q :$C_6H_5ONa + CH_3Br$

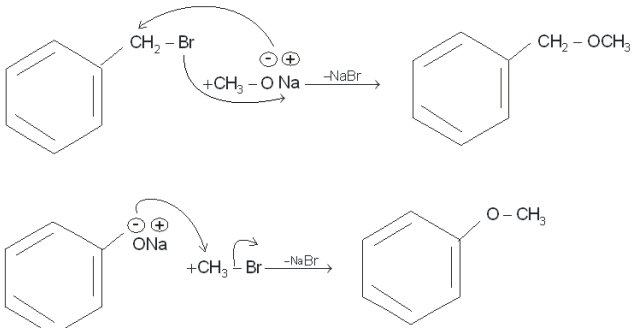
R :$(CH_3)_3C\text{-}Cl + CH_3ONa$

S :$C_6H_5CH = CHCl + CH_3ONa$

(A) Both Q and S (B) Both R and S

(C) Both P and Q (D) Both P and R

Sol. Answer (C)



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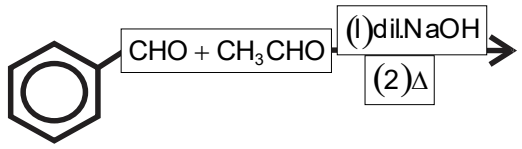
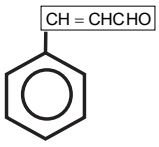
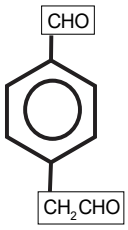
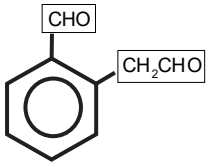
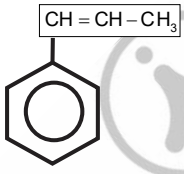


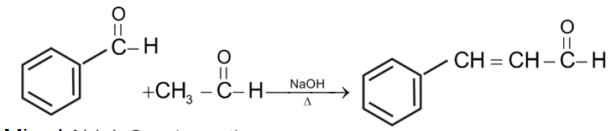
(A) 

(B) 

(C) 

(D) 

Sol. Answer (A)



Mixed Aldol Condensation

07. Which of the following has the lowest boiling point?

(A) CH_3-O-CH_3

(B) CH_3CH_2OH

(C) HCOOH

(D) $CH_3-CH_2-NH_2$

Sol. Answer (A)

Due to absence of H-bonding, ether has lower boiling point

08. Which of the following is the strongest base?

(A) OH^-

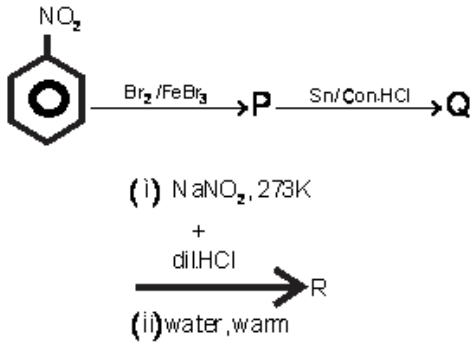
(B) CH_3COO^-

(C) CH_3O^-

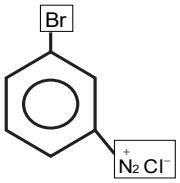
(D) Cl^-

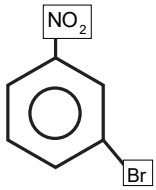
Sol. Answer (C)

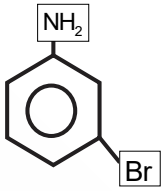
Conceptual

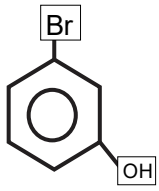
09. 

