SOLUTIONS & ANSWERS FOR KERALA ENGINEERING ENTRANCE EXAMINATION-2010
VERSION – A1

[PHYSICS & CHEMISTRY]

1. Ans: Time

Sol: RC → $\frac{L}{R}$ → both time constant.

2. Ans: 4

3. Ans: 25.5 m s^{-1}

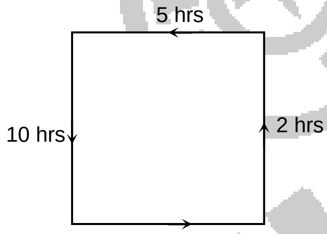
Sol: $\sqrt{\frac{u^2+v^2}{2}} = \sqrt{\frac{20^2+30^2}{2}}$

$= \sqrt{\frac{400+900}{2}} = \sqrt{650}$

$\cong 25.5$ m s^{-1}

4. Ans: 190.5 km/h

Sol:



Average speed = $\frac{\text{total distance}}{\text{total time}}$

$= \frac{4000}{21}$

= 190.5 km/h

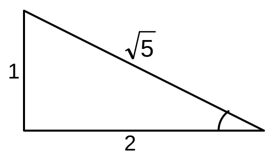
5. Ans: Uniform acceleration

Sol: Theoretical.

6. Ans: $\frac{4u^2}{5\ g}$

Sol: $\frac{R}{H}$. 4 cotθ ⇒ cotθ = $\frac{1}{2}$

tanθ = 2



$\therefore R = \frac{2u^2 \sin\theta\cos\theta}{g}$

$= \frac{2u^2 \frac{1}{\sqrt{5}} \times \frac{2}{\sqrt{5}}}{g} = \frac{4u^2}{5\ g}$

7. Ans: 30 rad/s

Sol: T = mrω^2

$\omega^2 = \frac{T}{mr} = 900 \Rightarrow \omega = 30$ rad/s

8. Ans: 4 m s^{-1} along x-direction.

Sol: $\vec{r} = 2t^2\hat{i} + 3t\hat{j} + 4\hat{k}$

$v = \frac{dr}{dt} = 4t + \hat{i} + 3\hat{j}$

$a = \frac{dv}{dt} = 4\hat{i} \Rightarrow 4$ m/s^2 in the x-direction.

9. Ans: Inertia of motion.

Sol: Theoretical.

10. Ans: 192 N

Sol: T = m(g + a)

= 16 × 12

= 192 N

11. Ans: Magnetic force

12. Ans: 4 W

Sol: $P = \vec{F} . \vec{v} = 4$ W

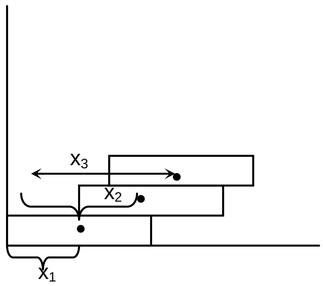
13. Ans: 10^{-20} J

Sol: Assuming hydrogen bond is broken energy required will be 10^{-20} J

14. Ans: Work done by friction over a closed path is zero.

15. Ans: (11/12)L

Sol:



$x_3 = \frac{5L}{4}$

$x_2 = L$

$x_1 = \frac{L}{2}$

$\therefore X_{CM} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{3\ m}$

$= \frac{11\ L}{12}$

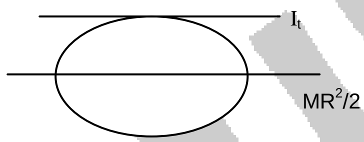
16. Ans: 2 s

Sol: $\tau = I\alpha$

$6.9 \times 10^2 = \frac{3\times10^2 \times 4.6}{t}$

17. Ans: $\frac{3}{2}MR^2$ solving t = 2 s

Sol:



$I_t = \frac{MR^2}{2} + MR^2 = \frac{3}{2}MR^2$

18. Ans: 2.16×10^{26} kg

Sol: $\sqrt{\frac{2\,GM_P}{R_P}}.3\sqrt{\frac{2\,GM_e}{R_e}}$

$\frac{M_P}{R_P} = 9\frac{M_e}{R_e}$

$\frac{M_P}{4\,R_e} = 9\frac{M_e}{R_e}$

$\therefore M_P = 36\ M_e = 36 \times 6 \times 10^{24}$

$= 2.16 \times 10^{26}$ kg

19. Ans: Half the potential energy of the satellite

Sol: $P.E = -\frac{GMm}{r}$

$T.E = -\frac{GMm}{2r}$

20. Ans: $\frac{mgR}{12}$

Sol: Energy required = Final energy – initial energy

$= -\frac{GMm}{2(3R)} - \left(-\frac{GMm}{2(2\ R)}\right)$

$= \frac{GMm}{2\ R}\left[\frac{1}{2} - \frac{1}{3}\right]$

$= \frac{GMm}{12\ R} = \frac{gR^2\,m}{12\ R}$

$= \frac{mgR}{12}$

21. Ans: 24 cc

Sol: $B = \frac{1}{\text{compressibility}} = \frac{PV}{dV}$

$\frac{1}{6\times10^{-10}} = \frac{4\times10^7 \times 1}{dV}$

$dV = 24 \times 10^{-3}$ litres

= 24 cc

22. Ans: Carburetor of automobile

23. Ans: Shearing stress there is change in volume.

24. Ans: Reynold's number

25. Ans: 4800 K

Sol: $\sqrt{\frac{3\ RT_H}{M_H}} = \sqrt{\frac{3\,RT_0}{M_0}}$

$\frac{T_H}{M_H} = \frac{T_0}{M_0}$

$\frac{300}{2} = \frac{T_0}{32}$

$T_0 = 16 \times 300 = 4800$ K

26. Ans: Inversely proportional to number of molecules per unit volume

Sol: $\lambda = \frac{1}{\sqrt{2}\pi n d^2}$

n = number of molecules / unit volume

d = diameter of the molecule

27. Ans: 150 J

Sol: $\frac{1}{3} = \frac{\theta_2}{\theta_1 - \theta_2}$

$= \frac{\theta_2}{200 - \theta_2}$

$\therefore \theta_2 = 50$

$\therefore W = 200 - 50 = 150$ J

28. Ans: 3 R

Sol: Heat capacity per mole of water = C_V

$\frac{f}{2}R = \frac{36}{2}R = 3R$

29. Ans: 75

Sol: No. of beats in 1 s = 1.25

$\therefore$ in 1 minute = $1.25 \times 60 = 75$

30. Ans: Damped oscillator.

31. Ans: 20

Sol: $\frac{1}{2}kA^2 = 4$

$A^2 = \frac{8}{800} = \frac{1}{100}$

$A = \frac{1}{10} = 0.1$ m

$a_{max} = \omega^2 A$

$= \frac{k}{m}.A$

$= \frac{800}{4} \times 0.1 = 20\ m/s^2$

32. Ans: Interference

33. Ans: 320 Hz

Sol: Fundamental frequency

$f_0 = \frac{v}{4L} = \frac{320}{4\times 1} = 80$ Hz

So it can resonate with f_0, $3f_0$, $5f_0$, $7f_0$------

$\therefore$ cannot resonate with 320 Hz.

34. Ans: 240 Hz

Sol: $f' = \frac{v + v_L}{v} \times f$

$= \frac{330+30}{330} \times 220$

= 240 Hz

35. Ans: $n^{5/3} : 1$

Sol: Capacitance of big drop = $C' = n^{1/3}$ C

Potential of big drop $V'_2 = n^{2/3}$ V

$\therefore$ Energy of big drop = $\frac{1}{2}C'V'^2$

$= \frac{1}{2}n^{1/3}C(n^{2/3}V)^2$

$= n^{5/3}\frac{1}{2}CV^2$

$\therefore$ Ratio = $n^{5/3} : 1$

36. Ans: $\frac{R_2}{R_1}$

Sol: Potential is same

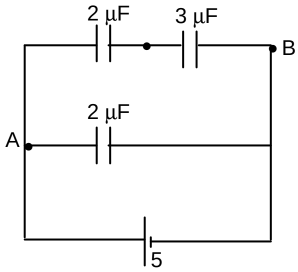
$\therefore\ k\frac{Q_1}{R_1} = k\frac{Q_2}{R_2}$

$\frac{4\pi R_1^2\sigma_1}{R_1} = \frac{4\pi R_2^2\sigma_2}{R_2}$

$\therefore\ \frac{\sigma_1}{\sigma_2} = \frac{R_2}{R_1}$

37. Ans: 2 V

Sol:



Charge across the combination of 2 μF and 3 μF = charge across 3 μF

$\therefore\ \frac{2\times 3}{2+3}\mu F \times 5 = 3\ \mu F \times V_1$

$\therefore\ V_1 = 2$ V

38. Ans: $\frac{20}{21}$ m

Sol:

Let the potential be zero at P and Q.

