FOR 2019 ASPIRANTS **MEDICAL EDT - 8** **DATE: 11 -04- 2019**

SOLUTIONS

1. (1)

2. (4)

Bohr radius $r = \frac{\in_o n^2h^2}{\pi zme^2} \therefore r \alpha n^2$

3. (4)

$\frac{1}{\lambda} = RZ^2\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

For di-ionized lithium the value of z is maximum.

4. (4)

5. (3)

Ionization potential = $z^2 \times 13.6$ volt = $(2)^2 \times 13.6 = 54.4V$

6. (1)

(Rydberg constant R = $1.097 \times 10^7 m$)

Total energy = PE + KE, where PE = - 2KE

Total energy = -2KE + KE = - KE

KE = - Total energy = 13.6 eV

7. (4)

$2E - E = \frac{hc}{\lambda} = E = \frac{hc}{\lambda}$

$\frac{4E}{3} - E = \frac{hc}{\lambda^1} \Rightarrow \frac{E}{3} = \frac{hc}{\lambda'}$

$\frac{\lambda^1}{\lambda} = 3, \lambda^1 = 3\lambda$

8. (2)

$En = \frac{13.6}{n^2} \times Z^2$ for first excited state n = 2 and for Li^{++}

Z = 3 $E = \frac{13.6}{4} \times 9 = 30.6eV$

9. (3)

$\sqrt{f} \propto (Z-1)$

or $f \propto (Z-1)^2$

$\therefore \quad \lambda \propto \frac{hc}{(Z-1)^2}$

$\frac{\lambda_1}{\lambda_2} = \frac{(Z_2-1)^2}{(Z_1-1)^2}$

$\frac{\lambda_1}{\lambda_2} = \left(\frac{28}{42}\right)^2$

$\frac{\lambda_1}{\lambda_2} = \left(\frac{2}{3}\right)^2$

$\frac{\lambda_1}{\lambda_2} = \frac{4}{9}$

$\lambda_2 = \frac{9}{4}\lambda_1$

10. (4)

$$a = \frac{v^2}{R} \alpha \frac{\left(\frac{Z}{n}\right)^2}{\frac{n^2}{Z}} \propto \frac{Z^3}{n^4}$$

$$a \propto \frac{1}{n^4}$$

$$\frac{a_m}{a_L} = \frac{(2)^4}{(3)^4} = \frac{16}{81}$$

$\therefore$ 16 : 81

11. (1)

$R = R_o A^{1/3}$

Surface area $= \pi R^2$

$= \pi\left(R_o A^{1/3}\right)^2$

$= \pi R_0^2 A^{2/3}$

12. (2)

One fission = 200 MeV

$= 200 \times 10^6 \times 1.6 \times 10^{-19}$

Power $= 10^3$ J/s

Fission/sec = X

$X \times 3.2 \times 10^{-11} = 10^3$

$X = 0.3125 \times 10^{14}$

$= 3.125 \times 10^{13}$

13. (3)

$${}^{4}_{2}\text{He} = \frac{28}{4} = 7\text{MeV}, \quad {}^{7}_{37}\text{Li} = \frac{52}{7} = 7.4\text{MeV}, \; {}^{12}_{6}\text{C} = \frac{90}{12} = 7.5\text{MeV}, \; {}^{14}_{7}\text{N} = \frac{98}{14} = 7\text{MeV}$$

14. (3)

$$N_1 = N_o e^{-\lambda t}$$

$$= N_o e^{-1} = \frac{N_o}{e}$$

15. (3)

$A = A_0 e^{-\lambda t}$

$\ln A = \ln A_0 - \lambda t$

$\therefore$ Answer is (3) as it is a linear relation between ln A and t.

