



Answers Key

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



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Hints and Solutions

PHYSICS

SECTION-A

1. Answer (3)

From equation of uniformly accelerated motion

$$v = u + at$$

$$7.5 = 15 + 5a$$

$$a = -1.5 \text{ m/s}^2$$

Now $F = ma$

$$|\vec{F}| = 120 \times 1.5$$

$$= 180 \text{ N}$$

2. Answer (3)

Elongation in the wire is given as

$$\Delta l = \frac{Fl}{AY}$$

$$T_{\max} = \frac{mv^2}{l} + mg$$

$$T_{\max} = 3mg$$

$$\Delta l_{\max} = \frac{3mgl}{\pi r^2 Y}$$

3. Answer (1)

$$\text{COP} = \frac{Q_L}{W} = \frac{T_{\text{Low}}}{T_{\text{High}} - T_{\text{Low}}} = \frac{250}{300 - 250} = 5$$

$$\frac{Q_L}{W} = 5$$

$$W = \frac{500 \times 4.2}{5} = 420 \text{ J}$$

4. Answer (3)

Kinetic energy $E \propto T$

$$\frac{E_1}{E_2} = \frac{T_1}{T_2}$$

$$T_2 = 2 \times 293$$

$$T_2 = 586 \text{ K} = 313^\circ\text{C}$$

5. Answer (2)

Diamagnetic materials create an induced magnetic field in a direction opposite to an externally applied magnetic field, and hence are repelled by the applied magnetic field.

6. Answer (3)

Reactance of the capacitor is $X = \frac{1}{\omega C}$

$$C' = 3C$$

$$\omega' = 3\omega$$

$$X' = \frac{1}{C'\omega'} = \frac{1}{9\omega C}$$

$$X' = \frac{X}{9}$$

7. Answer (1)

From Wien's displacement law,

$$\lambda_m T = b \Rightarrow T = \frac{2.89 \times 10^{-3}}{2.5 \times 10^{-6}} = 1.156 \times 10^3$$

$$= 1156 \text{ K}$$

8. Answer (2)

The desirable properties for handling a cooking pan is low thermal conductivity and high specific heat as it needs to quickly transmit heat and retain more heat for a given rise in temperature.

9. Answer (2)

According to Gauss's law for magnetism

$$\oint \vec{B} \cdot d\vec{s} = 0$$

10. Answer (1)

Interference is the result of the superposition of waves.

11. Answer (2)

Torque on a bar magnet in external uniform magnetic field is

$$\vec{\tau} = \vec{M} \times \vec{B}$$



$$\begin{aligned}\vec{\tau} &= NIAB \sin 90^\circ \\ &= 500 \times 2 \times 50 \times 10^{-4} \times 2 \times 10^{-3} \\ &= 0.01 \text{ N m}\end{aligned}$$

12. Answer (3)

Given beat frequency

$$|X - 95| = 5$$

$$\text{and } |3X - 290| = 10$$

$$\Rightarrow X = 100 \text{ Hz}$$

13. Answer (1)

Frequency in the stretched wire is

$$f = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$$

$$f_1^2 = \frac{T_1}{4\mu l^2}$$

$$f_2^2 = \frac{T_2}{4\mu l^2}$$

$$\frac{T_1 + T_2}{4\mu l^2} = f^2$$

$$f^2 = f_1^2 + f_2^2$$

$$f = \sqrt{(80)^2 + (150)^2} = 170 \text{ Hz}$$

14. Answer (1)

In a measurement, a choice of change of different units does not change the number of significant figures.

15. Answer (3)

Unit of temperature is Fahrenheit

Unit of mass is atomic mass of unit

Unit of length is light year

Unit of time is shake

16. Answer (2)

On repetitive use of NAND gate or NOR gate, any logic gate can be prepared.

17. Answer (3)

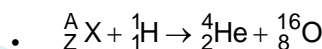
In intrinsic semiconductors, conductivity is mainly due to breakage of covalent bonds

In extrinsic semiconductors, the conductivity is due to the addition of impurities.

18. Answer (3)

The spectrum of H-atom is formulated and drawn by Bohr's model. These spectrums are line spectrum. Lyman series lies in UV region, Balmer Partly lies UV and partly in the visible region and Paschen series lies in the infrared region.

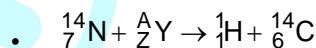
19. Answer (1)



$$Z + 1 = 2 + 8 \Rightarrow Z = 9 \Rightarrow X \rightarrow \text{F}$$

$$A + 1 = 4 + 16 \Rightarrow A = 19$$

$$\Rightarrow {}^A_Z X = {}^{19}_9\text{F}$$



$$7 + Z = 1 + 6 \Rightarrow Z = 0$$

$$14 + A = 1 + 14 \Rightarrow A = 1$$

$$\Rightarrow {}^A_Z Y = {}^1_0\text{n}$$

20. Answer (1)

Distance travelled by the body = Sum of areas under the curve (both below and above x-axis)

$$= \frac{1}{2} \times 3 \times 10 \times 2$$

$$= 30 \text{ m}$$

21. Answer (3)

Since the water removed from the pond will be equal to the water displaced by the (man + boat) system, the level of water in the pond remains the same.

