

### ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A.	3	2	4	4	1	2	3	1	4	1	3	3	2	2	1	1	4	2	1	4	4	3	4	2	2	4	4	4	2	1
Q.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A.	4	3	2	1	1	4	1	1	1	3	3	2	3	4	2	1	2	1	1	4	2	4	2	1	3	2	3	1	3	2
Q.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
A.	2	4	1	4	4	2	4	3	4	3	4	2	3	4	4	2	1	2	3	2	1	1	2	4	2	3	2	4	1	3
Q.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
A.	1	4	2	3	3	3	3	3	4	3	3	3	4	1	4	1	1	1	2	2	2	2	4	3	4	3	2	1	4	4
Q.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
A.	1	2	4	3	1	3	3	3	3	3	3	1	4	4	2	3	4	1	1	1	3	1	3	3	3	1	4	3	3	2
Q.	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
A.	1	2	3	4	3	3	2	3	4	1	3	4	4	2	1	3	3	2	2	1	2	3	2	2	2	3	1	3	3	1
Q.	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200										
A.	4	4	4	4	1	1	4	1	4	3	1	1	1	2	2	1	4	4	3	1										

### HINT - SHEET

#### SUBJECT : PHYSICS

##### SECTION-A

1. Ans (3)

$$I_0 = \left( \frac{(2M)L^2}{3} \right) \times 3$$

$$I_0 = 2ML^2$$

2. Ans (2)

Angular momentum will remain conserved,

$$\text{we, know, } KE = \frac{L^2}{2I}$$

$$\because L = \text{constant}$$

$$\therefore KE \propto \frac{1}{I}$$

$$\frac{KE_1}{KE_2} = \frac{I_2}{I_1} \Rightarrow \frac{K}{K'} = \frac{2I}{I} \Rightarrow K' = \frac{K}{2}$$

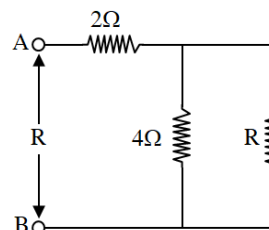
3. Ans (4)

In 1<sup>st</sup> case :  $H = I^2 R t \Rightarrow H \propto I^2 t$ ;  $t_1 = 20$  seconds,  
 $t_2 = 18$  seconds

$$\Rightarrow \frac{H_2}{H_1} = \left( \frac{I_2}{I_1} \right)^2 \frac{t_2}{t_1}$$

$$\Rightarrow \frac{H_2}{600} = \left( \frac{4}{3} \right)^2 \times \frac{18}{20} \Rightarrow H_2 = 960J$$

4. Ans (4)



$$\Rightarrow R = 2 + \frac{4R}{4+R} \Rightarrow 4R + R^2 = 8 + 6R$$

$$\Rightarrow R^2 - 2R - 8 = 0 \Rightarrow R^2 - 4R + 2R - 8 = 0$$

$$\Rightarrow R(R - 4) + 2(R - 4) = 0$$

$$\Rightarrow R = 4, R = -2 \text{ (not possible)}$$

$$\Rightarrow R = 4\Omega$$

5. **Ans (1)**

$$\begin{aligned} T.E_i &= T.E_f \\ K.E_i + P.E_i &= K.E_f + P.E_f \\ \frac{1}{2}mv^2 + \frac{kQ^2}{r} &= 0 + \frac{kQ^2}{x} \\ \frac{1}{2}m \frac{2kQ^2}{r^2} + \frac{kQ^2}{r} &= \frac{kQ^2}{x} \\ \frac{2kQ^2}{r} = \frac{kQ^2}{x} &\Rightarrow x = \frac{r}{2} \end{aligned}$$

6. **Ans (2)**

$$t = \frac{4.8 \times 10^{-6}}{1.6 \times 10^{-19} \times 10^{10}} = 3 \times 10^3 \text{ sec}$$

7. **Ans (3)**

$$\begin{aligned} y_{\text{Bright}} - y_{\text{dark}} &= \frac{n\lambda D}{d} - \frac{(2n-1)\lambda D}{2d} \\ &= \frac{\lambda D}{d} \frac{(2n-2n+1)}{2} \\ &= \frac{\lambda D}{2d} \end{aligned}$$

