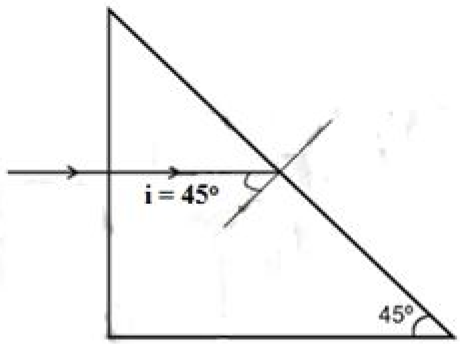
MHTS - 12 - Physics (2017 Aspirants) - Solution

1. (b)
Sol.

$x = 45$ m $2\pi t$, $y = 4\cos(2\pi t)$
Squiring and adding $x^2 + y^2 = 4^2$ $\Rightarrow$ $R = 4$
$\Rightarrow$ Circular motion
$V = \omega R = (2\pi)(4) = 8\pi$

2. (d)
Sol.
E of x-ray E (100 ev to 100 kev)

3. (c)
Sol.

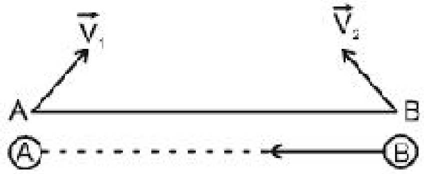


For TIR $i > i_c$ so $\sin i > \sin i_c$

$\sin 45° > \frac{1}{\mu}$ $\Rightarrow$ $\mu > \sqrt{2}$ $\Rightarrow$ $\mu > 1.414$

Since μ of green and voilet are greater than 1.414 so they will total internal refrected. But red colour will be vetracted
So Ans. is (3)

4. (d)
Sol.

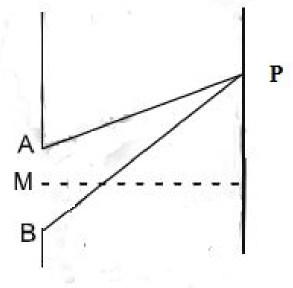


For collision $\vec{V}_{B/A}$ should be along $\overrightarrow{B \to A}$ $(\vec{r}_{A/B})$

So, $\frac{\bar{V}_2 - \bar{V}_1}{|V_2 - V_1|} = \frac{\bar{r}_1 - \bar{r}_2}{|r_1 - r_2|}$

5. (b)
Sol.

For first minima
AP - BP = λ



AP - MP = $\frac{\lambda}{2}$

So phase difference = $\frac{2\pi}{\lambda} \times \frac{\lambda}{2} = \pi$

6. (c)
Sol.

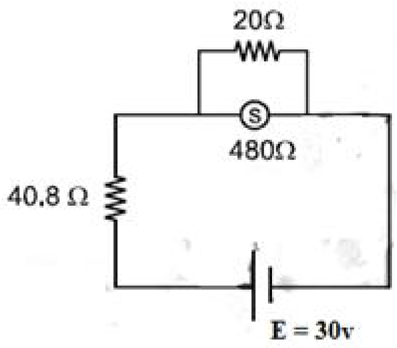
$R = \frac{mV}{qB} - \frac{\sqrt{2m(kE)}}{qB}$

Since R is same so KE $\propto \frac{q^2}{m}$

So KE of α particle will be $\frac{(2)^2}{4}$ = same = 1 MeV

Ans. is (3)

7. (d)
Sol.



Resitance of ammeter = $\frac{480 \times 20}{480 + 20} = 19.2\ \Omega$.

$i = \frac{30}{40.8 + 19.2} = 0.5$ **A**

8. (a)

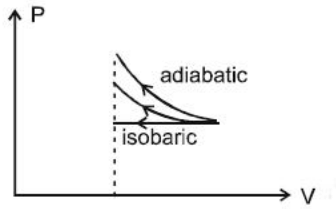
Sol.

$\rho = \rho_0(1 - \gamma\Delta t)$

$\frac{\Delta\rho}{\rho_0} = \gamma\Delta T = (5 \times 10^{-4})\,(40) = 0.02$

9. (d)

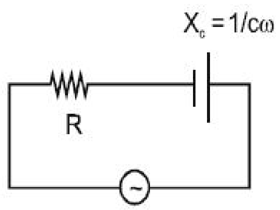
Sol.



