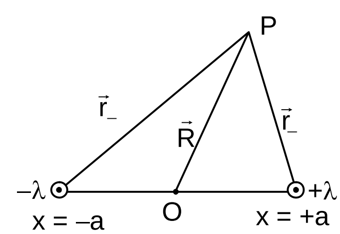
FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
OPEN TEST – II
PAPER –1
TEST DATE: 13-04-2025

ANSWERS, HINTS & SOLUTIONS

Physics PART – I

Section – A

1. B, D



Sol. $E = \dfrac{2k\lambda}{r}$

$$\Rightarrow \int_0^V dV = -\int_{r_0}^{r} E dr$$

$$\Rightarrow V = -2k\lambda(\ell nr - \ell nr_0)$$

$$V = -2k\lambda\ell n(r) + C$$

$$V_P = V_{-\lambda} + V_{+\lambda} = 2k\lambda\ell n(r_-) - 2k\lambda\ell n(r_+) = 2k\lambda\ell n\left(\frac{r_-}{r_+}\right)$$

$$\vec{r}_- = (x+a)\hat{i} + y\hat{j}$$

$$\vec{r}_+ = (x-a)\hat{i} + y\hat{j}$$

$$V_P = 2k\lambda\ell n\sqrt{\frac{(x+a)^2 + y^2}{(x-a)^2 + y^2}}$$

for $v_P = \dfrac{\lambda}{4\pi\varepsilon_0}\ln 2$

$$\Rightarrow \frac{(n+a)^2 + y^2}{(x-a)^2 + y^2} = 2$$

$$(x+a)^2 + y^2 = 2(x-a)^2 + 2y^2$$

$$(x-3a)^2 + y^2 = 8a^2$$

$\Rightarrow$ Equipotential surface is cylinder with radius $2\sqrt{2}a$

2. A, C

Sol. For oscillation to occur it must be in the stable equilibrium i.e. centre of mass of the system must be below the centre of hemisphere.

3. A, C, D

Sol. $1000 = \frac{320}{4\ell_1} \Rightarrow \ell_1 = 8$ cm

$1000 = \frac{3\times 320}{4\ell_2} \Rightarrow \ell_2 = 24$ cm

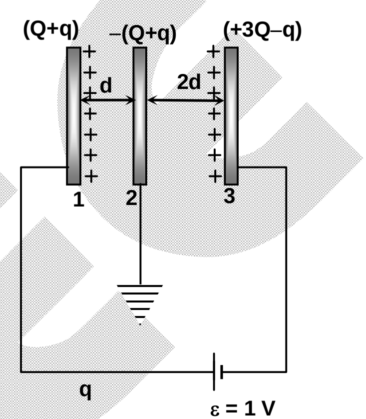
$-A\frac{dh}{dv} = 2\sqrt{2gh} \Rightarrow -\int\frac{dh}{\sqrt{h}} = \frac{a}{A}\sqrt{2g}\int dt$

4. B, D

Sol. Charge flown through S_1 is Q + 3Q = 12 mC

$0 + \frac{(Q+q)}{\varepsilon_0 A}d - \varepsilon - \frac{(3Q-q)2d}{\varepsilon_0 A} = 0$

By solving q = 15 mC



5. A, C, D

Sol. Conserve angular momentum about O. $2mv_0 2\ell = I\omega$

Where $I = \frac{40m\ell^2}{3}$

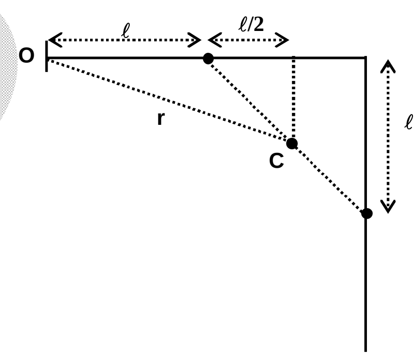
$\therefore \omega = \frac{3v_0}{10\ell}$

$r = \sqrt{\frac{\ell^2}{4} + \left(\ell + \frac{\ell}{2}\right)^2}$

$r = \sqrt{\frac{5}{2}}\ell$

$v_c = r_c\omega = \sqrt{\frac{5}{2}}\ell \times \frac{3v_0}{10\ell} = \frac{3}{2\sqrt{10}}v_0$