8. **Ans (1)**

$$\begin{aligned} C &= \frac{\epsilon_0 A}{d} = 8 \text{ pF} \\ C' &= \frac{\epsilon_0 \times 6A}{d/2} = 12 \times 8 = 96 \text{ pF} \end{aligned}$$

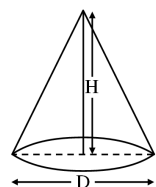
9. **Ans (4)**

By work-energy theorem  
 $W_F = \Delta K.E.$   
 Work done by gravity  
 $Mgy_0 = \Delta K.E. = K_f - K_i$   
 Here,  $K_i = 0$   
 So  $K_f = K = mgy_0$

10. **Ans (1)**

$$\begin{aligned} \text{Unit of force} &= (109) (10 \text{ cm}) (0.1 \text{ sec})^{-2} \\ &= (10 \times 10^{-3} \times 10 \times 10^{-2} \times 10^2) \text{ N} \\ &= 0.1 \text{ N} \end{aligned}$$

11. **Ans (3)**



$$V = \frac{1}{3} \pi \left( \frac{D}{2} \right)^2 H$$

$\therefore$  % Error in  $V = 2(\% \text{ error in } D) + \% \text{ error in } H.$

$\therefore$  Least count is 2mm.

$$\therefore \% \text{ error in } D = \frac{2\text{mm}}{20\text{cm}} \times 100\% = 1\%$$

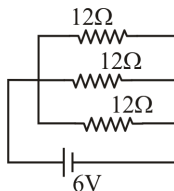
$$\& \% \text{ error in } H = \frac{2\text{mm}}{20\text{cm}} \times 100\% = 1\%$$

$$\text{So \% error in } V = 2 \times 1\% + 1\% = 3\%$$

12. **Ans (3)**

By LMC  $\rightarrow$   
 $mv = (7m) V' + mv'$   
 $V' = V/8$

13. **Ans (2)**



$$6 = 12 \times i$$

$$i = \frac{1}{2} \text{ A}$$

14. **Ans (2)**

Conceptual / theory

15. **Ans (1)**



$$T_{\text{max}} - mg = ma_{\text{max}}$$

$$800 - 500 = 50a$$

$$a = \frac{300}{50} = 6 \text{ m/s}^2$$

16. **Ans (1)**

$$\begin{aligned} \text{Work} &= T \times \text{Area} \\ &= 0.02 \times 0.05 \\ &= 0.001 \text{ J} \end{aligned}$$

17. **Ans (4)**

$$h \propto \frac{1}{r}$$

$$\frac{h_2}{h_1} = \frac{r_1}{r_2}$$

$$h_2 = \frac{r}{(r/3)} h_1 = 3h_1$$

$$\text{Given } h_1 = 3 \text{ mm}$$

$$\therefore h_2 = 9 \text{ mm}$$

18. **Ans (2)**

$$\left( \frac{x}{a} \right)^2 + \left( \frac{y}{a} \right)^2 = \sin^2 \omega t + \cos^2 \omega t$$

$$\Rightarrow \frac{x^2}{a^2} + \frac{y^2}{a^2} = 1$$

$$\Rightarrow x^2 + y^2 = a^2$$

Hence, it is a circular path.

19. Ans (1)

$$v = \frac{C}{\sqrt{\mu_r \epsilon_r}}$$

$$\mu_r = \frac{C^2}{V^2 \epsilon_r} = \frac{C^2}{\frac{C^2}{9} \times 2} = 4.5$$

20. Ans (4)

$$I_{\text{avg}} = \frac{\frac{1}{2} \times 50 \times 2}{(2-0)} = 25 \text{ A}$$

21. Ans (4)

$$\therefore P = \frac{NhC}{t\lambda}$$

$$\Rightarrow \text{No of incident photons per unit 't'}$$

$$\frac{N}{t} = \frac{P\lambda}{hC} = \frac{5 \times 10^{-3} \times 500 \times 10^{-9}}{20 \times 10^{-26}} = 125 \times 10^{14}$$

$$\text{No. of photo electrons emitted per second} = \frac{1}{100} (\text{No. of photons emitted})$$