Since area under the curve is max for adiabatic process so work done on the gas will be max for adiabatic process.

10. (a)

Sol.



$$i = \frac{v}{\sqrt{R^2 + \left(\frac{1}{c\omega}\right)^2}}$$

$$V_c = \frac{v}{\sqrt{R^2 + \left(\frac{1}{c\omega}\right)^2}} \times \left(\frac{1}{c\omega}\right)$$

$$V_c = \frac{V}{\sqrt{(Rc\omega)^2 + 1}}$$

If we fill a di-electric material

$C\uparrow \Rightarrow V_c \downarrow$

11. (b)

Sol.

$$KE_{max} = \frac{hc}{\lambda} - \psi$$

$$KE_{max} = \frac{1240}{500} - 2.82$$

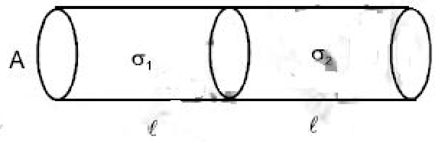
$$KE_{max} = 2.48 - 2.28 = 0.2 \text{ ev}$$

$$\lambda_{min} = \frac{h}{\sqrt{2m(KE)_{max}}} = \frac{\frac{20}{3} \times 10^{-34}}{\sqrt{2 \times 9 \times 10^{-31} \times 0.2 \times 1.6 \times 10^{-19}}}$$

$$\lambda_{min} = \frac{25}{9} \times 10^{-9} = 2.80 \times 10^{-9} \text{ nm} \qquad \text{so } \lambda \geq 2.8 \times 10^{-9} \text{ m}$$

12. (d)

Sol.



$$R_{eq} = \frac{\ell}{\sigma_1 A} + \frac{\ell}{\sigma_2 A} = \frac{\ell_{eq}}{\sigma_{eq} A_{eq}}$$

$$\frac{2\ell}{\sigma_{eq} A} = \frac{\ell}{A}\left(\frac{\sigma_1 + \sigma_2}{\sigma_1 \sigma_2}\right)$$

$$\sigma_{eq} = \frac{2\sigma_1\sigma_2}{\sigma_1 + \sigma_2}$$

13. (d)

Sol.

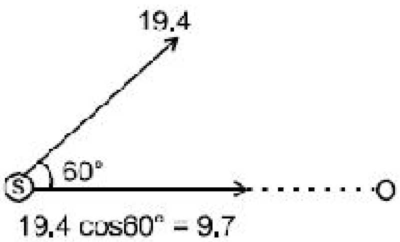
$$\omega_i = \frac{15}{0.45} = \frac{100}{3} \qquad \omega_f = 0$$

$$\omega_f = \omega_i + \alpha t$$

$$0 = \frac{100}{3} + (-\alpha)(15) \qquad \alpha = \frac{100}{45}$$

$$\tau = (I)(\alpha) = 3 \times \frac{100}{45} = 6.66 \text{ N.m.}$$

14. (a)



Sol.

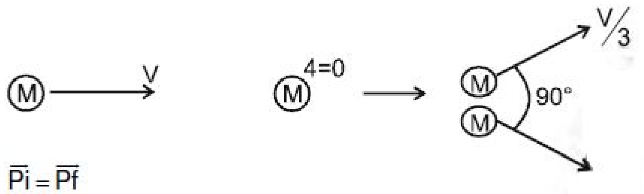
$$f^1 = f_0\left(\frac{v - v}{v - v_s}\right)$$

$$f^1 = 100\left(\frac{v - 0}{v - (+9.7)}\right)$$

$$f^1 = 100 \frac{v}{v\left(1 - \frac{9.7}{v}\right)}$$

$$f^1 = 100\left(1 + \frac{9.7}{330}\right) = 103 \text{ Hz}$$

15. (d)
Sol.



$\overline{Pi} = \overline{Pf}$

$\Rightarrow |Pi| = |P_f| \Rightarrow\ = mV = \sqrt{\left(m\frac{V}{3}\right)^2 + (mV_2)^2}$ $\qquad V_2 = \frac{2\sqrt{2}}{3}V$

16. (c)
Sol.

