1. (b)

Sol. $eV_1 = \frac{hc}{\lambda_1} - \phi$

$eV_2 = \frac{hc}{\lambda_2} - \phi$

$V_1 - V_2 = \frac{hc}{e}\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)$

2. (a)

Sol. $K.E._{max} = 4h\nu_0 - h\nu_0$

$K.E._{max} = 3\ h\nu_0$

3. (a)

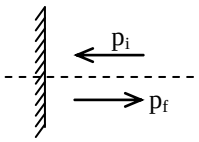
Sol. $\lambda_{th} = \frac{hc}{\phi} = \frac{12400}{4}\text{Å} = 3100\ \text{Å} = 310\ \text{nm}$

$\lambda \le \lambda_{th}$

$\Rightarrow \lambda \le 310\ \text{nm}$

4. (b)

Sol.



let $p = E/c$

$\Delta p = \frac{E}{c} - \left(-\frac{E}{c}\right) = \frac{2E}{c}$

5. (b)

Sol. $\frac{1}{2}mv^2 = eV_0$

$v = \sqrt{\frac{2eV_0}{m}} = \sqrt{\frac{2\times1.6\times10^{-19}\times1000}{9.1\times10^{-31}}}$

$= 1.88 \times 10^7\ \text{m/s}$

6. (b)

Sol. $P = \frac{nhc}{\lambda t}$

$1.7 \times 10^{-18} = \frac{n\times6.6\times10^{-34}\times3\times10^8}{6000\times10^{-10}\times1}$

$n = 5.15 \approx 5$

7. (c)

Sol. ΔV = same

$\lambda \propto \frac{1}{\sqrt{qm_0}}$

$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{q_\alpha m_\alpha}{q_p m_p}} = \sqrt{\frac{(2e)(4m_p)}{(e)m_p}}$

$= 2\sqrt{2} : 1$

8. (b)

Sol. $E = \frac{hc}{\lambda} - \phi$ .....(1)

$2E = \frac{hc}{\lambda'} - \phi$ .....(2)

$2E - E = hc\left[\frac{1}{\lambda'} - \frac{1}{\lambda}\right] = E$

$E + \frac{hc}{\lambda} = \frac{hc}{\lambda'}$

$\frac{E\lambda + hc}{\lambda} = \frac{hc}{\lambda'}$

$\lambda' = \left(\frac{hc\lambda}{E\lambda + hc}\right)$

9. (c)

Sol. $E = \frac{hc}{\lambda} - \phi_0$;

$2E = \frac{hc}{\lambda'} - \phi_0$ or $\frac{2hc}{\lambda} - 2\phi_0 = \frac{hc}{\lambda'} - \phi_0$

or $\frac{hc}{\lambda'} = \frac{2hc}{\lambda} - \phi_0$

or $\frac{hc}{\lambda'} = \frac{2hc}{\lambda} + E - \frac{hc}{\lambda}$

or $\frac{hc}{\lambda'} = E + \frac{hc}{\lambda}$

or $\frac{hc}{\lambda'} = \frac{E\lambda + hc}{\lambda}$

or $\lambda' = \frac{hc\lambda}{E\lambda + hc}$

10. (a)

Sol. $P = \frac{E}{C} = \frac{h\nu}{C}$

11. (d)

Sol. $E = qV = \frac{1}{2}mv^2$

12. (c)

Sol. $E = \frac{hc}{\lambda} = 3.55\ \text{eV}$ $E > \phi_1$ & $E > \phi_2$

13. (c)

Sol. For proton,

Specific charge $=\frac{e}{m}=9.6\times10^{7}\,Ckg^{-1}$

For alpha particle

Specific charge

$=\frac{2e}{4m}=\frac{1}{2}\frac{e}{m}=\frac{1}{2}\times9.6\times10^{7}$

$=4.8\times10^{7}\,Ckg^{-1}$

14. (c)