22. Answer (4) (Explanation can be elaborate)

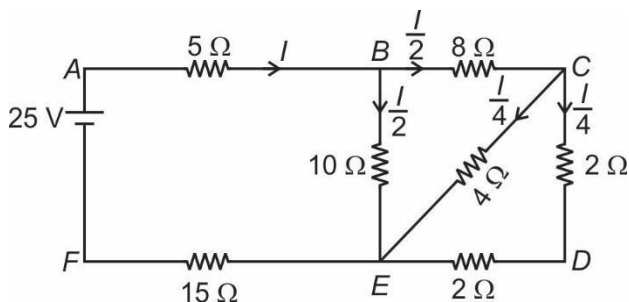
For a region of constant electric potential

(1) The electric field may be uniform

(2) The electric field may be zero

(3) There can be no charge inside the region

23. Answer (3) (Explanation can be elaborate)



$$I = \frac{25}{R_{eq}}$$

$$R_{eq} = 25 \Omega$$

$$I = \frac{25}{25} = 1 \text{ A}$$

$$\text{Current in } 4 \Omega \text{ resistance} = \frac{I}{4} = \frac{1}{4} = 0.25 \text{ A}$$

24. Answer (2)

Resistance of whole wire is

$$R = r \times l$$

$$20 = 1 \times l$$

$$l = 20 \text{ m}$$

Let length of the shorter section = a

$$\frac{1}{R} = \frac{1}{a} + \frac{1}{(20-a)}$$

$$\frac{1}{1.8} = \frac{20-a+a}{a(20-a)} \Rightarrow 20a - a^2 = 36$$

$$a = 2 \text{ and } 18$$

$$\Rightarrow a = 2 \text{ m}$$

25. Answer (1)

$$\text{Flux through a surface } \phi = \vec{E} \cdot \vec{A}$$

$$\phi = (6\hat{i} - 4\hat{j} + 7\hat{k}) \cdot 200\hat{i}$$

$$= 1200 \text{ unit}$$

26. Answer (2)

From work energy theorem

$$W_{sp} + W_E = \Delta K$$

$$-\frac{1}{2} kx_0^2 + QE \cdot x_0 = 0$$

$$\Rightarrow x_0 = \frac{2QE}{k}$$

27. Answer (3)

Elastic potential energy stored in the spring

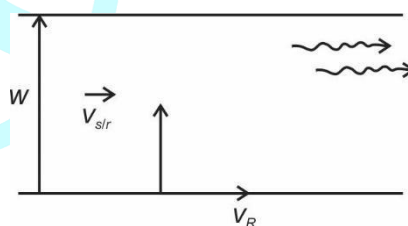
$$U = \frac{1}{2} kx^2$$

$$= \frac{1}{2} Fx = \frac{F^2}{2k}$$

$$\text{Hence } \frac{U_1}{U_2} = \frac{k_2}{k_1} \quad [F \text{ is same for both springs}]$$

$$= \frac{500}{1200} = \frac{5}{12}$$

28. Answer (2)



Time (minimum) taken to cross the river

$$t = \frac{W}{v_{s/r}} = \frac{200 \times 10^{-3}}{2}$$

$$= 100 \times 10^{-3} \text{ h}$$

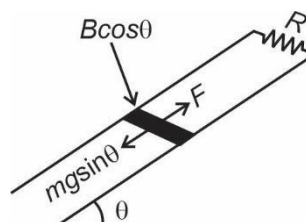
$$= 0.1 \text{ h} = 6 \text{ minutes}$$

29. Answer (1)

Inside a spherical shell gravitational field is zero, so net force acting on a particle placed inside it is also zero.

Total energy of a bound system is always negative.

30. Answer (2)



$$F = il \times B$$

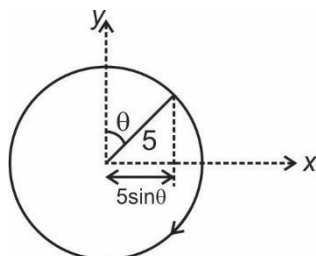
$$\Rightarrow mg \sin \theta = il \times B$$



$$\Rightarrow mg \sin \theta = \left(\frac{B \cos \theta l v}{R} \right) l B \cos \theta$$

$$\Rightarrow v = \frac{Rmg \sin \theta}{B^2 l^2 \cos^2 \theta}$$

31. Answer (1)



$$\omega = \frac{2\pi}{T} = \frac{\pi}{5} \text{ rad/s}$$

$$\theta(\text{at } t = 0) = 0^\circ$$

$$x = 5 \sin \omega t$$

$$x = 5 \sin \left(\frac{\pi}{5} t \right)$$

32. Answer (4)

For thin prism, deviation = $(\mu - 1)A$

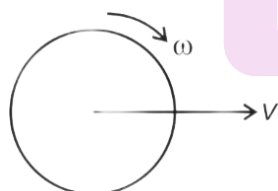
33. Answer (3)

Magnify power of telescope for far point is given as

$$m = \frac{\theta_i}{\theta_o} = \frac{f_o}{f_e}$$

$$\Rightarrow \theta_i = \theta_o \left(\frac{f_o}{f_e} \right) = 1^\circ \left(\frac{100}{5} \right) = 20^\circ$$

