1. (d)

Sol. At Antinodes displacement is maximum but pressure change is minimum.

2.(b)

Sol. By comparing with standard equation $\therefore \frac{2\pi x}{\lambda} = 5x$

$\Rightarrow \lambda = \frac{2}{5} \times \pi$ = 1.256 meter

3.(c)

Sol. $I \propto A^2$ and $I \propto \frac{1}{r^2}$ so $r \propto \frac{1}{A}$; $\frac{r_1}{r_2} = \frac{A_2}{A_1} \Rightarrow A_2 = A_1 \left(\frac{r_1}{r_2}\right) = A\left(\frac{1}{2}\right) = A/2$

4.(a)

Sol. The direction of wave must be opposite and frequencies will be same then by superposition, standing wave formation takes place.

5.(d)

Sol. $v = \frac{\omega}{k} = \frac{200\pi}{0.5\pi} = 400$ cm/sec

6.(d)

Sol. $\frac{I_{max}}{I_{min}} = \left(\frac{A_1 + A_2}{A_1 - A_2}\right)^2 = \left(\frac{5+3}{5-3}\right)^2 = 16:1$

7.(c)

Sol. The energy is inversely proportional to the square of distance. Hence the amplitude is inversely proportional to the distance.

8.(b)

Sol. The maximum particle velocity of a SHM of amplitude y_0 and frequency f is $2\pi f Y_0$. The wave velocity is $f\lambda$. For $2\pi f y_0$ to be equal to $4f\lambda$, λ has to be $\pi y_0 / 2$ (Here $\lambda = a$).

9.(a)

Sol. $v = \frac{h}{m\lambda} = \frac{6.6\times10^{-34}}{9.1\times10^{-31}\times10^{-10}} = 7.25 \times 10^6$ m/s

10. (b)

Sol. $v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{T}{\rho A}}$

where, ρ = density

A = Area of cross-section

$\mu = \rho A$ = mass of unit length

11. (a)

Sol. $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$ ….(1)

$y = 2a \sin kx \cos \omega t$ ….(2)

from comparison 1 & 2

$k = \frac{\pi}{15} = \frac{2\pi}{\lambda}$

$\lambda = 30$

Distance b/w nearest node and Antinode = $\lambda/4$

$= \frac{30}{4} = 7.5$ unit

12. (a)

Sol. $v = \sqrt{\frac{T}{\mu}}$

13. (a)

Sol. As net transfer of energy is zero.

14. (b)

Sol. $\boxed{V = \sqrt{xg}}$ where 'x' is the distance from lower end, so on moving up velocity also increases.

15. (b)

Sol. $\lambda_1 = \frac{2\ell}{n}$

$\lambda_2 = \frac{2\ell}{n+1}$

$\frac{4}{2} = \frac{n+1}{n}$

$4n = 2n + 2$

$n = 1$

$4 = 2 \times \ell$

$\ell = 2m$

16. (c)

Sol. $\frac{I_2}{I_1} = \frac{a_2^2 n_2^2}{a_1^2 n_1^2} = \left(\frac{10}{5}\right)^2 \times \left(\frac{2}{1}\right)^2 = 16 : 1$

17. (a)

Sol. $\frac{x}{a} = \sin\omega t$; $y = a\sin\left(\omega t + \frac{\pi}{4}\right)$

$= a\,[\sin\omega t\cos\frac{\pi}{4} + \cos\omega t\sin\frac{\pi}{4}]$

$= \frac{a}{\sqrt{2}}\left[\frac{x}{a} + \sqrt{1 - \frac{x^2}{a^2}}\right]$

Equation $\rightarrow$ ellipse

18. (c)

Sol. $\nu = \frac{1}{2L}\sqrt{\frac{T}{m}}$

$\therefore \sqrt{T} \propto \nu\ell$

$\frac{T_1}{T_2} = \frac{\nu_1^2}{\nu_2^2} \times \frac{\ell_1^2}{\ell_2^2}$

19. (b)

Sol. $\because L = \frac{\lambda}{2}$ $\therefore \lambda = 2L$ & $\nu = \frac{v}{\lambda} = \frac{7}{4}$ Hz

20. (a)

Sol. a = 0.6 m

21. (d)

Sol. $L' = 2L$, $d' = 2d$ & $T' = 2T$

$\nu = \frac{P}{2L}\sqrt{\frac{T}{m'}}$

22. (b)

Sol. $L = \frac{\lambda}{2}$ $\therefore \lambda = 2 \times 100$ cm = 2m

$v = \nu\lambda = 2 \times 330 = 660$ m/s

23. (b)