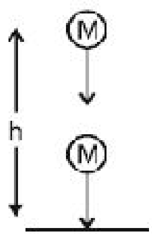
K.E. $= \frac{1}{2} I \omega^2$

I is min. about the centre of mass

So. $(m_1)(x) = (m_2)(L-x)$

$x = \frac{m_2 L}{m_1 + m_2}$

17. (a)
Sol.



$\frac{KE_f}{KE_i} - \frac{1}{2}$

$\frac{V_f}{V_i} = \frac{1}{\sqrt{2}}$

$\frac{\sqrt{2gh}}{\sqrt{V_0^2 + 2gh}} = \frac{1}{\sqrt{2}}$

$V_0 = 20\ m/sec$

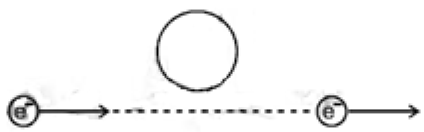
18. (d)
Sol.

$U \longrightarrow Th + \alpha$

$KE_{Th} = \frac{P^2}{2m_{Th}}$, $KE_\alpha = \frac{P^2}{2m_\alpha}$

sinc m_α is less so KE_α will be mone

19. (b)
Sol.



When e- comes closer the induced current will be anticlockwise when e-comes farther induced current will b

20. (c)

Sol.

$$\omega^2 A = \alpha$$
$$\omega A = \beta$$
$$\Rightarrow \quad \omega = \frac{\alpha}{\beta}$$
$$\Rightarrow T = \frac{2\pi}{\omega} = \frac{2\pi\beta}{\alpha}$$

21. (d)

Sol.

$$\frac{I_1}{I_2} = \frac{25}{1} \Rightarrow \frac{A_1}{A_2} = \frac{5}{1}$$
$$\frac{A_{max}}{A_{min}} = \frac{5+1}{5-1} = \frac{6}{4} = \frac{3}{2}$$
$$\frac{I_{max}}{I_{min}} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

22. (a)

Sol.

$$V = 6xy - y + 24z$$
$$\vec{E} - \left(\frac{\partial V}{\partial x}\hat{i} + \frac{\partial V}{\partial y}\hat{j} + \frac{\partial V}{\partial z}\hat{k}\right)$$
$$\vec{E} = \left[(6y)\hat{i} + (6x - 1 + 2z)\hat{j} + (2y)\hat{k}\right]$$
$$\vec{E}\Big| \quad = -(6\hat{i} + 5\hat{j} + 2\hat{k})$$

23. (a)

Sol.

Attraction between the plates

$$F = \frac{q^2}{2A\varepsilon_0} \text{ where } q = CV \text{ and } C = \frac{\varepsilon_0 A}{d}$$
$$F = \frac{C^2V^2}{2Cd} = \frac{CV^2}{2d}$$

24. (a)
Sol.

$$\mu_s = \tan 30^o = \frac{1}{\sqrt{3}} = 0.5$$

$$\mu_s = 0.57 = 0.6$$

$$S = ut + \frac{1}{2} a t^2$$

$$4 = \frac{1}{2} a(4)^2 \Rightarrow a = \frac{1}{2} = 0.5$$

$$a = g\sin\theta - \mu_k (g) \cos\theta$$

$$\Rightarrow \mu_K = \frac{0.9}{\sqrt{3}} = 0.5$$

25. (c)
Sol.

$$\frac{1}{\lambda_1} = R_e\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$$

$$\frac{1}{\lambda_2} = R_e\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$\frac{\lambda_1}{\lambda_2} = \frac{5}{27}$$

26. (d)
Sol.

$$\text{Current} = \frac{(3.5 - 0.5)}{100} A$$

$$= \frac{3}{100} A = 30mA$$

27. (c)
Sol.
The gravitation force on the satellite will be aiming toward the centre of earth so acceleration of the satellite will also be aiming toward the centre of earth

28. (d)
Sol.
If If $\bar{L}$ = constant then $\bar{\tau} = 0$

so $\bar{r} \times \bar{F} = 0 \Rightarrow \bar{F}$ should be parallel to $\bar{r}$ so coefficient should be in same ratio.So $\frac{\alpha}{2} = \frac{3}{-6} = \frac{6}{-12}$

So $\alpha = -1$

29. (a)

Sol.

$$K = \text{potential gradient} = \left(\frac{E_0 r}{r+r_1}\right)\frac{1}{L}$$

$$\text{so } E = K\,\ell = \frac{E_0 r\ell}{(r+r_1)L}$$

30. (d)

Sol.

