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CAREER INSTITUTE PVT.LTD.

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BOOKLET CODE

E6

ANSWER KEY + SOLUTION KEY

Physics : Section - A (Q. No. 1 to 35)

01. A bullet is fired from a gun at the speed of 280 ms^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is ($g = 9.8\ ms^{-2}$, $\sin 30° = 0.5$) :

(1) 2800 m

(2) 2000 m

(3) 1000 m

(4) 3000 m

Sol. **(3)** $H = \frac{u^2 \sin 2\theta}{2g} = \frac{280 \times 280 \times \frac{1}{4}}{2 \times 9.8} = 1000m$

2. A metal wire has mass (0.4 ± 0.002) g, radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be :

(1) 1.2%

(2) 1.3%

(3) 1.6%

(4) 1.4%

Sol. **(3)** $m \pm \Delta m = 0.4 \pm 0.002$

$r \pm \Delta r = 0.3 \pm 0.001$

$\ell \pm \Delta l = 5 \pm 0.02$

$d = \frac{m}{\pi r^2 l}$, $d \propto m r^{-2} l^{-1}$

$$\left| 100 \times \frac{\Delta d}{d} = \left[\frac{\Delta m}{m} + \frac{2\Delta r}{r} + \frac{\Delta l}{l} \right] \times 100 \right|$$

$$100 \times \frac{\Delta d}{d} = \left[\frac{0.002}{4} + \frac{2 \times 0.001}{0.3} + \frac{0.02}{5} \right] \times 100 = 1.6\%$$

03. Given below are two statements :

Statements I : Photovoltaic devices can convert optical radiation into electricity.

Statement II : Zener diode is designed to operate under reverse bias in breakdown region.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both Statement I and Statement II are correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect.

(4) Statement I is incorrect but Statement II is correct.

Sol. **(1)** Photovoltaic devices light energy $\rightarrow$ Electrical energy

Zener diode $\rightarrow$ Reverse Biased mode

04. The magnetic energy stored in an inductor of inductance 3μH carrying a current of 2A is :

(1) 4 μJ

(2) 4 mJ

(3) 8 mJ

(4) 8 μJ

Sol. **(4)** $U = \frac{1}{2} LI^2 = \frac{1}{2} 4 \times 10^{-6} \times 2 \times 2 = 8\mu J$

05. If $\oint \vec{E} \cdot \overrightarrow{dS} = 0$ over a surface, then :

(1) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

(2) the magnitude of electric field on the surface is constant.

(3) all the charges must necessarily be inside the surface.

(4) the electric field inside the surface is necessarily uniform.

Sol. **(1)** $\phi = \int \vec{E} \cdot \overrightarrow{ds} = \frac{a}{\varepsilon_0} = 0$

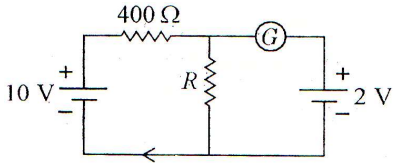
06. The net magnetic flux through any closed surface is

(1) Zero (2) Positive

(3) Infinity (4) Negative

Sol. (1) Magnetic monopoles do not exist

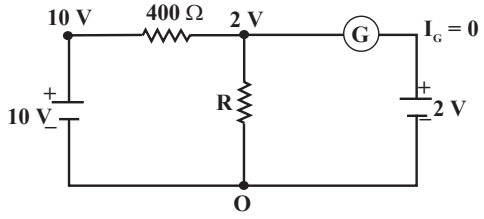
07. If the galvanometer G does not show any deflection in the circuit shown. the value of R is given by :



(1) 200 Ω (2) 50 Ω

(3) 100 Ω (4) 400 Ω

Sol. (3)



$$I_1 = \frac{10-2}{400} = \frac{1}{50} A$$

$$\text{So } R = \frac{V}{I} = \frac{2-0}{1/50} = 100\Omega$$

08. In a series LCR circuit inductance L is 10 mH, capacitance C is 1μF and resistance R is 100 Ω. The frequency at which resonance occurs is :

(1) 15.9 rad/s (2) 15.9 kHz

(3) 1.59 rad/s (4) 1.59 kHz

Sol. (4) $f = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} = \frac{1}{2\pi}\sqrt{\frac{1}{10\times10^{-3}\times1\times10^{-6}}}$

$$f = 1.59\, KHz$$

09. The temperature of a gas is –50° C. To what temperature the gas should be heated so that the rms speed is increased by 3 times.

(1) 669°C (2) 3295°C

(3) 3097 K (4) 223 K

Sol. (2) As $U_{rms} = \sqrt{\frac{3RT}{M}}$ So $V_{rms} \propto \sqrt{T}$

$$\text{So } \frac{4V}{V} = \sqrt{\frac{T}{273+(-50)}}$$

T = 3568 K

So $t^0C = 3568 - 273 = 3295^0C$

10. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is

(1) 2W/A (2) W/A

(3) W/2A (4) Zero.

Sol. (2) $Stress = \frac{F}{A} = \frac{W}{A}$

11. A Carnot engine has an efficiency of 50% when its source is at a temperature 327°C. The temperature of the sink is :

(1) 27° C (2) 15°C

(3) 100°C (4) 200°C

Sol. (1) $\eta = \frac{50}{100} = \frac{1}{2} = 1 - \frac{T_2}{T_1}$

$$\frac{T_2}{T_1} = \frac{1}{2}$$

$$T_2 = \frac{600}{2} = 300\, k$$

$T_2 = 300 - 273 = 27^0C$

12. Resistance of a carbon resistor determined from colour codes is (22000 ± 5%) Ω. The colour of third band must be :

(1) Red (2) Green

(3) Orange (4) Yellow

Sol. (3) $R = (22\times10^3 \pm 5\%)\Omega \Rightarrow Orange = 3$

13. The minimum wavelength of X-rays produced by an electron accelerated through a potential difference of V volts is proportional to :

(1) $\sqrt{V}$ (2) $\frac{1}{V}$

(3) $\frac{1}{\sqrt{V}}$ (4) V^2

Sol. (2) $\lambda = \frac{hc}{\Delta KE}$

$$\lambda \propto \frac{1}{\Delta KE} \propto \frac{1}{V}$$

14. For Young's double slit experiment, two statements are given below :

Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true.

(2) Both Statement I and Statement II are false.

(3) Statement I is true but Statement II is false.

(4) Statement I is false but Statement II is true.

Sol. **(3)** Angular separation i.e. angular fringe width is given by $\theta = \frac{\lambda}{d}$ and it is independent of the distance of screen D. Therefor if screen is shifted away from the plane of slits then the angular separation of the fringes will remain the same.

If the wavelength of incident radiation is increased then angular width of the fringes will increase.

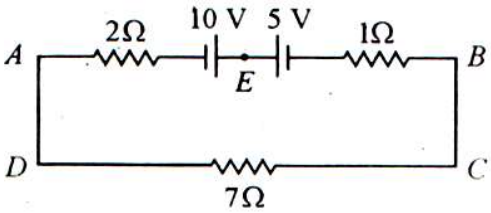
15. The work functions of Caesium (Cs), Potassium (K) and Sodium (Na) are 2.14 eV, 2.30 eV and 2.75 eV respectively. If incident electromagnetic radiation has an incident energy of 2.20 eV, which of these photosensitive surfaces may emit photoelectrons?

(1) Cs only (2) Both Na and K

(3) K only (4) Na only

Sol. **(1)** As the energy of incident radiation is 2.20 eV and it is greater than the work function of Caesium (Cs) only, out of the three given melts hence photoelectrons will be emitted from Cs only.