34. Answer (4)



$$\theta = \omega t$$

$$2\pi = \left(\frac{v}{3R} \right) t$$

$$\Rightarrow t = \frac{6\pi R}{v}$$

The distance travelled by car in this time is

$$s = vt$$

$$\Rightarrow s = v \left(\frac{6\pi R}{v} \right)$$

$$= 6\pi R$$

35. Answer (2)

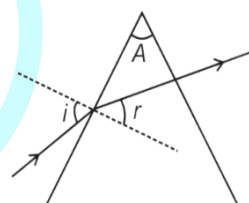
Balancing torque about COM

$$T_A \left(\frac{l}{2} \right) = T_B \left(\frac{l}{6} \right)$$

$$\Rightarrow \frac{T_A}{T_B} = \frac{1}{3}$$

SECTION-B

36. Answer (3)



For normal emergence

$$r = A$$

From Snell's Law

$$\frac{\sin i}{\sin r} = \frac{\mu}{1}$$

$$\Rightarrow \sin i = \sqrt{2} \sin 30^\circ$$

$$\Rightarrow i = 45^\circ$$

37. Answer (2)

Angular momentum imparted to sprinkler per

$$\text{second} = vr \frac{dm}{dt} = \frac{0.6}{60} \times 0.5 \times 1 = 0.005 \text{ N.m}$$

$$\Rightarrow I \frac{d\omega}{dt} = 0.005$$

$$\Rightarrow \frac{d\omega}{dt} = \frac{0.005}{500 \times 10^{-7}}$$

$$= 100 \text{ rad/s}^2$$

38. Answer (4)

Applying conservation of momentum for collision of blocks

$$2mv + 0 = 3mv'$$

$$\Rightarrow v' = \frac{2v}{3} \quad \dots(1)$$

Now, from conservation of energy

$$\frac{1}{2} \times 3m \times v'^2 = \frac{1}{2} kx_0^2$$

$$x_0 = \sqrt{\frac{3mv'^2}{k}} = v' \sqrt{\frac{3m}{k}}$$

$$= \frac{2v}{3} \sqrt{\frac{3m}{k}} = v \sqrt{\frac{4m}{3k}}$$

39. Answer (3)

Given $F \propto \frac{1}{r^n}$

$$m\omega^2 R = \frac{K}{R^n}$$

$$\Rightarrow \frac{m.4\pi^2 R}{T^2} = \frac{K}{R^n}$$

$$\Rightarrow T^2 \propto R^{n+1}$$

$$T \propto R^{\frac{n+1}{2}}$$

40. Answer (2)

When wire is stretched uniformly

$$R \propto l$$

$$\frac{R}{R'} = \left(\frac{l}{nl}\right)^2 = \frac{1}{n^2}$$

$$R' = n^2 R$$

When this elongated wire is cut into 5 parts,

$$\text{resistance of each part} = \frac{n^2 R}{5}$$

$$\text{Effective resistance between A and C} = \frac{n^2 R}{5}$$

(As the system forms a Wheatstone's Bridge)

41. Answer (4)

$$C_1 = 1 \mu\text{F} \quad V_1 = 100 \text{ V} \Rightarrow U_1 = \frac{1}{2} \times 1 \times 10^{-6} \times (100)^2$$

$$= 5 \times 10^{-3} \text{ J}$$

$$C_2 = 1 \mu\text{F}, \text{ common potential } V = \frac{C_1 V_1}{C_1 + C_2} = \frac{100}{2} = 50 \text{ V}$$

Final electrostatic energy stored in both the capacitors

$$= \frac{1}{2} (C_1 + C_2) V^2 = \frac{1}{2} \times 2 \times (50)^2 \times 10^{-6}$$

$$= 2.5 \times 10^{-3} \text{ J}$$

$$\text{Energy lost} = 5 \times 10^{-3} - 2.5 \times 10^{-3}$$

$$= 2.5 \times 10^{-3}$$

$$\% \text{ loss of energy} = \frac{2.5 \times 10^{-3}}{5 \times 10^{-3}} \times 100$$

$$= 50\%$$

42. Answer (3)

$$\vec{F} = eE_0 \hat{j}$$

$$\vec{a}_y = \frac{eE_0}{m} \hat{j}$$

$$v_x = u_x + a_x t = v_0 \quad (\square a_x = 0)$$

$$v_y = 0 + a_y t$$

$$v_y = \left(\frac{eE_0}{m} t\right)$$

$$\vec{v} = v_x \hat{i} + v_y \hat{j}$$

$$= v_0 \hat{i} + \left(\frac{eE_0}{m} t\right) \hat{j}$$

$$|\vec{v}| = \sqrt{v_0^2 + \left(\frac{eE_0 t}{m}\right)^2} = v_0 \sqrt{1 + \left(\frac{eE_0 t}{mv_0}\right)^2}$$

$$\lambda = \frac{h}{m|\vec{v}|} = \frac{h}{mv_0 \sqrt{1 + \left(\frac{eE_0 t}{mv_0}\right)^2}}$$

$$\lambda = \frac{\lambda_0}{\sqrt{1 + \left(\frac{eE_0 t}{mv_0}\right)^2}}$$

43. Answer (3)

$$kx = mg - F_{\text{up}}$$

$$kx = mg - \frac{md}{D} g$$

$$kx = mg \left\{ 1 - \frac{d}{D} \right\}$$

$$x = \frac{mg}{k} \left(1 - \frac{d}{D} \right)$$

44. Answer (3)

In a number without decimal, trailing zeros are insignificant. If a number has a decimal, then preceding zeros are insignificant.