16. (3)

$$N = N_0\left(1 - e^{-\lambda t}\right)$$

17. (2)

$T_{1/2}$ = 2 hours

To work safely the number of reacting molecules must decrease by 64 times

$$N = N_0\left(\frac{1}{2}\right)^n$$

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^n$$

$$\frac{1}{64} = \left(\frac{1}{2}\right)^n$$

$n = 6$

$t = (6)(2 \text{ hrs}) = 12 \text{ hrs}$

18. (3)

Energy of daughter nucleus = 0.2 MeV

$$0.2\ \text{MeV} = \frac{m_\alpha}{m_\alpha + m_D} Q$$

$$0.2\ \text{MeV} = \frac{4}{220} Q$$

$$\frac{0.2 \times 220}{4} MeV = Q$$

$$\frac{2 \times 55}{10} = Q$$

$Q = 11$ MeV

19. (3)

After two half lives $\frac{1}{4}$ th fraction of nuclei will remain undecayed or $\frac{3}{4}$ th will decay.

Hence the probability that a nucleus decays in two half lives is $\frac{3}{4}$.

20. Correct option is (1)

$2R_A = R_B$

$2\lambda_1 N_1 = \lambda_2 N_2$ ....(i)

Radio-activity is same after say time t

$\lambda_1 N_1 e^{-\lambda_1 t} = \lambda_2 N_2 e^{-\lambda_2 t}$ ....(ii)

Dividing (i) by (ii)

$2e^{\lambda_1 t} = e^{\lambda_2 t}$

$2 = e^{(\lambda_2 - \lambda_1)t}$

Taking ln on both sides

$0.693 = (\lambda_2 - \lambda_1)t$

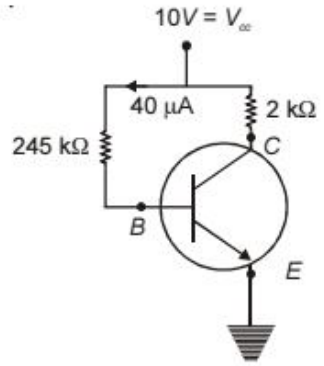
$$1 = \left(\frac{1}{T_2} - \frac{1}{T_1}\right) t$$

$$\frac{T_2 T_1}{T_1 - T_2} = t$$

21. (2)

22. (4)

23. (2)



Applying Kirchoff Rule

$10 - 245 \times 40 \times 10^{-3} = V_{BE}$

$V_{BE} = 0.2$ V

24. (1)

At room temperature some electrons moves from *VB* to *CB*

25. (4)

26. (1)

$n_i^2 = n_e n_h$

$(10^{19})^2 = n_e \times 10^{21}$

$n_e = 10^{17} / m^3$

27. (3)

In forward biasing, both electrons and holes move towards junction.

28. (2)

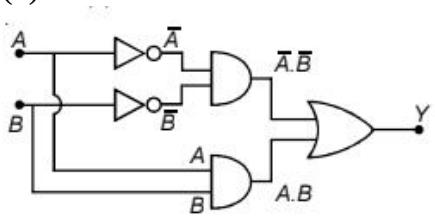
In forward bias $V_P > V_N$

29. (2) Upper diode is in reverse bias, no current in this branch lower diode is in forward bias.

$$i = \frac{5}{20+30} = \frac{5}{50} A$$

30. (4)

31. (3)

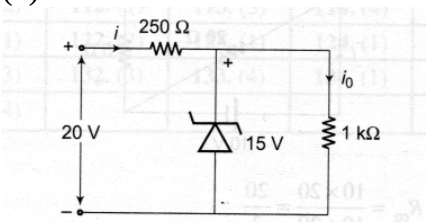


$Y = \bar{A}.\bar{B} + A.B$

32. (4)

$$R = \frac{6-2}{10 \times 10^{-3}} = 400\,\Omega$$

33. (2)



Voltage across zener diode remains constant

$$i_0 = \frac{15}{10^3} = 15 \text{ mA}$$

$$i = \frac{20-15}{250} = \frac{1}{50} \text{ A} = 20 \text{ mA}$$

$$i_{zener} = i - i_0 = 5 \text{ mA}$$

34. (2)