No. of mole of gas = 1 so molar mass = 4g/mole

$$V = \sqrt{\frac{\gamma RT}{m}} \quad \Rightarrow 952\times952 = \frac{\gamma\times3.3\times273}{4\times10^{-3}} \quad \Rightarrow \gamma = 1.6 = \frac{16}{10} = \frac{8}{5}$$

$$\gamma = \frac{C_P}{C_V} = \frac{8}{5} \quad \text{os } C_P = \frac{8\times5}{5} = 8\text{jk}^{-1}\text{mole}^{-1}$$

31. (d)

Sol.

$$F_c = \frac{mv_1^2}{r} - \frac{2mv_2^2}{(r/2)} - \frac{4mv_2^2}{r}$$

$$\text{so } v_1 = 2v_2$$

32. (d)

Sol.

$$V_0 = \sqrt{\frac{GM}{r}} = \sqrt{\frac{GM}{R^2}.\frac{R^2}{r}}$$

$$= \sqrt{\frac{9.8\times6.38\times6.38}{6.63\times10^6}} = \sqrt{60\times10^6}\,\text{m/sec}$$

$$= 7.76 \text{ km/sec}$$

33. (c)

Sol.

Fundametal frequency = highest commo factor = 105Hz

34. (d)

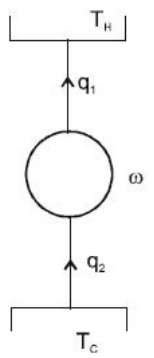
Sol.

$$\text{cop} = \frac{q_1}{w} = \frac{q_2}{q_1-q_2} = \frac{T_C}{T_H - T_C} = 5$$

$$T_C = 5T_H - 5T_C$$

$$6T_C = 5T_H$$

$$T_H = \frac{6}{5}\times253\text{k} = 303.6\text{ k} = 30.6°\text{C} = 31°\text{C}$$



35. (a)

Sol.

Water will not overflow but will change its radius of curvature.

36. (a)

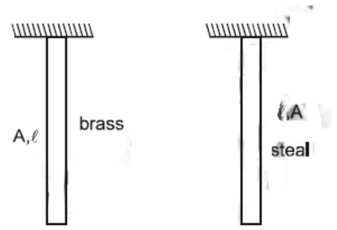
Sol.

$$P_A = \frac{\rho_A M_A}{RT}, \quad P_B = \frac{\rho_B M_B}{RT} = \frac{3}{2} \Rightarrow \frac{P_A}{P_B} = \frac{\rho_A}{\rho_B}\frac{M_A}{M_B} = 2\frac{M_A}{M_B} = \frac{3}{2}$$

so, $\frac{M_A}{M_B} = \frac{3}{4}$

37. (a)

Sol.



$$Y = \frac{W}{A}.\frac{\ell}{\Delta\ell}$$

$$SO\,\Delta\ell = \frac{W\ell}{AY}$$

$\Delta e_1 = \Delta e_2$ $\qquad \frac{W_1\ell}{AY_1} = \frac{W_2\ell}{AY_2}$

$$\frac{W_1}{W_2} = \frac{Y_1}{Y_2} = 2$$

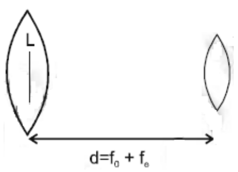
38. (c)

Sol.

CE amplifier causes phase difference of $\pi(=180^0)$ so $v_{out} = 300\,COS\left(15t + \frac{\pi}{3}\pi\right)$

39. (c)

Sol.



Magnification by yepiece

$$m = \frac{f}{f+u}$$

$$-\frac{I}{L} = \frac{f_e}{f_e + \left(-(f_0 + f_e\right)} \Rightarrow \frac{I}{L} = \frac{f_e}{f_0}$$

$$m.p. = \frac{f_0}{f_e} = \frac{L}{I}$$

40. (d)

Sol.

$\text{power} = \bar{F}.\bar{V} = PA\bar{V} = \rho ghAV$

$= 13.6 \times 10^3 \times 10 \times 150 \times 10^{-3} \times 0.5 \times 10^{-3} / 60 \text{ watt} \qquad = \frac{102}{60} \text{watt} = 1.70 \text{watt}$

41. (d)

Sol.