Hence, In 40.40 all zeros are significant

45. Answer (4)

The relation between α and β is given as

$$\beta = \frac{\alpha}{1 - \alpha}$$

$$\beta_1 = \frac{\frac{20}{21}}{1 - \frac{20}{21}} = 20$$

$$\beta_2 = \frac{\frac{100}{101}}{1 - \frac{100}{101}} = 100$$

46. Answer (2)

From Ampere's circuital law

$$\begin{aligned} \oint \vec{B} \cdot d\vec{l} &= \mu_0 i_{\text{enc}} \\ &= \mu_0 (3 + 1) \\ &= 4\mu_0 \end{aligned}$$

47. Answer (1)

For minima

$$d \cos \theta = \left(n + \frac{1}{2} \right) \lambda$$

$$\Rightarrow \cos \theta = \frac{2n+1}{8}$$

$$\square -1 \leq \cos \theta \leq 1$$

$$\Rightarrow n = -4, -3, -2, -1, 0, 1, 2, 3$$

$$\Rightarrow 8 \text{ minimas}$$

48. Answer (2)

From F. B. Ds of

$$9 \text{ kg} \rightarrow 90 - T_1 = 9a \quad \dots(1)$$

$$6 \text{ kg} \rightarrow T_1 - T_2 = 6a \quad \dots(2)$$

$$5 \text{ kg} \rightarrow T_2 - 50 = 5a \quad \dots(3)$$

$$(1) + (2) + (3)$$

$$40 = 20a \Rightarrow a = 2 \text{ m/s}^2$$

$$T_1 = 72 \text{ N} \Rightarrow T_1' = 72\sqrt{2} \text{ N}$$

$$T_2 = 60 \text{ N} \Rightarrow T_2' = 60\sqrt{2}$$

49. Answer (1)

From first law of thermodynamics

$$\Delta W = \Delta Q - \Delta U$$

$$\Delta Q = nC_p \Delta T$$

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

$$\Delta W = n(C_p - C_v) \Delta T$$

$$\frac{\Delta Q}{\Delta W} = \frac{\gamma}{\gamma - 1} \quad \left[\frac{C_p}{C_v} = \gamma \right]$$

50. Answer (1)

$$\text{As } V^2 = V_R^2 + V_C^2$$

$$\begin{aligned} \Rightarrow V_R &= \sqrt{V^2 - V_C^2} = \sqrt{10^2 - 8^2} \\ &= 6 \text{ V} \end{aligned}$$

$$\text{Now, } \tan \phi = \frac{X_C}{X_R} = \frac{V_C}{V_R} = \frac{8}{6} = \frac{4}{3}$$

CHEMISTRY

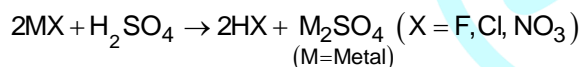
SECTION-A

51. Answer (2)

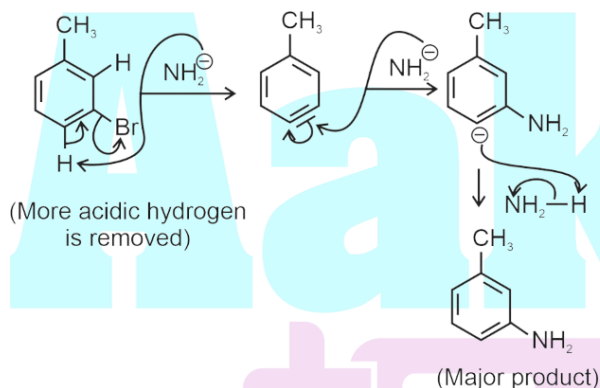
Compound	Melting Point(K)
HF	190
HCl	159
HBr	185
HI	222

52. Answer (3)

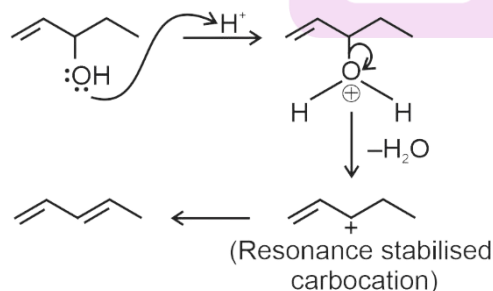
Sulphuric acid, because of its low volatility can be used to manufacture more volatile acids from their corresponding salts.



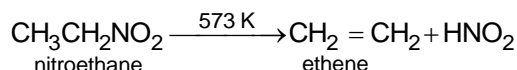
53. Answer (1)



54. Answer (2)



55. Answer (2)



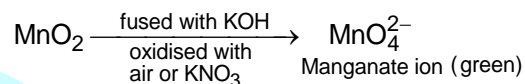
56. Answer (4)

High density polythene is chemically inert.

57. Answer (4)

Brompheniramine (Dimetapp) acts as antihistamine

58. Answer (2)

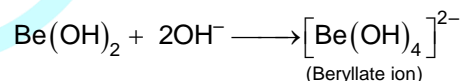


59. Answer (3)

Generally, $\Delta_i H$ decreases down the group but Pb has higher $\Delta_i H$ than Sn due to poor shielding effect of intervening *d* & *f* orbitals.

60. Answer (2)

$Be(OH)_2$ is amphoteric in nature



61. Answer (4)

- s-block and p-block elements together are called as representative elements.
- $Zn (Z = 30)$ is a *d*-block element.

62. Answer (4)

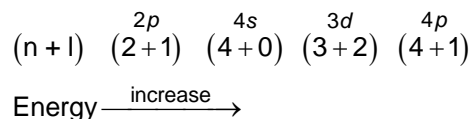
HF molecules are associated with strong intermolecular hydrogen bonding hence its boiling point is highest

63. Answer (1)

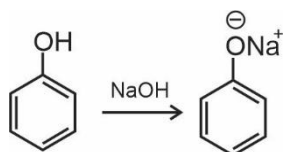
SO_2 is the component of classical smog.