The final product R is

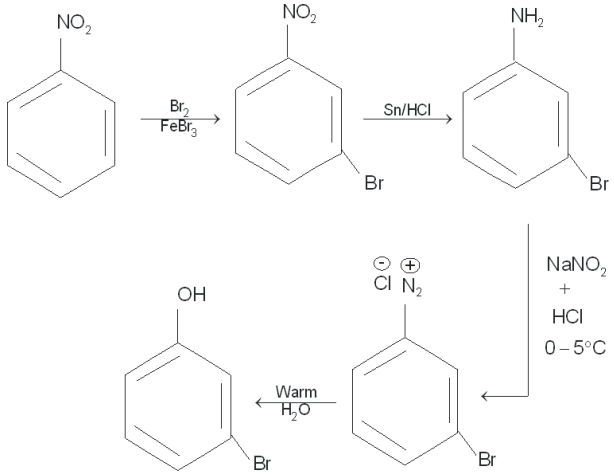
(A) 

(B) 

(C) 

(D) 

Sol. Answer (D)



10. Hinsberg's reagent is

(A) $C_6H_5SO_2NH_2$

(B) $(CH_3CO)_2O$ / pyridine

(C) CH_3COCl / pyridine

(D) $C_6H_5SO_2Cl$

Sol. Answer (D)

Conceptual

11. The carbonyl compound that does not undergo aldol condensation is

(A) trichloroacetaldehyde

(B) acetone

(C) acetaldehyde

(D) dichloroacetaldehyde

Sol. Answer (A)

Due to absence of $\alpha-H$

12. Hypothyroidism is caused by the deficiency of
(A) Thyroxine (B) Vitamin B-12
(C) Glucocorticoid (D) Adrenalin

Sol. Answer (A)

Hypothyroidism is due to low levels of Thyroxine harmone

13. $C_1 - C_4$ glycosidic bond is NOT found in
(A) lactose (B) maltose
(C) starch (D) sucrose

Sol. Answer (D)

$C_1 - C_4$ glycosidic bond is not present in sucrose

14. Which of the following polymer has strongest intermolecular forces of attraction?
(A) Polythene (B) Neoprene
(C) Polystyrene (D) Terylene

Sol. Answer (D)

Terylene is a fiber polymer.

15. Which one of the following vitamins is not stored in adipose tissue?
(A) D (B) A
(C) E (D) B_6

Sol. Answer (D)

B,C vitamins are water soluble

$\therefore$ They are not stored in fat (Adipose tissue)

16. A food additive that acts as an antioxidant is
(A) Sugar syrup (B) BHA
(C) Salt (D) Saccharin

Sol. Answer (B)

Conceptual

17. Which of the following is not related to drug – enzyme interaction?
(A) co-enzymes (B) allosteric site
(C) enzyme inhibitor (D) Antagonist

Sol. Answer (A)

Conceptual

18. Which of the following monomers can undergo condensation polymerization?
(A) Isoprene (B) Styrene
(C) Propene (D) Glycine

Sol. Answer (D)

Conceptual

19. With regard to photoelectric effect, identify the CORRECT statement among the following
(A) Number of e^- ejected increases with the increase in work function
(B) Energy of e^- ejected increases with the increase in the intensity of incident light
(C) Number of e^- ejected increases with the increase in the intensity of incident light
(D) Number of e^- ejected increases with the increase in the frequency of incident light

Sol. Answer (C)

Conceptual

20. 0.4 g of dihydrogen is made to react with 7.1 g of dichlorine to form hydrogen chloride. The volume of hydrogen chloride formed at 273 K and 1 bar pressure is
(A) 90.8 L (B) 9.08 L
(C) 45.4 L (D) 4.54 L

Sol. Answer (D)

$$\underset{0.2\text{ moles}}{H_2} + \underset{0.1\text{ moles}}{Cl_2} \rightarrow \underset{0.2\text{ moles}}{2HCl}$$

Cl_2 is limiting reagent

$\therefore$ no of moles of $HCl = 0.2$

$$PV = nRT$$

$$\frac{1}{1.013} \times v = 0.2 \times 0.0821 \times 273$$

$v = 4.54$ lit

21. The conjugate base of NH_3 is
(A) NH_2OH (B) NH_4^+
(C) NH_2^- (D) NH_4OH

Sol. Answer (C)

Conceptual

22. A gas mixture contains 25% He and 75% CH_4 by volume at a given temperature and pressure. The percentage by mass of Methane in the mixture is approximately _____
(A) 92% (B) 75%
(C) 8% (D) 25%

Sol. Answer (A)