K.E. = $\frac{1}{2}I\omega^2 = \frac{3}{5}mv_0^2$



6. A, B, C, D

Sol. Torque along vertical axis is zero

7. B

Sol. (I) $P_N = P_0 + \rho g\left(\frac{3H}{2}\right)$

$P_N - P_0 = 3\rho g\frac{H}{2}$

(II) $V = \sqrt{2g(2H)} = 2\sqrt{gH}$

$$P_0 + \rho gH = P_N - \rho g\frac{H}{2} + \frac{1}{2}\rho(4gH)$$

$$P_N - P_0 = \rho gH + \frac{\rho gH}{2} - 2\rho gH = -\frac{\rho gH}{2}$$

(III) $P_N = P_0 + \rho gh + \frac{1}{2}\rho\omega^2\left(\frac{H}{2}\right)^2$

$$P_N - P_0 = \rho gH + \frac{1}{8}\rho\omega^2H^2$$

$$\omega^2 H = 2g$$

$$\therefore\ P_N - P_0 = \frac{5}{4}\rho gH$$

(IV) $P_N = P_0 + \rho(g\cos 60°)2H$

$$P_N - P_0 = \rho gH$$

8. B

Sol. (I) $v_I = \frac{4}{3}\times 3 = 4$

$v_r = 4 - 3 = 1$ m/s

(II) $\frac{dv}{dt} = -\left(\frac{v}{u}\right)^2 \frac{du}{dt}$

$\Rightarrow v_I = 1$ m/s and $v_r = 10$ m/s

(III) $v_{I,m} = 4$

$\Rightarrow v_{I,g} = 7 \Rightarrow v_r = 8$ m/s

(IV) final image is at the position of object hence magnification is 1

$\Rightarrow v_I = v_0 = 1$m/s

$\Rightarrow v_r = 0$

9. C

Sol. (I) $Q = \int T ds$ = Area between T-s diagram = 700 J

(II) $\Delta Q = n\frac{3}{2}R(T_f - T_i) + n\frac{5}{2}R(T_f - T_i)$

$= \frac{3}{2}(nRT_f - nRT_i) + \frac{5}{2}(nRT_f - nRT_i)$

$= \frac{3}{2}(500 - 100) + \frac{5}{2}(1000 - 500) = 1850$ J

(III) Process is T = 100 V $\Rightarrow \frac{T}{V}$ = constant i.e. pressure = constant

$\therefore$ Q = $nC_P\Delta T$ = $2\frac{5}{2}R(300-100) = 1000R$

(IV) A $\rightarrow$ B is V = constant and B $\rightarrow$ C, P = constant

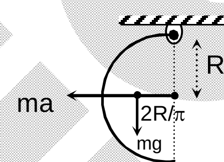
$$\Delta Q = n\frac{3}{2}R(T_B - T_A) + n\frac{5}{2}R(T_C - T_B) = (1000-500) + \frac{5}{3}(500-1000)$$

10. D

Sol. (I) $-mg\frac{R}{2}\theta = \frac{2}{3}mR^2\alpha \Rightarrow \alpha = -\left(\frac{3g}{4R}\right)\theta$

$$T = 2\pi\sqrt{\frac{4R}{3g}}$$

(II) $maR = mg\frac{2R}{\pi}$



$$a = \frac{2g}{\pi}$$

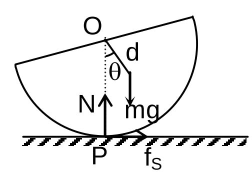
$$-mg_{eff}\sqrt{R^2 + \frac{4R^2}{\pi^2}}\sin\theta = 2mR^2\alpha$$

$$g_{eff} = \sqrt{a^2 + g^2} = g\sqrt{1 + \frac{4}{\pi^2}}$$

$$\therefore\ \alpha = -\left[\frac{g}{2R}\left(1 + \frac{4}{\pi^2}\right)\right]\theta \Rightarrow T = 2\pi\sqrt{\frac{2R}{g\left(1 + \frac{4}{\pi^2}\right)}}$$

(III) $\tau_P = I_P\alpha$

$-mgd\sin\theta = I_P\theta$

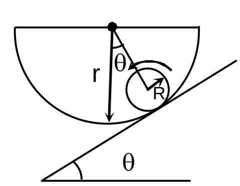


$d = \frac{3R}{8}$, $I_P = \frac{13}{20}mR^2$

$$\alpha = -\left(\frac{mgd}{I_P}\right)\theta$$

$$T = 2\pi\sqrt{\frac{I_P}{mgd}} \Rightarrow T = 2\pi\sqrt{\frac{26R}{15g}}$$

(IV) $a = \frac{g\sin\theta}{1 + \frac{I_C}{mR^2}}$

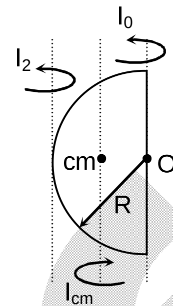


$$a = -\frac{5g}{7} = -\frac{5g}{7}\frac{x}{r-R} = -\frac{g}{7R}x$$

$$T = 2\pi\sqrt{\frac{7R}{g}}$$

Section – B

11. 0.68



Sol. $I_1 = \frac{MR^2}{4} + MR^2$ ...(i)

$I_2 = I_{cm} + M\left(R - \frac{4R}{3\pi}\right)^2$ ...(ii)