16. The magnitude and direction of the current in the following circuit is



(1) 0.2 A from B to A through F

(2) 0.5 A from A to B through E

(3) $\frac{5}{9}$ A from A to B through E

(4) 1.5 A from B to A through E

Sol. **(2)** $i = \frac{10-5}{2+1+7} = \frac{5}{10} = 0.5\,A$

as 10 volt battery has greater EMF hence current will be along AEB

17. In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is :

(1) 2λ (2) 4λ

(3) 9λ (4) 16λ

Sol. **(2)** Shortest wavelength of Balmer series is

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{\infty}\right) = \frac{R}{4} \Rightarrow \lambda = \frac{4}{R}$$

for Brackett series,

$$\frac{1}{\lambda'} = R\left(\frac{1}{4^2} - \frac{1}{\infty^2}\right) = \frac{R}{16} \Rightarrow \lambda' = \frac{16}{R}$$

So $\lambda' = 4\lambda$

18. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 NC^{-1}. It experiences a torque equal to 4 Nm. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.

(1) 8 mC (2) 6 mC

(3) 4 mC (4) 2 mC

Sol. **(4)** $\tau = PE\sin\theta$

on $p = qd$

So $\tau = qd\,E\sin\theta$

Substituting the given values

$$4 = q\left(\frac{2}{100}\right)\left(2\times10^5\right)\sin 30^0$$

$$q = 2\times10^{-3}C = 2mC$$

19. The half life of a radioactive substance is 20 minutes. In how much time, the activity of substance drops to $\left(\frac{1}{16}\right)^{th}$ of its initial value?

(1) 20 minutes (2) 40 minutes

(3) 60 minutes (4) 80 minutes

Sol. **(4)** $t_{1/2} \rightarrow 20$ min

$$x \xrightarrow[t_{1/2}]{} \frac{x}{2} \xrightarrow[t_{1/2}]{} \frac{x}{4} \xrightarrow[t_{1/2}]{} \frac{x}{8} \xrightarrow[t_{1/2}]{} \frac{x}{16}$$

$T = 20 \times 4$

$= 20 \times 4$

$= 80$ min

20. The venturi-meter works on :

(1) Huygen's principle

(2) Bernoulli's principle

(3) The principle of parallel axes

(4) The principle of perpendicular axes

Sol. **(2)** Venturi meter works on B.T.

21. An ac source is connected to a capacitor C. Due to decrease in its operating frequency :

(1) capacitive reactance decreases

(2) displacement current increases

(3) displacement current decreases

(4) capacitive reactance remains constant

Sol. (3) $\uparrow X_C = \frac{1}{C\omega} = \frac{1}{2\pi C_f} \downarrow$

$\therefore \downarrow I_C = \frac{V_C}{X_C \uparrow}.$

$\because I_C = I_d$

$\therefore I_d \downarrow$

22. A foot ball player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is

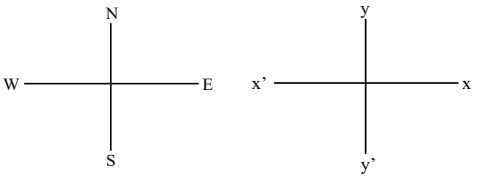
(1) along eastward

(2) along northward

(3) along north-east

(4) along south - west

Sol. **(3)**



$\downarrow$

$(-mv\hat{j}) = p_I$

$\rightarrow$

$(mv\hat{i}) = p_f$

$\Delta p = mv\hat{i} + mv\hat{j}$

i.e. along east - north.

23. A full wave rectifier circuit consists of two p-n junction diodes, a centre-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output ?

(1) A centre - tapped transformer

(2) p-n junction diodes

(3) Capacitor

(4) Load resistance

Sol. **(3)** Capacitor work As filter device.

24. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be :

(1) 2U

(2) 4U

(3) 8U

(4) 16U

Sol. **(4)** $U = \frac{1}{2}Kx^2$

$U = \frac{1}{2}K(2)^2 = \frac{1}{2}K(4) = 2K$ .....(i)

$U = \frac{1}{2}K(8)^2 = \frac{1}{2}K(64) = 32K$ .....(ii)

From (i) and (ii)

$U_f = 16$ U.

25. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude 48 Vm^{-1}. Then the amplitude of oscillating magnetic field is : (Speed of light in free space = 3×10^8 ms^{-1})

(1) 1.6×10^{-9} T (2) 1.6×10^{-8} T

(3) 1.6×10^{-7} T (4) 1.6×10^{-6} T

Sol. **(3)** $B_0 = \frac{E_0}{C} = \frac{48}{3\times10^8} = 16\times10^{-8}$

$= 1.6 \times 10^{-7}$ T.

26. Light travels a distance x in time t_1 in air and $10x$ in time t_2 in another denser medium. What is the critical angle for this medium ?

(1) $\sin^{-1}\left(\frac{t_2}{t_1}\right)$ (2) $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$

(3) $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$ **(4)** $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$

Sol. **(4)** $\sin\theta_C = \frac{1}{\mu}$ .....(i)

$C_m = \frac{C_0}{\mu}$

$\mu = \frac{C_m}{C_0} = \frac{x/t_1}{10x/t_2}$

$\mu = \frac{t_2}{10t_1}$ .....(ii)

from (i) and (ii)

$\sin\theta_C = \frac{1}{\mu} = \frac{10t_1}{t_2}$

27. The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly: (surface tension of soap solution = 0.03 Nm^{-1})

(1) 30.16×10^{-4} J (2) 5.06×10^{-4} J

(3) 3.01×10^{-4} J (4) 50.1×10^{-4} J

Sol. **(3)** Given, T = 0.03 N/m

$A = 4\pi r^2$

$\because \Delta E = U_f - U_i$

$= 8\pi R^2 \times T - 0$

$= 8 \times 3.14 \times (2\times10^{-2})^2 \times 0.03$

$\approx 3.01 \times 10^{-4}$ J

28. A 12 V, 60 W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding ?

(1) 0.27 A (2) 2.7 A

(3) 3.7 A (4) 0.37 A

Sol. **(1)** $\because$ In transformer

$P_{i/p} = P_{o/p}$

60 W = 220 × i_p

$\Rightarrow i_p = \frac{60}{220}$

$\Rightarrow i_p = \frac{3}{11} \simeq 0.27$ A.

29. The angular acceleration of a body, moving along the circumference of a circle , is :

(1) along the radius, away from centre

(2) along the radius towards the centre

(3) along the tangent to its position

(4) along the axis of rotation

Sol. **(4)** In rotational motion all angular vector are along he axis of rotation.

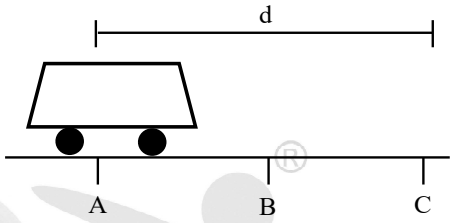
$\therefore$ Angular acceleration is along the axis of rotation.

30. A vehicle travels half the distance with speed υ and the remaining distance with speed 2υ. Its average speed is

(1) $\frac{\upsilon}{3}$ (2) $\frac{2\upsilon}{3}$

(3) $\frac{4\upsilon}{3}$ (4) $\frac{3\upsilon}{4}$

Sol. **(3)**



Let AB = d

For path AC

speed = v

distance = $d/2$

$\therefore t_1 = \frac{distacne}{speed} = \frac{d}{2v}$

and , for path CB

speed 2v

distance = $d/2$

$\therefore t_2 = \frac{distacne}{speed} = \frac{d}{4v}$

Now According to definition of average speed

$v_{av} = \frac{\text{Total distance}}{\text{total time}} = \frac{d}{\frac{d}{2v} + \frac{d}{4v}}$

$= \frac{1}{\frac{1}{2v} + \frac{1}{4v}}$

$\therefore v_{av} = \frac{4v}{3}$.

31. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are :

(1) Instrumental errors (2) Personal errors

(3) Least count errors **(4) Random errors**

Sol. **(4)** Random error

$\rightarrow$ all the uncertain condition are cause of random error.