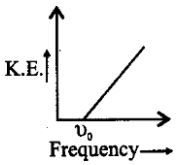
Sol. The saturation photoelectric current is directly proportional to the intensity of intensity of incident radiation but it is independent of its frequency, therefore the saturation photoelectric current becomes doubled. When both intensity and frequency of the incident light are doubled

15. (d)

Sol. The maximum kinetic energy of photoelectron ejected is given by

$K.E.=h\upsilon-\phi_0$

$=h\upsilon-h\upsilon_0$



Where work function depends on the type of material

If the frequency of incident radiation is greater than υ_0 only th4en the ejection of photoelectrons start. After that as frequency increases kinetic energy also increases

16. (b)

Sol. the maximum kinetic energy of the emitted electron is given by

$K_{\max}=h\upsilon-\phi_0=h(4\upsilon)-h(\upsilon)=3h\upsilon$

17. (d)

Sol. for red light $\lambda=760nm$

From (i)

$E=\frac{6.63\times10^{-34}\times3\times10^{8}}{760\times10^{-9}}\,j$

$=2.62\times10^{-19}\,j=\frac{2.62\times10^{-19}}{1.6\times10^{-19}}eV=1.64\ eV$

18. (d)

Sol. Energy spent to convert ice into water

$=mL=(1000\ g)\times80\,cal\,g^{-1}=80000\ cal$

Energy of photons used

$=nT\times E=nT\times h\upsilon$

$\therefore nTh\upsilon=mL$

$or\,T=\frac{mL}{nh\upsilon}$

$\therefore\ T\propto1/n$ when υ is constant $T\propto1/\upsilon$ when n fixed, $T\propto1/n\upsilon$ thus t is constant if $n\upsilon$ is constant. Thus options (a), (b) and (c) are correct

19. (c)

Sol. Louis victor de Broglie

20. (a)

Sol. Energy of a photon

$E=3MeV=3\times10^{6}eV$

Linear momentum of the photon $p=\frac{E}{c}$

Where c is the speed of light in vacuum

$p=\frac{3\times10^{6}eV}{3\times10^{8}ms^{-1}}=10^{-2}eVsm^{-1}=0.01eV\,sm^{-1}$

21. (d)

Sol. As $\lambda=\frac{h}{\sqrt{2mqV}}$

$\therefore\lambda\propto\frac{1}{\sqrt{mq}}\therefore\frac{\lambda_p}{\lambda_\alpha}=\frac{\sqrt{m_\alpha q_\alpha}}{m_p q_p}$

$=\frac{\sqrt{4m_p\times2e}}{\sqrt{m_p\times e}}=\sqrt{8}\ \ (\because m_\alpha=4m_p, q_\alpha=2q_p)$

22. (a)

Sol. As $\lambda=\frac{h}{p}\,or\,p=\frac{h}{\lambda}\,or\,p\propto\frac{1}{\lambda}$

$\therefore \frac{p_1}{p_2}=\frac{\lambda_2}{\lambda_1}=\frac{\lambda}{\lambda}=1 or\ p_1=p_2$

Also $E=\frac{1}{2}\frac{p^2}{m}=\frac{1}{2m}\frac{h^2}{\lambda^2} \quad \left(\therefore p=\frac{h}{\lambda}\right)$

Or $E\propto\frac{1}{m}\therefore\frac{E_1}{E_2}=\frac{m_2}{m_1}<1 or\ E_1<E_2$

23. (a)

Sol. Mass of the ball

$m=150g=0.15kg$

Speed of the ball $v=30ms^{-1}$

Momentum $p=mv=0.15\times30=4.5kgms^{-1}$

De Broglie wavelength

$\lambda=\frac{h}{p}=\frac{6.63\times10^{-34}}{4.5}=1.47\times10^{-34}$

24. (d)

