FIITJEE

ALL INDIA TEST SERIES

FULL TEST – X

JEE (Advanced)-2021

PAPER –2

TEST DATE: 19-09-2021

ANSWERS, HINTS & SOLUTIONS

Physics

PART – I

SECTION – A

1. B, C, D

Sol. $m_2g = \mu m_1 g \Rightarrow m_2 = \frac{m_1}{2}$

Now, $T - \mu m_1 g = m_1 a$ …(i)

$m_2 g + m_2\frac{v_0^2}{\ell} - T = m_2 a$ …(ii)

Solving equation (i) and (ii), we get

$\frac{m_2 v_0^2}{\ell} = (m_1 + m_2)a$

$a = \frac{v_0^2}{3\ell}$

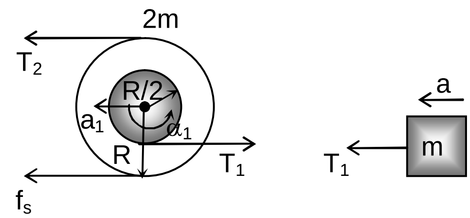
The initial acceleration of block of mass m_1 is $a = \frac{v_0^2}{3\ell}$

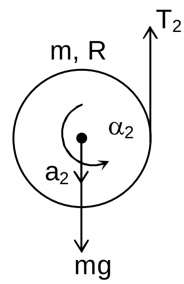
The initial acceleration of block of mass m_2 is $a_2 = \frac{v_0^2}{\ell} - a = \frac{2v_0^2}{3\ell}$

The initial radius of curvature of trajectory followed by the block of mass m_2 is

$R = \frac{v_0^2}{a_2} = \frac{v_0^2}{2v_0^2/3\ell} = \frac{3\ell}{2}$

2. A, B, C, D





Sol. $a_1 = \alpha_1 R$ …(i)

$a = a_1 - \frac{\alpha_1 R}{2} = \frac{a_1}{2}$ …(ii)

$a_2 - \alpha_2 R = 2a_1$

$\alpha_2 R = a_2 - 2a_1$ …(iii)

$T_1 = ma = \frac{ma_1}{2}$ …(iv)

$T_2 + f_s - T_1 = 2ma_1$ …(v)

$T_2 R + T_1 \frac{R}{2} - f_s R = mR^2 \alpha_1$

$T_2 + \frac{T_1}{2} - f_S = ma_1$ …(vi)

$mg - T_2 = ma_2$ …(vii)

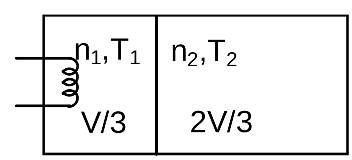
$T_2 R = \frac{mR^2}{2}\alpha_2$

$T_2 = \frac{m\alpha_2 R}{2} \Rightarrow T_2 = \frac{m}{2}(a_2 - 2a_1)$ …(viii)

Solving the above equations, we get

$a_1 = \frac{8g}{55}$, $a_2 = \frac{42g}{55}$, $a = \frac{4g}{55}$, and $f_s = \frac{7mg}{55}$

3. B, D



$n_1 = \frac{2}{3}$ mole

$n_2 = \frac{4}{3}$ mole

Sol. Let the temperature difference

$(T_1 - T_2) = T$

$n_1 C_{V_1} \frac{dT_1}{dt} = (P_{max} - HT)$

$\frac{2}{3} \times \frac{3R}{2} \frac{dT_1}{dt} = (P_{max} - HT)$

$\frac{dT_1}{dt} = \frac{(P_{max} - HT)}{R}$ …(i)

$n_2 C_{V_2} \frac{dT_2}{dt} = HT$

$\frac{4}{3} \times \frac{3R}{2} \frac{dT_2}{dt} = HT \Rightarrow \frac{dT_2}{dt} = \frac{HT}{2R}$ …(ii)

From (i) and (ii)

$\frac{d}{dt}(T_1 - T_2) = \frac{P_{max}}{R} - \frac{3HT}{2R}$

$\frac{dT}{dt} = \frac{3H}{2R}\left(\frac{2P_{max}}{3H} - T\right)$

In the steady state,

$\frac{dT}{dt} = 0 \Rightarrow T = T_0 = \frac{2P_{max}}{3H}$ …(iii)

Now, $P_1 - P_2 = \left(\frac{n_1 RT_1}{V_1} - \frac{n_2 RT_2}{V_2}\right) = \frac{2R}{V}(T_1 - T_2)$

$\Rightarrow \Delta P = \frac{2RT_0}{V} \Rightarrow \Delta P = \frac{2R}{V}\left(\frac{2P_{max}}{3H}\right)$

$$\Rightarrow P_{max} = \frac{3VH\Delta P}{4R} = \frac{3\times 20\times 10^{-3}\times 0.3\times 10^{3}}{4\times \frac{25}{3}}$$

