ANSWER KEY (AIPMT-2009)

Ques.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans	2	4	2	3	2	3	3	2	3	1	4	4	2	2	1	3	4	1	4	1
Ques.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans	3	4	1	3	4	2	4	2	2	2	2	1	4	2	2	3	3	2	4	3
Ques.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans	3	1	1	3	2	1	3	1	4	1	4	2	2	4	4	2	2	2	2	2
Ques.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
Ans	3	2	2	2	3	1	4	4	1	2	3	1	3	3	2	2	2	4	4	3
Ques.	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
Ans	4	2	2	1	1	2	1	1	2	4	2	2	3	2	1	1	4	2	4	1
Ques.	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
Ans	4	3	4	2	2	3	4	4	3	1	2	1	4	1	4	1	4	4	2	2
Ques.	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**	**136**	**137**	**138**	**139**	**140**
Ans	3	2	3	2	4	3	1	1	2	1	3	4	3	4	1	1	4	3	4	2
Ques.	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**	**151**	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**
Ans	1	1	1	1	4	4	1	4	1	1	3	2	3	3	3	3	2	3	3	2
Ques.	**161**	**162**	**163**	**164**	**165**	**166**	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**	**176**	**177**	**178**	**179**	**180**
Ans	1	1	3	4	4	2	3	3	2	3	4	2	3	3	2	3	1	2	3	2
Ques.	**181**	**182**	**183**	**184**	**185**	**186**	**187**	**188**	**189**	**190**	**191**	**192**	**193**	**194**	**195**	**196**	**197**	**198**	**199**	**200**
Ans	2	1	3	4	4	1	3	3	2	4	4	3	3	2	3	2	4	3	1	4

HINTS & SOLUTIONS

1. $[P] = \frac{F}{A} = \left[\frac{MLT^{-2}}{L^2}\right] = [ML^{-1}T^{-2}]$

2. $s = \frac{1}{2}at^2$

$$\frac{s_2}{s_1} = \left(\frac{20}{10}\right)^2 = 4$$

$s_2 = 4s_1$

3.

$$S_r = v_r t$$

$$1000 = (v - 10) \times 100$$

$$v = 20 \text{ m/s}$$

4. $\Sigma F = ma$

$\Rightarrow \quad T - mg = ma$

$$a = \frac{T - mg}{m} = 4 \text{ m/s}^2$$

5. $\vec{P}_1 + \vec{P}_2 + \vec{P}_3 = 0$

$$|\vec{P}_3| = |\vec{P}_1 + \vec{P}_2|$$

$$m \times 4 = \sqrt{P_1^2 + P_2^2}$$

$$= \sqrt{12^2 + 16^2}$$

$$m = 5 \text{ kg}$$

6. Loss in grav. PE = gain in spring PE

At maximum elongation

$$Mgx = \frac{1}{2}kx^2$$

$$x = \frac{2Mg}{k}$$

7. $\vec{R}_{cm} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2}{m_1 + m_2} = -2\hat{i} - \hat{j} + \hat{k}$

8. $I = 4 \times \left[\frac{M\ell^2}{12} + M\left(\frac{\ell}{2}\right)^2\right]$ the parallel axis theorem $= \frac{4}{3}M\ell^2$

9. Apply conservation of angular momentum.

$$L_i = L_f$$

$$MR^2\omega = (M + 2m)R^2\omega'$$

$$\omega' = \frac{M\omega}{M+2m}$$

10. $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$

$$|\vec{F}| = \sqrt{6^2 + 8^2 + 10^2} = 10\sqrt{2}$$

$$m = \frac{|\vec{F}|}{a} = \frac{10\sqrt{2}}{1} = 10\sqrt{2}\ \text{kg}$$

11. $\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{\tau}$ is perpendicular to $\vec{r}$ and $\vec{F}$.