Then solving for x_1

$\frac{K\times 5}{x_1} = \frac{2}{(1-x_1)}$

$\therefore\ x_1 = \frac{5}{7}$

Similarly, $\frac{K\times 5}{1+x_2} = \frac{K\times 2}{x_2}$

$\therefore\ x_2 = \frac{2}{3}$

Separation PQ = $1 - \left(\frac{2}{7} + \frac{2}{3}\right)$

$= \frac{20}{21}$

39. Ans: 10^{12}

Sol: qE = mg

$n \times 1.6 \times 10^{-19} \times 100$

$= 1.6 \times 10^{-6} \times 10$

$n = 10^{12}$

40. Ans: 4 V

Sol: $I = \frac{E}{R_{eff}} = \frac{12}{24} = \frac{1}{2}$ A

$\therefore E = \frac{1}{2} \times 8 = 4$ V

41. Ans: 20 Ω

Sol: $500 = \frac{V^2}{R} = \frac{20000}{R}$

R = 20 Ω

$I^2R = 500$

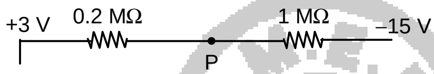
I = 5 A

$\therefore \frac{200}{(20+R_1)} = 5$

Solving, $R_1 = 20$ Ω

42. Ans: 0 V

Sol:



$I = \frac{18}{1.2\times10^{-6}}$

V across 1 MΩ = $\frac{18}{1.2\times10^{-6}} \times 1\times10^{6} = 15$ V

$\therefore$ Potential at P = 0 V

43. Ans: Nichrome

44. Ans: $\frac{1}{3}$ A

Sol: $E_{eff} = \frac{E_1r_2 + E_2r_1}{r_1 + r_2} = 2$ V

$I = \frac{E_{eff}}{R_{eff}} = \frac{2}{5+1} = \frac{2}{6} = \frac{1}{3}$ A

45. Ans: 2.5×10^5 A/m

Sol: $I = \chi H$

$= (\mu_r - 1) \times nI$

$= 499 \times 500 \times 1$

$= 2.495 \times 10^5$

$\cong 2.5 \times 10^5$ A/m

46. Ans: The resultant magnetic moment in an atom of a diamagnetic substance is zero.

47. Ans: 1.25 m

Sol: $B = \frac{\mu_0 I}{2r} = \frac{\mu_0 qf}{2r}$

$6.28 = \frac{4\pi\times10^{-7}\times2\times10^{-6}\times6.25\times10^{12}}{2r}$

$= \frac{157.08\times10^{-1}}{2r}$

$r = \frac{157.08\times10^{-1}}{2\times6.28}$

= 1.25 m

48. Ans: 0.1 Ω

Sol: $I_g = \frac{10}{10.1}$ mA = 0.99 mA ~ 1 mA

$S = \frac{I}{I - I_g} \times 100$

$= \frac{1}{1 - 1\times10^{-3}} \times 100$

$= \frac{100}{1000-1} \cong \frac{100}{1000} = 0.1$ Ω

49. Ans: μ_0

Sol: $\oint B.d\lambda = \mu_0 I_{enclosed}$

$= \mu_0[3 - 2]$

$= \mu_0$

50. Ans: 20 V, 20 V and 10 V

Sol: When resistance is halved current will be doubled.

$V_R = 2I \times \frac{R}{2} = 10$ V

$V_L = 2I \times X_L = 20$ V

$V_C = 2I \times X_C = 20$ V

51. Ans: 30π V

Sol: $E_S = \frac{d\phi}{dt} = \frac{d}{dt} MI_0 \sin\omega t$

$= MI_0\omega \cos\omega t$

E_S is maximum when $\cos\omega t = 1$

$\therefore E_S = MI_0\omega$

$= 150 \times 10^{-3} \times 2 \times 2\pi \times 30$

$= 30\pi$ V

52. Ans: 91%

Sol: $P_{in} = 220 \times 0.5 = 110$ W

$P_{out} = 100$ W

Efficiency = $\frac{P_{out}}{P_{in}} = \frac{100}{110} = 90.9\%$

$\cong 91\%$

53. Ans: Its impedance is purely resistive.

54. Ans: 5.8 V/m

Sol: Energy transmitted per unit area / unit time = poynting's vector

$S = \frac{1}{\mu_0} \times \vec{E} \times \vec{B}$

When power becomes four times both $\vec{E}$ and $\vec{B}$ will double. Hence 5.8 V/m