$V_c = \eta^x \rho^y r^z$

critical velocity is given by $V_C = \frac{R\eta}{2\rho r}$

so, $x = 1$

$y = -1 \qquad z = -1$

42. (d)

Sol.

$k_1 = \frac{hc}{\lambda} - \psi \qquad k_2 = 3k_1 = \frac{2hc}{\lambda} - \psi = \frac{3hc}{\lambda} - 3\psi$

so $2\psi = \frac{hc}{\lambda} \qquad$ so $\psi = \frac{hc}{2\lambda}$

43. (a)

Sol.

Volume inflow rate = volume anflow rate

$\pi R^2 V = n\pi r^2 (v) \quad \Rightarrow v = \frac{\pi R^2 V}{n\pi r^2} = \frac{VR^2}{nr^2}$

44. (b)

Sol. $\bar{A} = \cos wt\,\hat{i} + \sin wt\,\hat{j}$

$\bar{B} = \cos\frac{wt}{2}\hat{i} + \sin\frac{wt}{2}\hat{j}$

for $\bar{A}.\bar{B} = 0$

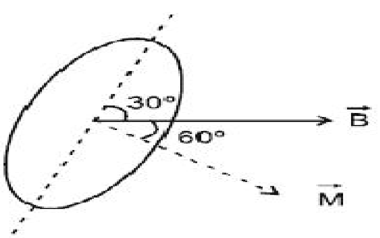
$\bar{A}.\bar{B} = 0 = \cos wt.\cos\frac{wt}{2} + \sin wt.\sin\frac{wt}{2}$

$= \cos\left(wt - \frac{wt}{2}\right) = \cos\left(\frac{wt}{2}\right)$

so $\frac{wt}{2} = \frac{\pi}{2} \Rightarrow t = \frac{\pi}{w}$

45. (a)

Sol.



$\tau = M \times B = MB\sin 60°$

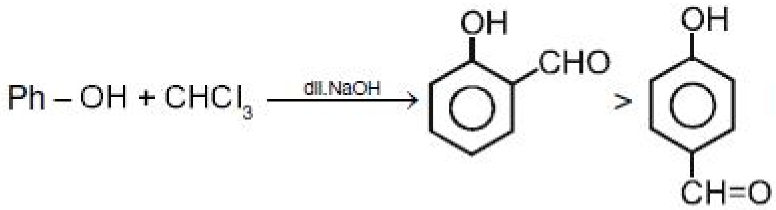
$= Ni\,AB\sin 60°$

$= 50 \times 2 \times 0.12 \times 0.1 \times 0.2 \times \frac{\sqrt{3}}{2}$

$= 12\sqrt{3} \times 10^{-2}\,\text{Nm} = 0.20784\,\text{Nm}$

MHTS - 12 - Chemistry (2017 Aspirants) - Solution

46. (d)
Sol.



It is Reimer - Tiemann reaction

47. (a)
Sol.

$$K = \frac{[NO]^2}{[N_2][O_2]}$$

$$K' = \frac{NO}{[N_2]^{1/2}[O_2]^{1/2}}$$

$$\therefore K' = \sqrt{K}$$

48. (d)
Sol.

$$MgCO_3 \longrightarrow MgO + CO_2$$

84 g 40g

$\therefore$ 8g MgO will be from $\frac{84}{5}$g

$\therefore$ % Purity = $\frac{84}{5} \times \frac{100}{20} = 84\%$

49. (d)
Sol.

1 mole contains 6.02×10^{23} molecule

$\therefore$ 18 mole will contain $18 \times 6.02 \times 10^{23}$

50. (a)

51. (d)
Sol.

$$\text{Molality } = \frac{1000 \times n}{N \times M} \therefore 1 = \frac{1000 \times n}{N \times 18} = \frac{n}{N} = \frac{18}{1000}$$

$$\therefore \frac{n}{n+N} = \frac{18}{1018} = 0.0177$$

52. (d)
Sol.

It is zero order reaction $\therefore\ 6\times10^{-4} = \dfrac{\text{con.}}{20\times60}$

$\therefore$ conc. of $B = 0.72M$

53. (a)
Sol.