$\beta = 50$

$\frac{I_C}{I_B} = 50$, $I_B = 40\ \mu A$

$I_C = 50 \times 40 \times 10^{-6}$

$= 2 \times 10^{-3}$ A

$V_{CE} = V_{CC} - I_C R_C$

$= 10 - 2 \times 10^{-3} \times 2 \times 10^3 = 6\ V$

35. (2) $\Delta I_C R_L = 10 - 5 = 5$

$\Delta I_C \times 10^3 = 5 \Rightarrow \Delta I_C = 5 \times 10^{-3}$ A

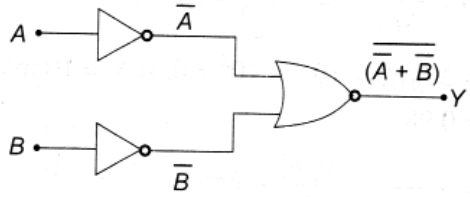
$$\Delta I_B = \frac{\Delta I_C}{\beta} = \frac{5\times10^{-3}}{100} = 5\times10^{-5} \text{ A}$$

$$R_{BE} = \frac{v_i}{\Delta I_B} = \frac{10}{5\times10^{-5}} = 2\times10^5\ \Omega$$

$= 200 \times 10^3\ \Omega$

36. (3)

37. (1)



A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$	$\overline{\overline{A}+\overline{B}}$
0	0	1	1	1	0
0	1	1	0	1	0
1	0	0	1	1	0
1	1	0	0	0	1

38. (4)

39. (3)

Height of TV tower $h = 240$ m

Distance $= \sqrt{2Rh} = \sqrt{2\times6.4\times10^6\times240} = 55425$ km $= 55.425$ km

40. (2)

$A = 2\pi Rh$

Take $R = 6.4 \times 10^6$ and $h = 1000$

41. (3)

Fact

42. (4)

Fact

43. (2)

Frequency of AM wave = Frequency of carrier wave

44. (2)

$\because\ d = \sqrt{2RH_T} + \sqrt{2RH_R} = 45536$ m $= 45.536$ km

45. (1)

Range$(r) = \sqrt{2Rh}$

$r_2 = \sqrt{2R2h}$

$r_2 = \sqrt{2}r$

46) $CH_3-CH_2-COOH \xrightarrow[red\ P]{Cl_2} CH_3-\underset{Cl}{CH}-COOH \xrightarrow{alc.\ KOH} CH_2=CH-COOH$

47) The given compound is Aspirin and is used as an analgesic

48) Picric acid is 2,4,6-Trinitrophenol

49) Carbylamine reaction

50) Basic strength of amines: $2^\circ > 1^\circ > NH_3$

51) 

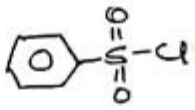
52) $CH_3-\overset{O}{\overset{\|}{C}}-\underset{CH_3}{CH}-CH_3$: IUPAC name: 3-methyl butan-2-one

53) $LiAlH_4$ is a selective reducing agent and will reduce the carboxylic acid into primary alcohol.

54) The general formula for an open chain carboxylic acid is $C_nH_{2n}O_2$

55) $CH_3CH_2NC \xrightarrow[H^+]{H_2O} CH_3CH_2\overset{+}{N}H_3 + H-\overset{O}{\overset{\|}{C}}-OH$

56) O-nitro benzoic acid will be the strongest due to ortho effect. p-nitro benzoic acid is stronger than m-nitrobenzoic acid because of -R effect of nitro group in the para position.

