1. (d)

Sol. Path difference $\Delta = \frac{\lambda}{2\pi} \times \phi$

$\Rightarrow \frac{2\pi}{\lambda} \times 11\lambda = 22\pi$ i.e. constructive interference obtained at the same point So, resultant intensity

$I_R = (\sqrt{I_1} + \sqrt{I_2})^2 = (\sqrt{9I} + \sqrt{4I})^2 = 25I$.

2. (b)

Sol. By using

$$\frac{a_1}{a_2} = \left(\frac{\sqrt{\frac{I_{max}}{I_{min}}} + 1}{\sqrt{\frac{I_{max}}{I_{min}}} - 1}\right) = \left(\frac{\sqrt{\frac{144}{81}} + 1}{\sqrt{\frac{144}{81}} - 1}\right) = \left(\frac{\frac{12}{9} + 1}{\frac{12}{5} - 1}\right) = \frac{7}{1}$$

3. (d)

Sol. Coherent sources produce light of same frequency and of constant phase difference

4. (c)

Sol. Let $I_1 = a^2$, $I_2 = b^2$

$$\therefore \frac{I_{max}}{I_{min}} = \frac{(a+b)^2}{(a-b)^2} \text{ and } \frac{I'_{max}}{I'_{min}} = \frac{\left(\frac{a+b}{\sqrt{2}}\right)^2}{\left(\frac{a-b}{\sqrt{2}}\right)^2}$$

Comparing them, we get $I'_{max} < I_{max}$; $I'_{min} > I_{min}$

Therefore the answer is (C).

5. (a)

Sol. It is given $\frac{a_1}{a_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\beta}$

$I_{max} = (a_1 + a_2)^2$

$I_{min} = (a_1 - a_2)^2$

$$\frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{(a_1 + a_2)^2 - (a_1 - a_2)^2}{(a_1 + a_2)^2 + (a_1 - a_2)^2} = \frac{2a_1a_2}{a_1^2 + a_2^2} = \frac{2\left(\frac{a_1}{a_1}\right)}{\left(\frac{a_1}{a_1}\right)^2 + 1}$$

$= \frac{2\sqrt{\beta}}{\beta+1}$

6. (b)

Sol. $I = \cos^2 30$

$\frac{I}{I_0} = \frac{3}{8} = .375 \quad \Rightarrow \; 37.5\%$

7. (a)

Sol. $y_0 = \frac{D}{d}(\mu - 1)\,t$ & $\beta = \frac{D\lambda}{d}$

$\therefore\; y_0 = \frac{\beta}{\lambda}(\mu - 1)\,t$

8. (a)

Sol. Phase difference between two successive fringes is 2π, the phase difference between two points separated by distance equal to one quarter of the distance between two successive fringes is equal to

$\phi = 2\pi\left(\frac{1}{4}\right) = \frac{\pi}{2}$

$\therefore\; I = I_{max}\cos^2\frac{\pi/2}{2}$

$\therefore\; \frac{I}{I_{max}} = 2.$

9. (b)

Sol. $\frac{3D \times 5000\,\mathring{A}}{d} = \frac{4D\lambda}{d}$

$\Rightarrow\; \lambda = 3750\ \mathring{A}$

10. (c)

Sol. $\Delta x = (2n - 1)\frac{\lambda}{2}$ [for minima]

$1.5 \times 10^{-6} = (2n - 1) \times \frac{6000 \times 10^{-10}}{2}$

$\therefore\; n = 3$

11. (a)

Sol. $\frac{10D\lambda}{\mu d} = \frac{11}{2}\frac{D\lambda}{d}$

$\therefore \mu = \frac{20}{11} = 1.8$

12. (b)

$\frac{I_{max}}{I_{min}} = \frac{4}{1} = \left[\frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}\right]^2$

$\therefore 2 = \frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}$

$\therefore \sqrt{\frac{I_1}{I_2}} = 3 = \frac{A_1}{A_2}$

13. (b)