Sol. $v = n\lambda$ or $360 = 500\lambda$ or $\lambda = 0.72$ m

Now $\Delta\phi = (2\pi/\lambda)\,\Delta x$

or $60^\circ = (360^\circ/0.72)\,\Delta x$

$\therefore$ $\Delta x = (0.72/6) = 0.12$ m

24. (c)

Sol. According to figure, $\frac{5\lambda}{2} = 20$

or $\lambda = \frac{20 \times 2}{5} = 8$ cm

$\therefore$ $n = \frac{v}{\lambda} = \frac{320 \times 100}{8} = 4000$ Hz

25. (b)

Sol. $V_1 = \sqrt{\frac{\gamma RT}{M_w}}$, $V_2 = \sqrt{\frac{3RT}{M_w}}$

So $\boxed{V_2 > V_1}$ As $\lambda_{max} = 1.67$

26. (b)

Sol. $\frac{I_1}{I_2} = \frac{4}{1} = \left(\frac{a_1}{a_2}\right)^2$ $\therefore$ $\frac{a_1}{a_2} = \frac{2}{1}$ So $\frac{a_1 + a_2}{a_1 - a_2}$

$= \frac{3}{1}$ So $\frac{I_{max}}{I_{min}} = \frac{9}{1}$ $\therefore$ L = 10 log $\frac{I_{max}}{I_{min}}$ = 10 log 9

= 20 log 3

27. (b)

Sol. As if $n_b = 48$ on filling A n_A increases and beat freq. increases So it can-not be the answer.

28. (a)

Sol. $e = \frac{\ell_2 - 3\ell_1}{2}$

$e = \frac{70.2 - 3 \times 22.7}{2} = \frac{70.2 - 68.1}{2} = \frac{2.1}{2}$

= 1.05 cm

29. (d)

Sol. $\frac{N}{N+5} = \frac{100}{101}$

101 N = 100 N + 500

N = 500 Hz

N + 5 = 505 Hz.

30. (a)

Sol. $\frac{v}{4\ell_1} - \frac{v}{4\ell_2} = 5$

or $\frac{v}{4}\left(\frac{1}{50}-\frac{1}{51}\right) = 5$

$\frac{v}{4} = \frac{5\times50\times51}{1}$

$\Rightarrow \nu_1 = \frac{v}{4\ell_1} = \frac{5\times50\times51}{50} = 255$ Hz

$\Rightarrow \nu_2 = \frac{v}{4\ell_2} = \frac{5\times50\times51}{51} = 250$ Hz

31. (d)
Sol. $\phi = 0, 2z$ ……..

$I' = I + I + 2\sqrt{I}\,.\sqrt{I} = 4I$

32. (c)
Sol.

$\Delta x = 40$ cm

$\Delta\phi = 1.6\,\pi$

$V = 330$ m/s

$n = ?$

$V = n\,\lambda$

$n = \frac{V}{\lambda} = \frac{330}{1/2}$

$n = 660$ Hz

$\Delta\,\phi = \frac{2\pi}{\lambda}\,\Delta x$

$\lambda = \frac{2\pi}{\Delta\phi} \times \Delta x$

$= \frac{2\pi}{1.6\pi}\times\frac{40}{100}$

$\lambda = \frac{8}{16} = \frac{1}{2}$ m

33. (d)
Sol. $40 = 10 \log \frac{I}{I_0}$ …(1)

$90 = 10 \log \frac{nI}{I_0}$ …(2)

$90 - 40 = 10 \log n$, $\boxed{n = 10^5}$

34. (c)
Sol. For natural frequency of string

$\nu_n \propto \frac{1}{L}$

$\Rightarrow \frac{\nu_A}{\nu_B} = \frac{97}{96}$ ... (i)

Also, $\nu_A - \nu_B = 4$ ... (ii)

$\because$ Beat frequency = 4

From (i) and (ii),

$\nu_A = 388, \nu_B = 384$

35. (c)
Sol. Particle which vibrate in opposite phase having different velocity but having same speed.

36. (c)
Sol. Ultrasonic waves are used in sonography.

37. (a)
Sol. Light, X – rays and require medium for their waves. They do not require medium for their propagation. They can travel through vacuum, Seismic waves are mechanical waves. They require medium for their propagation. They do not travel in vacuum.

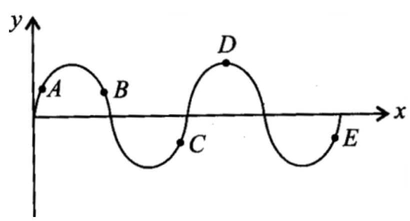
38. (a)
Sol. Sound waves travel fastest in solids.

