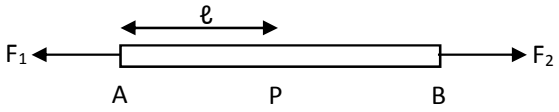
1. Suppose that drop leaves the tap after equal intervals of 'T'. Assume that first drop leaves at t = 0. Then second leaves at t = T and third at t = 2T. It is given that when the third drop leaves the tap, first drop just touches the ground. So first drop reach the ground at t = 2T.

   Hence, $h = \frac{1}{2} g (2T)^2$ where h is height from the ground.

   Distance covered by second drop till this time will be $h' = \frac{1}{2} g (2T - T)^2 = \frac{1}{2} gT^2 = \frac{h}{4}$

   So height of second drop from ground = h – h' = 3h/4.

   Answer : Option (1)

2. 

   Consider a point P at distance ℓ from end A.

   Acceleration of the rod $a = \frac{F_1 - F_2}{m}$ where m is the mass of the rod.

   Assume tension at point P is T.

   Mass of part PB = $m' = \frac{m}{L}(L - \ell)$

   Writing Newton's second las for part PB,

   $T - F_2 = m'a = \frac{F_1 - F_2}{L}(L - \ell)$

   $T = \frac{F_1 - F_2}{L}(L - \ell) + F_2$

   Answer : Option (2)

3. If single force is acting on an object, its momentum will always change.

   Answer : Option (3)

4. $mg = ky \rightarrow k = \frac{mg}{y}$

   $U = \frac{1}{2} ky^2 = \frac{mgy}{2}$

   Answer : Option (4)

5. If h is the maximum height achieved then,

   $\frac{1}{2} mu^2 = mgh.$

   At highest point, it will get velocity 2u in the downward direction due to elastic collision. (Velocity of approach is u and that of separation has to be u)

   Applying law of conservation of energy between highest and lowest point,

   $mgh + \frac{1}{2} m(2u)^2 = \frac{1}{2} mv^2$

   $\frac{1}{2} mu^2 + 2mu^2 = \frac{1}{2} mv^2$

   Answer : Option (1)

6. Note: Object CAN roll on smooth horizontal surface if it is set into motion such that v = Rω is satisfied.

   Answer : Option (4)

7. $F_{avg} = \frac{Change\ in\ momentum}{Time} = \frac{mv-(-mv)}{\frac{\pi r}{v}}$

   Answer : Option (3)

8. **Answer : Option (4)**

9. **Answer : Option (3)**

10. **Answer : Option (2)**

11. $\Delta\ell = \frac{FL}{AY} = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{L^2}\frac{L}{AY}$

Answer : Option (2)

12. When ball is going down,

$v_T = \frac{2(\rho_{solid} - \rho_{liquid})r^2 g}{9\eta} = \frac{2(3\rho - 2\rho)r^2 g}{9\eta} = \frac{2\rho r^2 g}{9\eta}$

When ball is going up,

$v_T = \frac{2(\rho_{liquid} - \rho_{solid})r^2 g}{9\eta} = \frac{2(2\rho - \rho)r^2 g}{9\eta} = \frac{2\rho r^2 g}{9\eta}$

Answer : Option (1)

13. From Bernoulli's theorem,

$2P_0 + \frac{1}{2}\rho v^2 = P_0 + \frac{1}{2}\rho(2v)^2$

Answer : Option (4)

14. Answer : Option (2)

15. Let the thermal resistances of rods be 4R and R. (They are of same dimensions so resistance will be inversely proportional to conductivity.)

When connected in series,

$H = \frac{\Delta T}{5R}$

When connected in parallel,

$H' = \Delta T\left(\frac{1}{4R} + \frac{1}{R}\right) = \frac{5}{4R}\Delta T = \frac{25}{4}H$

Answer : Option (3)

16. Answer : Option (3)

17. Answer : Option (2)

18. Q = (Heat capacity) x (Change in temperature)

$= 4R\,\Delta T$

$\Delta U = Q - \Delta W = 2R\,\Delta T$

$C_V = \frac{\Delta U}{\Delta T} = 2R.$

$C_P = C_V + R = 3R.$

Answer : Option (1)

19. As length of the spring is halved, its force constant has become double.

$T \propto \frac{1}{\sqrt{k}}$

Answer : Option (2)

20. For resonance, angular frequency of external source should match with the natural frequency of the system.

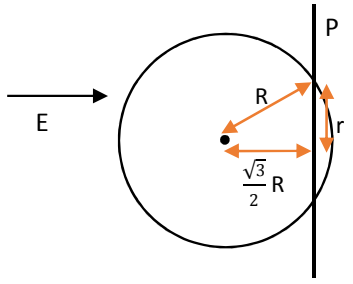
$\omega_{ext} = \omega_0 = \sqrt{\frac{g}{l}}$

Answer : Option (2)

21. Answer : Option (3)

22. Answer : Option (4)

23.