Sol. d = 2λ

Path difference Δ = d sinθ = 2λ sinθ

Maximum path difference $\Delta_{max} = 2\lambda$

So path difference for maxima

$\boxed{2\lambda, \lambda, 0, \lambda, 2\lambda}$

14. (d)

Sol. For good visibility condition is

$I_{min} = 0 \Rightarrow \boxed{I_1 = I_2}$

15. (b)

Sol. Width of fringe = β

if frequency is doubled then, wavelength becomes halved, because velocity of light in air remain same

$\beta \propto \lambda \Rightarrow \frac{\beta'}{\beta} = \frac{\lambda'}{\lambda} = \frac{\lambda/2}{\lambda} = \frac{1}{2}$ $\boxed{\beta' = \frac{\beta}{2}}$

16. (b)

Sol. For I^{st} minima;

$\sin\theta = \frac{\lambda}{a} = \frac{1}{2} \Rightarrow \theta = 30^0$

$\therefore$ Angular width of central maxima = 2 × 30 = 60

17. (b)

Sol. $\frac{3D\lambda}{2a} - \frac{D\lambda}{a} = \frac{D\lambda}{2a} = \frac{2\times4000\times10^{-10}}{2\times0.5\times10^{-3}}$

$= 0.8 \times 10^{-3}$ m = 0.8 mm

18. (d)

Sol. $\mu = \tan\theta_p \Rightarrow \mu = \tan60^o = \sqrt{3}$

$\Rightarrow \frac{1}{\sin c} = \sqrt{3}$; $c = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

19. (c)

Sol. Intensity of polarized light from 1st polarizer

$= \frac{100}{2} = 50$

$I = 50\cos^2 60^0 = \frac{50}{4} = 12.5\%$

20. (c)

Sol. $\mu = \tan i_p \quad \therefore \frac{c}{v} = \tan i_p$

$\therefore v = \frac{3\times10^8}{\sqrt{3}} = \sqrt{3} \times 10^8$ m/s

21. (a)

Sol. $\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} \quad \Rightarrow \frac{R_{max}}{R_{min}} = \frac{a_1 + a_2}{a_1 - a_2}$

22. (c)

Sol. They will remain spherical, with the same curvature but sing of curvature reversed

23. (d)

Sol. $\mu = \frac{c}{v} = \frac{v\lambda_v}{v\lambda_g}$

$\therefore \lambda_g = \frac{\lambda_v}{\mu} = \frac{6000}{1.5} = 4000 \mathring{A}$

24. (c)

Sol. Width ratio, $\frac{\beta_1}{\beta_2} = \frac{I_1}{I_2} = \frac{81}{1}$

$\therefore$ Amplitude ratio,

$\frac{A_1}{A_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\frac{81}{1}} = 9:1$

25. (c)

Sol. Fringe width, $\beta = \frac{\lambda D}{d}$

Also, $\lambda = \frac{h}{mv}$

Here h is Planck's constant. This wavelength is inversely proportional to the velocity. Hence, the fringe width increases with decreases in electron speed

26. (b)

Sol. the colours of a thin oil film are due to interference

27. (c)

Sol. Farther from the centre than the first maxima for green light

28. (d)

Sol. When a bright fringe is formed opposite to one of the slits, $x = \frac{d}{2}$

Path difference $= \frac{xd}{D} = \frac{d}{2} \times \frac{d}{D} = \frac{d^2}{2D}$

If it is n^{th} order bright fringe

Path difference $n\lambda = \frac{d^2}{2D}$ or $n = \frac{d^2}{2D\lambda}$

29. (b)

Sol. here $a = 2mm = 2 \times 10^{-3} m$

$\lambda = 500 nm = 500 \times 10^{-9} m = 5 \times 10^{-7} m$

D = 1m

The distance between the first minima on either side on a screen is

$=\frac{2\lambda D}{a}=\frac{2\times5\times10^{-7}\times1}{2\times10^{-3}}$

$=5\times10^{-4}m=0.5\times10^{-3}m=0.5mm$

30. (c)