32. The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is :

(1) 3 : 5 (2) 5 : 3

(3) 2 : 5 (4) 5 : 2

Sol. **(1) (BONUS)**

Solid sphere

$$MK^2 = \frac{2}{5}MR^2$$

$$K_{SS} = \sqrt{\frac{2}{5}}R$$

Hollow sphere

$$MK^2 = \frac{2}{3}MR^2$$

$$K_{HS} = \sqrt{\frac{2}{3}}R$$

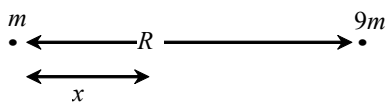
$$\therefore \frac{K_{SS}}{K_{HS}} = \frac{\sqrt{\frac{2}{5}}R}{\sqrt{\frac{2}{3}}R} = \sqrt{\frac{3}{5}} = \sqrt{3} : \sqrt{5}.$$

33. Two bodies of mass m and $9m$ are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be (G = gravitational constant)

(1) $-\frac{8Gm}{R}$ (2) $-\frac{12Gm}{R}$

(3) $-\frac{16Gm}{R}$ (4) $-\frac{20Gm}{R}$

Sol. **(3)**



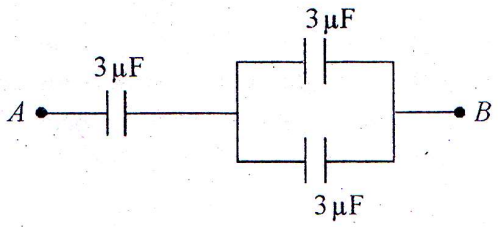
$$x = \frac{\sqrt{m}}{\sqrt{m}+\sqrt{9m}}R$$

$$x = \frac{R}{4}$$

$$V = -\frac{Gm\times 4}{R} - \frac{G9m\times 4}{3R}$$

$$V = -\frac{16Gm}{R}$$

34. The equivalent capacitance of the system shown in the following circuit is :



(1) 2 μF (2) 3 μF

(3) 6 μF (4) 9 μF

Sol. **(1)** C_{eq} parallel = 3 + 3 = 6 μF.

$$\frac{1}{C_{eq}} = \frac{2+1}{6} \qquad \therefore C_{eq} = 2\mu F.$$

35. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is :

(1) 1 : 2 **(2) 2 : 1**

(3) 1 : 3 (4) 3 : 1

Sol. **(2)** $\frac{U_{open}}{U_{closed}} = \frac{v/2l}{v/4l} = \frac{4l}{2l} = \frac{2}{1} = 2:1.$

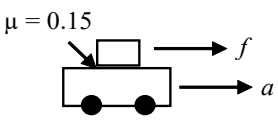
Physics : Section - B (Q. No. 36 to 50)

36. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 g (g = 10 ms^{-2})

(1) 1.2 ms^{-2} (2) 150 ms^{-2}

(3) 1.5 ms^{-2} (4) 50 ms^{-2}

Sol. **(3)** for maximum acceleration $\Rightarrow$ friction is limiting

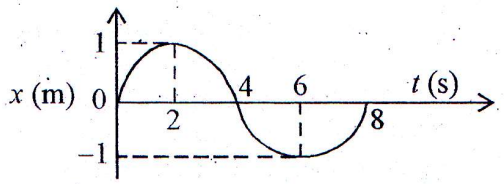


$$\therefore f_{lim} = ma$$

$$\mu_s mg = ma \Rightarrow a = \mu_s g$$

$$= 0.15 \times 10 = 1.5 \text{ m/s}^2.$$

37. The x-t graph of a particle performing simple harmonic motion is shown in the figure. The acceleration of the particle at t = 2s is :



(1) $\frac{\pi^2}{8}\text{ms}^{-2}$ (2) $-\frac{\pi^2}{8}\text{ms}^{-2}$

(3) $\frac{\pi^2}{16}\text{ms}^{-2}$ **(4)** $-\frac{\pi^2}{16}\text{ms}^{-2}$

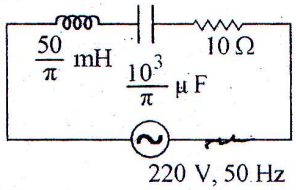
Sol. **(4)** at t = 2sec, x = 1 m ; T = 8 sec

$$\left\{T=\frac{2\pi}{\omega}\Rightarrow\omega=\frac{2\pi}{T}\right\}$$

$$\therefore a=-\omega^2 x$$

$$=-\left(\frac{2\pi}{T}\right)^2\times1=-\frac{4\pi^2}{T^2}=-\frac{4\pi^2}{8^2}=-\frac{4\pi^2}{64}=-\frac{\pi^2}{16}$$

38. The net impedance of circuit (as shown in figure) will be :



(1) $10\sqrt{2}\ \Omega$ (2) $15\ \Omega$

(3) $5\sqrt{5}\ \Omega$ (4) $25\ \Omega$

Sol. **(3)** $\omega=2\pi\nu=2\pi\times50=100\pi$

$$L=\frac{50}{\pi}\times10^{-3}\,Hz$$

$$C=\frac{10^3}{\pi}\times10^{-6}=\frac{10^{-3}}{\pi}.$$

$$R=10\ \Omega.$$

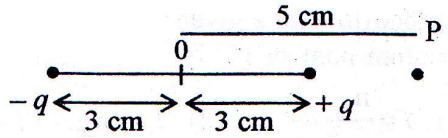
$$X_C=\frac{1}{\omega C}=\frac{1}{100\pi\times\frac{10^{-3}}{\pi}}=10$$

$$X_L=\omega L=100\pi\times\frac{50}{\pi}\times10^{-3}=5.$$

$$\therefore Z=\sqrt{R^2+(X_C-X_L)^2}$$

$$=\sqrt{10^2+(10-5)^2}=\sqrt{100+25}=\sqrt{125}=5\sqrt{5}.$$

39. An electric dipole is placed as shown in the figure.

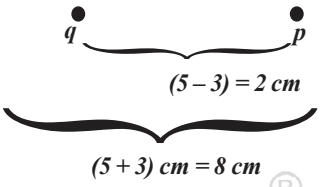


The electric potential (in 10^2 V) at point P due to the dipole is ($\in_0$ = permittivity of free space and $\frac{1}{4\pi\in_0}=K$)

(1) $\left(\frac{3}{8}\right)qK$ (2) $\left(\frac{5}{8}\right)qK$

(3) $\left(\frac{8}{5}\right)qK$ (4) $\left(\frac{8}{3}\right)qK$

Sol. **(1)**



Potential formula for the dipole can't be used as point P isn't too for away from the dipole's centre.

$$V_P=\frac{kq}{(2cm)}-\frac{kq}{(8cm)}=\frac{kq}{10^{-2}}\left(\frac{1}{2}-\frac{1}{8}\right)=$$

$$kq\left(\frac{3}{8}\right)\times10^2\,\text{Volts}$$

40. A wire carrying a current I along the positive x-axis has length L. It is kept in a magnetic field $\vec{B}=(2\hat{i}+3\hat{j}-4\hat{k})$ T. The magnitude of the magnetic force acting on the wire is :

(1) 3 IL (2) $\sqrt{5}IL$

(3) 5 *IL* (4) $\sqrt{3}IL$

Sol. **(3)**

Force $(\vec{F})=I\left(\vec{L}\times\vec{B}\right)$

$$\vec{B}=\left(2\hat{i}+3\hat{j}-4\hat{k}\right)$$

$$\vec{F}=I(L\hat{i})\times(2\hat{i}+3\hat{j}-4\hat{k})$$

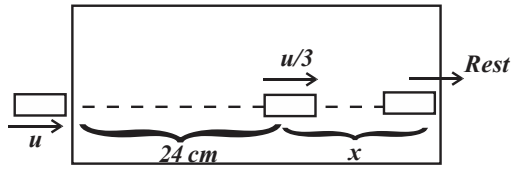
$$\vec{F}=I\,L(3\hat{k}+4\hat{j})$$

$$\left|\vec{F}\right|=1L\sqrt{3^2+4^2}=5\ IL$$

41. A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\frac{u}{3}$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is :