39. (c)
Sol. A transverse wave travels through a medium in the form of crests and troughs.

40. (c)
Sol. Resultant amplitude

$= \sqrt{3^2 + 4^2} = \sqrt{9+16} = 5\text{cm}$

41. (d)
Sol.



In the given figure, point C and E are in the same phase.

42. (a)
Sol. Speed of sound in water is

$$v = \sqrt{\frac{B}{\rho}} = \sqrt{\frac{2100\times10^6}{10^3}} = 1450\text{ms}^{-1}$$

Where B is the bulk modulus and ρ is the density of water.

Here, $B = 2100\,\text{MPa} = 2100\times10^6\,\text{Pa}$

$\rho = 10^3\,\text{kg}\,\text{m}^{-3}$

$\therefore v = \sqrt{\dfrac{2100\times10^6}{10^3}} = 1450ms^{-1}$

43. (a)

Sol. Velocity of te4h sound in gas

$v = \sqrt{\dfrac{\gamma RT}{M}}$

Where the symbols have their usual meanings.

All the given gases are diatomic and are at same temperature,

$\therefore v \propto \dfrac{1}{\sqrt{M}}$

44. (b)

Sol. Tuning fork of 256 Hz. Will resonate with fork frequencies $1\times256, 2\times256, 3\times256$ etc.

256Hz, 512Hz, 768 Hz etc.

45. (b)

Sol. At the node the pressure change in maximum while the displacement is minimum.

46. (c)

Sol. An organ pipe of length L open at both ends vibrates with frequencies given by

$\upsilon_n = \dfrac{nv}{2L}$ where n = 1,2,3,4,………

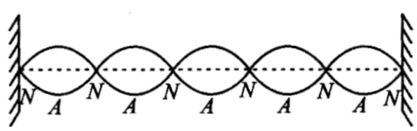
The fundamental frequency corresponds to n = 1 and is given by

$\upsilon_1 = \dfrac{v}{2L}$

In an open pipe all harmonics are present

47. (b)

Sol.



Form Figure, Total nodes = 6

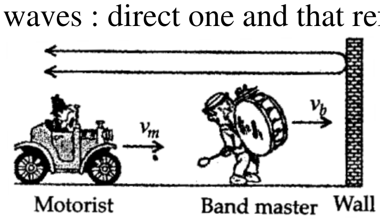
Total antinodes = 5

48. (c)

Sol. The Doppler Effect is applicable for both sound and light waves.

49. (c)

Sol. The motorist receives two sound waves : direct one and that reflected from the wall.



For direction sound waves,

$$\upsilon' = \frac{v + v_m}{v + v_b}\upsilon$$

For reflected sound waves,
Frequency of sound wave reflected from the wall

$$\upsilon' = \frac{v}{v - v_b} \times \upsilon$$

Frequency of the reflected waves as received by the moving motorist

$$\upsilon''' = \frac{v + v_m}{v} \times \upsilon'' = \frac{v + v_m}{v - v_b} \times \upsilon$$

$\therefore$ Beat frequency $= \upsilon''' - \upsilon'$

$$= \frac{v + v_m}{v - v_b} \times \frac{v + v_m}{v + v_b}\upsilon = \frac{2v_b(v + v_m)}{v^2 - v_b^2}\upsilon$$

50. (c)
Sol. Speed of sound wave in air increases with increases in humidity. This is because presence of moisture decreases the density of air.

SECTION-A

51. (c)

Sol. On moving down the group electropositive character increases.

52. (d)

Sol. Element – Li Na K Rb

Atomic radius (pm) –	152	186	227	248

53. (b)

Sol. Li is much softer than the other group I metals. Actually Li is harder then other alkali metals.

54. (d)

Sol. Anhydrous form of Na_2CO_3 does not decompose on heating even to redness. It is a amorphous powder called soda ash.

55. (c)

Sol. Fehling's solution is a mixture of Alk.

$CuSO_4 + Na - K$ tartarate (Rochelle salt)

56. (a)

Sol. $CaCl_2$ because it is hygroscopic.

57. (d)

Sol. Setting of plaster of paris is exothermic process

$$CaSO_4.\frac{1}{2}H_2O \xrightarrow{H_2O} \underset{\text{Orthorhombic}}{CaSO_4.2H_2O}$$

$$\xrightarrow{\text{Hardening}} \underset{\substack{\text{Mono orthorhombic} \\ \text{Gypsum}}}{CaSO_4.2H_2O}$$

The setting is due to formation of another hydrate.