B.O.	O_2^+	> O_2	> O_2^-	> O_2^{2-}
	2.5	2	1.5	1.0

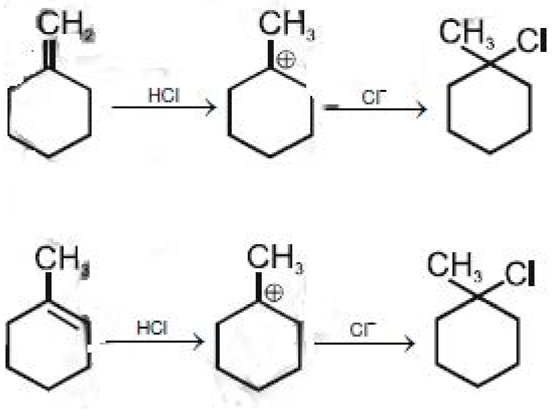
54. (a)
Sol.
In basic medium rate of hydrolysis increases with electron with drawing group (-M effect predominates)

55. (c)
Sol.
$BeCO_3$ to $BaCO_3$ stability increases

56. (a)
Sol.
Stong acid with its salt can not form duffer solution.

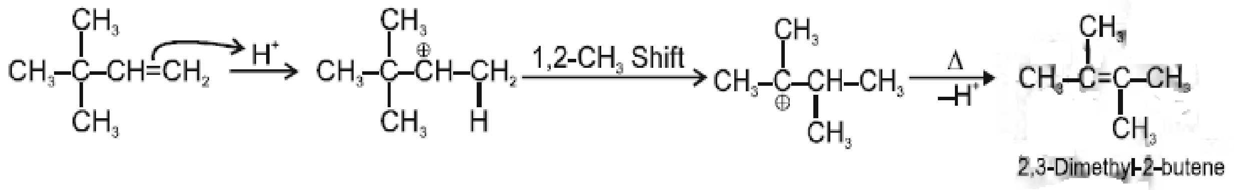
57. (a)
Sol.
C.No. = 6
O.No. = +3

58. (d)
Sol.
OF_2 is oxygen difluoride.

59. (c)
Sol.


60. (b)

Sol.



61. (d)
62. (c)
63. (b)
64. (b)
65. (a)

Sol.

Lucas reagent in I & IV while S_N1 in III

66. (d)
67. (a)
68. (d)

69. (a)

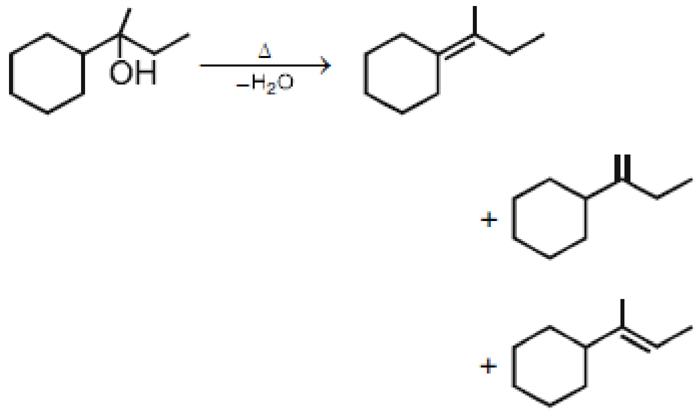
Sol.

Caprolactum is used for the manufacturing on Nylon-6

70. (a)
71. (c)
72. (c)

73. (b)

Sol.



74. (a)
75. (b)
76. (a)
77. (a)

78. (a)

Sol.

Structure isomers of C_3H_9 are

$CH_3-CH_2-CH_2-NH_2, CH_3-\underset{\large NH_2}{\underset{|}{CH}}-CH_3, CH_3-NH-CH_{2-}CH_3, CH_3-\underset{CH_3}{\underset{|}{N}}-CH_3$ TOtal $=4$

79. (a)
80. (c)
81. (d)

82. (b)

Sol. Inversion product will be more than retention product due to close ion pair formation.

83. (d)
84. (a)
85. (b)
86. (b)

87. (b)

Sol.

With Ammonia derivation carbonyl compounds give addition followed by elimination reaction. Sligtly acidic medium will generate a nucleophilic centre for weak base like ammonia derivatives.

88. (d)

Sol.

Chlorine of chlorobenzene is inert towards nucleophile, which is phthalimide ion.

89. (c)
90. (c)