64. Answer (4)

- For a multielectron system, the energy of orbitals increases with increase in $(n + l)$ value.
- For same $n + l$ value, the orbital with higher value of *n* has higher energy.

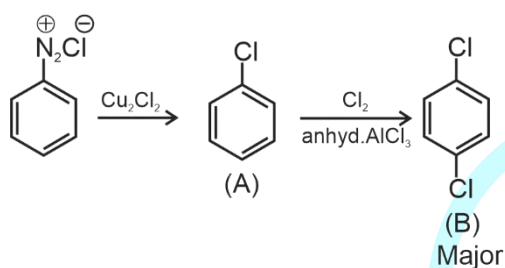


65. Answer (3)

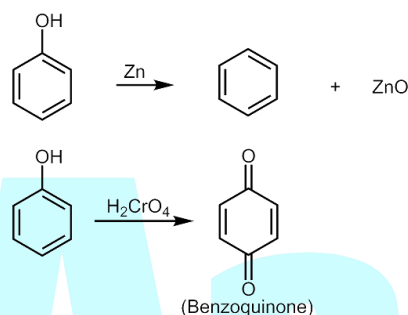


Sodium phenoxide is resonance stabilised hence phenol is most easily soluble in aqueous alkali.

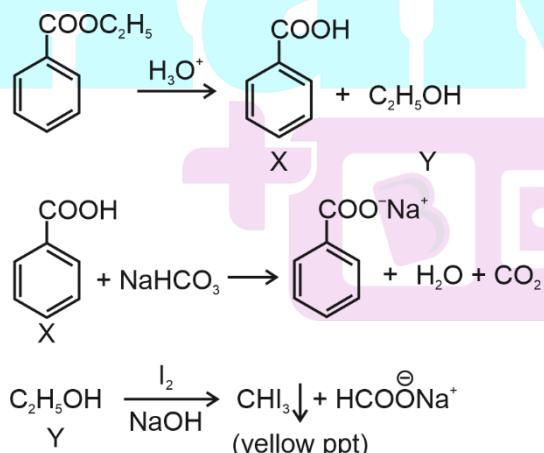
66. Answer (3)



67. Answer (3)



68. Answer (2)



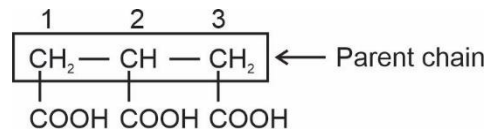
69. Answer (3)

$$\begin{aligned} \text{Energy of the complex for low spin } d^4 \text{ cation (CFSE)} &= -\frac{2}{5} \times 4\Delta_0 + P \\ &= -1.6 \Delta_0 + P \end{aligned}$$

70. Answer (2)

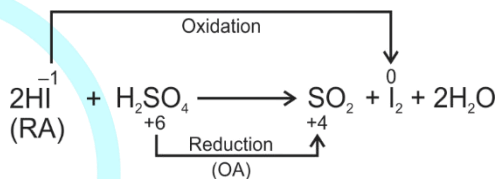
Kjeldahl's method is not applicable to compounds containing nitrogen in nitro and azo groups and nitrogen present in the ring.

71. Answer (3)

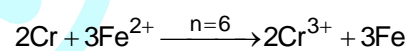


IUPAC name: Propane-1, 2, 3-tricarboxylic acid.

72. Answer (3)



73. Answer (2)



$$\Delta G^\circ = -nE^\circ F$$

$$-170 \times 10^3 = -6 \times E^\circ \times 96500$$

$$E^\circ_{\text{cell}} = 0.29 \text{ V}$$

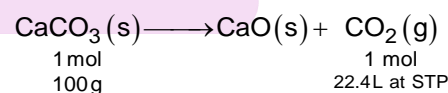
74. Answer (1)

- Packing efficiency for both ccp and hcp structures are 74%
- $Z_{\text{ccp}} = Z_{\text{FCC}} = 4$
- $Z_{\text{HCP}} = 6$

75. Answer (1)

Electricity produced by applying pressure on a crystal is known as piezoelectricity.

76. Answer (4)

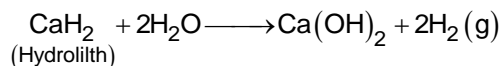


$$\text{Volume of CO}_2 \text{ obtained} = 22.4 \times \frac{25}{100} = 5.6 \text{ L at STP}$$

77. Answer (4)

Ellingham diagram explains the feasibility of reduction process not the kinetics of process.

78. Answer (1)



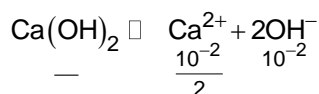
79. Answer (2)

- $2\text{Cl(g)} \rightarrow \text{Cl}_2(\text{g})$ is exothermic process so $\Delta H < 0$
- $\Delta n_g < 0$ so, $\Delta S < 0$