55. Ans: $\frac{U}{c}$

Sol: Theoretical

56. Ans: $\frac{L}{f_0}\left(\frac{D}{f_e}\right)$

57. Ans: 5000 $\overset{0}{A}$

Sol: $\frac{\Delta\lambda}{\lambda} = \frac{v}{C}$

$\frac{0.5 \text{ nm}}{\lambda} = \frac{300 \times 10^3}{3 \times 10^8}$

$\Rightarrow \lambda = 5000 \overset{0}{A}$

58. Ans: 30 cm and 6 cm

Sol: $\frac{f_0}{f_e} = 5$

$f_0 + f_e = 36$

Solving $f_e = 6$ cm

and $f_0 = 36$ cm

59. Ans: Concave only

60. Ans: $\frac{x(\mu_1 + \mu_2)}{2\mu_1\mu_2}$

Sol: $\frac{x}{2}\left(\frac{1}{\mu_1} + \frac{1}{\mu_2}\right)$

$= \frac{x}{2} \frac{(\mu_1 + \mu_2)}{\mu_1\mu_2}$

61. Ans: $c\sqrt{\frac{2m}{E}}$

Sol: $E = \frac{hc}{\lambda_P}$

$\lambda_P = \frac{hc}{E}$ ----(1)

$\lambda_e = \frac{h}{P} = \frac{h}{\sqrt{2mE}}$ ----(2)

$\frac{(1)}{(2)} \Rightarrow \frac{\lambda_P}{\lambda_e} = \frac{\frac{hc}{E}}{\frac{h}{\sqrt{2mE}}}$

$= \frac{c\sqrt{2mE}}{E} = c\sqrt{\frac{2m}{E}}$

62. Ans:($_1H^2$, $_1H^3$), ($_2He^3$, $_1H^3$) and ($_{79}Au^{197}$, $_{80}Hg^{198}$)

63. Ans: 2 : 1

Sol: For X → $\frac{1}{16} = \left(\frac{1}{2}\right)^{8/T_X}$

$4 = \frac{8}{T_X}$ ---- (1)

For Y → $\frac{1}{256} = \left(\frac{1}{2}\right)^{8/T_Y}$

$\Rightarrow 8 = \frac{8}{T_Y}$ ---- (2)

$\frac{(1)}{(2)} \frac{T_X}{T_Y} = \frac{2}{1}$

64. Ans: 1.17 MeV and 1.33 MeV in sucession

65. Ans: 2×10^9 /m^3

Sol: $n_i^2 = n_e n_h$

$(10^{16})^2 = n_e \times 5 \times 10^{22}$

Solving $n_e = 2 \times 10^9$ /m^3

66. Ans: 0.05 mA

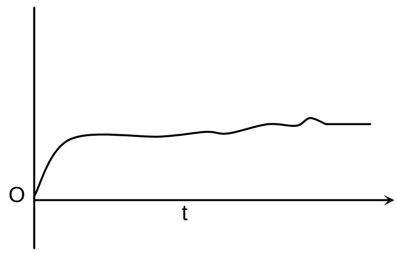
Sol: $I_C R_C = 0.6$ V

$I_C = \frac{0.6}{600} = 1$ mA

$\therefore \beta = \frac{I_C}{I_B}$

$I_B = \frac{I_C}{\beta} = 0.05$ mA

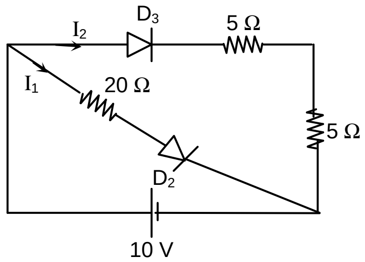
67. Ans:



Sol: Due to filter circuit.