12. Kepler's 2nd law

$$\Rightarrow \left(\frac{\Delta A}{\Delta t}\right)_{\text{planet}} = \text{constant}$$

$$\frac{A_1}{t_1} = \frac{A_2}{t_2}$$

$$\Rightarrow \frac{2A}{t_1} = \frac{A}{t_2}$$

$$\Rightarrow t_1 = 2t_2$$

13. $mv = \frac{dm}{du} \times \frac{du}{dt} = \frac{dm}{dt} = \text{Rate of flowing mass}$

$$F_{av} = \frac{dm}{dt} \times \frac{v}{2} = \frac{(mv)v}{2} = \frac{mv^2}{2}$$

$$p = \frac{dK}{dt} = \frac{mv^2}{2} \times v = \frac{mv^3}{3}$$

14. Loss of energy $= \frac{1}{2}mv^2 - mgh = 20$ J

15. For steady state $\frac{dQ}{dt} = \frac{kA(T_1 - T_2)}{L}$

16. Isochoric $\rightarrow$ Volume constant

17. $P \propto T^4$

$$\frac{P_2}{P_1} = \left(\frac{1000}{500}\right)^4$$

$$P_2 = 16P_1 = 112$$

18. $dU = Q - W = 8400 - 500 = 7900$ J

19. $n' = \nu\left(\frac{c+u}{c-u}\right)$

$$= 600\left(\frac{330+30}{330-30}\right) = 720\ \text{Hz}$$

20. $v = \omega\sqrt{A^2 - x^2}$

$$= \frac{2\pi}{T}\sqrt{a^2 - \frac{a^2}{4}} = \frac{\pi a\sqrt{3}}{T}$$

21. In SHM, $F_{restoring} \propto -x$

22. As the coefficient of x is negative, it is moving along +ve x-axis and equating the equation

$$E_y = 2.5\cos[(2\pi \times 10^6)t - (\pi \times 10^{-2})x]$$

with $y = A\cos(\omega t - kx)$

$$\omega = 2\pi \times 106$$

$$\Rightarrow f = \frac{\omega}{2\pi} = 10^6\ \text{Hz}$$

$$k = \pi \times 10^{-2}$$

$$\Rightarrow \lambda = \frac{2\pi}{k}$$

$$= \frac{2\pi}{\pi \times 10^{-2}} = 200\text{m}$$

23. $5\lambda = 4$

$$\lambda = \frac{4}{5}$$

$$k = \frac{2\pi}{\lambda} = \frac{10\pi}{4} = 7.85$$

wave moves along positive X-direction

24. $\Delta\nu = \frac{V}{2\ell_1} - \frac{V}{2\ell_2} = \frac{V}{2}\left[\frac{1}{\ell_1} - \frac{1}{\ell_2}\right]$

$= \frac{1}{2}\sqrt{\frac{T}{\mu}}\left\{\frac{1}{\ell_1} - \frac{1}{\ell_2}\right\}$

25. In series, $C_{eq} = \frac{C}{3}$,

$V_{eq} = 3V$

26. Total resistance of wire = $12\ \Omega \times 2\pi \times 10^{-1}$

$= 2.4\pi$

Resistance of each half = $\frac{2.4\pi}{2} = 1.2\pi$

and as about diameter both parts are in parallel

$\text{Req.} = \frac{1.2\pi}{2} = 0.6\ \pi\Omega$

27. $W = MB(\cos\theta_1 - \cos\theta_2)$

$= 2 \times 10^4 \times 6 \times 10^{-4} (\cos\theta - \cos 60^o)$

$= 12 \times \frac{1}{2} = 6\ J$

28. $\vec{F} = q(\vec{v} \times \vec{B})$

$= -2 \times 10^{-6}[(2\hat{i} + 3\hat{j}) \times 10^6 \times 2\hat{j}]$

$= -(8N)\hat{k}$

29. $e = \frac{d\phi}{dt} = \frac{d}{dt}(B\pi r^2)$

$= 2\pi r B \frac{dr}{dt}$

$= 2 \times \pi \times 2 \times 10^{-2} \times 4 \times 10^{-2} \times 2 \times 10^{-3}$

$= 3.2 \times 10^{-6}\ \pi\text{Vol} = 3.2\ \pi\mu V$

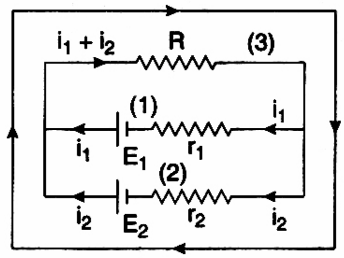
30. $V = -x^2y - xz^3 + 4$

$\vec{E} = -V = -\left(\hat{i}\frac{\delta}{\delta x} + \hat{j}\frac{\delta}{\delta y} + \hat{k}\frac{\delta}{\delta z}\right)$

$(-x^2 - xz^3 + 4)$

$= (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$

31.