$V \propto n$ (constant T & P)

$$\frac{V_{CH_4}}{V_{He}} = \frac{n_{CH_4}}{n_{He}} \Rightarrow \frac{75}{25} = \frac{n_{CH_4}}{n_{He}} \Rightarrow \frac{3}{1} = \frac{\frac{(Wt)_{CH_4}}{16}}{\frac{(Wt)_{He}}{4}}$$

$$\frac{(Wt)_{CH_4}}{(Wt)_{He}} = 12$$

$$\text{Wt\% of } CH_4 = \frac{(Wt)_{CH_4}}{(Wt)_{CH_4} + (Wt)_{He}} \times 100 = 92.3\%$$

23. The last element of the p-block in 6th period is represented by the outer most electronic configuration
(A) $4f^{14}5d^{10}6s^26p^4$ (B) $7s^27p^6$
(C) $4f^{14}5d^{10}6s^26p^6$ (D) $5f^{14}6d^{10}7s^27p^6$

Sol. Answer (C)

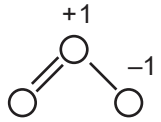
Radon $(Rn) - [Xe]4f^{14}5d^{10}6s^26p^6$

24. The formal charge on central oxygen atom in ozone is

(A) +2 (B) -1

(C) +1 (D) 0

Sol. Answer (C)



$$F = V - L.P - \frac{B.P}{2}$$

25. When the same quantity of heat is absorbed by a system at two different temperatures T_1 and T_2, such that $T_1 > T_2$, change in entropies are ΔS_1 and ΔS_2 respectively. Then:

(A) $S_2 > S_1$ (B) $\Delta S_1 < \Delta S_2$

(C) $\Delta S_2 < \Delta S_1$ (D) $\Delta S_1 = \Delta S_2$

Sol. Answer (B)

$$\Delta S = \frac{q}{T} \Rightarrow \Delta S \propto \frac{1}{T}$$

26. The percentage of s – character in the hybrid orbitals of nitrogen in NO_2^+, NO_2^- and NH_4^+ respectively are:

(A) 50%, 33.3%, 25% (B) 33.3%, 50%, 25%

(C) 25%, 50%, 33.3% (D) 33.3%, 25%, 50%

Sol. Answer (A)

$NO_2^+ \Rightarrow sp$

$NO_3^- \Rightarrow sp^2$

$NH_4^+ \Rightarrow sp^3$

27. A Lewis acid 'X' reacts with $LiAlH_4$ in ether medium to give a highly toxic gas. The gas when heated with NH_3 gives a compound commonly known as inorganic benzene. The gas is

(A) $B_3N_3H_6$ (B) B_2O_3

(C) BF_3 (D) B_2H_6

Sol. Answer (D)

$$BF_3 + LiAlH_4 \rightarrow \underset{(gas)}{B_2H_6} \xrightarrow{NH_3} B_3N_3H_6$$

28. The oxide of potassium that does not exist is

(A) K_2O_2 (B) K_2O

(C) K_2O_3 (D) KO_2

Sol. Answer (C)

Conceptual

29. The oxidation number of nitrogen atoms in NH_4NO_3 are

(A) +3, – 5 (B) + 5, + 5

(C) – 3, – 3 (D) –3, + 5

Sol. Answer (D)

$\overset{-3}{N}H_4\overset{+5}{N}O_3$

30. Which of the following is NOT a pair of functional isomers?

(A) $CH_3CH_2NO_2$ and H_2NCH_2COOH

(B) $C_2H_5OC_2H_5$ and $C_3H_7OCH_3$

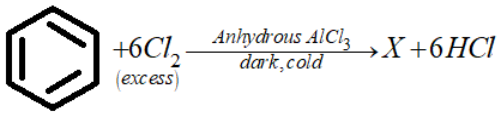
(C) CH_3COOH and $HCOOCH_3$

(D) CH_3CH_2OH and CH_3OCH_3

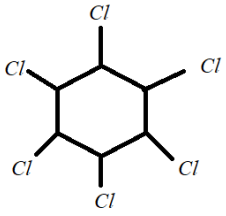
Sol. Answer (B)

$C_2H_5OC_2H_5$ & $C_3H_7OCH_3$ are chain isomers as well as metamers

31. Identify 'X' in the following reaction



(A)