Area of left part projected along the direction perpendicular to the direction of the field is a circle of radius r in plane P.

$r^2 + (\frac{\sqrt{3}}{2}R)^2 = R^2 \rightarrow r = R/2.$

Answer : Option (4)

24. Force on charge q = q E_0 a $\hat{j}$

Force on charge –q = (-q)(-E_0 a) $\hat{j}$ = q E_0 a $\hat{j}$

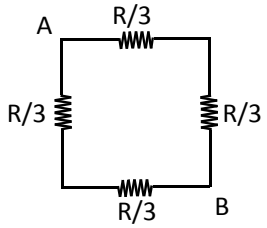
Answer : Option (2)

25. C = $\frac{A\varepsilon_0}{d}$ ➔ Cd = constant

Hence graph will be rectangular hyperbola.

Answer : Option (3)

26. Given circuit is equivalent to:



Answer : Option (1)

27. PD = IR = I x (Resistance per unit length) x (Distance between the hands)

Answer : Option (1)

28. τ = MB sinθ = IAB sinθ

Answer : Option (4)

29. As momentum and charge are same, radii will be same as well.

Answer : Option (4)

30. Field due to wire carrying current 3I = $\frac{\mu_0(3I)}{2\pi d}$ in upward direction.

Field due to wire carrying current 4I = $\frac{\mu_0(4I)}{2\pi d}$ towards left.

Note that these two are perpendicular.

Net field will be = $\frac{\mu_0 I}{2\pi d}\sqrt{3^2+4^2} = \frac{5\mu_0 I}{2\pi d}$

Answer : Option (2)

31. Answer : Option (3)

32. $|E| = \frac{d\Phi}{dt} = -6t^2 + 12t + 4.$

For maxima, $\frac{dE}{dt} = 0$ ➔ -12t + 12 = 0 ➔ t = 1

Answer : Option (3)

33. L = $\mu_0 N^2 A/L$

Answer : Option (3)

34. Answer : Option (3)

35. Answer : Option (3)

36. Angular dispersion = A($\mu_V - \mu_R$)

Answer : Option (2)

37. Answer : Option (1)

38. Answer : Option (2)

39. Angular width = $\frac{2\lambda}{a}$

Answer : Option (1)

40. Decreasing intensity of light may not reduce the stopping potential if frequency remains same. Answer : Option (2)

41. Answer : Option (2)

42. $N = N_0 e^{-\lambda t}$

$N_0/2 = N_0 e^{-\lambda T}$ ➔ $T = \frac{\ell n\, 2}{\lambda}$

$N_0/3 = N_0 e^{-\lambda T'}$ ➔ $T' = \frac{\ell n\, 3}{\lambda} = T\, \ell n3/\ell n2$

Answer : Option (1)

43. Answer : Option (3)

44. Current gain = $\left.\frac{\Delta I_C}{\Delta I_B}\right|_{V_{CE}}$

Answer : Option (4)

45. Modulation factor = $\frac{A_{max} - A_{min}}{A_{max} + A_{min}}$

Answer : Option (4)

46. (c)

Sol. $C_nH_{2n}O = 44$

$C_nH_{2n} = 44 - 16$

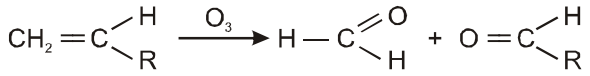
$C_nH_{2n} = 28$

$n = 2$

$CH_3–CH=CH–CH_3 \xrightarrow{O_3/Zn} CH_3–CH=O$

47. (b)

Sol.



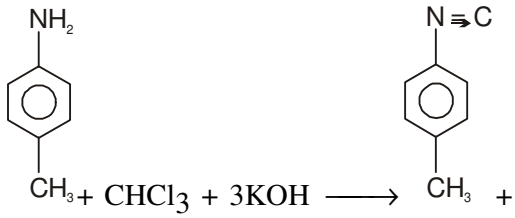
Presence of one vinyl group gives formaldehyde as one of the product in ozonolysis.