58. (a)

Sol. $MgCO_3 \xrightarrow{\text{Heat}} MgO + CO_2$

The metal whose oxide is stable, it's carbonate is unstable.

59. (d)

Sol. $\underset{\text{(Molten)}}{MgCl_2} \xrightarrow{Electrolysis} \underset{\text{Cation}}{Mg^{+2}} + \underset{\text{Anion}}{2Cl}$

Anode – $2Cl^- \rightarrow 2Cl + 2e^-$, $Cl + Cl \rightarrow Cl_2$

Cathode – $Mg^{+2} + 2e^- \rightarrow Mg$.

60. (a)

Sol. Because of small atomic size and high I.E. Be forms covalent chloride.

61. (b)

62. (a)

63. (b)
Sol. Although lattice energy of $LiCl$ higher than $NaCl$ but $LiCl$ is covalent in nature and $NaCl$ ionic there after, the melting point decreases as we move $NaCl$ because the lattice energy decreases as a size of alkali metal atom increases (lattice energy $\propto$ melting point of alkali metal halide).
64. (a)
Sol.

$$\xrightarrow{LiOH < NaOH < KOH < RbOH}$$

Down the group basic character increases
65. (b)
Sol. $FeSO_4.(NH_4)_2SO_4.6H_2O$ Mohr's salt.
66. (a)
Sol. $6Li + N_2 \rightarrow 2Li_3N$ Lithium nitride.
67. (c)
Sol. $KF + HF \rightarrow KHF_2 \rightleftharpoons K^+ + HF_2^-$
68. (b)
Sol. $Cs > Rb > K > Na > Li$
Metallic character decreasing order.
69. (d)
Sol. $2Rb + 2H_2O \rightarrow 2RbOH + H_2$

$$\xrightarrow{Li < Na < K < Rb < Cs}$$

As we go down the group reactivity with H_2O increases.
70. (b)
Sol. Atomic number $11 \rightarrow Na \rightarrow Na_2O$

$$Na_2O + H_2O \rightarrow \underset{\text{(base)}}{2NaOH}$$

71. (d)
Sol. $2Na + 2NH_3 \xrightarrow{\text{heat}} 2NaNH_2 + H_2$
72. (d)
Sol. Due to free electron liquid ammonia becomes
paramagnetic.
73. (a)
Sol. They possess highest atomic volume in their respective periods.
74. (c)
Sol. $Fe(OH)_3$ is soluble in sodium hydroxide solution.
75. (a)
Sol. Li is a more reducing agent compare to other element.
76. (b)
Sol.

Element	– Li	Na	K	Rb	Cs
M.pt in K	– 4535	370.8	336.2	312	301.5

77. (d)

Sol. BF_3 is a strong lewis acid due to increased electron density on B due to back – bonding Hence, it is used as a catalyst in many organic reactions.

78. (c)

Sol. Its low solubility in water makes it of biological and chemical importance. It form carbonic acid with water which dissociateds to give HCO_3^- ions. H_2CO_3/HCO_3^- buffer system helps to mainatain pH of blood between $7.26-7.42$

79. (a)

Sol. Due to non – availability of d- orbitals, boron is restricted to a maximum covalence of four (using) 2s and three 2p orbitals) while others (Al, Ga, In) can expand their covalence above four by using their 3d orbitals. Thus, B forms only $[BF_4]^-$ and others form $[MF_6]^{3-}$

80. (b)

Sol. As we go down the group, the atomic size increases and electronegativity decreases and thereby, tendency to show catenation decreases. Hence, the order of catentation is C >>Si> Ge ≈ Sn.

81. (d)

Sol. The decrease in ionisation enthalpy from B to Al is associated with increase in size. The observed discontinuity in the ionisation enthalpy values between Al and Ga, and between In and Tl are due to inability of d – and f – electrons, which have low screening effect, to compensate theincrease in nucler charge.

82. (b)

Sol. Cement is a mixture of calcium (Group 2) and aluminium silicates (Group 13 and 14).

83. (b)

Sol. $AlCl_3$ in acidified aqueous solution forms

$[Al(H_2O)_6]^{3+}$ ion.

$$AlCl_3 + 9H_2O \rightarrow [Al(H_2O)_6](OH)_3 + 3H^+ + 3Cl^-$$

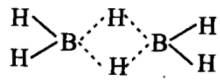
84. (a)

Sol. $Na_2B_4O_7.10H_2O \xrightarrow{\Delta} \underset{\substack{\text{Sod.metaborate} \\ (X)}}{Na_2B_4O_7} \xrightarrow{\Delta} \underset{(Y)}{2NaBO_2}$

$+\underset{(Z)}{B_2O_3}$

85. (b):

Sol.