(1) 27 cm (2) 24 cm
(3) 28 cm (4) 30 cm

Sol. (1)



$$\left(\frac{u}{3}\right)^2 = u^2 - 2a(24\,cm) \quad \text{....(i)}$$

$$O^2 = \left(\frac{u}{3}\right)^2 - 2a(x\,cm) \quad \text{....(ii)}$$

From (i) and (ii)

x = 3 cm

Length = 24 cm + 3 cm = 27 cm

42. Two thin lenses are of same focal lengths (*f*), but one is convex and the other one is concave. When they are placed in contact with each other, the equivalent focal length of the combination will be :

(1) Zero (2) *f*/4
(3) *f*/2 (4) Infinite

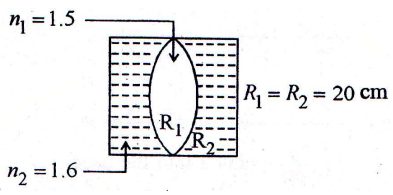
Sol. (1) Focal length of concave lens $(f_1) = -f$

Focal length of convex lens $(f_2) = f$

$$\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{-f} + \frac{1}{f} = 0$$

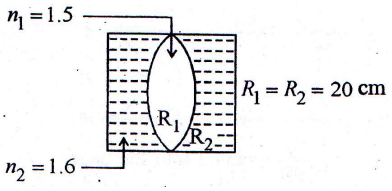
$$f_{eq} = \infty$$

43. In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin) ?



(1) 40 cm (2) – 40 cm
(3) – 100 cm (4) – 50 cm

Sol. (3)



$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

$$f_1 = f_3$$

$$\frac{1}{f} = 2\frac{1}{f} + \frac{1}{f_2}$$

$$= 2(1.6-1)\left(\frac{-1}{20}\right) + (1.5-1)\times\frac{2}{20}$$

$$= -2\times\frac{0.6}{20} + 0.5\times\frac{2}{20}$$

$$= -2\times\frac{0.6}{20} + 0.5\times\frac{2}{20}$$

$$= -0.06 + 0.05$$

$$\frac{1}{f} = -0.01$$

f = – 100 cm

44. A satellite is orbiting just above the surface of the earth with period T. If d is the density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi}{Gd}$ represents :

(1) T **(2) T^2**
(3) T^3 (4) $\sqrt{T}$

Sol. (2) $T = \frac{2\pi R_e}{\sqrt{\frac{GM_e}{r_e}}}$

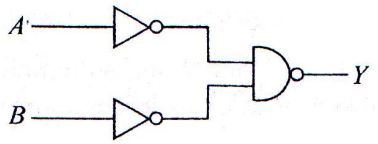
$$\frac{T = 2\pi R_e^{\frac{3}{2}}}{\sqrt{4M_e}}$$

$$T = \sqrt{\frac{4\pi^2 R_e^3}{G\times\frac{4}{3}\pi R_e^3 p}}$$

$$T = \sqrt{\frac{3\pi}{\rho G}}$$

$$\frac{3\pi}{\rho G} = T^2$$

45. For the following logic circuit, the truth table is :



(1)

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

(2)

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

(3)

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

(4)

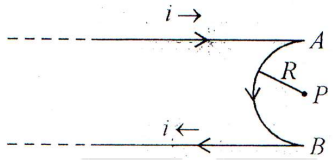
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Sol. **(2)** $Y = \left(\overline{\bar{A}\bar{B}}\right) = (A+B)$

Hence this behaves like OR gate.

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

46. A very long conducting wire is bent in a semi-circular shape from *A* to *B* as shown in figure. The magnetic field at point *P* for steady current configuration is given by :



(1) $\frac{\mu_0 i}{4R}$ pointed into the page

(2) $\frac{\mu_0 i}{4R}$ pointed away from the page

(3) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ **pointed away from page**

(4) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed into the page

Sol. **(3)** $B_{net} = B_{loop} - 2\,B_{wire}$

$$B_{net} = \frac{\mu_0 i}{4R} - \frac{\mu_0 i}{2\pi R}$$

$$= \frac{\mu_0 i}{4R}\left(1-\frac{2}{\pi}\right)$$

out of the plane of the paper

47. The resistance of platinum wire at 0°C is 2Ω and 6.8Ω at 80°C. The temperature coefficient of resistance of the wire is :

(1) $3 \times 10^{-4}\,{}^{o}C^{-1}$ (2) $3 \times 10^{-3}\,{}^{o}C^{-1}$

(3) $\mathbf{3 \times 10^{-2}\,{}^{o}C^{-1}}$ (4) $3 \times 10^{-1}\,{}^{o}C^{-1}$

Sol. **(3)** Given at 0°C , resistance = $2\,\Omega$

and at 80°C = $6.8\ \Omega$

$$\alpha = \frac{\Delta R}{R_0 \Delta T} = \frac{R_t - R_0}{R_0 \Delta T} = \frac{6.8-2}{2\times 80}$$

$$= \frac{48\times 10^{-2}}{16} = 3\times 10^{-2\,o} C^{-1}$$

48. 10 resistors, each of resistance *R* are connected in series to a battery of emf E and negligible internal resistance. The those are connected in parallel to the same battery, the current is increased *n* times. The value of *n* is

(1) 10 **(2) 100**

(3) 1 (4) 1000

Sol. **(2)** 10 equal resistors $R_S = 10R$

R_{eq} (series) $= 10R$

$$R_{eq}\,(\text{parallel}) = \frac{R}{10}$$

in case of parallel

$$i' = ni = \frac{V}{\left(\frac{R}{10}\right)} = 10\left(\frac{V}{R}\right) = 10\times 10$$

$n = 100.$

49. The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius of third allowed orbit of hydrogen atom ?

(1) 0.53 Å (2) 1.06 Å

(3) 1.59 Å **(4) 4.77 Å**

Sol. **(4)** Radiation of nth orbit $= \frac{r_0 n^2}{Z}$

For 3rd orbital

$= 5.3 \times 10^{-11} \times 3^2$

$= 9 \times 5.3 \times 10^{-11}$

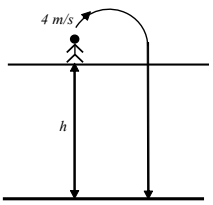
$= 4.77$ Å

50. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 m s^{-1}. The ball strikes the water surface after 4 s. The height of bridge above water surface is (Taken g = 10 m s^{-2}) :

(1) 56 m (2) 60 m

(3) 64 m (4) 68 m

Sol. **(3)**



$$h = ut - \frac{1}{2}gt^2 = 4\times 4 - \frac{1}{2}\times 10\times 16$$

$= 16 - 80 = -64m.$

For downward

$h = 64\ m$

Chemistry : Section - A (Q. No. 51 to 85)

51. The relation between n_m, (n_m = the number of permissible value so magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is

(1) $l = \frac{n_m - 1}{2}$

(2) $l = 2n_m + 1$

(3) $n_m = 2l^2 + 1$

(4) $n_m = l + 2$

Sol. (1)

$n_m = 2\ell + 1$

$n_m - 1 = 2\ell$

$\frac{n_m - 1}{2} = \ell$

52. The element expected to form largest ion to achieve the nearest noble gas configuration is :

(1) O (2) F

(3) N (4) Na

Sol. (3)

N atom $\xrightarrow{+3e^-}$ N^{-3} (10)

(2, 5) Anion

more the e^-, greater will be size.

53. Which amongst the following molecules on polymerization produces neoprene ?

(1) $H_2C = CH - CH = CH_2$

Cl

|

(2) $\mathbf{H_2C = C - CH = CH_2}$ **3**

(3) $H_2C = CH - C \equiv CH$

CH_3

|

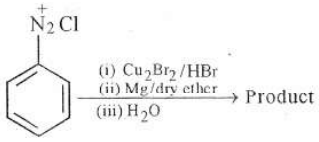
(4) $H_2C = C - CH = CH_2$

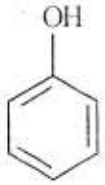
Sol. (2)

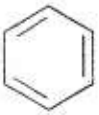
$CH_2 = \underset{\text{(Chloroprere)}}{\overset{Cl}{\overset{|}{C}} - CH = CH_2} \xrightarrow{\text{Polymerisation}} \underset{\text{(Neoprene)}}{\left(CH_2 - \overset{Cl}{\overset{|}{C}} = CH - CH_2\right)_n}$

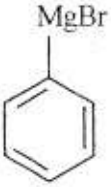
- We follow free radical addition polymerisation.