$I_0 = I_{cm} + M\left(\frac{4R}{3\pi}\right)^2$

$I_0 = \frac{MR^4}{4}$

Solving the equations

$\left|\frac{I_2 - I_1}{I_1}\right| = 0.68$

12. 0.01

Sol. $F = n\frac{h}{\lambda}$

and F = mg

$\therefore$ Power P = $n\frac{hc}{\lambda}$

$\therefore\ mg = \frac{P}{c}$

P = mgc

Also, $P = \frac{dm}{dt}c^2$

$\therefore\ \frac{dm}{dt} = \frac{mg}{c} = 0.01$ kg/s

13. 19.11

Sol. $mv_0 \cos\theta = 2mv_C$

$\Rightarrow v_C = \frac{v_0 \cos\theta}{2}$

Conservation of angular momentum

$mv_0 \cos\theta \frac{\ell}{4} = \left(\frac{m\ell^2}{16} + \frac{m\ell^2}{12} + \frac{m\ell^2}{16}\right)\omega$

$\omega = \frac{6v_0 \cos\theta}{5\ell}$

$\theta = \omega t$ and N= $\frac{\theta}{2\pi} = \frac{3v_0^2 \sin 2\theta}{10\pi g\ell}$

14. 3.14

Sol. $f_S = ma$

$N = mg$

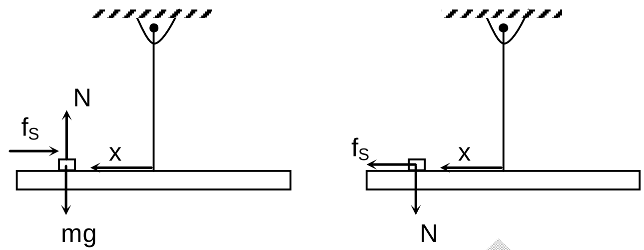
$\tau_0 = 0$

$Nx - f_S\ell = 0$

$f_s = \frac{mgx}{\ell}$

$a = -\frac{g}{\ell}x$

Time = $\pi\sqrt{\frac{\ell}{g}} = \pi$ sec



15. 1.19

Sol. $\sqrt{2\times 4k_\alpha} = \sqrt{2\times 1\times k_p}\cos 60° + \sqrt{2\times 17k_0}\cos\theta$

$\sqrt{2\times 1\times k_P}\sin 60° = \sqrt{2\times 17\times k_0}\sin\theta$

Solving k_0 = 0.71 MeV

$\therefore$ Q = $(k_\alpha - k_P - k_0)$ = 1.19 MeV

16. 0.80

Range (0.79 to 0.82)

Sol. For rotation equilibrium net torque is zero

$-$ NIAB + 4g $\times$ 5 $\times$ 10^{-2} + (100x) $\times$ 2.5 $\times$ 10^{-2} = 0

x = 0.8 m

17. 0.75

Sol. Minimum speed of sphere w.r.t. block at highest point is v_{min}=5m/s.

Conservation of momentum

$1v_0 = (1+4)v = 5v_1 + 5(v_1-5)$

Conservation of energy

$$\frac{1}{2}\times 5v^2 = 5g(2\times 2.5) + \frac{1}{2}5v_1^2 + \frac{1}{2}5(v_1-5)^2$$

18. 0.75

Sol. Velocity of pendulum before collision

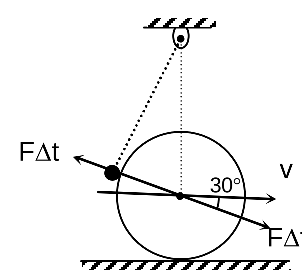
$v_0 = \sqrt{2g\ell\cos 30°} = \sqrt{6}$ m/s