$P_{max} = 0.54$ watt

From equation (iii), $T_0 = \frac{2P_{max}}{3H} = \frac{2\times 0.54}{3\times 0.3} = 1.2\,°C$

4. A, D

Sol. Let the movable support is shifted downwards by a distance 'x'

$axS_0 = bxS$

$S_0 = \left(\frac{b}{a}\right)S = \frac{0.1}{0.5}\times 1 = 0.2\ m^2$

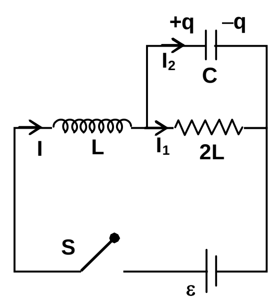
Now, $k(1-a)x = \rho g(a+b)x\left(\frac{b}{a}S\right)$

$K = \frac{2\times 10^3\times 10\times 0.6\times 0.1\times 1}{0.5\times 0.5}$

k = 4800 N/m

k = 4.8 kN/m

5. A, C, D



Sol. $L\frac{dI}{dt} + 2L\frac{dI_1}{dt} = \varepsilon$

$\frac{dI}{dt} = \frac{\varepsilon}{L} - 2\frac{dI_1}{dt}$ …(i)

$q = 2LC\frac{dI_1}{dt}$ …(ii)

Now, $I = I_1 + I_2$

$\frac{dI}{dt} = \frac{dI_1}{dt} + \frac{dI_2}{dt}$

$\frac{\varepsilon}{L} - 2\frac{dI_1}{dt} = \frac{dI_1}{dt} + \frac{dI_2}{dt}$

$\frac{dI_2}{dt} = \frac{\varepsilon}{L} - 3\frac{dI_1}{dt}$

$\frac{d^2q}{dt^2} = \frac{\varepsilon}{L} - \frac{3q}{2LC} \Rightarrow \frac{d^2q}{dt^2} = -\frac{3}{2LC}\left(q - \frac{2C\varepsilon}{3}\right)$

$\omega = \sqrt{\frac{3}{2LC}}$

Now, $q - \frac{2C\varepsilon}{3} = A\sin(\omega t + \alpha)$ …(iii)

$I_2 = \frac{dq}{dt} = \omega A\cos(\omega t + \alpha)$ …(iv)

At t = 0, q = 0, $I_2 = 0$

From (iii) and (iv), we get

$\alpha = \frac{3\pi}{2},\ A = \frac{2C\varepsilon}{3}$

Hence $q = \frac{2C\varepsilon}{3}\left[1-\cos\left(t\sqrt{\frac{3}{2LC}}\right)\right]$

$I_2 = \varepsilon\sqrt{\frac{2C}{3L}}\sin\left(t\sqrt{\frac{3}{2LC}}\right)$

6. A, B, D

Sol. The equation of standing wave is

$y = A \sin kx \cos \omega t$

The kinetic energy of the string at time 't' is

$$K = \int_0^{\ell} \frac{1}{2}\rho\left(\frac{\partial y}{\partial t}\right)^2 S dx$$

$$K = \frac{1}{2}\rho\omega^2 A^2 S \sin^2 \omega t \int_0^{\ell} \sin^2 kx dx$$

$$K = \frac{1}{2}\rho\omega^2 A^2 S \sin^2 \omega t \int_0^{\ell} \frac{[1-\cos(2kx)]}{2} dx$$

$$K = \frac{1}{4}\rho\omega^2 A^2 S\ell \sin^2 \omega t \quad \ldots(i)$$

At $t = \frac{\pi}{3\omega}$

$$K = \frac{3}{16}\rho\omega^2 A^2 S\ell$$

The elastic potential energy stored in the string at time 't' is

$$U = \int_0^{\ell} \frac{1}{2}\rho v^2\left(\frac{\partial y}{\partial x}\right)^2 S dx$$

$$U = \int_0^{\ell} \frac{1}{2}\rho v^2 k^2 A^2 \cos^2 kx \cos^2 \omega t S dx$$

$$U = \int_0^{\ell} \frac{1}{2}\rho\omega^2 A^2 S \cos^2 \omega t \cos^2 kx dx$$

$$U = \frac{1}{2}\rho\omega^2 A^2 S \cos^2 \omega t \int_0^{\ell} \frac{(1+\cos(2kx))}{2} dx$$

$$U = \frac{1}{4}\rho\omega^2 A^2 S\ell \cos^2 \omega t \quad \ldots(ii)$$

At $t = \frac{\pi}{3\omega}$

$$U = \frac{1}{16}\rho\omega^2 A^2 S\ell$$

SECTION – B

7. 2

Sol. $q = \frac{|\Delta\phi|}{R} = \frac{\phi}{R}$ …(i)

We mentally replace the magnet by a small current loop. If the area of the loop is S and the current is I, the magnetic moment of the magnet is

$M = IS$ …(ii)

If current flows through the coil is I_0.