Sol. Conservation of energy holds good and energy is redistributed

31. (b)

Sol. For destructive interference the path difference should be an odd multiple of $\frac{\lambda}{2}$

32. (b)

Sol. Fresnel distance $z_F=\frac{a^2}{\lambda}=\frac{(4\times10^{-3})^2}{500\times10^{-9}}$

$=\frac{4\times4\times10^{-6}}{5\times10^{-7}}$

$\therefore z_F=32\,m$

33. (b)

Sol. Width of central maximum in diffraction patern due to single slit $=\frac{2\lambda D}{a}$ where λ is the wavelength D is the distance between screen and slit and a is the slit width.

As the slit width a increases width of central maximum decrease i.e. central maximum becomes sharper or narrower. As same energy is distributed over a smaller area therefore central maximum becomes brighter.

34. (b)

Sol. As $\lambda_{blue}<\lambda_{red,}$ and width of diffraction bands is directly proportional to λ, therefore diffraction bands become narrower and crowded.

35. (a)

Sol. An optically active compound rotates the plane of polarized light.

36. (d)

Sol. Using $\tan i_p=\mu=1.5$

Or $i_p=\tan^{-1}(1.5)=56.3^o$

37. (b)

Sol. For dark fringe path difference $\Delta = (2n-1)\frac{\lambda}{2}$; here n = 3 and $\lambda = 6000 \times 10^{-10}$ m

So $\Delta = (2\times 3 - 1)\times \frac{6\times 10^{-7}}{2} = 15\times 10^{-7}\,m = 1.5\,microns.$

38. (c)

Sol. Fringe width $\beta = \frac{\lambda D}{d}$

Where λ is the wavelength of light D is distance between slits and the screen d is distance between the two slits. As D and d remain the same $\beta \propto \lambda$

Or $\frac{\beta'}{\beta} = \frac{\lambda'}{\lambda}$ or $\beta' = \frac{\lambda' B}{\lambda}$

Substituting the given values, we get

$\beta' = \frac{4000\text{Å}\times 3\text{mm}}{6000\text{Å}} = 2\,\text{mm}$

39. (b)

Sol. Here, Critical angle, $i_c = \sin^{-1}\left(\frac{3}{5}\right) \therefore \sin i_c = \frac{3}{5}$

As $\mu = \frac{1}{\sin i_c} = \frac{5}{3}$

According to Brewster's law

$\tan i_p = \mu$

Where i_p is the polarizing angle

$\therefore \tan i_p = \frac{5}{3} \Rightarrow i_p \tan^{-1}\left(\frac{5}{3}\right)$

40. (b)

Sol. As reflected light is completely polarized, therefore,

$i_p = 60^\circ$

$\mu = \tan i_p = \tan 60^\circ = \sqrt{3}$

As $\mu = \frac{c}{v} \therefore v = \frac{c}{\mu} = \frac{3\times 10^8}{\sqrt{3}} = \sqrt{3}\times 10^8\ \text{ms}^{-1}$

41. (c)

Sol. The refractive index of water

$$\mu = \frac{\text{speed of light in air}}{\text{speed of light in water}} = \frac{3\times10^8}{2.2\times10^8} = 1.36a$$

From Brewsters law,

$\tan i_p = \mu = 1.363$

$\therefore i_p = \tan^{-1}(1.36) = 53.74^\circ$

42. (c)

Sol. Using $\tan i_p = \sqrt{3}$

$\therefore i_p = \tan^{-1}(\sqrt{3}) = 60^\circ$

As $r = 90^\circ - i_p \quad \therefore r = 90^\circ - 60^\circ = 30^\circ$

43. (d)