80. Answer (2)

$$\text{pH} = 12, \text{pOH} = 14 - 12 = 2$$

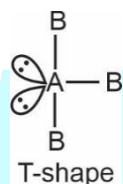
$$[\text{OH}^-] = 10^{-2}$$



$$K_{sp} = [\text{Ca}^{2+}][\text{OH}^-]^2 = \frac{(10^{-2})}{2} (10^{-2})^2 = 0.5 \times 10^{-6}$$

$$K_{sp} = 5 \times 10^{-7}$$

81. Answer (2)



82. Answer (3)

Optimum pH range for enzymatic activity is 5 to 7

83. Answer (4)

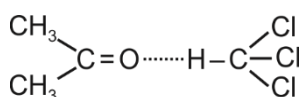
$$t_{99.9} = \frac{2.303}{k} \log \frac{100}{100 - 99.9} = 3 \times \frac{2.303}{k}$$

$$t_{50} = \frac{0.693}{k}$$

$$\frac{t_{99.9}}{t_{50}} = \frac{3 \times 2.303 \times k}{k \times 0.693} = 9.96 \approx 10$$

84. Answer (1)

Mixture of acetone and chloroform shows negative deviation from Raoult's law because of hydrogen bonding



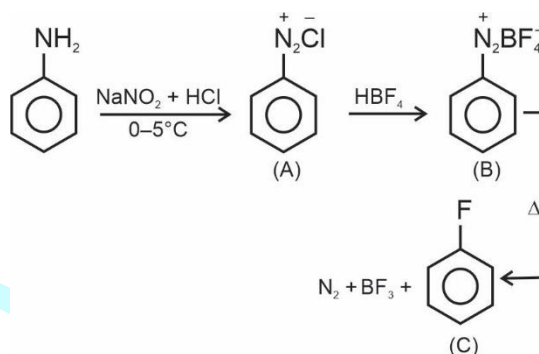
85. Answer (3)



$$i = 1 - \alpha + n\alpha = 1 - 1 + 3 = 3$$

SECTION-B

86. Answer (3)



87. Answer (2)

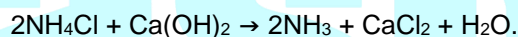
$$u_{rms1} = \sqrt{\frac{3RT}{M}}$$

When the temperature is tripled,

$$u_{rms2} = \sqrt{\frac{3R(3T)}{M}} = \sqrt{3} \times u_{rms1} = 1.73 \times u_{rms1}$$

88. Answer (2)

NH_3 is recovered when solution containing NH_4Cl is treated with Ca(OH)_2 (slaked lime).



89. Answer (1)

$$\text{Power of bulb} = 662 \text{ watt} = 662 \text{ J s}^{-1}$$

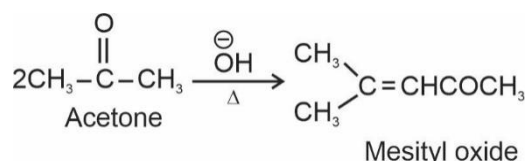
$$\begin{aligned} \text{Energy of one photon} &= \frac{6.62 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9}} \\ &= 6.62 \times 10^{-19} \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Number of photons emitted} &= \frac{662}{6.62 \times 10^{-19}} \\ &= 10^{21} \text{ s}^{-1} \end{aligned}$$

90. Answer (1)

- $[\text{Co(NH}_3)_5\text{Cl}]\text{Cl}_2 + \text{AgNO}_3(\text{excess}) \longrightarrow [\text{Co(NH}_3)_5\text{Cl}](\text{NO}_3)_2 + 2\text{AgCl} \downarrow$
- Secondary valence of Co in $[\text{Co(NH}_3)_5\text{Cl}]\text{Cl}_2$ is six.

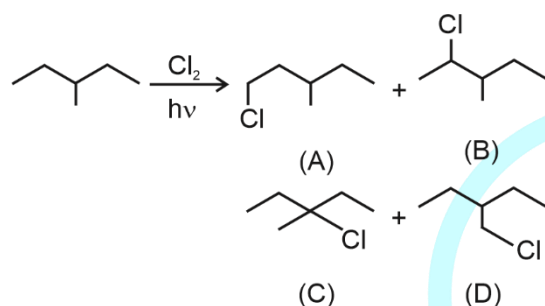
91. Answer (3)



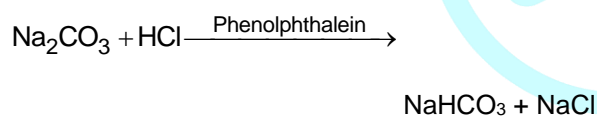
92. Answer (4)

For esters, prefix used is alkoxycarbonyl.

93. Answer (3)



94. Answer (4)



$$E_{\text{Na}_2\text{CO}_3} = \frac{M_{\text{Na}_2\text{CO}_3}}{\text{n-factor}} = \frac{106}{1} = 106$$

95. Answer (1)



$$(\wedge_m^\circ)_{\text{salt}} = 3(\wedge_m^\circ)_{\text{Ca}^{2+}} + 2(\wedge_m^\circ)_{\text{PO}_4^{3-}}$$

$$(\wedge_{\text{eq}}^\circ)_{\text{salt}} = \frac{(\wedge_m^\circ)_{\text{Ca}^{2+}}}{2} + \frac{(\wedge_m^\circ)_{\text{PO}_4^{3-}}}{3}$$

96. Answer (2)

$$\Delta G^\circ = -2.303 RT \log K$$

$$= -2.303 \times R \times 300 \times \log 10^{10}$$

$$= -2.303 \times 3000 R$$

$$= -6909 R$$

97. Answer (3)

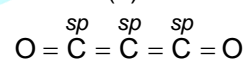
In case of gas in gas, true solution will be always formed.