The magnetic flux through the small loop is

$$\phi_0 = \frac{\mu_0 N I_0 S}{2a}$$

Mutual inductance is

$$M_0 = \frac{\mu_0 NS}{2a} \quad \text{…(iii)}$$

The magnetic flux through the coil is

$$\phi = M_0 I = \frac{\mu_0 NSI}{2a} \quad \text{…(iv)}$$

From (i) and (ii)

$$\phi = qR$$

$$\frac{\mu_0 NIS}{2a} = qR$$

$$IS = \frac{2aRq}{\mu_0 N} \Rightarrow M = \frac{2aRq}{\mu_0 N}$$

Hence k = 2

8. 3

Sol. $$I\frac{d^2\theta}{dt^2} = -\left(mg\frac{3h}{4}\right)\theta$$

$$\frac{3mh^2}{20}(4+\tan^2\alpha)\frac{d^2\theta}{dt^2} = -\left(\frac{3mgh}{4}\right)\theta$$

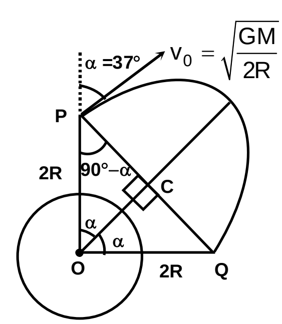
$$\frac{d^2\theta}{dt^2} = -\left(\frac{5g}{h(4+\tan^2\alpha)}\right)\theta$$

$$\frac{d^2\theta}{dt^2} = -\left(\frac{15g}{13h}\right)\theta$$

Time period, $T = 2\pi\sqrt{\frac{13h}{15g}}$

9. 8

Sol. Total mechanical energy of the satellite



$$\varepsilon = -\frac{GMm}{2R} + \frac{1}{2}mv_0^2$$

$$\varepsilon = \frac{-GMm}{2R} + \frac{GMm}{4R}$$

$$\varepsilon = -\frac{GMm}{4R}$$

Semi-major axis, a = 2R

a cos α = ae

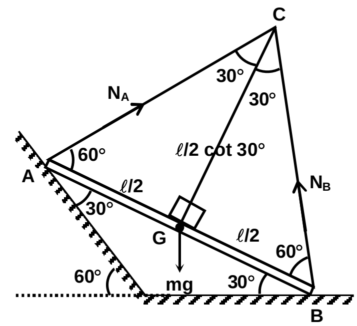
$$e = \cos 37° = \frac{4}{5}$$

e = 0.8

n = 8

10. 6

Sol. 'C' is the point through which the instantaneous axis of rotation passes and G is the centre of mass of the rod.



CG = $\frac{\ell}{2}\cot 30° = \frac{\ell\sqrt{3}}{2}$

The moment of inertia abut the instantaneous axis of rotation is

$$I = \frac{m\ell^2}{12} + m\left(\frac{\ell\sqrt{3}}{2}\right)^2$$

$$I = \frac{m\ell^2}{12} + \frac{3m\ell^2}{4}$$

$$I = \frac{5m\ell^2}{6}$$

Now, $mg\frac{\ell\sqrt{3}}{4} = \left(\frac{5m\ell^2}{6}\right)\alpha$

$$\alpha = \frac{3\sqrt{3}g}{10\ell}$$

Hence k = 6

11. 4

Sol. $\sigma = \frac{Q}{\pi R^2}$

Let the charge on the ball be 'q'

$$\frac{\sigma R}{2\varepsilon_0} + \frac{q}{4\pi\varepsilon_0 a} = 0$$

$q = -\sigma R 2\pi a$ …(i)

The electrostatic force on the ball due to the uniformly charged disc is

$$F = \frac{\sigma}{2\varepsilon_0}|q| = \frac{\sigma}{2\varepsilon_0}(\sigma R 2\pi a) = \frac{\sigma^2 \pi a R}{\varepsilon_0}$$