$F\Delta t = mv_0$

$F\Delta t\cos 30° = mv$

$\therefore\ mv_0\frac{\sqrt{3}}{2} = mv \Rightarrow v = \frac{v_0\sqrt{3}}{2}$

$$e = \frac{v\frac{\sqrt{3}}{2}}{v_0} = \frac{3}{4}$$

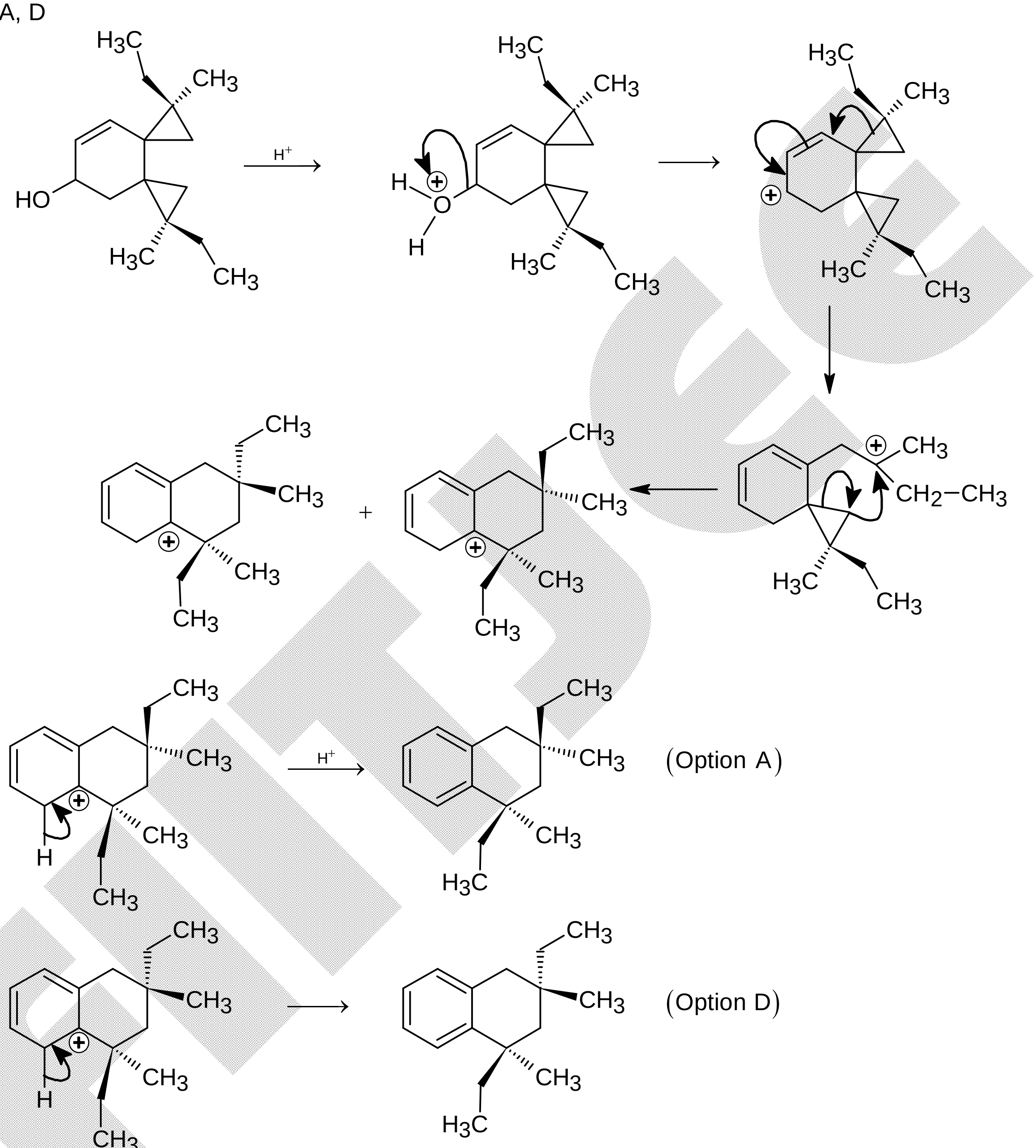


Chemistry PART – II

Section – A

19. A, D

Sol.



20. A, B, C, D

Sol. The driving force behind these reactions (A and B) is the formation of LiCl or LiBr (very large lattice energy and insoluble in organic solvents in which the reaction is performed)

- Benzene is more acidic than C_2H_6, so the reaction (C) can occur.
- Li_3N converts into amides and hydrides by reaction with hydrogen.

21. B, D

Sol. $\underset{(\text{Amphoteric oxide})}{BeO} + \underset{\underset{(\text{basic})}{(\text{Baryta water})}}{Ba(OH)_2} \longrightarrow Ba\left[Be(OH)_4\right]$

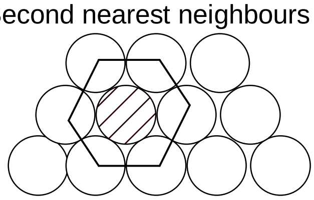
22. A, B, C

Sol. $\beta-$keto acids, gem-dioic acids and $\beta,\gamma-$unsaturated acids decarboxylates on simple heating. (D) is however a $\beta-$keto acid but in transition state, there will be a double bond at bridge head position which is not stable. So, (D) will not decarboxylate on heating.

23. B, D

Sol. (A) Second nearest neighbours of Cs^+ are 6 and not 8 (in CsCl crystal).

(B)



There are 6 triangular voids around a sphere in two dimensional hcp layer.

(C) $\frac{r_+}{r_-} = \frac{0.3}{0.4} = 0.75$ which indicates that cations are present in cubic void of a simple cubic unit cell, so its coordination number is 8 and not 6.

(D) Definition of Frenkel defect.