$$\Rightarrow \frac{n}{t} = 125 \times 10^{12}$$

$$\text{then } i = \frac{ne}{t} = 125 \times 10^{12} \times 1.6 \times 10^{-19}$$

$$= 2 \times 10^{-5} \text{ A} = 20 \mu\text{A}$$

22. Ans (3)

From momentum conservation,

$$|p_{\text{atom}}| = |p_{\text{photon}}|$$

$$\therefore p_{\text{photon}} = \frac{E}{C} \text{ \& } p_{\text{atom}} = mv$$

$$\therefore E_{\text{atom}} = \frac{1}{2}mv^2$$

$$\therefore mv = p_{\text{atom}} = \frac{2E_{\text{atom}}}{V}$$

$$\text{Also, } \frac{E}{C} = \frac{2E_{\text{atom}}}{V}$$

$$\therefore E_{\text{atom}} = \frac{EV}{2C}$$

23. Ans (4)

$$\begin{array}{ccccccc} 256 & & 256-4(m) & & 256-(4m) & & 224 \\ \text{A} & \xrightarrow{\quad} & \text{X} & \xrightarrow{\quad} & \text{Y} & = & \text{B} \\ 96 \text{ m no. of } \alpha & & 96-(2m) & \text{ n no. of } \beta & 96-(2m)+n & & 88 \end{array}$$

$$\text{So that } 256 - 4m = 224 \Rightarrow 4m = 32, m = 8 \text{ no. of } \alpha$$

$$96 - (2m) + n = 88 \Rightarrow 96 - 16 + n = 88$$

$$\Rightarrow n = 7 \text{ no. of Beta}$$

24. Ans (2)

For the 4<sup>th</sup> member lyman :  $n_1 = 1, n_2 = 5$   
for the 3<sup>rd</sup> member of balmer :  $n_1 = 2, n_2 = 5$

$$\frac{\lambda_1}{\lambda_2} = \frac{R \left( \frac{1}{4} - \frac{1}{25} \right)}{R \left( \frac{1}{1} - \frac{1}{25} \right)}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{\frac{21}{100}}{\frac{24}{25}}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{21}{24 \times 4} = \frac{21}{96}$$

25. Ans (2)

$$B_1 = B_3 = 0$$

$$B_2 = \frac{\mu_0 I Q}{4\pi R}$$

$$= \frac{\mu_0 I}{4\pi R} \times \frac{\pi}{2} = \frac{\mu_0 I}{8R}$$

26. Ans (4)

$$F = qvB$$

$$k = qV = \frac{1}{2}mv^2$$

$$v \propto \sqrt{V'}$$

$$\therefore F \propto v \propto \sqrt{V'}$$

$$\therefore \frac{F}{F'} = \sqrt{\frac{V}{6V}}$$

$$\therefore F' = \sqrt{6}F$$

27. Ans (4)

$$T = \frac{2\pi m}{qB}$$

$$\Rightarrow \frac{T_1}{T_2} = \frac{m_1}{m_2} \times \frac{q_2}{q_1}$$

$$\Rightarrow \frac{T_1}{T_2} = \frac{4m}{m} \times \frac{e}{2e} = \frac{2}{1}$$

$$\Rightarrow T_1 : T_2 = 2 : 1$$

28. Ans (4)

For a molecule in solid no degree of freedom associated with translation and rotational, but degree of freedom associated to vibration along x, y and z axis,  $f = 2 \times 3 = 6$

29. Ans (2)

$$C_p - C_v = R$$

$$C_p - C_v = 2 \text{ cal/mole}^\circ\text{C}$$

$$8 - C_v = 2 \text{ cal/mol}^\circ\text{C} \Rightarrow C_v = 6 \text{ cal/mole}^\circ\text{C}$$