54. Identify the product in the following reaction :



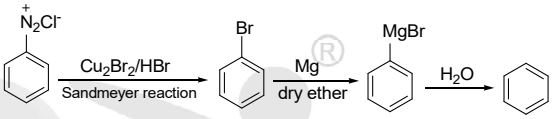
(1) 

(2) 

(3) 

(4) 

Sol. (2)



55. The conductivity of centimolar solution of KCl at 25^0C is 0.0210 ohm^{-1} cm^{-1} and the resistance of the cell containing the solution at 25^0C is 60 ohm. The value of cell constant is

(1) 1.34 cm^{-1} (2) 3.28 cm^{-1}

(3) 1.26 cm^{-1} (4) 3.34 cm^{-1}

Sol. (3)

K = 0.0210

$\frac{1}{\rho} = 0.0210$

R = 60

$R = \frac{\rho\ell}{A}$

$\frac{\ell}{A} = \frac{R}{A}$

$= R \times \frac{1}{\rho}$

$= 60 \times 0.0210$

$\frac{\ell}{A} = 1.26$

56. Match List - I with List - II :

List - I	List - II
A. Coke	I. Carbon atoms are sp^3 hybridised.
B. Diamond	II. Used as dry lubricant
C. Fullerene	III. Used as a reducing agent
D. Graphite	IV. Cage like molecules

Choose the correct answer from the options given below :

(1) A -II, B-IV, C-I, D-III

(2) A -IV, B-I, C-II, D-III

(3) A -III, B-I, C-IV, D-II

(4) A -III, B-IV, C-I, D-II

Sol. (3)

A. Coke $\rightarrow$ used as Reducing agent

B. Diamond $\rightarrow$ sp^3 carbon

C. Fullerene $\rightarrow$ Cage like molecule

D. Graphite $\rightarrow$ used as Lubricant

57. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : A reaction can have zero activation energy.

Reasons R : The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value, is called activation energy.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true and R is NOT the correct explanation of A.

(3) A is true but R is false.

(4) A is false but R is true.

Sol. (2)

A Rxn can have zero activation energy.

(Photochemical Rxn) $\rightarrow$ True

Minimum Energy absorbed by reactant molecules is called Activation energy.

58. homoleptic complex from the following complexes is :

(1) Potassium trioxalatoaluminate (III)

(2) Diamminechloridonitrito - N - platinum (II)

(3) Pentaamminecarbonatocobalt (III) chloride

(4) Triamminetriaquachromium (III) chloride

Sol. (1)

$K_3[Al(C_2O_4)_3]$

$\downarrow$

Only one type of ligand

$\therefore$ Homoleptic ligand

59. A compound is formed by two elements A and B. The element B forms cubic close packed structure and atoms of A occupy 1/3 of tetrahedral voids. If the formula of the compound is A_xB_y, then the value of x + y is in option

(1) 5 (2) 4

(3) 3 (4) 2

Sol. (1)

$B \rightarrow CCP \rightarrow 4 \begin{cases} TV = 8 \\ OV = 4 \end{cases}$

$A \rightarrow \frac{1}{3} \times TV = \frac{1}{3} \times 8 = 8/3$

$A = B = 8/3 : 4$

$= 8 : 12$

$A : B = 2 : 3$

A_2B_3

60. The right option for the mass of CO_2 produced by heating 20g of 20% pure limestone is (Atomic mass of Ca = 40)

$[CaCO_3 \xrightarrow{1200\ K} CaO + CO_2]$

(1) 1.12 g **(2) 1.76 g**

(3) 2.64 g (4) 1.32 g

Sol. (2)

$CaCO_3(s) \xrightarrow{1200K} CaO(s) + CO_2(g)$

% Purity = 20%

$W_{smaple} = 20g$

$W_{CaCO_3} = \frac{20}{100} \times 20\,g$

$= 4g$

$$n_{CaCO_3} = \frac{4}{100}$$

$$\frac{n_{CO_2}}{n_{CaCO_3}} = 1$$

$$\Rightarrow n_{CO_2} = n_{CoCO_3} = \frac{4}{100}$$

$$\Rightarrow W_{CO_2} = \frac{4}{100} \times M_{CO_2}$$

$$= \frac{4}{100} \times 44$$

$$= \frac{176}{100} = 1.76 \text{ g}$$

61. Taking stability as the factor, which one of the following represents correct relationship ?

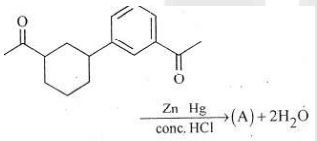
(1) $TlC_3 > TlCl$ (2) $InI_3 > InI$

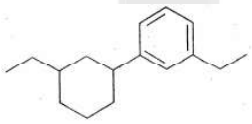
(3) $AlCl > AlCl_3$ **(4) $TlI > TlI_3$**

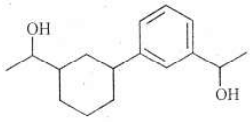
Sol. (4)

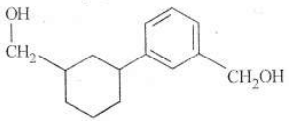
$TlI > TlI_3$ (Stability due to inert pair effect)

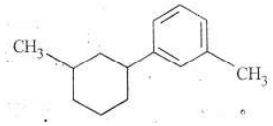
62. Identify product (A) in the following reaction :



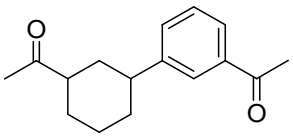
(1) 

(2) 

(3) 

(4) 

Sol. (1)



Clemenson's reduction : This reagent reduces $>C=O$ group to $-CH_2-$

63. Select the correct statements from the following :

A. Atoms of all elements are composed of two fundamental particles.

B. The mass of the electro is 9.10939×10^{-31} kg.

C. Al the isotopes of a given element show same chemical properties.

D. Protons and electrons are collectively known as nucleons.

E. Dalton's atomic theory, regarded the atom as an ultimate particle of matter.

Choose the correct answer from the options given below :

(1) A, B and C only (2) C, D and E only

(3) A and E only **(4) B, C and E only**

Sol. (4)

- Atoms of all elements are composed of three fundamental particles.
- Mass of the electron is 9.10939×10^{-31} kg.
- Protons and neutrons are collectively known as nucleons.
- Dalton's atomic theory, regarded the atom as an ultimate particle of matter.

64. For a certain reaction, the rate = $k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

(1) decrease by a factor of nine.

(2) increase by a factor of six.

(3) increase by a factor of nine.

(4) increase by a factor of three.

Sol. (3)

$R = K(A)^2(B)$

$[A]_{New} = 3\,[A]$

$[B]_{New} =$ Constant

$R_{New} = K(3A)^2(B) = 9K(A)^2(B)$

$R_{New} = 9\,R_{Initial}$

65. Given below are two statements :

Statement I : A unit formed by the attachment of a base to 1' position of sugar is known as nucleoside

Statement I : When nucleoside is linked to phosphorous acid at 5'-position of sugar moity, we get nucleotide.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false.

(3) Statement I is true but Statement II is false.

(4) Statement I is false but Statement II is true.

Sol. (3)

Statement I is true but Statement II is false.

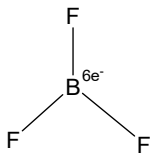
66. Amongst the given options which of the following molecules /ion acts as a Lewis acid ?

(1) NH_3 (2) H_2O

(3) BF_3 (4) OH^-

Sol. (3)

According to Lewis structure of BF_3



B has incomplete octet, hence it hence accept 2 electrons to complete its octet hence acts as Lewis acid.