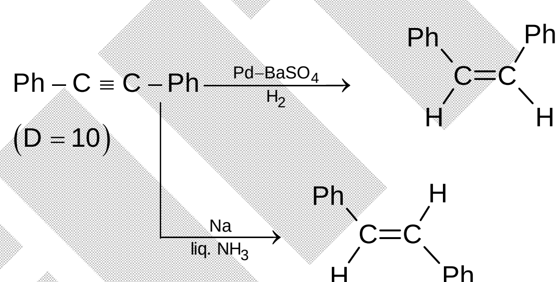
24. B, C

Sol. $-\underset{\underset{O}{||}}{C}-Cl$ has less priority than ester, so, (A) is wrong but (B) is correct.

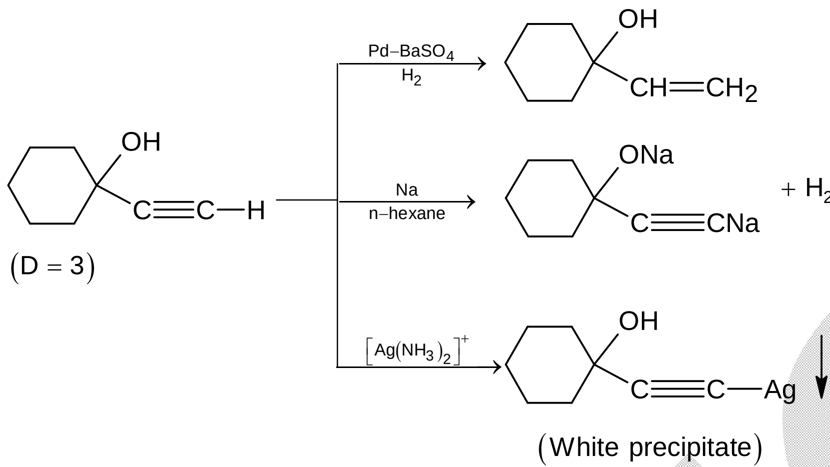
Double bond has more priority than 'Br'.

25. B

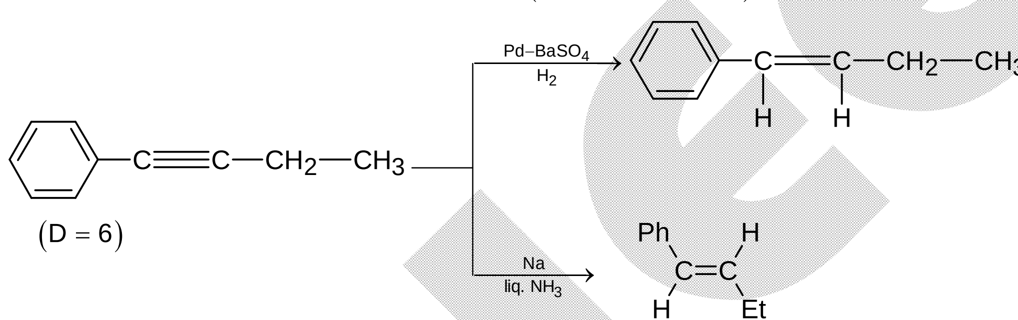
Sol. (I)



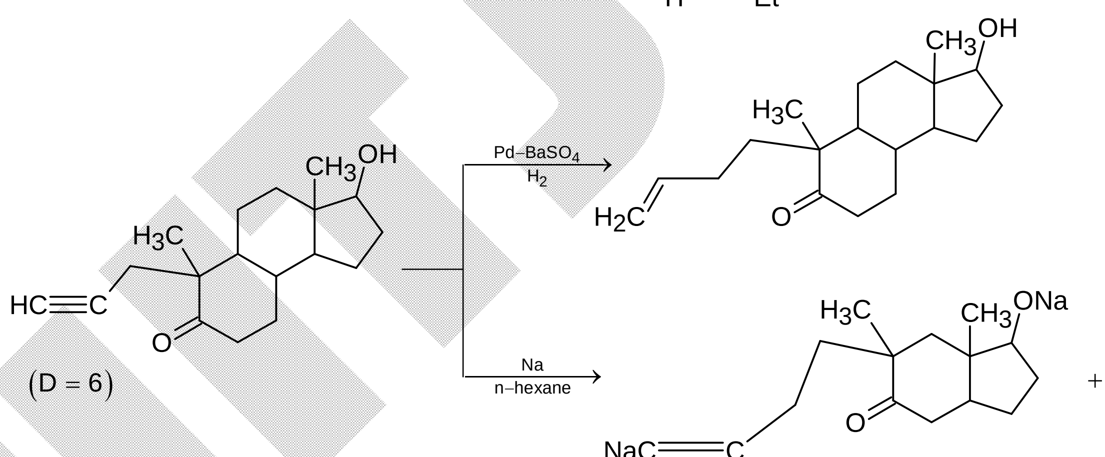
(II)



(III)



(IV)



26. D

Sol. $AlCl_3 + H_2O \longrightarrow [Al(H_2O)_6]^{3+} \longrightarrow [Al(H_2O)_5(OH)]^{2+} + H^+$

$BCl_3 + 3H_2O \longrightarrow H_3BO_3 + 3HCl$

$B_2H_6 + H_2O \longrightarrow \underset{(Acid)}{H_3BO_3} + H_2$

Alums contains Al^{3+} or Cr^{3+} or Fe^{3+} ions whose aqueous solution is strongly acidic.