Sol. The intensity of the light after passing through the polariser

$I = I_0 \cos^2\phi = I_0 \cos^2 45^\circ$

$= I_0\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{I}{2}\times\frac{1}{2} = \frac{I}{4} \quad \left(\because I_0 = \frac{1}{2}\right)$

44. (c)

Sol. The light from two slits of : The light from two slits of Young's double slit experiment is of different colours/ wavelengths/ frequencies. Hence there shall be no interference fringes

45. (a)

Sol. For constructive interference,

$x = n\lambda\frac{D}{d}$

Here $n=4, d=0.28\times10^{-3}m$ and $D=1.4m$

$\therefore \lambda = \frac{xd}{nD} = \frac{1.2\times10^{-2}\times0.28\times10^{-3}}{4\times1.4} = 6\times10^{-7}m$

46. (b)

Sol. resulting intensity

$I_R = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\theta$

If path difference $=\lambda$ phase difference $=2\pi$

$\therefore I_R = I + I + 2\sqrt{I\times I}\cos 2\pi \quad (\because I_1 = I_2 = I)$

= 4I = M .... (i)

If path difference $\frac{\lambda}{3}$, phase difference $\phi = \frac{2\pi}{3} rad$

$$I_R' = I + I + 2\sqrt{I \times I}\cos\frac{2\pi}{3}$$

$$= 2I + 2I\left(-\frac{1}{2}\right) = I = \frac{M}{4} \quad (u\sin g(i))$$

47. (c)

Sol. The linear separation between n bright fringes in an interference pattern on the screen is $x_n = \frac{n\lambda D}{d}$?

As $x_n << D$, the angular separation between n bright fringes

$$\theta_n = \frac{x_n}{D} = \frac{n\lambda}{d}$$

For 10 bright fringes

$$\theta_{10} = \frac{10\lambda}{d}$$

The angular width of the central maximum in the diffraction pattern due to slit of width a is

$$2\theta_1 = \frac{2\lambda}{a}$$

Now $\frac{10\lambda}{d} < \frac{2\lambda}{a}$ or $a \le \frac{d}{5} = \frac{1}{5}$ mm $= 0.2 mm$

48. (b)

Sol. Brewster's law is given by

$$\mu = \tan i_\beta$$

49. (b)

Sol. Here, $\beta_1 = 2.4 \times 10^{-4} m$

$$\lambda_1 = 6400\,\mathring{A}, \lambda_2 = 4000\,\mathring{A}$$

$$\because \frac{\beta_2}{\beta_1} = \frac{\lambda_2}{\lambda_1} = \frac{4000}{6400} = \frac{5}{8}$$

Or $\beta_2 = \frac{5}{8} \times \beta_1$

$$= \frac{5}{8} \times 2.4 \times 10^{-4} = 1.5 \times 10^{-4} m$$

Decreases in fringe width

$$\Delta\beta = \beta_1 - \beta_2 = (2.4 - 1.5) \times 10^{-4} = 0.9 \times 10^{-4} m$$

50. (a)

Sol. Since a fringe of width β is formed on the screen at distance D from the slits, so the angular fringe width

$$\theta = \frac{\beta}{D} = \frac{D\lambda/d}{D} = \frac{\lambda}{d} \quad [\because \beta = \frac{D\lambda}{d}]$$

$$\Rightarrow d = \frac{\lambda}{\theta}$$

If the wavelength in water be λ' and the angular fringe width be θ' then

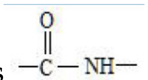
$$d = \frac{\lambda'}{\theta'} \quad \text{or} \quad \frac{\lambda}{\theta} = \frac{\lambda'}{\theta'}$$

Or $\theta' = \frac{\lambda'}{\lambda}.\theta = \frac{\lambda/\mu}{\lambda}.\theta \quad [\because \lambda' \frac{\lambda}{\mu}]$

$$= \frac{0.2^o}{4/3} = 0.15^o$$

CHEMISTRY

SECTION-A

51. (a) Proteins and peptides are linked by peptide linkages 

52. (a)

Glucose is found to exist in two different crystalline forms which are named as α and β. The α-form of glucose (m.p. 419 K) is obtained by crystallisation from concentrated solution of glucose at 303 K while the β-form (m.p. 423 K) is obtained by crystallisation from hot and saturated aqueous solution at 371 K.