67. Which of the following reactions will NOT give primary amine as the product ?

(1) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ Product

(2) $CH_3CN \xrightarrow[(ii)\ H_3O^+]{(i)\ LiAlH_4}$ Product

(3) $CH_3NC \xrightarrow[(ii)\ H_3O^+]{(i)\ LiAlH_4}$ Product

(4) $CH_3CONH_2 \xrightarrow[(ii)\ H_3O^+]{(i)\ LiAlH_4}$ Product

Sol. (3)

$$CH_3 - NC \xrightarrow[H_3O^+]{LiAlH_4} CH_3 - NH - CH_3$$

2^0-amine

68. Amongst the following the total number of species NOT having eight electrons around central atom in its outer most shell, is

$NH_3, AlCl_3, BeCl_2, CCl_4, PCl_5$

(1) 3

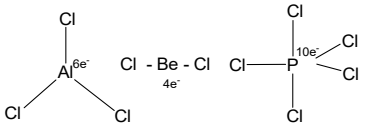
(2) 2

(3) 4

(4) 1

Sol. (1)

According to Lewis structures



Only three structures of given 5 structures not having $8e^-$ around the centras atom.

69. Which of the following statements are NOT correct?

A. Hydrogen is used to reduce heavy metal, oxides to metals.

B. Heavy water is used to study reaction mechanism

C. Hydrogen is used to make saturated fats from oils.

D. The H-H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any element.

E. Hydrogen reduces oxides of metals that are more active than iron.

(1) B, C, D, E only

(2) B, D only

(3) D, E only

(4) A, B, C only

Sol. (3)

A . Reactivity of heavy metals is less than hydrogen hence oxides of heavy metals can be reduced by hydrogen.

B. Heavy water in used to study reaction mechanism because it reduces the rate of reaction and hence allow reaction can be studied easily.

C. Veg-oil + $H_2 \rightarrow$ vanaspati ghee

D. H-H is strong single bond known due to shortest bond length.

E. Hydrogen is less reactive than metal above Fe hence can't reduce their oxides.

70. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is :

(1) 16

(2) 32

(3) 30

(4) 18

Sol. (2)

$$\underset{\text{Sodium Ethanoate}}{CH_3 - \overset{\overset{O}{\|}}{C} - ONa} \xrightarrow[CaO]{NaOH} \underset{\text{Methane}}{CH_4} + Na_2CO_3$$

Organic compound produced is CH_4(methane)

mass of 2 moles of $CH_4 = 2 \times 16$ g

$= 32$ g

71. The number of σ bonds, π bonds and lone pair of electrons in pyridine, respectively are:

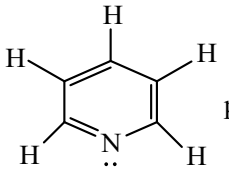
(1) 11, 2, 0

(2) 12, 3, 0

(3) 11, 3, 1

(4) 12, 2, 1

Sol. (3)



pyridine

No. of σ-bonds = 11

No. of π-bonds = 3

No. of lone pair = 1

72. Which one of the following statements is correct?

(1) The daily requirement of Mg and Ca in the human body is estimated to be 0.2 - 0.3 g.

(2) All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor.

(3) The bone in human body is an inert and unchanging substance.

(4) Mg plays roles in neuromuscular function and interneuronal transmission.

Sol. (1)

It is the fact according to which human body needs 200 mg to 300 mg amount of Mg & Ca daily.

73. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.

Reason R: The deep blue solution is due to the formation of amide.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true but R is NOT the correct explanation of A.

(3) A is true but R is false.

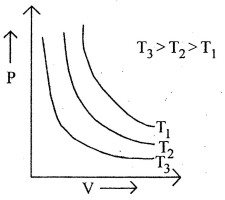
(4) A is false but R is true.

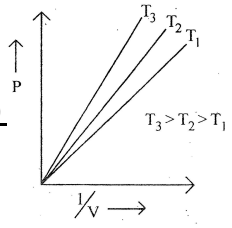
Sol. (3)

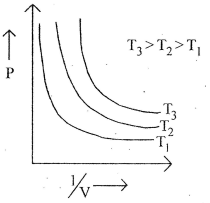
Due to ammoniated electron gives deep blue colour solution.

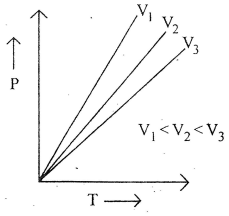
$$M + x + y\,NH_3 \longrightarrow M(NH_3)_x + e^-(NH_3)_y$$

74. Which amongst the following options is correct graphical representation of Boyle's Law?

(1) 

(2) 

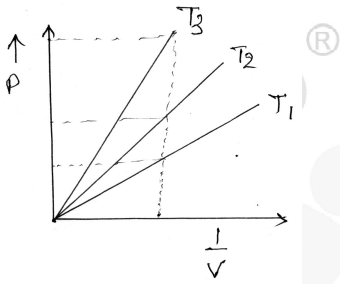
(3) 

(4) 

Sol. (2)

Acc. to Boyle's Law-

$$P \propto \frac{1}{V}$$



$T_3 > T_2 > T_1$

75. The correct order of energies of molecular orbitals of N_2 molecule, is:

(1) $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$

(2) $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < \sigma 2p_z$
$(\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$

(3) $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < \sigma 2p_z < \sigma^* 2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y)$

(4) $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y) < \sigma 2p_z < \sigma^* 2p_z$

Sol. (1)

If atomic number ≤ 14

then $\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2p_x = \pi 2p_y) < \sigma 2p_z < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$

76. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

(1) Chlordiazepoxide

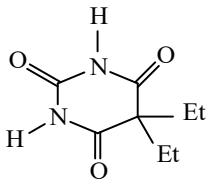
(2) Meprobamate

(3) Valium

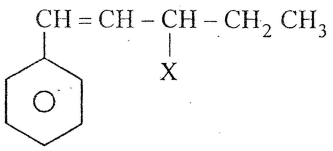
(4) Veronal

Sol. (4)

Veronal is belongs to tranquilizers of barbiturate derivative.



77. The given compound



is an example of _____.

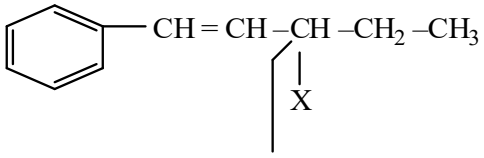
(1) benzylic halide

(2) aryl halide

(3) allylic halide

(4) vinylic halide

Sol. (3)



Allylic carbon so it belongs to allylic halide

78. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include:

A. dipole - dipole forces.

B. dipole - induced dipole forces.

C. hydrogen bonding.

D. covalent bonding

E. dispersion forces.

Choose the most appropriate answer from the options given below:

(1) B, C, D, E are correct

(2) A, B, C, D are correct

(3) A, B, C, E are correct

(4) A, C, D, E are correct

Sol. (3)

In covalent bonding does not occular force & force or repulsion.

79. Which one is an example of heterogenous catalysis?

(1) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen.

(2) Hydrolysis of sugar catalysed by H^+ ions.

(3) Decomposition of ozone in presence of nitrogen monoxide.

(4) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.

Sol. (4)

$$\underset{(g)}{N_2} + 3\underset{(g)}{H_2} \xrightarrow{Fe(s)} 2\underset{(g)}{NH_3}$$

80. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Helium is used to dilute oxygen in diving apparatus.

Reason R: Helium has high solubility in O_2.

In the light of the above statements, choose the correct answer from the options given below.