Also, in B_2H_6, there is 3c-2e bond formation in which vacant 2p-orbital of 'B' is also involved in sp^3-hybridisation.

27. C

Sol. $Pt(s)/\underset{(1\,bar)}{H_2}(g)\,|\left(\underset{(100\ mL,\ 0.2\ M)}{H_3PO_4} + \underset{(100\ mL,\ 0.1\ M)}{Na_3PO_4}\right)\Bigg\|\left(\underset{(100\ mL,\ 0.1\ M)}{CH_3COOH}\ |\ \underset{(1\,bar)}{H_2}(g)/Pt(s)\right)$

From Nernst Equation

$$E_{cell} = -0.06\times\log\frac{[H^+]_a}{[H^+]_c}$$

or $E_{cell} = \left[(pH)_a - (pH)_c\right]\times 0.06$ … (1)

(I)
$$H_3PO_4 + PO_4^{3-} \longrightarrow H_2PO_4^- + HPO_4^{2-}$$

20	10	0	0
10	0	10	10

Again,

$$H_3PO_4 + HPO_4^{2-} \longrightarrow 2H_2PO_4^-$$

10	10	10
0	0	30

$$\therefore (pH)_a = \frac{pK_{a_1}+pK_{a_2}}{2} = \frac{4+8}{2} = 6$$

Also, at cathode

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$$

$$\alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{10^{-5}}{0.1}} = 10^{-2}, \qquad [H^+]_c = 10^{-3}$$

$$\therefore (pH)_c = 3$$

$$E_{cell} = 0.06[6-3] = 0.18\ V$$

(II) If 100 mL, 0.1 M NaOH is added in anode compartments

H_3PO_4,	PO_4^{3-},	NaOH
20 m.mol	10 m.mol	10 m.mol

$$H_3PO_4 + OH^- \longrightarrow H_2PO_4^- + H_2O$$

20	10	0
10	0	10

Also,

$$H_3PO_4 + PO_4^{3-} \longrightarrow H_2PO_4^- + HPO_4^{2-}$$

10	10	10	0
0	0	20	10

So, it is a buffer.

$$(pH)_a = pK_{a_2} + \log\frac{[HPO_4^{2-}]}{[H_2PO_4^{2-}]} = 8 + \log\frac{10}{20}$$

$$\therefore (pH)_a = 7.7$$

$$E_{cell} = 0.06[7.7-3] = 0.282\ V$$

(III) 50 mL, 0.1 M NaOH is added in cathode compartment

$$\begin{array}{llll} CH_3COOH + & OH^- & \longrightarrow & CH_3COO^- + H_2O \\ 10 & 5 & & 0 \\ 5 & 0 & & 5 \end{array}$$

$\therefore$ P it is also a buffer.

$(pH)_c = 5 + \log\frac{5}{5} = 5$

$\therefore E_{cell} = 0.06[6-5] = 0.06\ V$

(IV) 100 mL, 0.1 M HCl is added in anode compartment

$$\begin{array}{llll} PO_4^{3-} + & H^+ & \longrightarrow & HPO_4^{2-} \\ 10 & 10 & & 0 \\ 0 & 0 & & 10 \end{array}$$

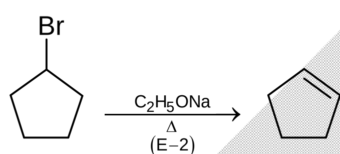
$$\begin{array}{llll} H_3PO_4 + & HPO_4^{2-} & \longrightarrow & 2H_2PO_4^- \\ 20 & 10 & & 0 \\ 10 & 0 & & 20 \end{array}$$

$\therefore (pH)_a = 4 + \log 2 = 4.3$

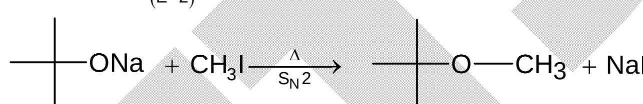
$E_{cell} = 0.06[4.3-3] = 0.06 \times 1.3 = 0.078\ V$

28. D

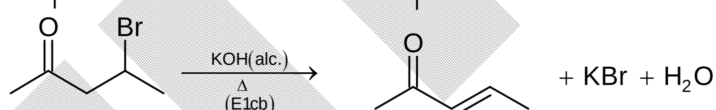
Sol. (I)



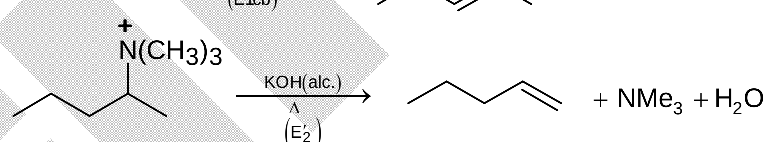
(II)



(III)



(IV)



Section – B

29. 3.50

Sol. Except statements (i) and (iv), all other statements are correct.