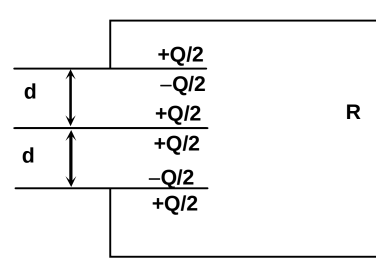
$$F = \left(\frac{Q}{\pi R^2}\right)^2 \frac{\pi a R}{\varepsilon_0}$$

$$F = \frac{Q^2 a}{\pi\varepsilon_0 R^3}$$

Hence n = 4

12. 2

Sol. When charge Q is given to the middle plate before shifting

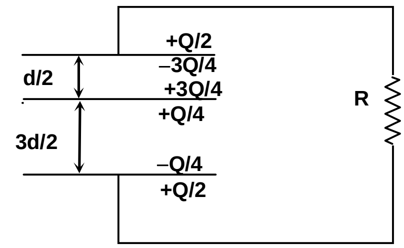


$C = \frac{\varepsilon_0 A}{d}$, $C_{eq} = 2C$

$U_i = \frac{Q^2}{2C_{eq}} = \frac{Q^2}{4C}$ …(i)

When the middle pate is shifted towards the upper plate by a distance d/2,

$$C_1 = \frac{2\varepsilon_0 A}{d} = 2C$$



$C_2 = \frac{2\varepsilon_0 A}{3d} = \frac{2C}{3}$

$C'_{eq} = (C_1 + C_2) = 2C + \frac{2C}{3}$

$C'_{eq} = \frac{8C}{3}$

$U_f = \frac{Q^2}{2C'_{eq}} = \frac{3Q^2}{2 \times 8C} = \frac{3Q^2}{16C}$ …(ii)

Heat dissipated in the resistor after this shift is

$\Delta H = U_i - U_f = \frac{Q^2}{4C} - \frac{3Q^2}{16C} = \frac{Q^2}{16C} = \frac{Q^2 d}{16\varepsilon_0 A}$

Hence n = 2

SECTION – C

13. 00001.60

Sol. Consider the motion of the block relative to the plank.
The retardation of the block relative to the plank is

$a = \mu g + \frac{\mu m g}{M}$

$a = \mu g\left(\frac{M+m}{M}\right)$ …(i)

$v_0^2 - 2a2\ell = 0 \Rightarrow v_0 = \sqrt{4a\ell}$ …(ii)

Now,

$v_0 - at = 0$

$t = \frac{v_0}{a} = \frac{\sqrt{4a\ell}}{a}$

$t = \sqrt{\frac{4\ell}{a}} = \sqrt{\frac{4M\ell}{\mu g(M+m)}}$

$t = \sqrt{\frac{4 \times 8 \times 4}{0.5 \times 10 \times 10}} = 1.60 \text{ sec}$

t = 1.60 sec

14. 00024.00

Sol. $\left(\frac{D+x}{D-x}\right)^2 = \frac{9}{4}$

$\frac{D+x}{D-x} = \frac{3}{2}$

$2D + 2x = 3D - 3x$

5x = D

$x = \frac{D}{5} = \frac{100}{5} = 20 \text{ cm}$

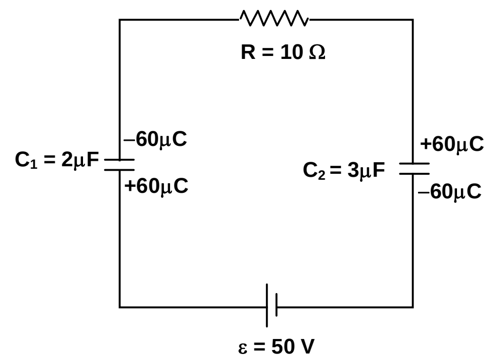
x = 20 cm

Now, $f = \frac{D^2 - x^2}{4D} = \frac{(100 \times 100) - (20 \times 20)}{4 \times 100}$

f = 24 cm

15. 00002.25

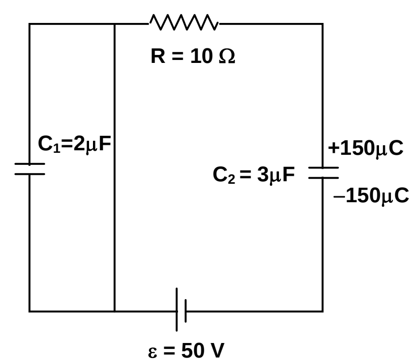
Sol. Before switch 'S' is closed



$$C_{eq} = \frac{6}{5}\mu F$$

$$Q = C_{eq}\varepsilon = \frac{6}{5}\times 50 = 60\mu C$$

After switch 'S' is closed



$\Delta Q = 150 - 60 = 90\ \mu C$

Now,

$\Delta W_b = \Delta U + \Delta H$

$$90\times 10^{-6}\times 50 = \frac{1}{2}\times 3\times 10^{-6}\times (50)^2 - \frac{1}{2}\times\frac{6}{5}\times 10^{-6}\times (50)^2 + \Delta H$$