68. Ans: 1.5 A

Sol:



$I_1 = \frac{10}{20} = 0.5$ A

$I_2 = \frac{10}{10} = 1$ A

$\therefore$ total current = 1.5 A

69. Ans: 0.05 and 1 $\pm$ 0.010 MHz

Sol: $m = \frac{E_m}{E_c} = \frac{0.5}{10} = 0.05$

band frequency = 1 MHz $\pm$ 0.01 Mh

= 1 $\pm$ 0.01 MHz

70. Ans: $\sqrt{2Rh_r} + \sqrt{2Rh_R}$

71. Ans: 3.7 to 4.2 MHz

72. Ans: Twice the audio signal frequency.

73. Ans: ${}^{16}O_8^{2-}$

Sol: For the species, ${}^{16}O_8^{2-}$,

No. of electrons = 8 + 2 = 10

No. of protons = 8

No. of neutrons = 8

74. Ans: 1×10^{21}

Sol: Energy of a photon, $E = \frac{hc}{\lambda}$

$= \frac{6.626 \times 10^{-34}\ (\text{Js}) \times 3 \times 10^{8}\ (\text{ms}^{-1})}{331.3 \times 10^{-9} (\text{m})}$

$= 6 \times 10^{-19}$ J

No. of photons emitted per second

$= \frac{600 (\text{J})}{6 \times 10^{-19} (\text{J})} = 10^{21}$

75. Ans: 911.7 $\overset{0}{\text{A}}$

Sol: $\bar{\upsilon} = R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$n_1 = 1$ and $n_2 = \alpha$

$\therefore\ \bar{\upsilon} = R_H$

$\lambda = \frac{1}{R_H} = \frac{1}{109678}$ cm

$= 9.117 \times 10^{-6}$ cm

= 911.7 $\overset{0}{\text{A}}$

76. Ans: Acetylene molecule has three pi bonds and three sigma bonds.

Sol: Acetylene molecule has two pi bonds and three sigma bonds.

77. Ans: N_2^+ becomes diamagnetic

Sol: N_2^+ is paramagnetic

78. Ans: Boron

Sol: BF_3 is a symmetrical molecule and hence dipole moment is zero.

79. Ans: 6, 4

Sol: $n_{N_2} = 2$ $\qquad n_{O_2} = 3$

$P_{O_2} = \frac{3}{5} \times 10 = 6$ atm

$P_{N_2} = 4$ atm

80. Ans: 1.673

Sol: Time required = $\frac{6.023 \times 10^{23}}{10^{20} \times 60 \times 60}$ hrs

= 1.673

81. Ans: II and V

Sol: I & II are alkali metals

II is more reactive.

V is an inert gas, hence the least reactive non–metal.

82. Ans: I_2

Sol: H_2O_2 in alkaline medium reduces I_2 to I^-

83. Ans: Cu_2O

Sol: C – CO curve is below Cu – Cu_2O curve at lower temperatures.

84. Ans: Rb

Sol: Rb produces red violet flame in flame test.

85. Ans: F

Sol: Oxidation state of fluorine in all its compounds is –1.

86. Ans: H_3PO_3

Sol: H_3PO_3 is a dibasic acid.

87. Ans: 1 and 5

Sol: Mn exhibits +7 oxidation state.
Zn exhibits +2 oxidation state.

88. Ans: +7

Sol: Maximum oxidation state of +7 is exhibited by Np and Pu

89. Ans: –130

Sol: $H - H + O = O \rightarrow H-O-O-H$

$\Delta H = 438 + 498 - (2 \times 464 + 138)$

$= 936 - 1066$

$= -130 \text{ kJ mol}^{-1}$

90. Ans: $q_{rev} + w_{rev}$

Sol: $\Delta U = q + w$

ΔU is a state function.

91. Ans: CH_3COONH_4

Sol: CH_3COONH_4 is a salt of weak acid and weak base.

92. Ans: 1.0×10^{-5}

Sol: $K_3 = \frac{1}{\sqrt{K_1}} \times K_2 = 1 \times 10^{-5}$

93. Ans: 60 g

Sol: $\left[\frac{P^0 - P}{P^0}\right] \times 100 = \frac{w_2}{M_2} \times \frac{M_1}{w_1} \times 100 = 10$

$\frac{w_2}{60} \times \frac{18}{180} \times 100 = 10$

$w_2 = 60$ g

94. Ans: 0.1428 M

Sol: 500 ml 0.2 M is diluted to 700 mL

$\therefore$ Final molarity $= \frac{0.2}{1.4} = 0.1428$

95. Ans: ClO^-

Sol: In ClO^-, chlorine is in +1 oxidation state, which is an intermediate one and hence an increase or decrease in oxidation state is possible.