Sol. As $\lambda=\frac{h}{\sqrt{2mE}}$

Or $E=\frac{h^2}{2m\lambda^2} i.e. E\propto\frac{1}{\lambda^2}$

Or $\frac{E'}{E}=\frac{\lambda^2}{(\lambda')^2}=\left(\frac{1}{0.5}\right)^2=4$

Or $E'=4E$

The energy should be added to decreases the wavelength $=E'-E=4E-E=3E$

25. (b)

Sol. As $p=\sqrt{2mK}$

$=\sqrt{2\times9\times10^{-31}\times120\times1.6\times10^{-19}}$

$=5.88\times10^{-24}kgms^{-1}$

de Broglie wavelength,

$\lambda=\frac{h}{p}=\frac{6.63\times10^{-34}}{5.88\times10^{-24}}$

$=1.13\times10^{-10}m=1.13Å$

26. (d)

Sol. Momentum of photon , $p=\frac{Ec}{c}=\frac{h\upsilon}{c}$

Where E is the energy of a photon and c is the velocity of light

$\therefore p=\frac{hc}{c\lambda}=\frac{h}{\lambda}=\frac{h}{0.01\times10^{-10}}=10^{12}h \quad \left[\because \upsilon=\frac{c}{\lambda}\right]$

27. (c)

Sol. de Broglie wavelength $\lambda=\frac{h}{p}$

Where p is the momentum of the particle

For electron $\lambda=\frac{h}{p_e}$

For proton $\lambda_p=\frac{h}{p_p}$

As $\lambda_e=\lambda_p \quad (Given)$

$\Rightarrow p_e=p_p$

Or momentum of electron = Momentum of proton

28. (a)

Sol. As $\lambda=\frac{h}{\sqrt{2mK}}$

So $\lambda\propto\frac{1}{\sqrt{m}}$

Out of the given particles m is least for electron, therefore electron has the largest value of de Broglie wavelength

29. (d)

Sol. Velocity acquired by a particle while falling from a height H is

$v=\sqrt{2gH}$ ……. (i)

As $\lambda=\frac{h}{mv}=\frac{h}{m\sqrt{2gH}}$ (using (i))

Or $\lambda\propto\frac{1}{\sqrt{H}}$

30. (b)

Sol. Here, $E=1MeV=10^6eV, h=6.63\times10^{-34}js$

$c=3\times10^8ms^{-1}$

$\because hc=\frac{6.63\times10^{-34}\times3510^8}{1.6\times10^{-19}}\approx1240\ eVnm$

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

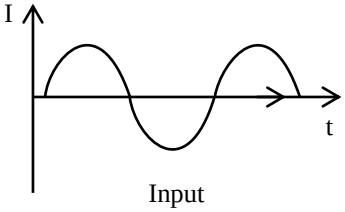
Or $\lambda = \frac{hc}{E} = \frac{1240 eVnm}{10^6 eV} = 1.24 \times 10^{-3} nm$

31. (a)

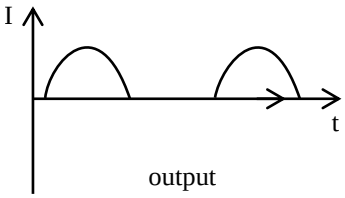
Sol. $E = \frac{V}{d} = \frac{0.50}{5 \times 10^{-7}} = 1 \times 10^6$ V/m.

32. (c)

Sol. The diode will be forward biased in one half cycle and will conduct where as it will be reverse biased in negative half cycle and will not conduct.