For loop (3)

$E_1 - (i_1 + i_2) R - i_1r_1 = 0$

For loop (4)

$-E_1 + i_1r_1 - i_2r_2 + E_2 = 0$

For loop (1)

$E_2 - (i_1 + i_2) R - i_2r_2 = 0$

32. $Ig = 1.0A,\ G = 60q,\ I = 5.0\ A$

$S = \frac{I_g}{I - I_g} G$

$G = \frac{1.0}{5.0 - 1.0} = 60$

$= 15\ \Omega$ in parallel

33. $T = \frac{2\pi m}{2B}$

T is time period

34. $P_{av} = E_{rms} . I_{rms} \cos\phi$

$= \varepsilon . \frac{\varepsilon}{z} . \frac{R}{z} = \frac{\varepsilon^2 R}{z^2}$

$= \frac{\varepsilon^2 R}{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

35. $q_A = 4\pi a^2\sigma$,

$q_B = -4\pi b^2\sigma$,

$q_C = 4\pi c^2\sigma,\ c = a + b$

$V_A = \frac{1}{4\pi\in_0}\left(\frac{q_A}{a} + \frac{q_B}{b} + \frac{q_C}{c}\right)$

$= \frac{2\sigma a}{\in_0}$

$V_B = \frac{1}{4\pi\in_0}\left(\frac{q_A}{a} + \frac{q_B}{b} + \frac{q_C}{c}\right)$

$$= \frac{\sigma}{\epsilon_0}\left(\frac{a^2}{b} - b + c\right)$$

$$= \frac{\sigma}{\epsilon_0}\left(a + \frac{a^2}{b}\right)$$

$$V_C = \frac{1}{4\pi\epsilon_0}\left(\frac{q_A}{a} + \frac{q_B}{b} + \frac{q_C}{c}\right)$$

$$= \frac{\sigma}{\epsilon_0}\left(\frac{a^2 - b}{c} + c\right) = \frac{2\sigma a}{\epsilon_0}$$

So, $V_C = V_A \neq V_B$

36. $E = V + Ir$

$\Rightarrow \quad V = E - Ir$

Comparing with $y = mx + c$

Slope = – r, intercept = E

37. Out of the four structures, when the circular and elliptical loops come out from the field, equal are is not traced in equal interval of time. So any induced in both is not constant.

38. As diamagnetic substances have negative intensity of magnetisation, they are weekly repelled by the external field.

39. No. of photoelectrons emitted is independent of frequency but depends on intensity.

40. No. of photons $= \dfrac{E}{(hc/\lambda)}$

$$= \frac{9\times10^{-3}\times6.67\times10^{-7}}{6.6\times10^{-34}\times3\times10^{8}}$$

$= 3 \times 10^{16}$

41. As a and b have same stopping potential and c has greater stopping potential, then $v_c > v_a = v_b$ as b and c have same saturation current and a has lesser value.

So $I_a < I_b = I_c$

42. ${}_{Z}X^{A} \xrightarrow{\alpha} {}_{Z-2}Y^{A-4} \xrightarrow{2\beta} {}_{Z}P^{A-4}$

As the resulting daughter and parent nucleus has same atomic number. So they are isotope.

43. $\dfrac{n(n-1)}{2} = 6$

$\Rightarrow \quad n = 4$

For maximum wavelength energy difference between states should be minimum because

$$\lambda = \frac{hc}{\Delta E}$$

So, transition state in n = 4 to n = 3

44. Energy $= \dfrac{1}{4\pi\epsilon_0}\dfrac{Z_1Z_2}{r_0}$

45. ${}_{Z}X^{A} \xrightarrow{\beta} {}_{Z+1}Y^{A} \xrightarrow{\alpha} {}_{Z-1}B^{A-4} \xrightarrow{\gamma}$ ${}_{Z-1}B^{A-4}$

46. $qV = 2eV$

$\Rightarrow \quad 1.6 \times 10^{-19}V = 2 \times 1.6 \times 10^{-19}$ V

$\Rightarrow \quad V = 2V$

$$E = \frac{V}{d}$$

$\Rightarrow \quad E = \dfrac{2V}{4\times10^{-8}} = 5 \times 10^{7}$

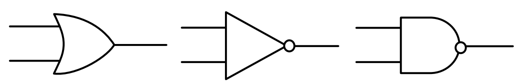
47. $\dfrac{\sqrt{3}a}{2} = 3.7$ Å

$\Rightarrow \quad a = \dfrac{2\times3.7}{\sqrt{3}} = 4.3$ Å

48. $\lambda_{max} = \dfrac{hc}{eV}$

$$= \frac{1242\,\text{eVÅ}}{2.5\,\text{eV}} = 4960\text{ Å}$$

49.