98. Answer (2)

Fraction of molecule having energy E_a or greater

$$\text{than } E_a = e^{\frac{-E_a}{RT}}$$

99. Answer (1)



100. Answer (3)

$$\text{Moles of Al} = \frac{5.4}{27} = \frac{1}{5}$$

$$q = nC\Delta T = \frac{1}{5} \times 24 \times 30 = 144 \text{ J}$$

BOTANY

SECTION-A

101. Answer (4)

There is a proton gradient created across the thylakoid membrane. The breakdown of this gradient is important because it leads to the release of energy. The gradient is broken down due to the movement of protons across the membrane to the stroma through the transmembrane channel with the help of F₀ part of the ATPase.

The ATPase enzyme consists of two parts: F₀ and F₁. This breakdown provides enough energy to cause a conformational change in the CF₁ particle

of the ATPase, which makes the enzyme synthesize ATP. It is the breakdown of proton gradient that leads to release of energy. So, the correct answer is "option (4)"

102. Answer (3)

In DNA, the nitrogenous bases present in the DNA are purines and pyrimidines. Purines are double ring while pyrimidines are single ring structure. Adenine and guanine are purines while thymine and cytosine are pyrimidines. A purine is attached to pyrimidine by hydrogen bond. Adenine is attached to thymine by two hydrogen bonds while three hydrogen bond is present between guanine and cytosine.



The hydrogen bond joins two adjacent nitrogenous bases present on the complementary strands. The bond joining two successive nucleotides in the same strand of DNA is called the phosphodiester bond. The phosphodiester bond is the linkage between the 3' carbon atom of one sugar molecule and the 5' carbon atom of another, deoxyribose in DNA and ribose in RNA. Strong covalent bonds form between the phosphate group and two 5-carbon ring carbohydrates (pentoses) over two ester bonds. So, as per the question, the correct answer is "option (3)"

103. Answer (4)

RNA dependent DNA synthesis occur in reverse transcription. The synthesis of DNA from an RNA template, via reverse transcription, produces complementary DNA (cDNA). Reverse transcriptase (RT), also known as RNA-dependent DNA polymerase, is a DNA polymerase enzyme that transcribes single-stranded RNA into DNA. This enzyme is able to synthesize a double helix DNA once the RNA has been reverse transcribed into a single-strand DNA.

Transcription occurs through the DNA-dependent-RNA Polymerase enzyme. Translation is the process of formation of the polypeptide chain from the RNA with the help of ribosomes and tRNA.

Replication is DNA-Dependent-DNA synthesis by the activity of DNA polymerase.

104. Answer (2)

Formation of new DNA molecule from a parent DNA molecule is called DNA replication. It occurs in cytoplasm in prokaryotes and nucleus in eukaryotes. During replication, energy rich deoxyribonucleoside triphosphates are the source of energy, in the formation of new DNA molecule. It inserts nucleotides into the existing chain to generate a completely new DNA strand using the DNA polymerase enzyme. The dNTPs significantly combine and synthesize a complete strand of DNA. Thymine, Cysteine, Adenine and Guanine are the nitrogenous pairs present in DNA,

which further forms dNTPs like dTTP, dCTP, and dGTP respectively. While in RNA, instead of adenine, uracil is present. So, dUTP does not act as substrate in DNA replication, as it is present in RNA and absent in DNA.

105. Answer (4)

Anthropogenic extinction is also known as Holocene extinction, which is the disappearance of large land animals or the megafauna due to human activities. As a result of human activities several families of flora and fauna including birds, mammals, amphibians etc have become extinct. This is majorly due to destruction of coral reefs and rainforests by human activities.

Natural factors usually occur at a slower rate than human factors and therefore cause a lower extinction rate. Human activities occur at a faster rate and cause higher anthropogenic extinction rates.

106. Answer (4)

Soil erosion is the natural process in which the topsoil of a field is carried away by physical sources such as wind and water. Overgrazing, over cropping and deforestation can lead to soil erosion. Restoring a forest do not cause soil erosion or desertification. Resorting a forest leads to growing of more trees and hence soil becomes less eroded.

107. Answer (3)

Paired condition of chromosomes is restored during fertilisation *i.e.*, in zygote. During gamete formation, both homologous chromosomes as well as genes carried by them segregate in such a way that only one of each pair is transmitted to a gamete. Hence, haploid gametes consist of only one of the chromosome or gene from the pair present before segregation.

108. Answer (4)

In codominance both alleles are simultaneously expressed in the heterozygote. The ABO blood group system is one of the best examples of codominance.



For example: If a person has blood group A, it means the RBC surface consists of antigen-A. But this is decided by the gene I. The gene I have three types of alleles namely, I^A , I^B and i . The alleles I^A and I^B produce two different antigens while the allele- i do not produce any antigen. Hence, alleles I^A and I^B are dominant over the allele i . In codominance, there is no intermediate expression as both the alleles express themselves equally and the phenotypic effect of both the alleles is equally prominent and therefore, they produce altogether a third type of phenotype. So, in co-dominance, both genotypic as well as phenotypic ratios are same i.e., 1 : 2 : 1.

109. Answer (2)

In humans, skin colour is expressed by more than two genes. Human skin colour is a polygenic trait, which is controlled by a number of genes.

Blood type is an example of codominant inheritance. In this inheritance pattern, neither allele masks the other, and instead, they are expressed equally. What do you mean by phenylketonuria Class 12?

Phenylketonuria is a condition in which the amino acid phenylalanine is accumulating inside the body. The disease is caused due to the defective gene of phenylalanine hydroxylase involved in the digestion of the amino acid phenylalanine. The gene controlling starch synthesis in pea exhibits pleiotropy. The gene regulates the starch synthesis and the shape of the seed. It has two alleles, B and b. Starch is synthesized by BB homozygotes and large starch granules are produced.