(B_2H_6)

There are two terminal hydrogen atoms with one boron atom (total 4) and two hydrogen atoms are bridged between two boron atoms.

SECTION-B

86. (b)

Sol. It reacts with water to abstract OH^- ions and releases H_3O^+ ions making it acidic.

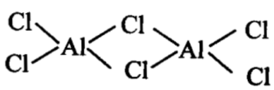
$H_3BO_3 + H_2O \rightarrow H_3O^+ + H_2BO_3^-$

87. (a)

Sol. The structure of BN is similar to graphite. Hence, it is also known as inorganic graphite.

88. (c)

Sol.



$AlCl_3$ (dimer)

89. (b)

Sol. (A) $\rightarrow$ (iii), (B) $\rightarrow$ (iv), (C) $\rightarrow$ (i), (D) $\rightarrow$ (ii)

90. (c)

Sol. C forms two oxides CO and CO_2 CO is neutral and poisonous. CO_2 can be compressed to a refrigerant dry ice or solid CO_2 SiO is unstable. SnO and PbO are amphoteric in nature.

91. (a)

Sol. Dioxides CO_2, SiO_2 and GeO_2 are acidic while

SnO_2 and PbO_2 are amphoteric.

92. (c)

Sol. X = Diamond, $Y = 1.54\,\overset{o}{A}, Z = 1.42\,\overset{o}{A}$

93. (b)

Sol. (A) $\rightarrow$ (iii), (B) $\rightarrow$ (i), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (ii)

94. (b)

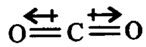
Sol. When excess of carbon dioxide is passed in lime water, calcium carbonate is converted to calcium bicarbonate which is soluble, hence the milkiness due to calcium carbonate disappears.

$$Ca(OH)_2 + CO_2 \rightarrow \underset{\text{Milkiness}}{CaCO_3 \downarrow} + H_2O$$

$$CaCO_3 + H_2O + CO_2 \rightarrow \underset{\text{So lub le}}{Ca(HCO_3)_2}$$

95. (d)

Sol. CO_2 is a linear, non – polar molecule.



96. (b)

Sol. Due to presence of lone pair of electrons on carbon $:C \equiv O:$ acts as a donor for metal carbonyls.

97. (c)

Sol. Increase in concentration of CO_2 will result in increase in greenhouse effect thus raising the temperature which might have serious consequences.

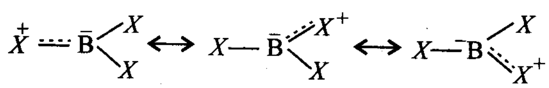
98. (a)

Sol. Except carbon halides, other halides are readily

hydroylsed by water. in CCl_4 the central atom cannot accommodate lone pair of electrons from oxygen atom of water molecule due to absence of d – orbitals.

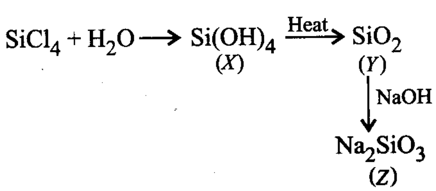
99. (b)

Sol. Due to back – bonding, B – X in BX_3 has double bond character which because of resonance results in shorter B – X distance.



100. (b)

Sol.



BOTANY									
Q.	ANS.	Q.	ANS.	Q.	ANS.	Q.	ANS.	Q.	ANS.
101	C	113	B	125	A	136	A	148	B
102	A	114	B	126	C	137	C	149	A
103	A	115	B	127	B	138	B	150	B
104	C	116	B	128	B	139	B		
105	B	117	B	129	A	140	B		
106	D	118	B	130	B	141	B		
107	D	119	A	131	C	142	C		
108	B	120	C	132	A	143	D		
109	B	121	D	133	C	144	D		
110	D	122	D	134	B	145	C		
111	C	123	D	135	B	146	B		
112	A	124	C			147	D		

ZOOLOGY									
Q.	ANS.	Q.	ANS.	Q.	ANS	Q.	ANS.	Q.	ANS
151	A	163	A	175	B	186	C	198	B
152	C	164	C	176	B	187	A	199	D
153	C	165	C	177	A	188	A	200	A
154	C	166	A	178	A	189	B		
155	B	167	A	179	A	190	D		
156	B	168	D	180	B	191	A		
157	B	169	D	181	C	192	A		
158	D	170	A	182	A	193	B		
159	A	171	C	183	C	194	B		
160	C	172	C	184	B	195	B		
161	B	173	A	185	C	196	C		
162	B	174	B			197	B		