48. (c)

Sol. It is 2, 4, 6-trinitrophenol

49. (d)

Sol.



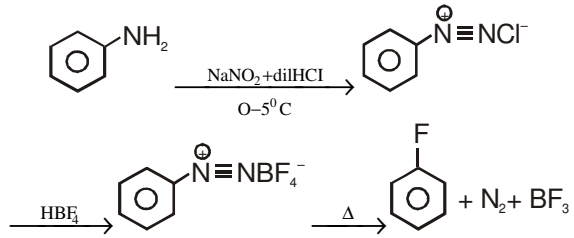
$+ 3H_2O$

50. (c)

Sol. In aryl halides the C–X bond has partial double bond character due to resonance so it will not give S_N reaction

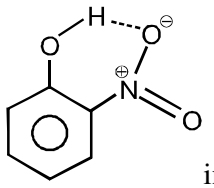
51. (a)

Sol.



52. (b)

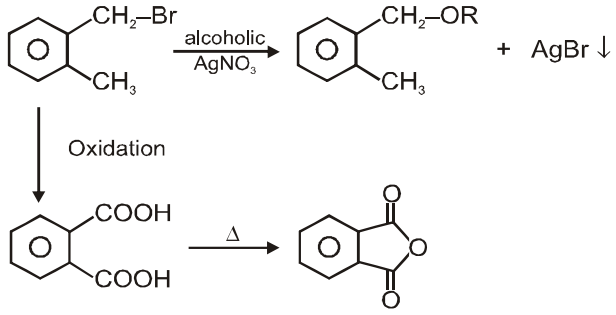
Sol.



intra-molecular H-bonding

53. (d)

Sol.



(Phthalic anhydride)

54. (d)

Sol. In presence of +M effect rate of mononitration increase and in presence of –M effect rate will decreases

55. (a)

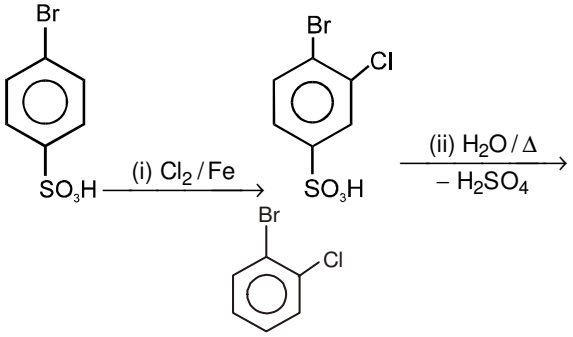
Sol. In the presence of +M effect, the rate of mononitration is increase and in the presence of – M effect, the rate of mononitration is decrease.

56. (a)

Sol. Benzene $+CH_3Cl \xrightarrow{\text{An hydrous } AlCl_3}$ gives toluene

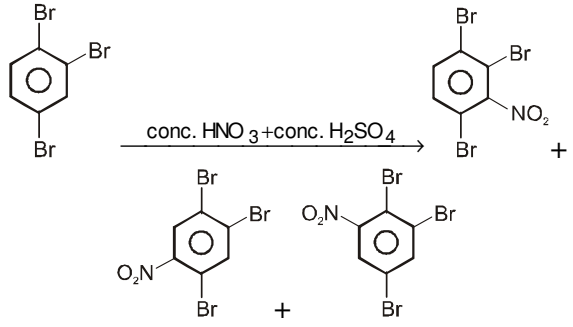
57. (c)

Sol.



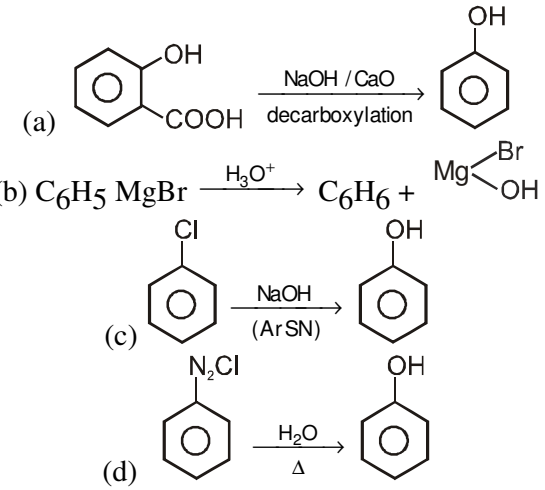
58. (b)

Sol.