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true and R is NOT the correct explanation of A

(3) A is true but R is false

(4) A is false but R is true

Sol. (3)

He is less solubility then O_2

Due to less vander waal force of attraction

81. The stability of Cu^{2+} is more than Cu+ salts in aqueous solution due to-

(1) first ionisation enthalpy

(2) enthalpy of atomization

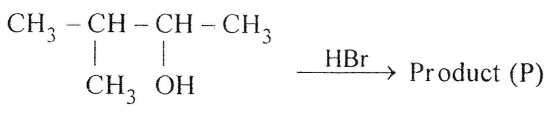
(3) hydration energy

(4) second ionisation enthalpy

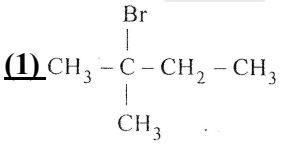
Sol. (3)

Cu^{2+} is more stable than Cu^{+} stability depend on hydration energy of the ions when the bond to the water. In aqueous solution Cu^{+} disproportionate to Cu^{2+} and Cu ($2Cu^{+} \longrightarrow Cu^{2+} + Cu$) Cu^{2+} ions has greater charge density and form much stronger bonds releasing more energy.

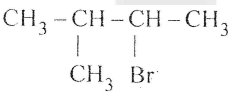
82. Consider the following reaction and identify the product (P).

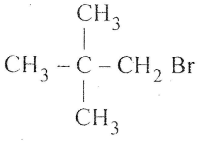


3 – Methylbutan – 2 – ol

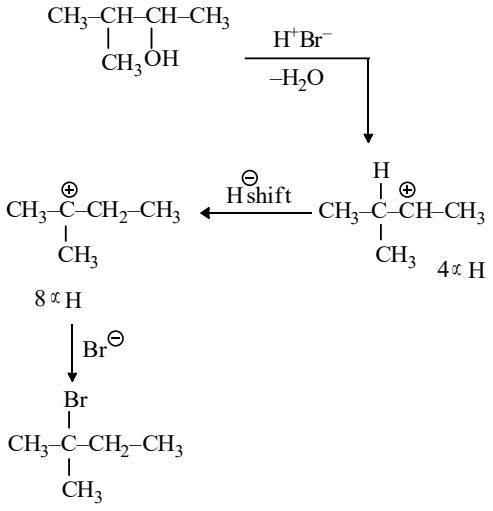
(1) 

(2) $CH_3CH=CH-CH_3$

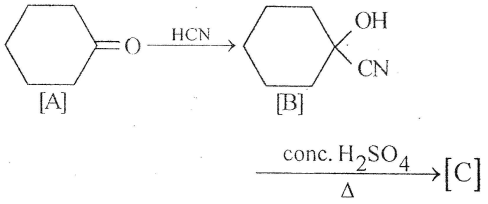
(3) 

(4) 

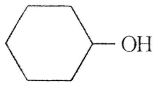
Sol. (1)

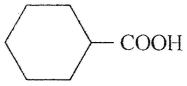


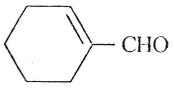
83. Complete the following reaction:

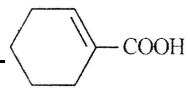


[C] is _____.

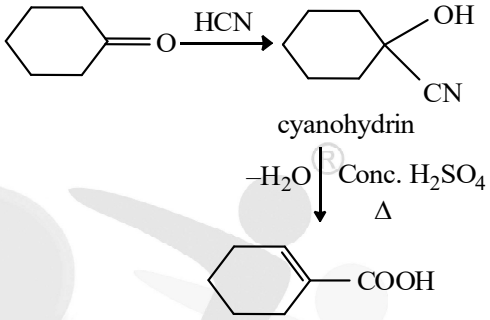
(1) 

(2) 

(3) 

(4) 

Sol. (4)



84. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: In equation $\Delta_r G = -nFE_{cell}$, value of $\Delta_r G$ depends on n.

Reason R: E_{cell} is an intensive property and $\Delta_r G$ is an extensive property.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true and R is NOT the correct explanation of A.

(3) A is true but R is false

(4) A is false but R is true

Sol. (1)

E_{cell} is an intensive parameter but $\Delta_r G$ is an extensive thermodynamic property and the value depends on n.

85. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of-

(1) $Fe_4[Fe(CN)_6]_3.xH_2O$

(2) NaSCN

(3) $[Fe(CN)_5NOS]^{4-}$

(4) $[Fe(SCN)]^{2+}$

Sol. (4)

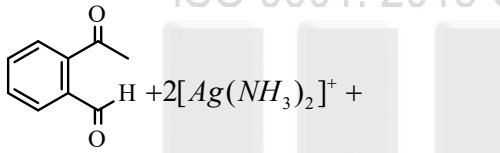
If both N + S are present then lassaigne's extract of organic compound gives

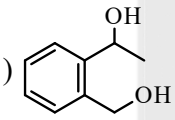
$Na + C + N + S \longrightarrow NaSCN$

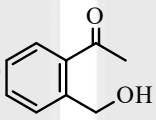
when we react it with Fe^{3+} then $[Fe(SCN)]^{2+}$ formed which gives blood red colour.

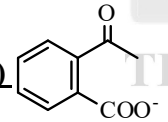
Chemistry : Section - B (Q. No. 86 to 100)

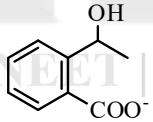
86. Identify the major product obtained in the following reaction :



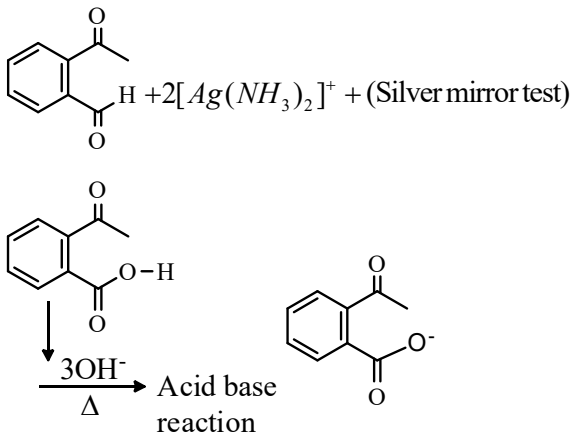
(1) 

(2) 

(3) 

(4) 

Sol. (3)



Note : - Ketone can't show silver mirror test

87. Match List-I with List-II :

List-I (Oxoacids of Sulphur)	**List-II (Bonds)**
A. Peroxodisulphuric acid	I. Two S-OH, Four S=O, One S-O-S
B. Sulphuric acid	II. Two S-OH, One S=O
C. Pyrosulphuric acid	III. Two S-OH, For S=O, One S-O-O-S
D. Sulphurous acid	IV. Two S-OH, Two S=O

Choose the correct answer from the options given below :

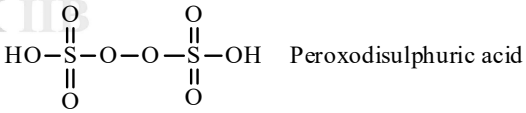
(1) A-I, B-III, C-II, D-IV

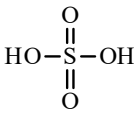
(2) A-III, B-IV, C-I, D-II

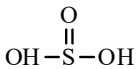
(3) A-I, B-III, C-IV, D-II

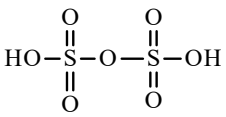
(4) A-III, B-IV, C-II, D-I

Sol. (2)


Peroxodisulphuric acid


Sulphuric acid


Sulphurous acid


Pyro sulphuric acid

88. On balancing the given redox reaction,

$aCr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \rightarrow$

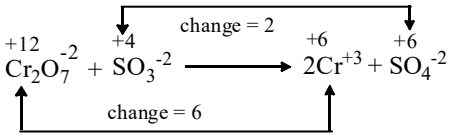
$2aCr^{3+}(aq) + bSO_4^{2-}(aq) + \frac{c}{2}H_2O(l) \rightarrow$

The coefficients a, b and c found to be respectively-

(1) 1, 3, 8 (2) 3, 8, 1

(3) 1, 8, 3 (4) 8, 1, 3

Sol. (1)



$8H^+ + Cr_2O_7^{-2} + 3SO_3^{-2} \xrightarrow{H^+} 2Cr^{+3} + 3SO_4^{-2} + 4H_2O$

a = 1 b = 3 c = 8

89. Pumice stone is an example of -

(1) sol (2) gel

(3) solid sol (4) foam

Sol. (3)

Pumice stone is sol of gas in solid it is also called solid sol.