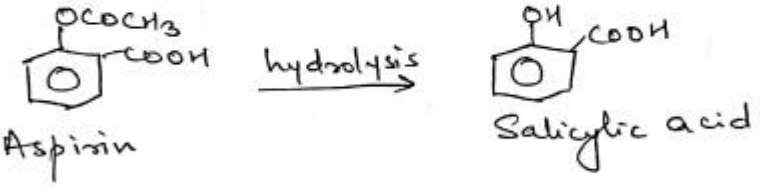
57) Hinsberg reagent is 

58) Benzylamine is the strongest base among the given as its lone pair on Nitrogen is not delocalised

59) No reaction

60) Clemmensen's reduction

61) Cannizaro reaction

62) 

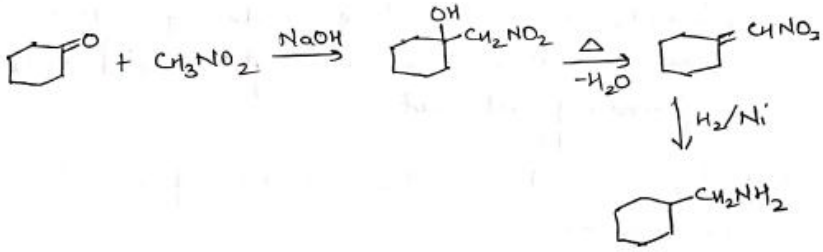
Aspirin Salicylic acid

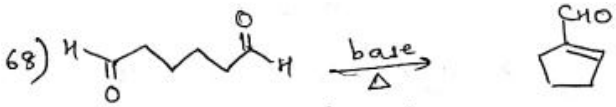
63) Luminal, is used as a sedative.

64) Dettol is chloroxylenol

65) Bithional has antiseptic properties.

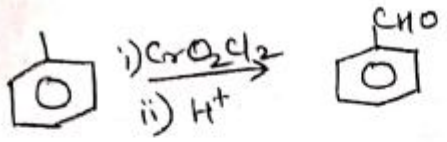
66) Lindane is used as an insecticide

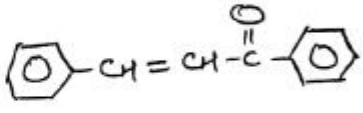
67) 

68) 

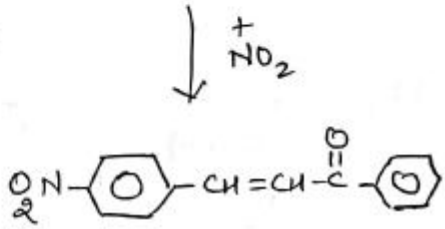
(Aldol Condensation)

69) Haloform test is given by compound having $CH_3-\overset{O}{\overset{\|}{C}}-$ group and $CH_3-\underset{OH}{CH}-$ group

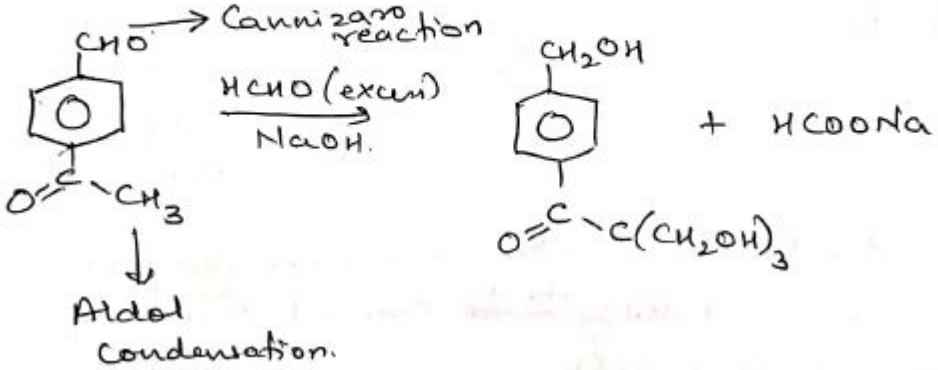
70)  Etard oxidation

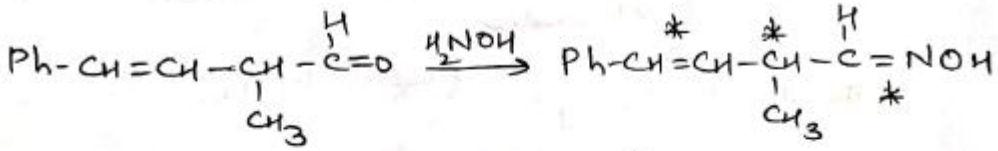
71) $PhCHO + PhCOCH_3 \xrightarrow[\Delta]{\bar{O}H}$ 