(i) SF_6 molecule has a maximum of 9 planes of symmetry (and not 5).

(iv) About **75%** (and not 60%) of the solar energy reaching the earth is absorbed by earth surface which increases its temperature.

30. 8.97

[Range :8.96 – 8.98]

Sol. PV = nRT

$$PV = \left(\frac{W_{He}}{4}\right) \times R \times T$$

$$\frac{20.14}{760} \times \frac{(110 + 100.5)}{1000} = \frac{W_{He}}{4} \times 0.082 \times (273 + 30.2)$$

$W_{He} = 8.97 \times 10^{-4}\ g = x \times 10^{-4}\ g$

$\therefore x = 8.97$

31. 19.82
[Range : 19.81 – 19.83]

Sol. $W = -P_2(V_2 - V_1)$

$$= -P_2\left(\frac{nRT}{P_2} - \frac{nRT}{P_1}\right)$$

$$= -nRT\left(1 - \frac{P_2}{P_1}\right)$$

$$= -2 \times 8.314 \times 298\left(1 - \frac{5}{1}\right)$$

$W = 19820.576\ J$

Now, $|W| = mgh$

$$h = \frac{W}{mg}$$

$$h = \frac{19820.576}{100 \times 10} = 19.82\ 'm'$$

32. 0.24
[Range : 0.23 – 0.25]

Sol. meq. of iodine in 200 mL solution = meq. of Ce^{4+} $= 15 \times 0.05$
= 0.75

$$\therefore \text{Normality of iodine} = \frac{0.75}{200}$$

$$\text{Eq. weight of } I^{-} = \frac{127}{2}$$

$$\text{Iodide ion concentration} = \frac{0.75}{200} \times \frac{127}{2} = 0.238 \text{ g/L}$$

33. 1.50

Sol. Total number of isomers of B.H.C. = 9

Total number of isomers of $K\left[Co(NH_3)_2(F)_2(Cl)_2\right]$ = 6

34. 2.20

Sol. $X = H_3PO_4$, $Y = H_2S$, $Z = PSCl_3$

$x = 8 + 3 = 11$

$y = 5$

$$\frac{x}{y} = \frac{11}{5} = 2.20$$

$$P_4S_{10} + 16H_2O \longrightarrow \underset{(X)}{4H_3PO_4} + \underset{(Y)}{10H_2S}$$

$$P_4S_{10} + 6PCl_5 \longrightarrow \underset{(Z)}{10PSCl_3}$$

35. 9.33
[Range : 9.33 – 9.34]

Sol.

$$\begin{array}{lcccccccccc} Pd(46): & 1s^2 & 2s^2 & 2p^6 & 3s^2 & 3p^6 & 3d^{10} & 4s^2 & 4p^6 & 4d^{10} & 5s^0 \\ & & & \downarrow & & \downarrow & \downarrow & & \downarrow & \downarrow & \\ & & & 4 & & 4 & 8 & & 4 & 8 & \end{array}$$

So, x = 28
y = 3

36. 1.33
[1.33 – 1.34]

Sol. Number of triangular faces in truncated cube = 8
Number of octagonal faces in truncated cube = 6
Each corner of the cube will become a triangular face and each square face will become an octahedral face in a truncated solid cube.

Mathematics PART – III

Section – A

37. A, B, D

Sol. Apply AM $\geq$ GM
d – ax – by – cz > 0
ax, by, cz, d – ax – by – cz
Apply AM $\geq$ GM

38. A, B, C

Sol. $S_n^2 = S_{n-1}^2 + 1 \Rightarrow S_n = \sqrt{n}$

39. B, C

Sol. $\sum_{r=0}^{10} \frac{{}^{10}C_r}{{}^{30}C_{10+r}} = \frac{1}{{}^{30}C_{20} \cdot {}^{20}C_{10}} \sum_{r=0}^{10} {}^{10+r}C_r \cdot {}^{20-r}C_{10}$ = coefficient of x^{10} is $(1-x)^{-22}$

40. A, B, C

Sol. $$f(x) = \begin{cases} -\sin x^2 & ; \quad x < -1 \\ \frac{\ln 4 - \sin 1}{2} & ; \quad x = -1 \\ \ln(3 + x^2) & ; \quad -1 < x < 1 \\ \frac{\ln 4 - \sin 1}{2} & ; \quad x = 1 \\ -\sin(x^2) & ; \quad x > 1 \end{cases}$$

41. A, B, D

Sol. $F(x) - f(x) = k(x-1)^2(x-2)^2(x-3)^2$

42. A, C, D

Sol. The plane $(\vec{r} \cdot \vec{n}_1 - a) + \lambda(\vec{r} \cdot \vec{n}_2 - b) = 0$ is identical with $\vec{r} \cdot \vec{n}_3 = c$