90. Which complex compound is most stable ?

(1) $[Co(NH_3)_4(H_2O)Br](NO_3)_2$

(2) $[Co(NH_3)_3(NO_3)_3]$

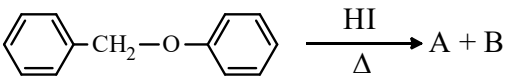
(3) $[CoCl_2(en)_2]NO_3$

(4) $[Co(NH_3)_6]_2(SO_4)_3$

Sol. (3)

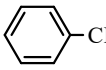
Polydentate ligands generally forms chelates. chelating complexes are more stable than normal complexes.

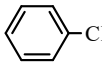
91. Consider the following reaction :

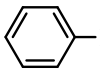


Identify products A and B

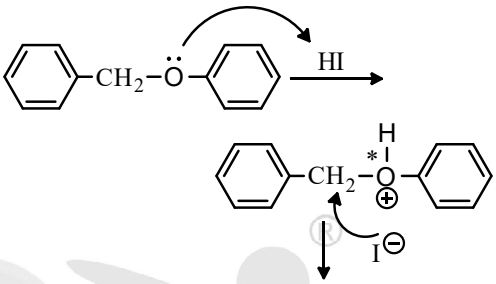
(1) A=  and B= 

(2) A=  and B= 

(3) A=  and B= 

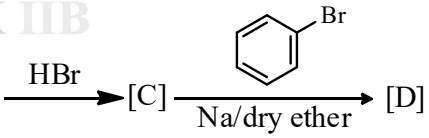
(4) A=  and B= 

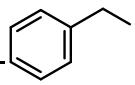
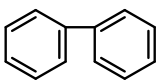
Sol. (3)



92. Identify the final product [D] obtained in the following sequence of reactions.

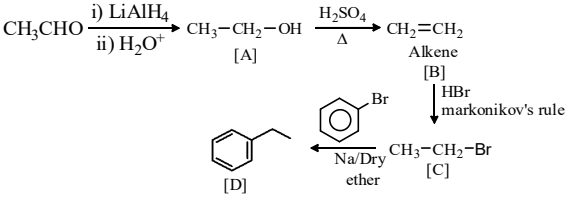
$CH_3CHO \xrightarrow[ii)H_3O^+]{i)LiAlH_4} [A] \xrightarrow[\Delta]{H_2SO_4} [B]$



(1)  (2) 

(3) C_4H_{10} (4) $HC \equiv C^{\odot}Na^+$

Sol. (1)



93. Given below are two statements :

Statement I : The nutrient deficient water bodies lead to eutrophication.

Statement II : Eutrophication leads to decrease in the level of oxygen in the water bodies.

(1) Both Statement I and Statement II are true.

(2) Both Statement I and Statement II are false

(3) Statement I is correct but Statement II is false

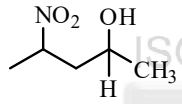
(4) Statement I is incorrect but Statement II is true.

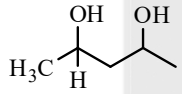
Sol. (4)

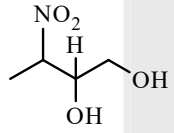
Correct statement for 1 is

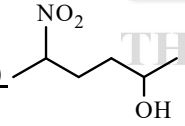
The nutrient enriched water bodies lead to eutrophication

94. Which amongst the following will be most readily dehydrated under acidic conditions ?

(1) 

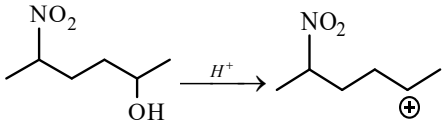
(2) 

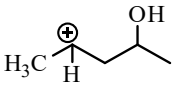
(3) 

(4) 

Sol. (4)

$\Rightarrow$ At first we know that in case of dehydration rate $\propto$ stability of carbocation. In case of option (4) Formed carbocation is most stable compare to other option.



2)  $\Rightarrow$ we apply distance dependant

95. What fraction of one edge centred octahedral void lies in one unit cell of fcc ?

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

(3) $\frac{1}{4}$ (4) $\frac{1}{12}$

Sol. (3)

In FCC unit cell

total O.V. are = 4

One present at body centre and 12 present at edge centres. Body centre shared by only one unit cell.

Each edge centre is shared by $\frac{1}{4}$.

Total O.V = $1 \times 1 + 12 \times \frac{1}{4} = 4$

96. The reaction that does NOT take place in a blast furnace between 900 K to 1500 K temperature range during extraction of iron is :

(1) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

(2) $FeO + CO \rightarrow Fe + CO_2$

(3) $\mathbf{C + CO_2 \rightarrow 2CO}$

(4) $CaO \rightarrow SiO_2 \rightarrow CaSiO_3$

Sol. (3)

At 900-1500 K (Higher temperature range)

$C + CO_2 \rightarrow 2\ CO$

$FeO + CO \rightarrow Fe + CO_2$

97. Which amongst the following options is the correct relation between change in enthalpy and change in internal energy ?

(1) $\Delta H = \Delta U - \Delta n_g RT$

(2) $\Delta H = \Delta U + \Delta n_g RT$

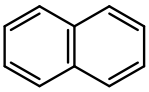
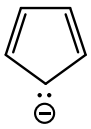
(3) $\Delta H - \Delta U = -\Delta nRT$

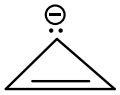
(4) $\Delta H + \Delta U = \Delta nR$

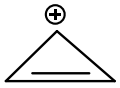
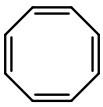
Sol. (2)

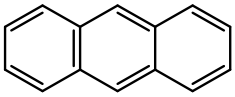
$\Delta H = \Delta U + \Delta n_g RT$

98. Consider the following compounds/species :

i.  ii. 

iii.  iv. 

v.  vi. 

vii. 

The number of compounds/species which obey Huckel's rule is_____.

(1) 4

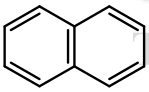
(2) 6

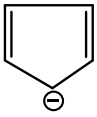
(3) 2

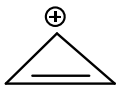
(4) 5

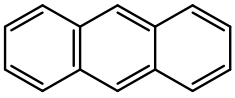
Sol. (1)

answer (4) compound obeys Huckel Rule.

i. 

ii. 

v. 

vii. 

ii. & iv. are antiaromatic

vi is non aromatic.

99. The equilibrium concentration of the species in the reaction $A+B \rightleftharpoons C+D$ are 2, 3, 10 and 6 mol L^{-1}, respectively at 300 K. ΔG^o for the reaction is (R = 2 cal / mol K)

(1) 1372.60 cal (2) – 137.26 cal

(3) – 1381.80 cal (4) –13.73 cal

Sol. (3)

$A+B \rightleftharpoons C+D$

[A]eq = 2 mol L–1

[B]eq = 3 mol L–1

[C]eq = 10 mol L–1

[D]eq = 6 mol L–1

T = 300 K

$$K_c = \frac{[C]_{eq}[D]_{eq}}{[A]_{eq}[B]_{eq}}$$

$$= \frac{10\times 6}{2\times 3} = 10$$

$$\Delta G^o = -2.303\, RT\, \log k_c$$

$$= (-2.303\times 2\times 300\, \log 10)\, cal$$

$$= -1381.8\, cal$$

100. Which of the following statements are INCORRECT?

A. All the transition metals except scandium form MO oxides which are ionic.

B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7.

C. Basic character increases from V_2O_3 to V_2O_4 to V_2O_5

D. V_2O_4 dissolves in acids to give VO_4^{3-} salts.

E. CrO is basic but Cr_2O_3 is amphoteric.

Choose the correct answer from the options given below :

(1) A and E only

(2) B and D only

(3) C and D only

(4) B and C only

Sol. (3)

C. Higher metal oxides are acidic in nature

D. V_2O_4 dissolves in acid to give VO_2^+ salts.

V_2O_5 react with alkalies as well as acid to give VO_4^{3-}