Input



output

33. (a)

Sol. $\alpha = \frac{I_c}{I_e} = \frac{I_c}{I_c + I_b} = 0.985$

$I_c = 0.985 (I_c + I_b)$

$I_c = 0.985\ I_c + 0.985\ I_b$

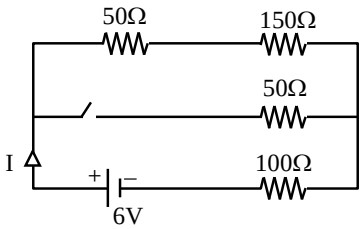
$0.985\ I_b = 0.015\ I_c = 0.015 \times 2$ mA

$I_b = \frac{0.015 \times 2}{0.985} = 0.03$ mA

$I_b \approx 0.03$ mA

34. (b)

Sol. $D_1 \rightarrow$ F.B. , $D_2 \rightarrow$ R.B



$I = \frac{V_{net}}{R_{net}}$ $I = \frac{6}{300}$ = 0.02A

35. (c)

Sol. (a) $Z = \overline{(\bar{P} + Q)}$

P	Q	Z
0	0	0
0	1	0

(b) $Z = \overline{(\bar{P}.Q)}$

P	Q	Z
0	0	1

(c) $Z = \overline{(\bar{Q}.\overline{(P+Q)})}$

P	Q	Z
0	0	0
0	1	1
1	0	1
1	1	1

(d) $Z = \overline{(P.Q)}$

P	Q	Z
0	0	0
0	1	0
1	0	0

36. (b)

Sol. $\frac{A_P}{A_R} = \frac{\alpha^2 A_R}{A_R} = \alpha^2$

37. (a)

Sol. p-side at higher potential and n-side at lower potential.

38. (a)

Sol. Upper diode is in forward bias,

So, i = V/R = 2V/20Ω = 0.1 A

39. (a)

Sol. Use $E = \frac{12400}{\lambda}$ Ev

40. (b)

Sol. Majority charge carrier in p-type is hole.

41. (c)

Sol. Resistively of a semiconductor decrease with increase in temperature.

42. (a)

Sol. Emitter is highly doped than collector and base is least doped.

43. (b)

Sol. 2,4,5 $\rightarrow$ F.B. ,1,3 $\rightarrow$ R.B.

44. (c)

Sol. Here (A + B). C = Y

Output is available if A & C are available.

45. (a)

Sol. The p-n junction diode is forward biased when p is at high potential with respect to n.

Hence option (a) is correct.

46. (d)

Sol.

$$\alpha - D - \text{Glucose} \underset{[\alpha]=+112^o}{\underset{(36\%)}{}} \rightleftharpoons \underset{[\alpha]_D=+52^o}{\underset{(0.02\%)}{\text{Equilibrium mixture}}} \rightleftharpoons \beta - D - \text{Glucose} \underset{[\alpha]_D=+19^o}{\underset{(64\%)}{}}$$

Glucose has two forms α and β. When either of these two is dissolved in water and allowed to stand, it gets converted to an equilibrium mixture of α and β forms.

47. (b)

Sol. Gun-cotton is a nitrocellulose or cellulose trinitrate which is used in explosive and as a binder for solid rocket propellant.

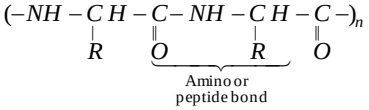
48. (d)

Sol. Arabinose is an aldopentose

$$HOCH_2-(CHOH)_3-CHO$$

49. (d)

Sol. In proteins amide group is present

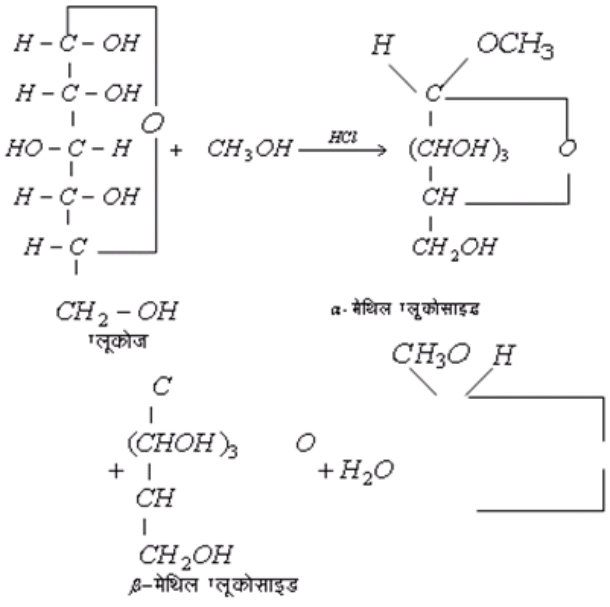


50. (d)

Sol. Glucose + Tollen's reagent → Gluconic acid + Ag-mirror.