Aldol condensation



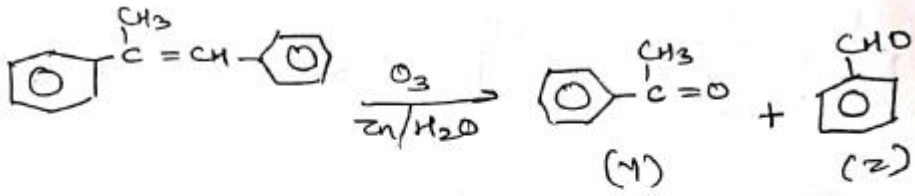
72) The reaction between two optically pure substances would result in a single stereoisomer.

73) 

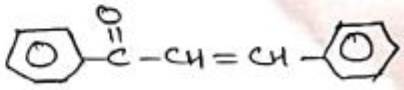
74) 

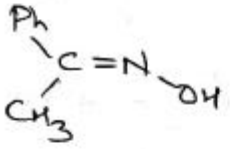
(3 stereocentres)

75) Aldehydes are more reactive than ketones in nucleophilic addition. Electron withdrawing groups increase the reactivity towards the reaction.

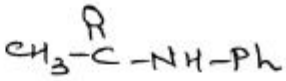
76) 

Aldol reaction $\downarrow \bar{O}H/\Delta$



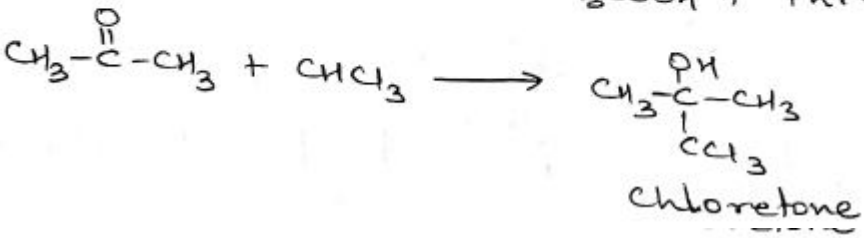
77) 

$\xrightarrow{H^+}$ Beckmann rearrangement



$\downarrow$ Hydrolysis

$CH_3COOH + PhNH_2$

78) 

79) $2C_6H_5CHO \xrightarrow{NaOH}$ Cannizaro reaction

$C_6H_5CHO + HCHO \xrightarrow{NaOH}$ Crossed Cannizaro

$2\text{-}C_6H_5CHO \xrightarrow[\text{alcoholic}]{KCN}$ Benzoin condensation

$C_6H_5CHO + (CH_3CO)_2O \xrightarrow[\Delta]{CH_3COONa}$ Perkin reaction

80) Tollen's test is given by aldehydes, hemiacetals, α-hydroxy ketones and ~~term~~ terminal alkynes.

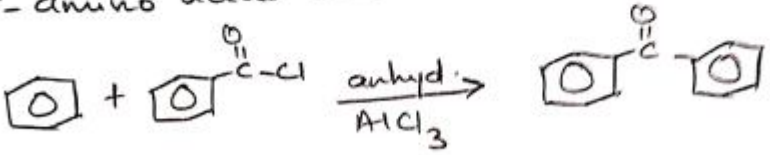
81) 2° amine will be the strongest base.
-I effect decreases the basic strength