(OR) (NOT) (NAND)

50. $\Delta I_B = 100\ \mu A$

$\Delta I_C = 5$ mA

$$\beta = \frac{\Delta I_C}{\Delta I_B} = \frac{5\times10^{-3}}{100\times10^{-6}} = 50$$

51. $\underset{2g}{H_2} + \underset{16g}{1/2O_2} \rightarrow \underset{18g}{H_2O}$

10g H_2 required O_2 = 80 which is not present 64 g O_2 required 8 g of H_2 and H_2 left = 2g. Thus, O_2 is the limiting reactant and H_2 is excess reactant.

Hence, H_2O formed from 64 of O_2

$$= \frac{18}{16} \times 64$$

$$= 72 \text{ g} = \frac{72}{18} \text{ mole}$$

$$= 4 \text{ mole}$$

52. PO_4^{3-}, oxidation no. of P $\Rightarrow$ +5

SO_4^{2-}, oxidation no. of S $\Rightarrow$ +6

$Cr_2O_7^{2-}$, oxidation no. of Cr $\Rightarrow$ +6

53. Maximum no. of electrons in any subshell

$= 4l + 2$

54. m value $-l$ to $+l$

55. ΔH = dissociation energy of reactant – Bond dissociation of energy of product.

$$\Delta H = (606.10 + 4 \times 410.5 + 431.37) - (6 \times 410.50 + 336.49)$$

$$= -120.0 \text{ kJ/mol}$$

56. $K_h = \frac{K_w}{K_b} = \frac{10^{-14}}{1.77 \times 10^{-5}} = 5.65 \times 10^{-10}$

57. $Cu^{2+} + 2e^- \rightarrow Cu$

$E^o = 0.337$ V

$\Delta G = -nFE^o_{cell}$

$= -2 \times F \times 0.337$

$= -0.674$

$Cu^{2+} \rightarrow Cu^{2+} + e^-$

$E^o = -0.153$ V

$\Delta G = +1 \times F \times 0.153$

Final

$Cu^+ + e^- \rightarrow Cu$

$\Delta G = -0.52$ V

$\Delta G = -nFE^o_{cell}$

$E^o_{cell} = 0.52$ V

58. 20 mL of 0.50 M HCl = 20×0.050 m mol

= 1.0 m mol = 1.0 meq. of HCl

30 mL of 0.10 M $Ba(OH)_2$

= 30 × 0.1 m mol

= 3m mol = 3 × 2 meq

= 6 meq $Ba(OH)_2$

1 meq of HCl will neutralize 1 meq of $Ba(OH)_2$

$Ba(OH)_2$ left = 5 meq.