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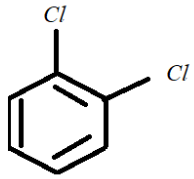
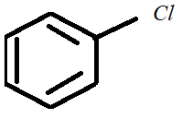
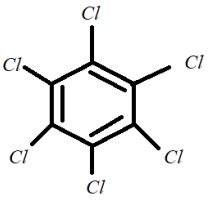


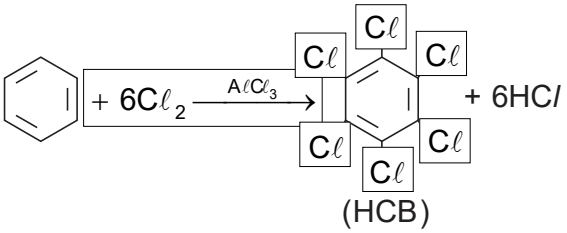
(C)



(D)



Sol. Answer (D)



32. The metal that produces H_2 with both dil HCl and NaOH (aq) is

(A) Ca (B) Zn

(C) Fe (D) Mg

Sol. Answer (B)

Zn is amphoteric

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

33. A metal exists as an oxide with formula $M_{0.96}O$. Metal M can exist as M^{+2} *and* M^{+3} in its oxide $M_{0.96}O$. The percentage of M^{+3} ion in the oxide is, nearly

(A) 5% (B) 8.3%

(C) 9.6% (D) 4.6%

Sol. Answer (B)

$M_{0.96}O_1$

Consider M^{+2} and M^{+3} ions = 0.96; oxide ions =1

$M^{+3} = x;\ M^{+2} = (0.96 - x)$

Total +ve charges = -ve charges

$3x + 2(0.96 - x) = 2$

$3x + 1.92 - 2x = 2$

$x = 0.08$

$\therefore$ % of $M^{+3} = \frac{0.08}{0.96} \times 100 = 8.3\%$

34. A metal crystallizes in face centred cubic structure with metallic radius $\sqrt{2}A^o$. The volume of the unit cell (in m^3) is

(A) 4×10^{-9} (B) 4×10^{-10}

(C) 6.4×10^{-30} (D) 6.4×10^{-29}

Sol. Answer (D)

In face central cubic, $4r = \sqrt{2}.a$

$a = \frac{4r}{\sqrt{2}} = \frac{4 \times \sqrt{2}}{\sqrt{2}} = 4A^o$

Volume = $a^3 = (4 \times 10^{-10} m)^3 = 64 \times 10^{-30} m^3$

$= 6.4 \times 10^{-29}\ m^3$.

35. Which of the following in NOT a green house gas?

(A) O_2 (B) CFC

(C) NO_2 (D) CO_2

Sol. Answer (A)

O_2 is not a greenhouse gas

36. The pair of electrolytes that possess same value for the constant (A) in the Debye – Huckel – Onsagar equation, $\lambda_m = \lambda_m^o - A\sqrt{C}$ is

(A) NaBr, $MgSO_4$ (B) $MgSO_4$, Na_2SO_4

(C) NaCl, $CaCl_2$ (D) NH_4Cl, NaBr

Sol. Answer (D)

'A' value is same for same type of electrolytes

37. Which of the following pair of solutions is isotonic?

(A) 0.001 M $CaCl_2$ and 0.001 M $Al_2(SO_4)_3$

(B) 0.01 M $BaCl_2$ and 0.015 M NaCl

(C) 0.001 M $BaCl_2$ and 0.01 M $CaCl_2$

(D) 0.001 M $Al_2(SO_4)_3$ and 0.01 M $BaCl_2$

Sol. Answer (B)

Solutions with same $i \times c$ will be isotonic at same T

In, 0.01 M $BaCl_2$, $\pi = 0.01 \times 3RT = 0.03RT$

In, 0.015M NaCl, $\pi = 0.015 \times 2RT = 0.03RT$

38. Silicon doped with gallium forms

(A) an intrinsic semiconductor

(B) n – type semiconductor

(C) p – type semiconductor

(D) Both n and p type semiconductor

Sol. Answer (C)

When silicon (14^{th}group) is doped with gallium (13^{th} group) gives p-type semiconductor.