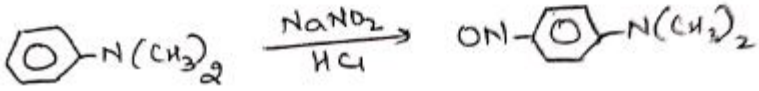
82) Kolbe's reaction

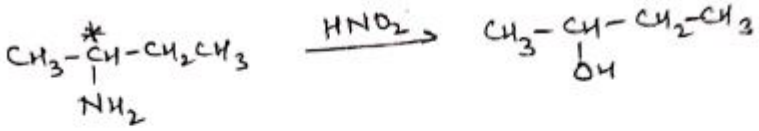
83) C_6H_5 group is more hydrophobic than C_2H_5 group

84) $(CH_3)_2CHMgBr + O=C=O \xrightarrow{\text{hydrolysis}} (CH_3)_2CH-COOH + Mg(Br)(OH)$

85) α-amino acids can exist as zwitter ions

86) 

87) 

88) 

89) Oxidation of amines yield nitro compounds.

90)

91. Organisms and population (4) page no. 225 (iv) suepend (E)
92. Ecosystem (3) page no. 243,244, 14.3 decomposition (E)
93. Biodiversity and conservation (2) page no. 263, 15.1.4 (E)
94. Environmental issue (1) Pg No. 271 Fig 16.1 (M)
95. 1
96. Ecosystem (2) Pg no. 243, 2nd paragraph (E)
97. Biodiversity and conservation (1) Pg no. 261, 15.1.2 (E)
98. Environmental issue (2) Pg no. 271, fig 16.1 (E)
99. Organisms and population (2) Pg no. 228, 1st paragraph (E)
100. 2
101. Biodiversity and conservation (4) Factual question (M)
102. Environmental issue (1) Pg no. 274, fig. 16.3 (M)
103. Organisms and populations (3) Page no. 231, (ii) Logistic (E)
104. Ecosystem (4) factual question (M)

105. Biodiversity and conservation (3) Pg no. 266 – 15.2.2 (E)
106. Environmental issue (2) pg no. 276, Figure 16.5 (M)
107. Organisms and population (3), Page no. 227, Fig 13.4 (M)
108. Ecosystem (4) Page no. 245, 14.4 (E)
109. Biodiversity and conservation (1) Pg no. 265, 1.5.2.1 (E)
110. Environmental issues (4), Pg no. 281, fig 16.6 (E)
111. Organisms and population (2) Pg no. 237 , (V)
112. Ecosystem (3) Page no. 247, (M) 10% law
113. Biodiversity and conservation (1), Page no. 262, fig 15.2 (E)
114. Environmental issue (2) Factual question (M)
115. Organisms and population (2) Pg No. 236, 4th paragraph (E)
116. Ecosystem (3) Pg No. 243, 1st paragraph . (E)
117. Biodiversity an conservation (3) Page no. 267 1st paragraph (E)
118. 1
119. Organisms and populations (3) Factual question (3) (M)
120. Ecosystem (1) Pg No. 251, (M)
121. Biodiversity and conservation (2) Pg No. 267 last paragraph (E)
122. Environmental issues (1) Pg no. 274 and 275 application based (D)
123. Organisms and population (4) Pg no. 235 2nd paragraph (E)
124. Organisms and population (3) Pg no. 235,2nd paragraph (E)
125. Biodiversity and conservation (2) Page no, 267 1st paragraph (M)
126. Environmental issue (3) Pg No. 285 (E) last paragraph
127. Organisms and population (3) Pg No. 233 (E) last paragraph
128. Ecosystem (1) Pg No. 243, 1st paragraph and 2nd paragraph (M)
129. Biodiversity and conservation (3) Pg No. 265 (iii) alien species invasions (E)
130. Environmental issue (4) Pg No. 272 2nd paragraph (E)
131. Organisms and population (1) (M) Page no. 233 to 238 examples of population inter actions
132. Ecosystem (2) page no. 243, 245 (M)
133. Biodiversity and conservation (1) Pg No. 263, 15.1.4 (E)
134. Environmental issue (4) factual question (M)
135. Organisms and population (4) Pg no. 236, (iv)