$$\Delta U = nC_v \Delta T$$

$$= 5 \times 6 \times (20 - 10)$$

$$= 300 \text{ cal.}$$

30. Ans (1)

$$\frac{V}{4\ell_c} - \frac{V}{2\ell_0} = 4$$

$$\frac{V}{4(2\ell_c)} - \frac{V}{2(2\ell_0)} = x$$

$$\frac{1}{2} \left[ \frac{V}{4\ell_c} - \frac{V}{2\ell_0} \right] = x$$

$$\Rightarrow \frac{1}{2} \times 4 = x$$

$$\Rightarrow x = 2$$

31. Ans (4)

$$f_0 = \frac{100}{0.5} = 200 \text{ cm}$$

$$f_e = \frac{100}{20} = 5 \text{ cm}$$

$$M = \frac{f_0}{f_e} = \frac{200}{5} = 40$$

33. Ans (2)

$$g_1 = g \left( 1 - \frac{d}{R} \right) \Rightarrow \frac{g}{5} = g \left( 1 - \frac{d}{R} \right)$$

$$\frac{1}{5} = 1 - \frac{d}{R} \Rightarrow \frac{4}{5} = \frac{d}{R}$$

$$d = \frac{4R}{5}$$

34. Ans (1)

By applying conservation of energy

$$KE_i + PE_i = KE_f + PE_f$$

$$\frac{1}{2}mv^2 - \frac{GM_em}{R} = 0 - \frac{GM_em}{2R}$$

$$\frac{1}{2}mv^2 = \frac{GM_em}{R} \left[ -\frac{1}{2} + 1 \right]$$

$$\frac{1}{2}mv^2 = \frac{GM_em}{2R} \Rightarrow v = \sqrt{\frac{GM_e}{R}}$$

35. Ans (1)

$$F = 6 \pi \eta \rho v$$

$$= 6 \times 3.14 \times 0.9 \times 5 \times 10^{-3} \times 10 \times 10^{-2}$$

$$= 847.8 \times 10^{-5} \text{ N}$$

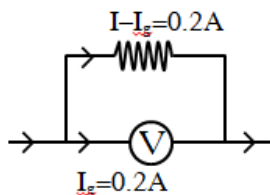
$$= 8.48 \times 10^{-3} \text{ N}$$

### SECTION-B

36. Ans (4)

$$I_g = \frac{20}{50} = 0.4 \text{ A} ; \text{ new } I'_g = \frac{10}{50} = 0.2 \text{ A}$$

$I_g$  has to be decreased by  $= 0.4 - 0.2 = 0.2 \text{ A}$ ; 0.2 ampere current needs to be passed by shunt (half the current)



so it needs to be shunted by resistance  $= 50 \Omega$ .

37. Ans (1)

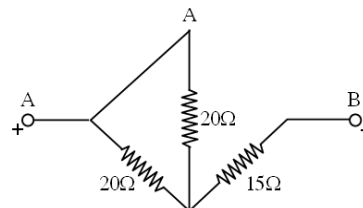
$$R = \frac{R_1 R_2}{R_1 + R_2} = \frac{200}{30} = \frac{20}{3} \Omega$$

$$\frac{dR}{R^2} = \frac{dR_1}{R_1^2} + \frac{dR_2}{R_2^2}$$

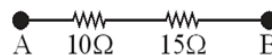
$$\frac{dR}{\frac{400}{9}} = \frac{1}{100} + \frac{0.5}{400}$$

$$dR = \frac{4}{9} + \frac{1}{18} = \frac{9}{18} = \frac{1}{2} \Omega$$

38. Ans (1)



The forward biased diode will conduct while the reverse biased will not



$\therefore$  Equivalent resistance  $= 10 + 15 = 25 \Omega$

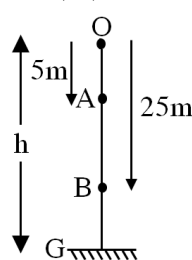
39. Ans (1)

$$F \cos 37^\circ = \mu (mg - F \sin 37^\circ)$$

$$F = \frac{\mu mg}{\cos 37^\circ + \mu \sin 37^\circ} = \frac{0.5 \times 20 \times 10}{\frac{4}{5} + 0.5 \times \frac{3}{5}} = 90.90 \text{ N}$$

$$\therefore F \approx 91 \text{ N}$$

40. Ans (3)



For first stone ( $A \rightarrow G$ )

$$h - 5 = v_A t + \frac{1}{2} g t^2 \quad [v_A = \sqrt{2 \times 10 \times 5}]$$

$$h - 5 = 10t + \frac{1}{2} g t^2 \quad \text{--- (1)}$$

For second stone ( $B \rightarrow G$ )

$$h - 25 = \frac{1}{2} g t^2 \quad \text{--- (2)}$$

Solve (1) & (2)

$$t = 2 \text{ s}$$

$$\text{Also time taken for } O \rightarrow A ; t' = \sqrt{\frac{2 \times 5}{10}} = 1 \text{ s}$$

So total time taken by first stone  $= t + t' = 3 \text{ s}$ .