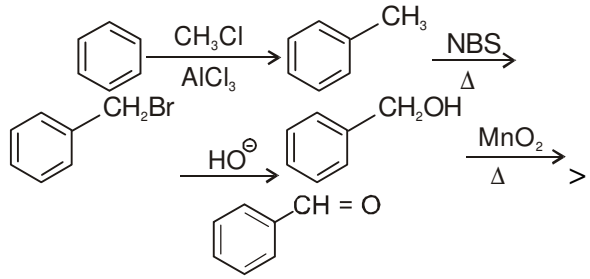
59. (b)

Sol.



60. (b)

Sol.

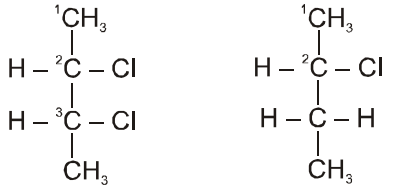


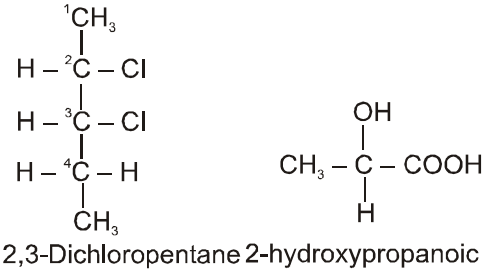
61. (d)

Sol. An equimolar mixture of two i.e., dextro and laevorotatory optical isomers is termed as racemic mixture or dl form or (±) mixture.

62. (b)

Sol.

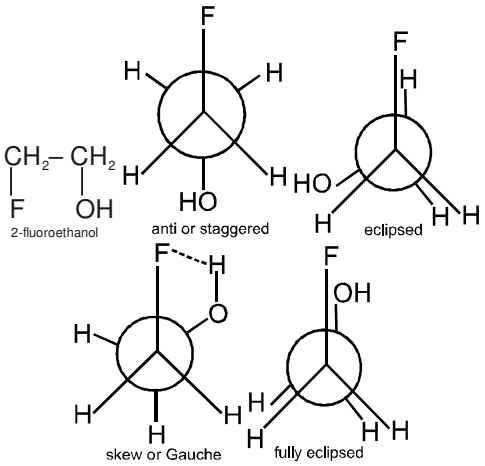




2,3-dichlorobutane have meso isomer due to the presence of plane of symmetry.

63. (c)

Sol.



Gauche form is more stable due to intramolecular H-bonding

64. (d)

Sol. Follow conditions of geometrical isomerism.

65. (a)

Sol. The eclipsed and staggered conformation of ethane is due to free rotation about C — C single bond.

66. (d)

67. (b)

Sol. Halogenation of alkanes is an example of free radical substitution reaction

68. (b)

Sol. $CH_4 \xrightarrow[Cl_2]{hv} CH_3Cl \xrightarrow[-HCl]{hv/Cl_2} CH_3Cl_2 \xrightarrow[-HCl]{hv/Cl_2} CHCl_3 \xrightarrow[-HCl]{hv/Cl_2} CCl_4$

69. (c)

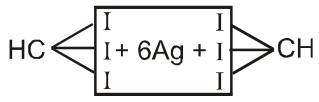
Sol. $\overset{(1)}{C}H_3 - \underset{\underset{CH_3}{|}}{\overset{(2)}{C}}H - \overset{(3)}{C}H_2 - \overset{(4)}{C}H_2 - \overset{(5)}{C}H_3$

70. (c)

Sol. Iodination of an alkane is carried out in presence of HNO_3 or HIO_3.

71. (d)

Sol.



$\longrightarrow$ CH^0CH + 6AgI

72. (a)

Sol. According to CIP rule first decide the seniority of groups and than decide the configuration.

73. (b)

Sol. In anti addition, cis reactant will give enantiomers.

74. (a)

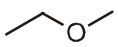
Sol. HNO_3 accepts a proton from H_2SO_4

$H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$

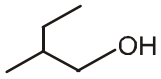
$HNO_3 + H^+ \longrightarrow H_2O + NO_2^+$

75. (b)

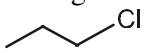
Sol.



does not form H-bond so has lower melting point.



forms H-bond so has higher melting point.