Tatal volume = 50 mL

$Ba(OH)_2$ conc. in final solution

$$= \frac{5}{50} \text{ N} = 0.1 \text{ N} = 0.05 \text{ M}$$

$[OH^-] = 2 \times 0.05 \text{ M} = 0.10 \text{ M}$

Alternatively,

$Ba(OH)_2 + 2HCl \rightarrow BaCl_2 + 2H_2O$

2 m mol of HCl neutralize 1 m mole of $Ba(OH)_2$

1 m mol of HCl neutralize 0.5 m mol of $Ba(OH)_2$

$Ba(OH)_2$ left = 3 – 0.5 m mol = 2.5 m mol

$$[Ba(OH)_2] = \frac{2.5}{50} \text{ M} = 0.05 \text{ M}$$

or $[OH]^- = 2 \times 0.05 = 0.1$ M

59. $KE = 4.4 \times 10^{-19} - 4.0 \times 10^{-19}$

KE/molecule = 0.4×10^{-19}

$$\text{KE/atom} = \frac{0.4 \times 10^{-19}}{2}$$

$$= 2 \times 10^{-20} \text{ J}$$

60. $\frac{1}{3}\frac{-d[H_2]}{dt} = \frac{1}{2}\frac{[NH_3]}{dt}$

$$\frac{-d[H_2]}{dt} = \frac{3}{2}\frac{d[NH_3]}{dt}$$

$$\frac{-d[H_2]}{dt} = \frac{3}{2} \times 2 \times 10^{-4}$$

$$= 3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

61. Rate $= k[A][B]^2$

$= k[2A][2B]^2$

$= k \times 8[A][B]^2$

62. $\alpha = \frac{A_C}{A_\infty} = \frac{8}{400}$

$K_a = C\alpha^2$

$= \frac{1}{32} \times \frac{8}{400} \times \frac{8}{400}$

$= 1.25 \times 10^{-5}$

63. $\Delta T_f = ik_f \cdot m$

$i = \frac{\Delta T_f}{k_f . m}$

$= \frac{0.00732}{1.86 \times 0.002} = \frac{0.00732}{0.00372}$

$i = 2$

Compound will be $[Co(NH_3)_5]NO_5NO_2]Cl$

Total possible ions = 2

64. $-\frac{1}{4}\frac{d(Br^-)}{dt} = -\frac{1}{3}\frac{d(Br_2)}{dt}$

$\frac{d(Br_2)}{dt} = -\frac{3}{5}\frac{d(Br^-)}{dt}$

65. for bcc type of unit cell

$\sqrt{3}a = 4r$

$r = \frac{\sqrt{3}}{4}a$

$= \frac{1.732 \times 351}{4}$

$= 151.98$

66. $K_c = K_{a(CH_3COOH)} \times \frac{1}{K_{a(HCN)}}$

$= 1.5 \times 10^{-5} \times \frac{1}{4.5 \times 10^{-10}}$

$\cong 3 \times 10^4$

67. For a spontaneous reaction

$\Delta G = -ve$

Or ar eq. $\Delta G = 0$

$\Delta H = T\Delta S$

$T = \frac{\Delta H}{\Delta S}$

$= \frac{170 \times 10^3}{170}$

$= 1000$ K

68. $K = \frac{0.693}{t_{1/2}} = \frac{0.693}{1386} = 0.5 \times 10^{-3}\ S^{-1}$

69. Both BF_3 and NO_2^- is sp^2 hybridized.

70. $F_2 \rightarrow$ reduction potential very high so strongest oxidizing agent.

71. $N_2 = 14e = B.O. = 3$

$N_2^- = 15e = B.O. = 2.5$

$N_2^{2-} = 16e = B.O. = 2$

72. MI > MBr > MCl > MF

Down the group increases covalent character

73. Since CaO itself is basic, It will not react with NaOH

74. $W = \frac{E}{96500} \times I \times t$

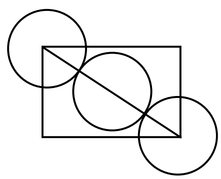
$W = \frac{9}{96500} \times 4.0 \times 10^4 \times 6 \times 3600$

$= 8.1 \times 10^4$ g

75. +I stability down the group increase due to inert pair effect

Al < Ga < In < Tl

76. Cu $\rightarrow$ fcc lattice



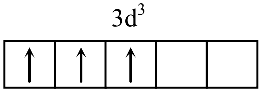
$4r = \sqrt{2}\ a$

$r = \frac{1}{2\sqrt{2}}a$

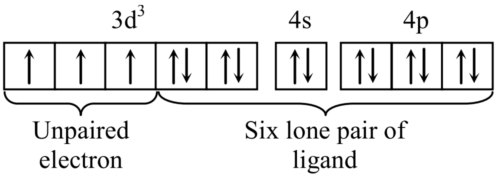
$r = \frac{1}{2\sqrt{2}} \times 361 = 128$

77. Inter molecular force in alcohol is mainly H-bonding

78. $Cr^{3+} \rightarrow 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^3$



$[Cr(NH_3)_6]^{3+}$



Unpaired electron shows colour so absorb visible light.

79. In both TiF_6^{2-} and Cu_2Cl_2, these no d-electrons or no unpaired electrons so, these are colourless.

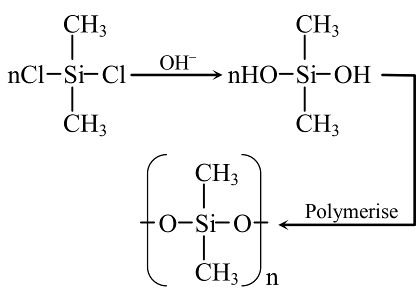
80. As complexes of the type $[MA_3B_3]$ can show geometrical isomerism knows as facmer isomerism and not optical isomerism. So here $[Co(NH_3)_3Cl_3]^0$ can not show optical isomerism.