51. (c)

Sol. A ring structure



52. (c)

Sol. Glucose + Benedict's solution → Red colour (Cu_2O)

53. (b)

Sol. Amylopectin is not soluble in water.

54. (c)

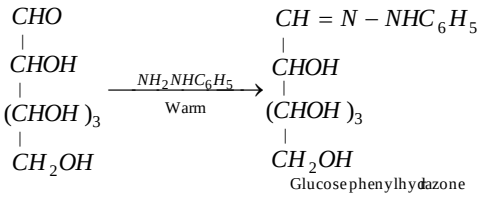
Sol. $\underset{\text{Maltose}}{C_{12}H_{22}O_{11}}$

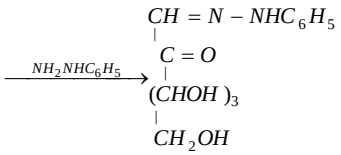
55. (b)

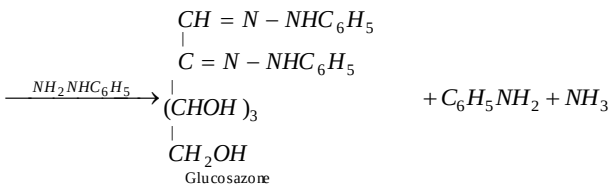
Sol. Sucrose is not a reducing sugar.

56. (b)

Sol.







57. (c)

Sol. $\underset{\text{Cane sugar}}{C_{12}H_{22}O_{11}} + H_2O \rightarrow \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$

58. (b)

Sol. Monosaccharide cannot be hydrolysed to simple forms.

59. (d)

Sol. Starch + I_2 → Blue colour.

60. (d)

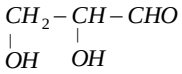
Sol. Glucose and sucrose are dextrorotatory Fructose is leavorotatory

61. (b)

Sol. Maltose $\xrightarrow[\text{Maltase}]{\text{Hydrolysis}}$ glucose + glucose.

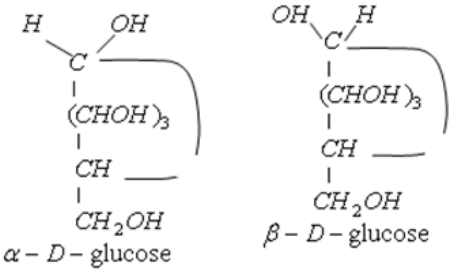
62. (b)

Sol. 3 carbons e.g. Glyceraldehyde



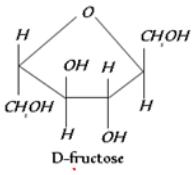
63. (c)

Sol.



64. (a)

Sol.



5 atoms in the ring

65. (a)

Sol. In sucrose the two monosaccharide units joined by α-1, 2 glycoside bond. Since sucrose does not have hemiacetal carbon. Therefore it is non- reducing sugar.

66. (a)

Sol. Glucose is the simplest carbohydrate i.e. mono saccharide rest are polysaccharide.

67. (a)

Sol. We can't digest cellulose which is a polysaccharide.

68. (d)

Sol. Diastase enzyme converts starch into maltose.

69. (b)

Sol. Lactose is present in milk (Glucose + Galactose).

70. (b)

Sol. Carbohydrates are rich source of energy.

71. (a)

Sol. That is called glycosidic linkage.