41. Ans (3)

$$\phi = \frac{1}{2} (4 - t^2)$$

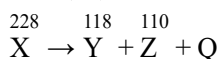
$$\text{at } t = 2, \phi = 0$$

$$\varepsilon = \frac{-d\phi}{dt} = -\frac{1}{2} (0 - 2t) = t$$

$$H = \int \frac{\varepsilon^2}{R} \cdot dt = \int_0^2 \frac{t^2}{8} \cdot dt = \frac{1}{8} \cdot \left( \frac{t^3}{3} \right)_0^2$$

$$= \frac{1}{8} \times \frac{1}{3} \times (8 - 0) = \frac{1}{3} \text{ J.}$$

42. Ans (2)



$$\begin{aligned} Q &= ((\text{BE})_{\text{Y}} + (\text{BE})_{\text{Z}})_{\text{total}} - (\text{BE}_{\text{X}})_{\text{total}} \\ &= (118 + 110)6.7 - (228)(4.2 \text{ MeV}) \\ &= (228)(6.7 - 4.2) \\ &= 570 \text{ MeV} \end{aligned}$$

43. Ans (3)

$$\begin{aligned} P &= \rho_{\text{Hg}} gh \\ &= 13.6 \times 10^3 \times 9.8 \times 10^{-10} \times 10^{-3} \\ &= 133.3 \times 10^{-10} \text{ N/m}^2 \end{aligned}$$

$$PV = NKT$$

$$N = \frac{PV}{KT}$$

$$\begin{aligned} N &= \frac{133.3 \times 10^{-10} \times 10^{-6}}{1.38 \times 10^{-23} \times 300} \\ &= 3.2 \times 10^6 \end{aligned}$$

44. Ans (4)

$$\because PT^4 = C$$

$$\Rightarrow \frac{nRT}{V} T^4 = C$$

$$\Rightarrow V = \frac{nR}{C} T^5$$

$$\therefore \frac{dV}{dT} = \frac{5nR}{C} T^4$$

$$\therefore \frac{1}{V} \frac{dV}{dT} = \frac{5nRT^4}{C} \times \frac{C}{nRT^5}$$

$$\Rightarrow \frac{5}{T}$$

45. Ans (2)

$$\frac{1}{2} K (A^2 - x^2) = \frac{1}{3} \left( \frac{1}{2} kx^2 \right)$$

$$\Rightarrow A^2 - x^2 = \frac{x^2}{3}$$

$$\Rightarrow A^2 = \frac{4x^2}{3}$$

$$\Rightarrow x = \frac{\sqrt{3}}{2} A = 0.87 A$$

$$\therefore \frac{x}{A} \times 100\% = 87$$

$$\Rightarrow x = 87$$

46. Ans (1)

From

$$x - 3t = 0$$

$$x = 3t$$

$$\therefore \frac{dx}{dt} = 3$$

$$\Rightarrow \text{wave speed} = 3 \text{ m/s}$$

47. Ans (2)

$$\cos^2 60^\circ + \cos^2 60^\circ + \cos^2 \gamma = 1$$

$$\Rightarrow \gamma = 45^\circ$$

$$\text{Vertical component of velocity} = v \cos \gamma = 50 \frac{1}{\sqrt{2}}$$

$$= 25\sqrt{2}$$

48. Ans (1)

$$F = \frac{Gm_1m_2}{r^2}$$

$$\Rightarrow F \propto \frac{1}{r^2}$$

$$\Rightarrow F \propto m_1m_2$$

$\Rightarrow$  This force provides centripetal force and acts towards sun

$$\Rightarrow T^2 \propto a^3 \text{ (Kepler's third law)}$$

49. Ans (1)

Angular width of central maxima

$$= \frac{2\lambda}{d} = \frac{2 \times 500 \times 10^{-9}}{10 \times 10^{-6}} = 0.1 \text{ rad}$$

$$= 5.75 \text{ degree}$$

$\therefore$  2.86 degree on both side of central maxima which is at  $\theta = 30^\circ$