81. 7^{th} group $\rightarrow$ largest number of oxidation state.

82. $(CH_3)_3B \rightarrow$ is electron efficient compound, so behaves as Lewis acid.

83. $[Ne]3s^2 3p^3$ has highest ionization energy (half-filled)

84.



85. $\underset{4}{CH} \equiv \underset{3}{C} - \underset{2}{CH} = \underset{1}{CH_2}$

1-butene-3-yne

86. $CH_3CH{=}CH{-}CH_3$

Can exists as

$$\begin{matrix} H{-}C{-}CH_3 \\ \| \\ H{-}C{-}CH_3 \end{matrix}$$

cis

And

$$\begin{matrix} H{-}C{-}CH_3 \\ \| \\ CH_3{-}C{-}H \end{matrix}$$

Trans

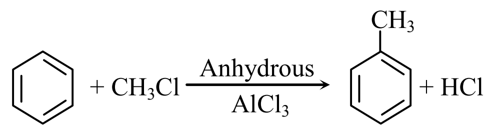
$\Delta G = \Delta H - T\Delta S$

87. $\begin{matrix} CH_2{-}OH \\ | \\ CH_2{-}OH \end{matrix} + HIO_4 \longrightarrow 2HCHO + HIO_3 + H_2O$

88. $CH_3{-}CH_2{-}OH \xrightarrow{PBr_3} CH_3{-}CH_2{-}Br \xrightarrow{\text{Alc. KOH}} CH_2{=}CH_2$

$CH_2{=}CH_2 \xrightarrow[\text{Room temp. (ii) } H_2O\text{, heat}]{\text{(i) } H_2SO_4} CH_3{-}CH_2{-}OH$

89.



Toluene

90. HNO_3 on nitrating mixture acts as a base.

91. $R - X + KOH \rightarrow R - OH + KX$

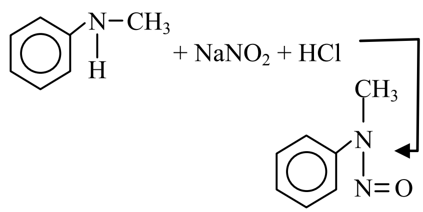
X– replaced by OH– show nucleophilic substitution reaction

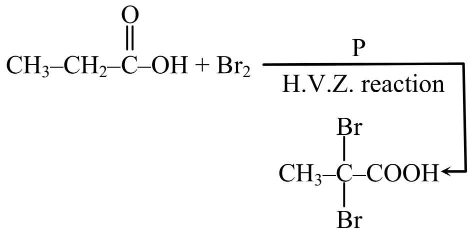
92. Equanil is a diasaccharide [Everday life]

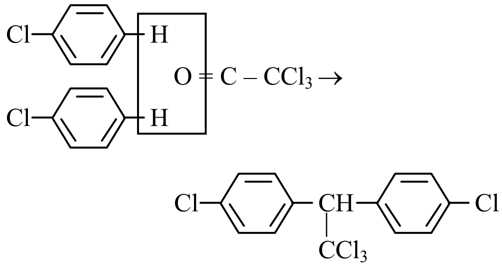
93. Neoprene is

$$\left(CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2 - CH_2 \right)_n$$

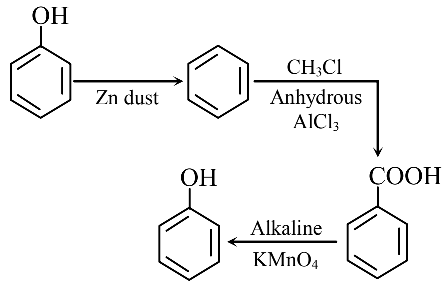
94.



95. 

96. 

DDT

97. 

98. C_2 having $\rightarrow$ 2-σ bond $\rightarrow$ sp

C_3 having $\rightarrow$ 4-σ bond $\rightarrow$ sp^3

C_5 having $\rightarrow$ 3-σ bond $\rightarrow$ sp^2

C_6 having $\rightarrow$ 4-σ bond $\rightarrow$ sp^3

99. Gene

100. Thyroxine contains iodine. Its structure is