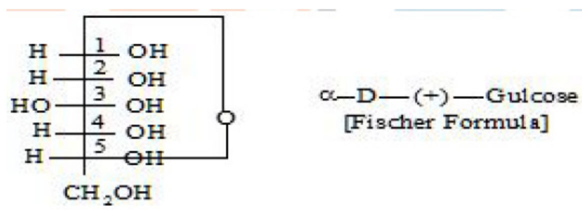
53. (a) The sequence in which the α – amino acids are linked to one another in a protein molecule is called the primary structure

54. (d) Red P + HI is a reducing agent

55. (a) Natural glucose is dextrorotatory and thus, glucose also known as dextrose. α – D – (+) – Glucose

[Fischer formule]

56. (c)



57. (b) Fructose has the molecular formula C6H12O6. It belongs to D – series and laevorotatory compound. It also exists in two cyclic forms which are obtained by the addition of –OH at C – 5 to the > C = 0 group. The ring thus formed is a five membered ring thus formed is a five membered ring and is named as furanose with anology to the compound furan. Furan is a five membered cyclic compound with one oxygen and four carbon atoms.

58. (a) The sequence in which the α – amino acids are linked to one another in a protein molecule is called the primary structure.

59. (a) Sucrose donot have free –CHO or CO group, hence it doesn't undergo mutarotation.

60. (b) The secondary structure of a protein refers to the shape in which the long peptide linkage present in protein, these are α – helix and β – conformation. The α – helix always has a right handed arrangement. In β – conformation all peptide chains are stretched out to nearly maximum extension and then laid side by side and held together by intermolecular hydrogen bonds. The structure resembles the pleated folds of drapery and therefore is known as β – pleated sheat

61. (c) Conceptual(Glucose have –CHO Functional group& Fructose have –CO Fuctional group)

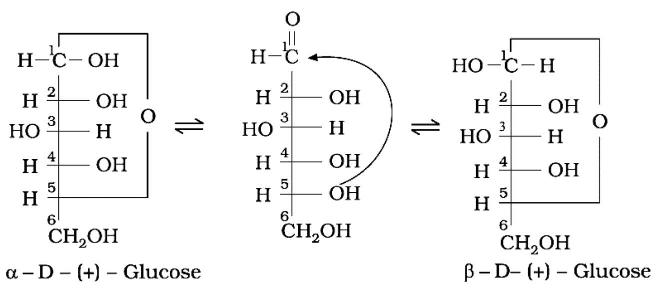
62. (d) A nucleotide consists of phosphoric acid,nitrogen containing base &carbon sugar

63. (b) It is the definition of mutation

64. (b) The hydrolysis of sugar is called inversion of sugar

$$C_{12}H_{22}O_{11} + H_2O \rightarrow \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$$

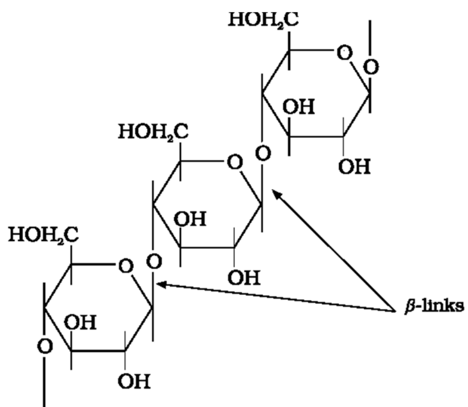
65. (b) Both differ from each other in the position of OH group on C – 1



66. (c) Due to ring structure

67.(b)Factual

Cellulose is a straight chain polysaccharide composed only of β-D-glucose units which are joined by glycosidic linkage between C_1 of one glucose unit and C_4 of the next glucose unit.