50. Ans (4)

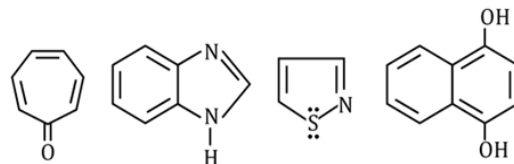
$$\because v_T \propto r^2 \Rightarrow \frac{r_1^2}{r_2^2} = \frac{v_{T1}}{v_{T2}} = \frac{9}{4} \Rightarrow \frac{r_1}{r_2} = \frac{3}{2}$$

$$\therefore \frac{V_1}{V_2} = \left( \frac{r_1}{r_2} \right)^3 = \frac{27}{8}$$

## SUBJECT : CHEMISTRY

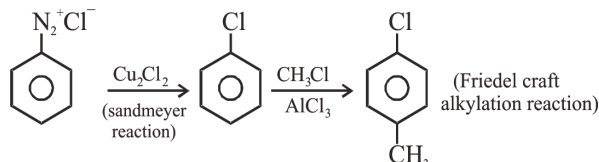
### SECTION-A

55. Ans (3)

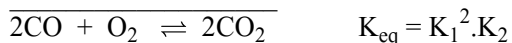
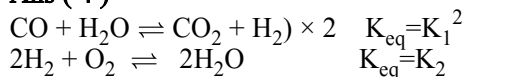


Above are aromatic in nature.

59. Ans (3)



64. Ans (4)



OR

Target rx<sup>n</sup> = 2 × eq(1) + eq (2)

(T.R.) So  $K_{\text{T.R.}} = K_1^2 \cdot K_2$

67. Ans (4)

$$h = \sqrt{\frac{K_h}{C}} = \sqrt{\frac{K_w}{K_a \times C}}$$

$h = \text{max.}, K_a = \text{min.}, pK_a = \text{max.}$

68. Ans (3)

NCERT-XI, Pg # 222, Part-1

71. Ans (4)

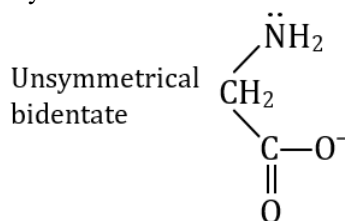
$\text{CuSO}_{4(s)} + 5\text{H}_2\text{O}(\ell) \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}_{(s)}$  is an example of  $\Delta_{\text{Hydration}} H^\circ$  of  $\text{CuSO}_4$

73. Ans (3)

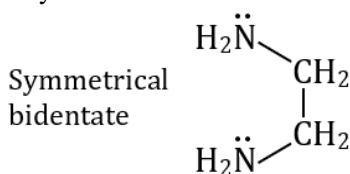
$$\begin{aligned} \Delta S &= nC_p \ln \frac{T_2}{T_1} \\ &= 2 \times \frac{5}{2} R \ln \frac{600}{300} \\ &= 5R \ln 2 \end{aligned}$$

77. Ans (1)

(1) Glycinate

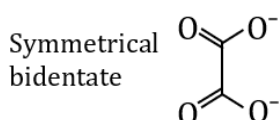


(2) Ethylenediamine



(3) Aqua  $\text{H}_2\text{O}$  monodentate.

(4) Oxalato ( $\text{C}_2\text{O}_4^{2-}$ )



#### SECTION-B

96. Ans (3)

$\text{sp}^3$  hybridisation can only have  $p\pi\text{-}d\pi$  bond as it can not form  $p\pi\text{-}p\pi$  bond.

#### SUBJECT : BOTANY

##### SECTION-A

101. Ans (3)

NCERT Pg. No. # 13

102. Ans (3)

NCERT Pg. # 22

103. Ans (4)

NCERT Pg. # 6

104. Ans (1)

NCERT Pg. # 60

105. Ans (4)

NCERT Pg. # 77

106. Ans (1)

NCERT, Pg. # 71

107. Ans (1)

NCERT Pg. # 85

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114. Ans (3)

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125. **Ans (1)**  
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