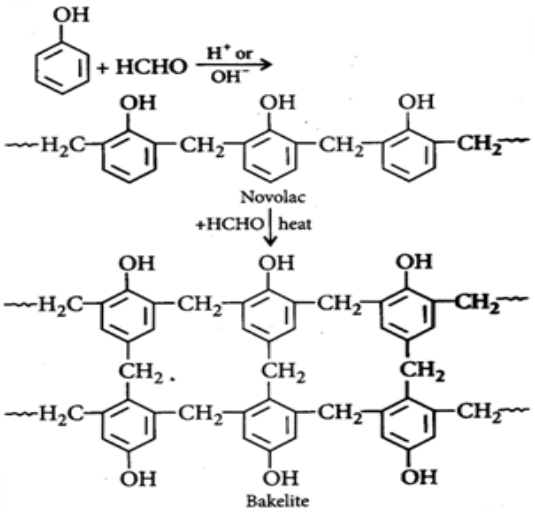
has dipole moment so higher melting point.

76. (a)

Sol. Natural rubber contains isoprene unit.

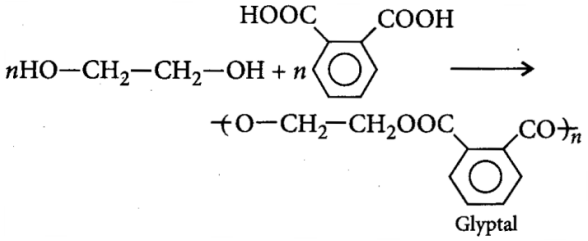
77. (d)

Sol.



78. (a)

Sol. Glyptal is synthesized polymerization of ethylene glycol (glycol) and phthalic acid.



79. (a)

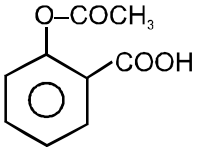
Sol. The repeating structural unit is $-CH_2C(CH_3)_2-$ and hence the monomer is iso-butylene, 

80. (d)

Sol. The given structure is of caprolactam hence, Nylon-6 can be formed.

81. (a)

Sol.



Aspirin (Acetyl salicylic acid)

82. (d)

Sol. DDT is a non-biodegradable pollutant.

83. (d)

Sol. Reserpine, morphine or quinine are complex nitrogeneous substances or alkaloids.

84. (b)

Sol. Due to the more inter nuclear distnace between carbon and chlorine, dipole moment (m = Charge × distance) of CH_3–Cl is more as compare to CH_3–F.

85. (a)

Sol. Solubility depend on extent of H-bonding. Lower the molecular wt. of alcohol greater the H-bonding and greater is the solubility.

86. (c)

Sol. In both complexes the oxidation state of cobalt is +3 with $3d^6$ configuration. Except

$[CoF_6]^{3-}$, all other complexes of cobalt with weak field and strong field ligands are inner orbital complexes and diamagnetic because of higher CFSE.

87. (d)

Sol. (A) $[Fe(CN)_6]^{4-}$ d^6 CN^- is strong field ligand.

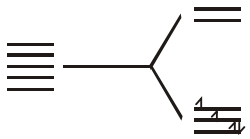
(B) $[Ni(CO)_4]$ d^{10} CO is strong field ligand.

(C) $[Ni(CN)_4]^{2-}$; Ni^{2+} has $3d^8$ configuration and CN^- is strong field ligand. So, complex is square planar and diamagnetic.

(d) $[CoF_6]^{3-}$ d^6 F^- being weak field ligand does not allow pairing.

88. (a)

Sol. $3d^4$



Sol. CN^- is strong field ligand ; so it compels for pairing of electrons to have two d-orbital empty.

$m = \sqrt{n(n+2)} = \sqrt{2(2+2)} = 2.84$ B.M

89. (d)

Sol. More easily liquefible gases are adsorbed readily. Thus, H_2 gas having low critical temperature (33 K) is not easily liquefied and shows least adsorption.

90. (b)

Sol. (i) $\rightarrow$(iii) $\rightarrow$(ii) $\rightarrow$ (iv) $\rightarrow$ (v)

91-b

92-b

93- a

94- c

95- b

96.-c

97- d

98- c

99- c

100- d

101- b

102- a

103- d

104- c

105- c

106- b

107- b

108- c

109- a

110- d

111-c

112-d

113- c

114- b

115- c

116- d

117- b

118-c

119-c

120- b

121- d

122- a

123- d

124- c

125- b

126- c

127- a

128-d

129- c

130- a
131- a
132-c
133- b
134- c
135- b
136- d
137- b
138- c
139- a
140- b
141-a
142- a
143- a
144- b
145- d
146- c
147- d
148- c
149- d
150-b
151- c
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167-c
168-c
169-d
170-c
171-a
172-c
173-d
174-c
175-a
176-c
177-b
178-b
179- d
180- d