43. A

Sol. Domain of g(x) is $[0, \infty)$ and range of g(x) is $[-1, \infty)$

44. D

Sol. (I) The point of intersection is (2, –1, 2)

(II) Line drawn from P intersects the line $\frac{x+2}{3} = \frac{2y+3}{4} = \frac{3z+4}{5}$ measured parallel to the plane $4x + 12y - 3z + 1 = 0$ at $\left(4, \frac{5}{2}, 2\right)$

(III) $\frac{AR}{RQ} = \frac{4}{9}$

(IV) $f'(x) = \left|\sin\left(x + \frac{\pi}{3}\right)\right| - |\sin x| = 0 \Rightarrow x = \frac{\pi}{3}$ or $\frac{5\pi}{6}$ at $x = \frac{\pi}{3}$ local maxima exists

45. B

Sol. $\frac{d}{dx}\left(\frac{g(x)}{g'(x)}\right) = \frac{-g(x)}{g'(x)} \Rightarrow g(x) = \frac{1}{e}\cdot e^{e^x}$

46. C

Sol. (I) Expand the square

(II) $\int_0^1 g(x)dx + \int_{g(0)}^{g(1)} g^{-1}(x)dx = 1\cdot g(1) - 0\cdot g(0)$

$\int_0^1 (e^x + x + 1)dx + \int_2^{e+2} g^{-1}(x)dx = (e+2)\times 1 - 0\times 2$

$\int_2^{e+2} g^{-1}(x)dx = (e+2) - \left|e^x + \frac{x^2}{2} + x\right|_0^1 = (e+2) - \left\{\left(e + \frac{1}{2} + 1\right) - e^0\right\} = e + 2 - e - \frac{1}{2} = \frac{3}{2}$

(III) g(x) = ax + b

(IV) Area bounded = $\frac{1}{2}\times 4\times 4 \quad -\int_{\frac{2}{3}}^{2}\left(2 - \frac{x}{2x-1}\right)dx - \pi\left(\frac{1}{2}\right)^2$

Section – B

47. 0.00

Sol. P(a) = b, P(b) = c and P(c) = a

$\Rightarrow \frac{b-c}{a-b} = l_1,\ \frac{c-a}{b-c} = l_2$ and $\frac{a-b}{c-a} = l_3$

48. 2.00

Sol. $AC\cdot BC = CS^2$

49. 2.00

Sol. Circle touches each other externally

50. 33.00

Sol. $P\left(\frac{3\sqrt{2}}{5}, \frac{-3}{5\sqrt{2}}\right) \Rightarrow \ell = \sqrt{\frac{36}{50} + \frac{9}{50} - \frac{1}{4}} = \sqrt{\frac{9}{10} - \frac{1}{4}} = \sqrt{\frac{36-10}{40}} = \sqrt{\frac{13}{20}}$

51. 1.00

Sol. Let $z = \frac{\cos\theta + i\sin\theta}{\cos\theta}$; $z^k = \frac{\cos k\theta + i\sin k\theta}{\cos^k\theta}$

$$\sum_{k=0}^{n-1} z^k = \frac{1-z^n}{1-z} = \frac{1 - \frac{\cos n\theta + i\sin n\theta}{\cos^n\theta}}{1 - \frac{\cos\theta + i\sin\theta}{\cos\theta}} = \frac{\sin n\theta}{\sin\theta\cos^{n-1}\theta} + i\frac{\cos^n\theta - \cos n\theta}{\sin\theta\cos^{n-1}\theta}$$

So, $\text{Re}\left(\sum_{k=0}^{n-1} z^k\right) = \frac{\sin n\theta}{\sin\theta\cos^{n-1}\theta} = \frac{\sin n\frac{\pi}{6}}{\sin\frac{\pi}{6}\left(\cos\frac{\pi}{6}\right)^{n-1}}$

52. 5.00

Sol. $P^{-1}+Q^{-1}=(P+Q)^{-1} \Rightarrow (P^{-1}+Q^{-1})(P+Q)=I \Rightarrow I+P^{-1}Q+Q^{-1}P+I=I$

Let $P^{-1}Q=A$, then $A+A^{-1}+I=0 \Rightarrow A^2+A+I=0$

$A^3 = I \Rightarrow |A| = 1$

$|P^{-1}Q|=1 \Rightarrow |P^{-1}||Q|=1 \Rightarrow \frac{1}{|P|}\times|Q|=1 \therefore |Q| = 5$

53. 0.50

Sol. The person B will score more if

Case-I: In first 9 chances A and B have same score and B is successful in 10th chance

Case-IIL In first 9 chances B has more score.

54. 2.00

Sol. Multiply and divide by sin 2° sin 4° sin 6° ..... sin 88°