72. (a)

Sol. Raffinose $(C_{18}H_{32}O_{16})$ is a trisaccharide

$$C_{18}H_{32}O_{16} + H_2O \rightarrow \underset{\text{D glucose}}{C_6H_{12}O_6} + \underset{\text{D fructose}}{C_6H_{12}O_6} + \underset{\text{D mannose}}{C_6H_{12}O_6}$$

73. (b)

Sol. Glucose + Fehling solution → Gluconic acid + $\underset{\text{(Red ppt)}}{Cu_2O}$

74. (a)

Sol. Glucose and mannose are epimers because they both differ in configuration at C–2 and the Isomer which differ at C_2 position known as epimers of each other.

75. (b)

Sol.

Sugar	Relative sweetness
Sucrose	100
Glucose	74
Lactose	16
Fructose	173

76. (b)

Sol. Fructose has three chiral centres and hence 23 = 8 optical isomers are possible.

77. (b)

Sol. Insulin is a protein consists of 51 amino acids in two chains. α and β α - 21 amino acids, β - 30 amino acids It is secreted by pancreas for controlling the sugar level in blood.

78. (a)

Sol. Fibrous proteins are insoluble in water.

79. (c)

Sol. $\text{Protein} \xrightarrow{\text{Enzyme}} \underset{\text{(Acidic medium in stomach)}}{\text{Amino acid}}$

80. (d)

Sol. Glycine $\rightarrow NH_2 - CH_2 - COOH$.

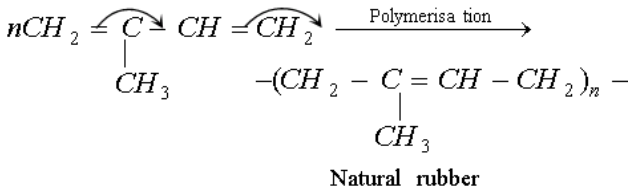
81. (a)

Sol. It is present in the cell wall of plant.

82. (b)

Sol. Natural rubber is addition polymer of isoprene

(2-methyl-1, 3-butadiene)



Natural rubber

83. (b)

Sol. Polyethylene is a homopolymer

$nCH_2 = CH_2 \rightarrow (-CH_2 - CH_2)_n$

84. (a)

Sol. Cellulose is the natural fibre which are biodegradable polymer rest are synthetic polymer which are not biodegradable.

85. (d)

Sol. Nylon is the copolymer of Hexamethylene diamine and adipic acid. It is not a homo-polymer because homopolymer formed by two same monomer unit.

86. (a)

Sol. Thermoplastic are those which becomes soft on heating and can be remoulded again.

87. (c)

Sol. Resins are amorphous organic solids or semisolids which usually have a typical lustre and are often transparent or translucent.

88. (c)

Sol. Step growth polymerization involves condensation reaction between two difunctional monomer to produce dimer which in turn, produce, tetramer and so on with the loss of simple molecules like H_2O, NH_3, HCl etc.

89. (c)

Sol. Buna-S and Neoprene both are synthetic rubber.

90. (b)

Sol. Nylon-66 is manufactured by the condensation polymerization of adipic acid and hexamethy lenediamine with the lose of H_2O as steam.

Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.
91	B	109	C	127	B	145	C	163	A
92	B	110	B	128	A	146	B	164	B
93	B	111	B	129	C	147	B	165	A
94	B	112	C	130	A	148	A	166	C
95	D	113	B	131	B	149	B	167	B
96	B	114	B	132	D	150	B	168	A
97	D	115	B	133	D	151	B	169	C
98	D	116	B	134	A	152	D	170	C
99	D	117	B	135	C	153	D	171	B
100	D	118	C	136	C	154	C	172	B
101	A	119	D	137	C	155	C	173	C
102	A	120	B	138	C	156	B	174	A
103	C	121	C	139	D	157	D	175	A
104	B	122	A	140	D	158	A	176	A
105	A	123	B	141	C	159	D	177	D
106	C	124	C	142	A	160	D	178	A
107	D	125	C	143	C	161	B	179	C
108	A	126	B	144	B	162	C	180	B