$$4500\times 10^{-6} = (3750 - 1500)\times 10^{-6} + \Delta H$$

$\Delta H = 2250 \times 10^{-6}$ J

$\Delta H = 2.25 \times 10^{-3}$ J

16. 00096.00

Sol.
$$A_r = \left(\frac{v_2 - v_1}{v_2 + v_1}\right)Ai$$

$$A_r = \left(\frac{\sqrt{\frac{F}{\mu_2}} - \sqrt{\frac{F}{\mu_1}}}{\sqrt{\frac{F}{\mu_2}} + \sqrt{\frac{F}{\mu_1}}}\right)A$$

$$A_r = \left(\frac{1-\sqrt{\frac{\mu_2}{\mu_1}}}{1+\sqrt{\frac{\mu_2}{\mu_1}}}\right)A$$

$$A_r = \left(\frac{1-\sqrt{\frac{4}{9}}}{1+\sqrt{\frac{4}{9}}}\right)A = \left(\frac{1-\frac{2}{3}}{1+\frac{2}{3}}\right)A = \frac{A}{5}$$

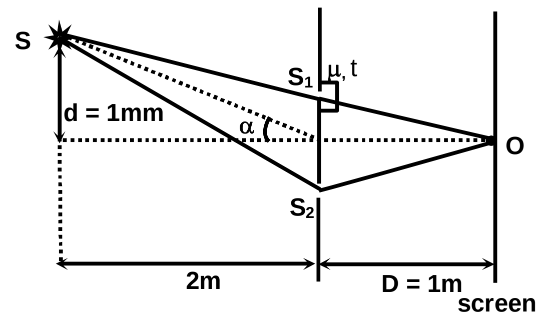
$$A_r = \frac{A}{5}$$

The percentage of incident power reflected from the joint O

$$\frac{P_r}{P_i}\times 100 = \left(\frac{A_r}{A_i}\right)^2\times 100 = \left(\frac{1}{5}\right)^2\times 100 = \frac{1}{25}\times 100 = 4\%$$

The percentage of incident power transmitted to the second string = 100 − 4 = 96%

17. 00000.20



Sol. $\tan\alpha = \frac{1\times10^{-3}}{2} = 5\times10^{-4}$

For the intensity at point 'O' to be maximum

$d \sin \alpha - (\mu - 1)t = \lambda$ (for $t = t_{min}$)

$1\times10^{-3}\times5\times10^{-4} - (1.5-1)t = 4\times10^{-7}$

$5\times10^{-7} - (1.5-1)t = 4\times10^{-7}$

$(1.5 - 1)t = 1 \times 10^{-7}$

$0.5t = 1 \times 10^{-7}$

$t_{min} = 0.20\ \mu m$

18. 00014.25

Range 14.24 to 14.26

Sol. Energy of each photon is

$E = \frac{hC}{\lambda} = \frac{1240}{500} = 2.48\text{ eV}$

Now,

$K_{max} = E - \phi$

$K_{max} = 2.48 - 1.83$

$K_{max} = 0.65\text{ eV}$

$E_n = -13.6\left(\frac{z^2}{n^2}\right)$

The energy of first excited state (n = 2) of He^{+} atom,

$E_2 = -13.6\left(\frac{2^2}{2^2}\right) = -13.6\text{ eV}$

The energy of photon emitted during combination

$\Delta E = K_{max} - E_2$

$\Delta E = 0.65 - (-13.6)$

$\Delta E = 14.25\text{ eV}$

Chemistry

PART – II

SECTION – A

19. A, B

Sol. (A) Monoclinic sulphur is stable above 95.6°C

(B) Both Rhombic and monoclinic sulphur are soluble in CS_2

20. A, B, C

Sol. (A) In quasistate i.e. at equilibrium no reaction occurs in either direction, forward or backward, then $(\text{Rate})_f = k_f[A]^a[B]^b$

(B) At 10 Kelvin, $(RT)^{\Delta n} = (0.0821\times10)^2 = 0.67$ hence $k_P < k_c$.

(C) Normal freezing point of water is freezing point at 1 atm pressure which is 0.0°C. Since specific volume of ice is greater than that of water, on applying pressure greater than 1 atm, ice at 0.0°C will change into water (le-Chatelier's Principle). Temperature will therefore has to be lowered below 0.0°C to get ice again.

(D) Active mass of NH_2COOHN_4(s) being solid, remains unity, despite the addition of more solid at equilibrium.