96. Ans: 2 : 3 : 6

Sol: Mole ratio of Al, Cu and Na deposited by 1 Faraday $= \frac{1}{3} : \frac{1}{2} : 1 = 2 : 3 : 6$

97. Ans: 2×0.693

Sol: For first order reaction,

Rate $= k A_0' = \frac{0.693}{t_{1/2}} . A_0$

For zero order reaction,

Rate $= k A_0^0 = \frac{A_0}{2t_{1/2}}$

Ratio in rates $= 2 \times 0.693$

98. Ans: -110 kJ mol^{-1}

Sol: $\Delta H = Ea_f - Ea_r = -110 \text{ kJ mol}^{-1}$

99. Ans: Gas and liquid

Sol: Soap lather is a gas in liquid system.

100. Ans: ZSM–5

Sol: ZSM–5 (type of zeolite) used to convert alcohols directly into gasoline.

101. Ans: 2 and 4

Sol: $[Co(NH_3)_6]\,[Cr(CN)_6]$ is an ionic compound. Both cation and anion carry 3 unit charges. It exhibits co–ordination isomerism.

102. Ans: Thiocyanato

Sol: Thiocyanate (CNS^-) is an ambidentate ligand.

103. Ans: to decompose Na_2S and NaCN, if present

Sol: Na_2S and NaCN are decomposed by nitric acid to volatile H_2S and HCN.

104. Ans: 1, 3–butadiene

Sol: $CH_2 = CH - CH = CH_2$ (1, 3–butadiene)

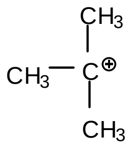
105. Ans: (III) > (IV) > (II) > (I)

Sol: Order of decreasing acidity is
ethyne > propyne > ethene > ethane

106. Ans: 2–Butene

Sol: 2–butene is a symmetrical alkene.

107. Ans: tert–butyl

Sol: 

t-butyl carbocation
It can have 9 hyperconjugative structures.

108. Ans: $(CH_3)_2CH - COOH$

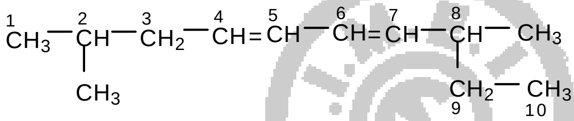
Sol: Presence of electron donating groups decreases the acid strength of carboxylic acids.

109. Ans: Geometrical isomerism

Sol: Geometrical isomerism is due to restricted bond rotation.

110. Ans: 2, 8–Dimethyl 4, 6–decadiene

Sol:



111. Ans: Aromatic electrophilic substitution

Sol: Chlorination of benzene in presence of halogen carrier is an example of aromatic electrophilic substitution.

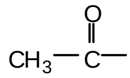
112. Ans: 1 and 4 only

Sol: Aryl halides are less reactive towards nucleophilic substitution because of the partial double bond character of carbon–halogen bonds. It is also partly due to repulsion between the electron cloud of the benzene ring and the nucleophile.

113. Ans: 2, 3 and 5 only

Sol: Aldol condensation is not given by aldehydes and ketones which do not contain α–hydrogen atoms.

114. Ans: 1, 2 and 4

Sol: Compounds containing  or $CH_3 - CHOH -$ group give positive iodoform test.

115. Ans: aniline

Sol: Since chlorobenzene does not undergo nucleophilic substitution reaction readily with potassium phthalimide, aniline cannot be prepared by Gabriel's phthalimide synthesis.

116. Ans: Aniline

Sol: Aniline is less basic than other given amines because of the delocalisation of the lone pair of electrons on nitrogen with the benzene ring.

117. Ans: Uracil

Sol: Uracil is present in RNA, not in DNA.

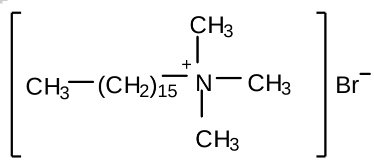
118. Ans: β–D–galactose and β–D–glucose

Sol: Lactose is composed of β–D–galactose and β–D–glucose

119. Ans: Sucrolose

Sol: Sucrolose is a trichloroderivative of sucrose.

120. Ans: Cationic detergent

Sol: 

cetyl trimethyl ammonium bromide