Cellulose

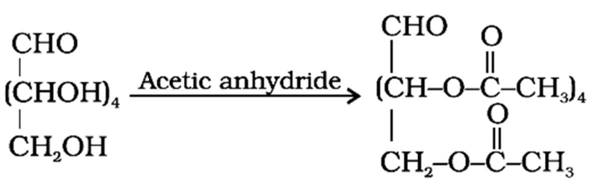
68.(c)Factual

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} \xrightarrow{\text{Maltase}} \underset{\text{Glucose}}{2\,C_6H_{12}O_6}$$

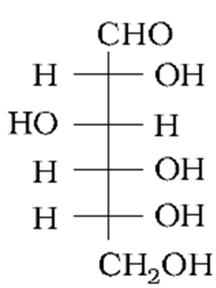
69.(c)Factual Cellulose occurs exclusively in plants and it is the most abundant organic substance in plant kingdom. It is

a predominantconstituent of cell wall of plant cells

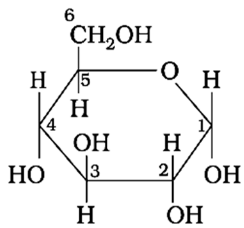
70.(c)Factual



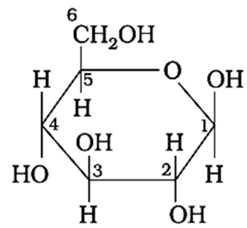
71.(b)Factual



72.(a)Factual



α – D – (+) – Glucopyranose



β – D – (+) – Glucopyranose

73.(d) Zwitter ions contains both +ve and –ve charge, proton of –COOH group is transferred to the –NH2 group $-NH_3^+$ group is acidic since it can donate a proton and $-COO^-$ group is basic since it cannot accept proton.

74. (b) There are 20 amino acids in man out of which 10 are essential amino acids. These amino acids are supplied to our bodies by food which use take because they cannot be synthesized in the body. These are

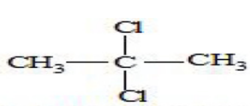
1. Valine 2. Leucine3. Isoleuim 4. Phenylalanine5. Threonine 6. Methionine7. Lysine 8. Trypthophone
9. Arginine 10. Histidine

75. (c)

$$Cl-CH_2-CH=CH_2$$

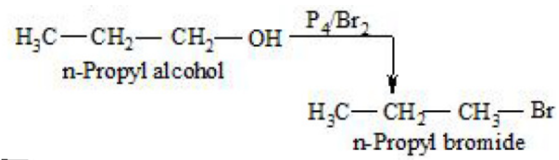
3-Chloroprop-1-ene

76. (b)



2, 2-Dichloropropane
(Geminal dihalide)

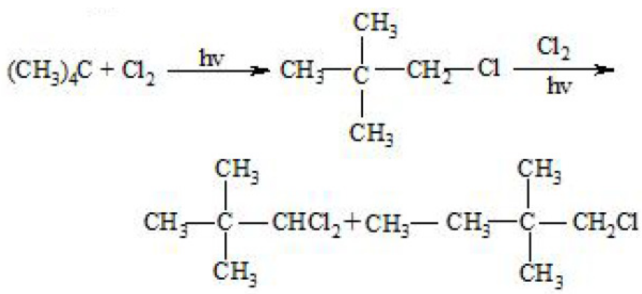
77. (a)



78. (b)

$$ROH + SOCl_2 \xrightarrow{\text{Pyridine}} RCl + SO_2\uparrow + HCl\uparrow$$

79. (c)



80. (b)

$$CH_3-CH=CH_2 \xrightarrow[-HCl]{Cl_2, 773\,K} \underset{\text{Allyl chloride}}{ClCH_2-CH=CH_2}$$

81. (c) Except for trans -1 , 2 –dichloroethene all other compounds have dipole moments