21. A, D

Sol. (A) $CaCN_2 + 3H_2O \longrightarrow 2NH_3 + CaCO_3$

(B) $NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$

(C) Red phosphorous is unreactive towards alkalies

(D) $PCl_5 + H_2O \longrightarrow POCl_3 + 2HCl(\text{insufficient water})$

$PCl_5 + 4H_2O \longrightarrow H_3PO_4 + 5HCl(\text{excess of water})$

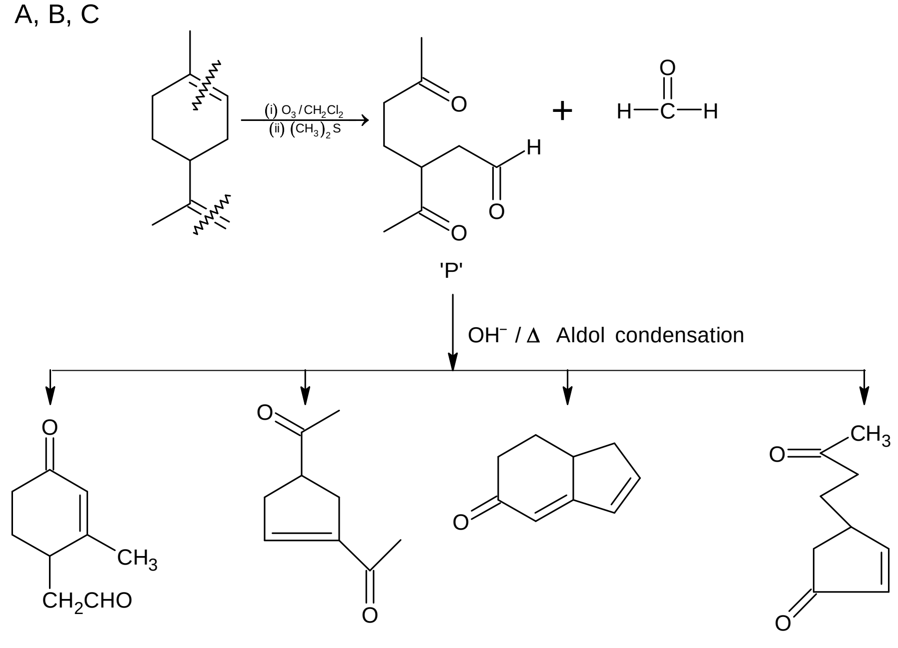
22. B, D

Sol. On cooling aqueous solution at 0°C or below water would be frozen out continuously resulting in decease of water content in the solution whereas the amount of glucose remains same.

In Beaker II, the dissolved solute continues to crystallize out with no change of water content, therefore concentration falls.

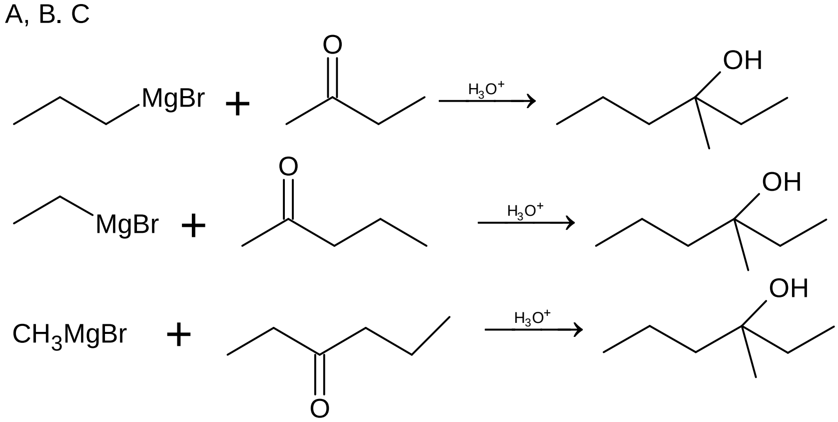
23. A, B, C

Sol.



24. A, B. C

Sol.



SECTION – B

25. 5

Sol. Nylon-6, 6, Glyptal, Bakelite, Polyurethane, Buna-S are co-polymers.

26. 6

Sol. Siderite – $FeCO_3$,
Cerrusite – $PbCO_3$
Magnesite – $MgCO_3$
Limestone – $CaCO_3$
Calamine – $ZnCO_3$
Dolomite – $MgCO_3.CaCO_3$

27. 6

Sol. In CCP number of 'A' atoms per unit cell = 4
No. of octahedral voids = 4
No. of tetrahedral voids = 8

Number of 'B' atoms present in O.V's = $\frac{4}{2} = 2$

Number of 'C' atoms present in T.V's = $\frac{8}{2} = 4$

No. of vacant voids per unit cell = $2 + 4 = 6$

28. 9

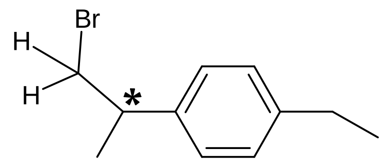
Sol. Compressibility factor of a non-ideal gas $Z = \frac{PV}{RT}$

or $1.125 = \frac{4.1 \times V\left(dm^3\right)}{0.082 \times 400}$

$V(dm^3) = 9$

29. 6

Sol.