39. Given $E^o_{Fe^{+3}/Fe^{+2}} = +0.76V$ and $E^o_{I_2/I^-} = +0.55V$. The equilibrium constant for the reaction taking place in galvanic cell consisting of above two electrodes is $\left[\frac{2.303RT}{F} = 0.06\right]$

(A) 3×10^8 (B) 1×10^7

(C) 5×10^{12} (D) 1×10^9

Sol. Answer (B)

$2I^- \rightarrow I_2 + 2e^-;$ $E^0 = -0.55V$

$(Fe^{+3} + 1e^- \rightarrow Fe^{+2}) \times 2;$ $E^0 = 0.76V$

$2Fe^{+3} + 2e^- \rightarrow 2Fe^{+2};$ $E^0 = 0.76V$

$E^0_{Cell} = 0.21V$

$E^0_{Cell} = \frac{0.06}{n} \log K_C$

$0.21 = \frac{0.06}{2} \log K_C \Rightarrow K_C = 10^7$

40. If an aqueous solution of NaF is electrolyzed between inert electrodes, the product obtained at anode is

(A) Na (B) F_2

(C) O_2 (D) H_2

Sol. Answer (C)

During electrolysis of aqueous solution of NaF, Water is oxidized to give oxygen at anode.

41. Solute 'X' dimerises in water to the extent of 80%. 2.5g of 'X' in 100g of water increases the boiling point by 0.3°C. The molar mass of 'X' is $\left[K_b = 0.52K\ kg\ mol^{-1}\right]$

(A) 65 (B) 13

(C) 26 (D) 52

Sol. Answer (C)

In case of association, $\alpha = \frac{i-1}{\frac{1}{n}-1}$

$\Rightarrow 0.8 = \frac{i-1}{\frac{1}{2}-1} \Rightarrow 0.8 = \frac{i-1}{-1/2}$

$i = 0.6$

$\therefore \Delta T_b = k_b \times \text{molality} \times i$

$0.3 = 0.52 \times \frac{2.5}{M.wt} \times \frac{1000}{100} \times 0.6$

$M.wt = 0.52 \times 25 \times 2 = 26$

42. The time required for 60% completion of a first reaction is 50 min. The time required for 93.6% completion of the same reaction will be

(A) 50 min (B) 100 min

(C) 150 min (D) 83.8 min

Sol. Answer (C)

K for 60% = K for 93.6%

$\frac{2.303}{50}\log\left[\frac{100}{40}\right] = \frac{2.303}{t}\log\left[\frac{100}{6.4}\right]$

$\frac{1}{50}[\log 10 - \log 4] = \frac{1}{t}[\log 1000 - \log 64]$

$\frac{1}{50}[1-0.6] = \frac{1}{t}[3-1.8]$

$t = \frac{1.2 \times 50}{0.1} = 150 \text{ min}$

43. For an elementary reaction 2A + 3B $\rightarrow$ 4C + D the rate of appearance of C at time 't' is $2.8\times10^{-3} mol\,L^{-1}S^{-1}$. Rate of disappearance of B at 't', t will be

(A) $2\left(2.8\times10^{-3} mol\,L^{-1}S^{-1}\right)$

(B) $\frac{4}{3}\left(2.8\times10^{-3}\right) mol\,L^{-1}S^{-1}$

(C) $\frac{1}{4}\left(2.8\times10^{-3}\right) mol\,L^{-1}S^{-1}$

(D) $\frac{3}{4}\left(2.8\times10^{-3}\right) mol\,L^{-1}S^{-1}$

Sol. Answer (D)

$-\frac{1}{3}\times\frac{d[B]}{dt} = \frac{1}{4}\frac{d[c]}{dt}$

$-\frac{d[B]}{dt} = \frac{3}{4}\frac{d[c]}{dt}$

44. In which of the following cases a chemical reaction is possible?

(A) Conc. HNO_3 is stored in a platinum vessel.

(B) $ZnSO_{4(aq)}$ is placed in a copper vessel.

(C) Gold ornaments are washed with dil HCl

(D) $AgNO_3$ solution is stirred with a copper spoon.

Sol. Answer (D)

Copper can displace Ag^+ ions from $AgNO_3$ solution

45. A sol of AgI is prepared by mixing equal volumes of 0.1 M $AgNO_3$ and 0.2 M KI, which of the following statement is correct?