82. (c) The C -H bond will be longest when C is sp3 hybridsed i.e., in ethane (C2H6)

83. (c) But-2-ene is a symmetrical alkene. As such addition of HBr in the presence or absence of peroxide gives the same product

84.(a) . The order of reactivities of the following alkyl halides for SN^2reaction is RF > RCl > RBr > RI

85 . (c) $COCl_2$ carbonyl chloride is commonly called as phosgene

SECTION-B

86. (d) $RCl + NaI \xrightarrow{\text{Acetone}} R-I + NaCl$ This reaction is known as Finkelstein Reaction

87. (d) -Cl is ortho, para directing group (Friedel- craft alkylation)

88. (a) $C_6H_5\overset{+}{C}H_2$ is stable carbocation and therefore, favours SN^1 reaction

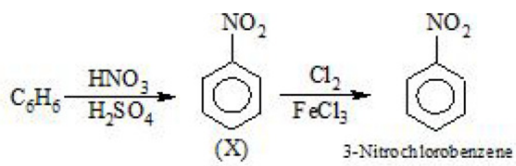
89. (d) Boiling Point α Molecular weight of compound

90. (c) Markovikov's rule is followed

91. (b) (ii) and (iii) carbon atoms are asymmetric

92. (c) $RX + 2Na + RX \xrightarrow{\text{Dry ether}} R - R + 2NaX$ is called Wurtz reaction

93. (b)



-NO2 is meta directing

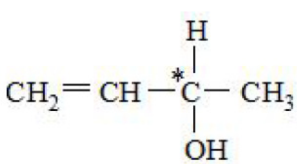
94. (b)

$$CHCl_3 + \frac{1}{2}O_2 \rightarrow \underset{\substack{\text{Carbonyl Chloride} \\ \text{Phosgene}}}{COCl_2} + HCl$$

95.(d) $CHCl_3 \xrightarrow{H_2O} CH(OH)_3 \xrightarrow{-H_2O} HCOOH$

96.(a) t-butyl chloride preferably undergo hydrolysis by SN^1 mechanism Because it forms 3^0-Carbocation

97. (d) Choice (d) represents an optically active compound because it has an asymmetric carbon (*C) atom.



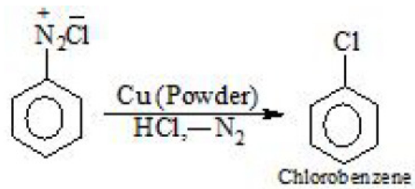
98. (c) Alcoholic AgNO2 with ethyl bromide give nitroethane as well as ethyl nitrite

99. (b)

$$CH_3-CH_2-CH_2-Br+KOH(alc.)\rightarrow$$
n – propyl bromide

$$CH_3CH=CH_2+KBr+H_2O$$
Propene

100. (b) Gattermann's Reaction



BOTANY	
Q. NO.	[ANS]
101	B
102	A
103	C
104	C
105	A
106	D
107	B
108	C
109	D
110	D
111	A
112	D
113	A
114	C
115	B
116	B
117	C
118	B
119	D
120	C

ZOOLOGY	
Q. NO.	[ANS]
151	C
152	B
153	D
154	B
155	C
156	B
157	A
158	C
159	C
160	D
161	B
162	A
163	D
164	A
165	A
166	A
167	C
168	C
169	B
170	B

BOTANY	
121	C
122	A
123	D
124	C
125	D
126	A
127	C
128	A
129	B
130	B
131	A
132	A
133	C
134	B
135	A
136	B
137	C
138	B
139	B
140	B
141	A
142	C
143	B
144	C
145	C
146	B
147	A
148	B
149	C
150	C

ZOOLOGY	
171	D
172	C
173	A
174	B
175	C
176	D
177	A
178	B
179	A
180	A
181	D
182	D
183	C
184	C
185	B
186	C
187	D
188	B
189	C
190	B
191	C
192	C
193	C
194	C
195	C
196	B
197	A
198	B
199	D
200	B