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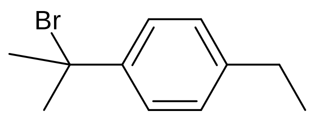

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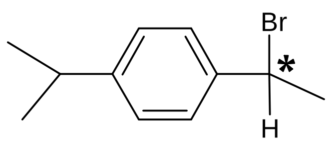

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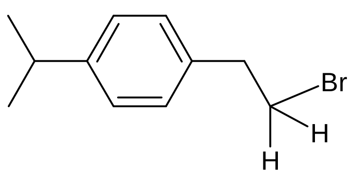


(1)

30. 5

Sol. Ag_2SO_3, $Ag_2S_2O_3$, CH_3COOAg, $Ag_2C_2O_4$, $AgCl$ = White

$\underset{(\text{Black})}{Ag_2S}$, $\underset{(\text{Pale yellow})}{AgBr}$, $\underset{(\text{Yellow})}{AgI}$, $\underset{(\text{Brick red})}{Ag_2CrO_4}$, $\underset{(\text{Reddish Brown})}{Ag_2Cr_2O_7}$

SECTION – C

31. 00058.38

Sol. $2Ag^{+} + 2e^{-} \longrightarrow 2Ag(s) \qquad E^{o} = 0.80V$

$C_6H_{12}O_6 + H_2O \longrightarrow C_6H_{12}O_7 + 2H^{+} + 2e^{-} \qquad E^{o} = -0.05V$

The net reaction is

$2Ag^{+} + C_6H_{12}O_6 + H_2O \longrightarrow 2Ag(s) + C_6H_{12}O_7 + 2H^{+} \qquad E^{o} = 0.75V$

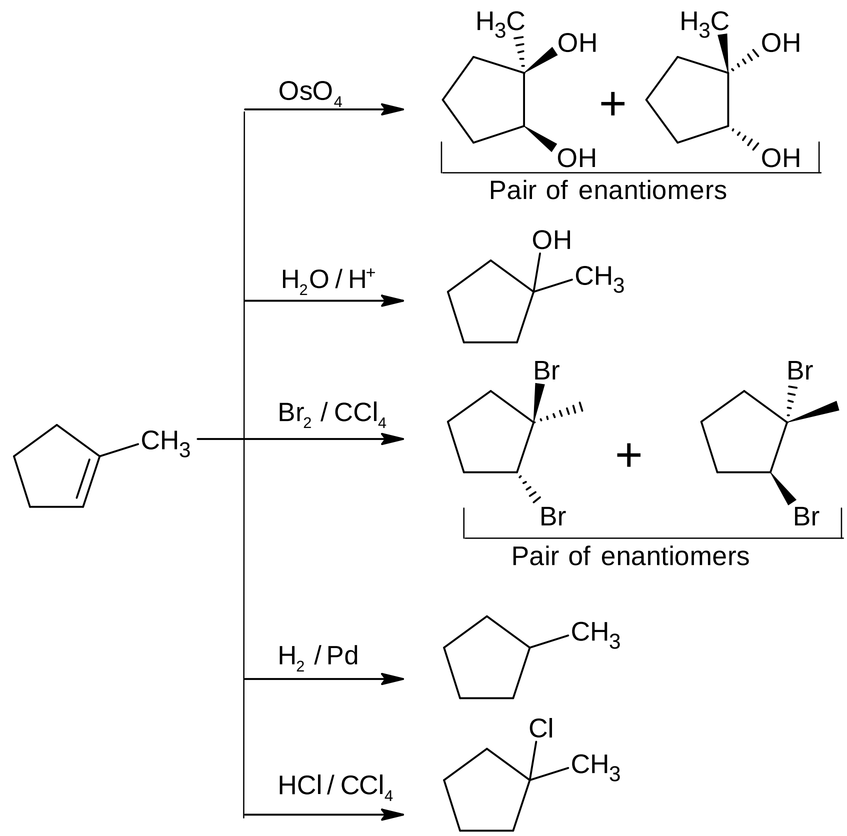
$$E_{cell} = E^{o} - \frac{RT}{nF}\ln K = 0$$

$$\text{or } \ln K = \frac{nFE^{o}}{RT} = 2 \times 0.75 \times 38.92$$

$= 58.38$

32. 00003.50

Sol.