(A) Sol obtained is a positive sol with K^+ adsorbed of AgI.

(B) Sol obtained is a negative sol with NO_3^- adsorbed of AgI.

(C) Sol obtained is a negative sol with I^- adsorbed of AgI.

(D) Sol obtained is a positive sol with Ag^+ adsorbed on AgI.

Sol. Answer (C)

$\underset{0.1}{AgNO_3} + \underset{0.2}{KI} \rightarrow \underset{-ve\ sol}{AgI/I^-}$

Preferential adsorption of common ion in the excess of reagent present.

46. During Adsorption of a gas on a solid

(A) $\Delta G < 0, \Delta H < 0, \Delta S > 0$

(B) $\Delta G < 0, \Delta H < 0, \Delta S < 0$

(C) $\Delta G < 0, \Delta H > 0, \Delta S > 0$

(D) $\Delta G > 0, \Delta H > 0, \Delta S > 0$

Sol. Answer (B)

Adsorption of a gas on a solid is spontaneous with decreased randomness and is an exothermic process

$\therefore \Delta G = \Delta H - T\Delta S \qquad \Delta G < 0, \Delta H < 0 \ \& \ \Delta S < 0$

47. The rate constant of a reaction is given by $k = PZe^{-Ea/RT}$ under standard notation. In order to speed up the reaction, which of the following factors has to be decreased?

(A) E_a (B) Z

(C) T (D) Both Z and T

Sol. Answer (A)

$K = PZe^{-\frac{Ea}{RT}}$

Lower is the activation energy, greater will be the speed of the reaction.

48. Function of potassium ethylxanthate in froth floatation process is to make the ore

(A) hydrophilic (B) lighter

(C) heavier (D) hydrophobic

Sol. Answer (D)

Potassium ethylxanthate makes the ore hydrophobic nature and increases non-wettable in water

49. Sulphide ore on roasting gives a gas X. X reacts with Cl_2 in the presence of activated charcoal to give Y. Y is:

(A) SCl_6 (B) SO_2Cl_2

(C) $SOCl_2$ (D) S_2Cl_2

Sol. Answer (B)

Roasting :

$$2ZnS + 3O_2 \rightarrow \underset{(x)}{2ZnO} + 2SO_2$$

$$SO_2 + Cl_2 \rightarrow SO_2Cl_2$$

50. Copper is extracted from Copper pyrites by

(A) Electrometallurgy

(B) Thermal decomposition

(C) Auto reduction

(D) Reduction by coke

Sol. Answer (C)

Copper is extracted from copper Pyrites by Autoreduction

51. Bond angle in PH_4^+ is more than that of PH_3. This is because

(A) PH_3 has planar trigonal structure

(B) lonepair – bond pair repulsion exists in PH_3

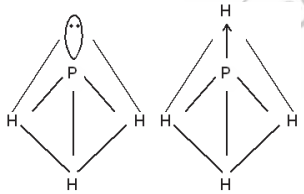
(C) hybridisation of P changes when PH_3 is converted to PH_4^+

(D) PH_4^+ has square planar structure

Sol. Answer (B)

In PH_3, lone pair – bond pair repulsion which decreases

Shape of pH_3 – Pyramidal
Shape of pH_4^+ – Tetrahedral



52. Incorrectly matched pair is:

(A) XeF_6 – distorted octahedral

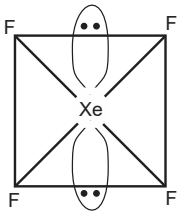
(B) XeO_3 – Pyramidal

(C) $XeOF_4$ – square pyramidal

(D) XeF_4 – tetrahedral

Sol. Answer (D)

XeF_4
↓
$sp^3d^2 \rightarrow$ Shape is square planar



53. Aqueous solution of a salt (A) forms a dense white precipitate with $BaCl_2$ solution. The precipitate dissolves in dilute HCl to produce a gas (B) which decolourises acidified $KMnO_4$ solution

A and B respectively are:

(A) $BaSO_3$, H_2S (B) $BaSO_3$, SO_2

(C) $BaSO_4$, SO_2 (D) $BaSO_4$, H_2S

Sol. No option is correct

54. Identify the set of paramagnetic ions among the following:

(A) Ti^{3+}, Cu^{2+}, Mn^{3+} (B) V^{2+}, CO^{2+}, Ti^{4+}

(C) Sc^{3+}, Ti^{3+}, V^{3+} (D) Ni^{2+}, Cu^{2+}, Zn^{2+}

Sol. Answer (A)

$Ti^{+3}\,(z = 22)\,[Ar]3d^1 4s^0$

$Cu^{+2}\,(z = 39)\,[Ar]3d^9 4s^0$

$Mn^{+3}\,(z = 25)\,[Ar]3d^4 4s^0$

All are having atleast one unpaired electron shows paramagnetic nature

55. How many moles of acidified $K_2Cr_2O_7$ is required to liberate 6 moles of I_2 from an aqueous solution of I^- ?

(A) 0.25 (B) 2

(C) 0.5 (D) 1

Sol. Answer (B)

$$\overset{+6}{K_2Cr_2O_7} + \overset{-1}{KI} + H_2SO_4 \rightarrow K_2SO_4 + \overset{+3}{Cr_2}(SO_4)_3 + \overset{0}{I_2} + H_2O$$

$$\downarrow n_f = 6 \quad \downarrow n_f = 1$$

$\therefore$ Moles ratio is 1 : 6

$$K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow 4K_2SO_4 + Cr_2(SO_4)_6 + 3I_2 + H_2O$$

$\therefore$ 1mole of $K_2Cr_2O_7$ Liberates 3 moles of I_2

2 moles of $K_2Cr_2O_7$ Liberates 6 moles of I_2

56. Phosphorous pentachloride

(A) has all the five equivalent bonds

(B) on hydrolysis gives an oxo acid of phosphorus which is tribasic.

(C) exists as an ionic acid solid in which cation has octahedral structure and anion has tetrahedral structure.

(D) on hydrolysis gives an oxo acid of phosphorus which is a good reducing agent.

Sol. Answer (B)

$$PCl_5 + H_2O \rightarrow POCl_3 + 2HCl$$

$$POCl_3 + 3H_2O \rightarrow \underset{\downarrow}{H_3PO_4} + 3HCl$$

It is tribasic acid & not good reducing agent

57. The coordination number of Fe and Co in the complex ions, $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$ and $\left[Co\left(SCN\right)_4\right]^{2-}$ are respectively.

(A) 4 and 6 (B) 3 and 4
(C) 6 and 4 (D) 6 and 8

Sol. Answer (C)

$\left[Fe\underset{\downarrow}{\left(C_2O_4\right)_3}\right]^{3-}$ Co-ordination number is 6

Since ligand is Bi dentate ligand

$\left[Co\underset{\downarrow}{\left(SCN\right)_4}\right]^{2-}$ Co-ordination number is 4

Since ligand is Mono dentate ligand

58. Number of stereoisomers exhibited by $\left[Co\left(en\right)_2 Cl_2\right]^{+}$ is

(A) 5 (B) 4
(C) 3 (D) 2

Sol. Answer (C)

$\left[CO\left(Cn\right)_2 Cl_2\right]^{+}$ shows two geometrical isomers cis & trans and cis- isomer has enantiomer
Total steoreo isomers = 3

59. Give the IUPAC name of $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_4\right]$ is

(A) tetra ammine platinate (0) tetra chlorido platinum (IV)
(B) tetra ammine platinum (0) tetra chlorido platinum (IV)
(C) tetra ammine platinum (II) tetra chlorido platinate (II)
(D) tetra ammine platinate (II) tetra chlorido platinum (II)

Sol. Answer (C)

tetra ammine platinum (II)
tetra chlorido palatinate (II)

60. Cu_2Cl_2 and $CuCl_2$ in aqueous medium

(A) Both are unstable
(B) $CuCl_2$ is more stable than Cu_2Cl_2
(C) Cu_2Cl_2 is more stable than $CuCl_2$
(D) Stability of Cu_2Cl_2 is equal to stability of $CuCl_2$

Sol. Answer (B)

$CuCl_2$ is more stable than Cu_2Cl_2

Due to high hydration enthalpy of Cu^{+2} than that of Cu^{+} in aqueous solution

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