33. 00026.46

Sol. Dissolution of KCl being endothermic, $\Delta H = +ve$

Moles of KCl dissolved = $\frac{7.45}{74.5} = 0.1$

Mass of water in calorimeter = $10 \times 18 = 180$ g

Heat absorbed = $(180 + 30) \times 4.2 \times (30 - 27)$

= 2.646 KJ

$\Delta H_{sol}\left(KJmol^{-1}\right) = \frac{2.646}{0.1} = 26.46$

34. 00078.58

Sol. Let fraction of laevo be 'x'

$\Rightarrow -21x + (1 - x)21 = 12$

$x = \frac{9}{42} = 21.42$

% laevo = 21.42 and % dextro = 75.58

35. 00067.02

Sol. $n_{SnCl_2.2H_2O} = \frac{45.10}{225.5} = 0.2;$ $\quad n_{CuCl_2} = \frac{26.9}{134.5} = 0.2$

$2CuCl_2 + SnCl_2 \longrightarrow Cu_2Cl_2 \downarrow + SnCl_4$

0.2 mole 0.1mole 0.1 mole

(white ppt.)

$$\underset{0.1\,\text{mole}}{2HgCl_2 + SnCl_2} \longrightarrow \underset{\substack{0.1\,\text{mole} \\ (\text{white ppt.})}}{Hg_2Cl_2} + SnCl_4$$

Total weight of white ppt. $= \underset{(Cu_2Cl_2)}{19.8} + \underset{(Hg_2Cl_2)}{47.22}$

$= 67.02$ g

36. 00035.84

Sol. Moles of $Al_4C_3 = \frac{1}{5} \times 0.5 = 0.1$

Moles of $CaC_2 = \frac{4}{5} \times 0.5 = 0.4$

$$\underset{0.1}{Al_4C_3} + 12H_2O \longrightarrow 4Al(OH)_3 + \underset{0.3\ \text{moles}}{3CH_4} \uparrow$$

$$\underset{0.4}{CaC_2} + 2H_2O \longrightarrow Ca(OH)_2 + \underset{0.4\ \text{moles}}{C_2H_2} \uparrow$$

The gases require oxygen for burning as

$$\underset{0.3\ \text{moles}}{CH_4} + \underset{0.6\ \text{moles}}{2O_2} \longrightarrow CO_2 + 2H_2O$$

$$\underset{0.4}{C_2H_2} + \underset{0.4 \times \frac{5}{2} = 1.0\ \text{mole}}{\frac{5}{2}O_2} \longrightarrow 2CO_2 + H_2O$$

Total number of moles of oxygen needed = 0.6 + 1.0 = 1.6

$V_{O_2}(NTP) = 1.6 \times 22.4 = 35.84\ L$

Mathematics

PART – III

SECTION – A

37. C, D

Sol. $(\vec{a}+\vec{b})\cdot(-7\hat{i}+2\hat{j}+3\hat{k}) = \pm(-14+6+12) = \pm 4$

38. A, B, C, D

Sol. $\Delta ABC = \Delta BD + \Delta ACD$

$EF = ED + DF = 2DE = 2 \times AD \tan\frac{A}{2}$

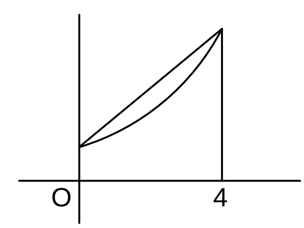
$AD \perp EF$, $DE = DF$, AD is bisector

39. A, B, C

Sol. Apply King's property and then calculate $(I_{n+2} - I_n)$

40. C, D

Sol. Concave up graph chord is above the graph



41. A, B, C

Sol. $\begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix} = 0$

42. A, C, D

Sol. Draw the figure

SECTION – B

43. 2

Sol. $\left(x-\frac{\pi}{4}\right) = t$ and then King's property

44. 5

Sol. Draw the figure

45. 2

Sol. Expanding $A = -x(x-3)^2$

46. 5

Sol. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ solve, $a + b + c + d = 5$

$a = -1, b = 0, c = 4, d = 2$

47. 1

Sol. $n(A) = {}^5C_1 \times 2! + {}^5C_2 \times 2! = 30$

$p(E) = \frac{30}{180} = \frac{1}{6}$

48. 7

Sol. Open $\cos(A_1 + A_2 + A_3) = \cos 2\pi$

SECTION – C

49. 00004.00

Sol. Use $(x + iy) = (a + ib)^3$

50. 00004.00

Sol. $T = S_1$ and equation of tangent and compare $\lambda = 4$

51. 00000.00

Sol. Draw the figure

52. 00001.00

Sol. Let $\cot^{-1}p = \theta$

53. 00002.00

Sol. Volume of tetrahedron = $\frac{1}{6}$ volume of parallelepiped

54. 00001.41

Sol. $(1-i) = \left(\sqrt{2}e^{-\frac{i\pi}{4}}\right)$