110. Answer (1)

Euglena is unusual in the fact it's both heterotrophic, like animals, and autotrophic, like plants. This means it is able to consume food such as green algae and amoebas by phagocytosis (engulfing cells) but they are also able to generate energy from sunlight by photosynthesis - which is perhaps the preferred method. So, *Euglena* is considered a photosynthetic protist.

111. Answer (3)

Claviceps is a sac fungus and it produces meiospores inside a sac like ascus. Ascomycetes are Commonly known as sac-fungi and are mostly multicellular, While *Colletotrichum* being imperfect fungus (Deuteromycetes) lacks sexual reproduction and only asexual or vegetative phases of these fungi are known.

112. Answer (4)

The fruiting bodies of fungi contain spores, which are dispersed for reproduction. Mushrooms are a familiar example of a fruiting body. They are formed from hyphae, the tiny threads that make up the bulk of most fungi. A network of hyphae, known as a mycelium, extends in all directions through the soil. Yeast does not form fruiting bodies. Yeast is a unicellular i.e. single-celled and non-mycelial saprophytic fungus. In anaerobic conditions, yeast converts sugar into alcohol with the release of carbon dioxide and some energy. Due to this, yeast is used in a fermentation process.

113. Answer (3)

When a cell is placed in a hypertonic solution water moves out of the cell. When a cell placed in hypertonic solution (has more solutes than cell), the cell will shrink because water moves out, firstly from the cytoplasm and then from the vacuole. This process is called as exosmosis which leads to the plasmolysis.

114. Answer (1)

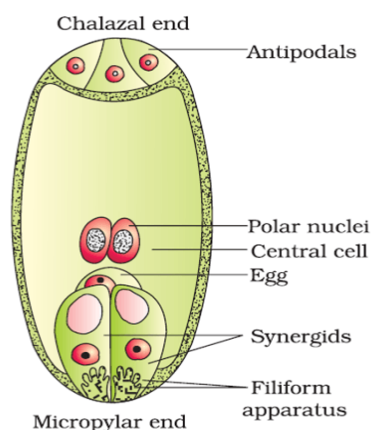
A typical mature embryo sac of Angiosperms is a 7-celled and 8-nucleate structure.

(i) At the micropylar end, an egg apparatus is present which consists of an egg cell and 2 synergid cells. Synergids contain filiform apparatus which guides the pollen tube entry into the embryo sac during fertilisation.

(ii) At the chalazal end, three antipodal cells are present.

(iii) In the centre, two polar nuclei are present which get fused prior to fertilisation to form a diploid secondary nucleus.

Hence, 8 nuclei are constituted within 7 cells. Thus, embryo sac is 7-celled and 8-nucleate.



115. Answer (2)

Algin and carrageen are hydrocolloids obtained from brown and red algae respectively. Carrageenan is present in red seaweeds. It is used to thicken a variety of foods, ice cream, salad dressings, chocolate milk, and jellies.

Algin is present in brown seaweeds. It is a carbohydrate. It is used in the formation of various medicines.

Algin is used to reduce the cholesterol levels and also decreases the levels of heavy chemicals such as barium, zinc, tin, mercury, cadmium which are taken up by the body.

116. Answer (3)

Magnesium constitutes the ring structure of chlorophyll. Magnesium helps to maintain the structural integrity of the chlorophyll pigment.

It forms the centre of the porphyrin ring of the green plant pigment chlorophyll. It helps the plant to be able to convert light into the usable form of energy.

117. Answer (4)

Crossing over is an enzyme-mediated process, where the exchange of genetic material between non-sister chromatids of homologous chromosomes takes place. It occurs at the pachytene stage of prophase I of meiosis.

118. Answer (3)

Only one chromosome out of a pair reaches the pole and the number of chromosomes becomes half in the daughter cells during anaphase I. In

anaphase I, there is a shortening of the spindle microtubules. Each daughter chromosome is pulled along by its centromere. The two sister chromatids of each chromosome are pulled apart by the spindle and dragged by their kinetochores toward opposite poles of the cell. Hence there is a reduction in the number of chromosomes to half. Thus the correct answer is option (3).

119. Answer (3)

Taxonomical aids are the collections of samples or preserved organisms which help in extensive research for the identification of various taxonomic hierarchy.

Flora contains information of plants found in a particular area. Flora contains the account of habitat and distribution of plants in a given area. Flora provides an index to the plant species found in a particular area.

The monograph contains complete information on any one taxon. Monographs provide information for the identification of species found in an area.

Keys are used for identifying plants and animals based on similarities and dissimilarities.

A catalogue can be defined as a complete list or a booklet or register, which comprises a list of characters and their alternates present in various taxa.

120. Answer (3)

Some characteristics of living organisms are growth, reproduction, responsiveness to stimuli, and metabolism. But, reproduction has exceptions in living organisms such as mules, infertile couples etc.

121. Answer (1)

The Krebs cycle, also known as TCA cycle, consumes pyruvate and produces three things: carbon dioxide, a small amount of ATP, and two kinds of reductant molecules called NADH and FADH. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes.



Substrate level phosphorylation occurs at a only two particular steps in Krebs cycle.

In eukaryotes, Krebs cycle takes place in the mitochondrial matrix.

122. Answer (3)

Explant is plant part used in tissue culture. Any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media is called explant. The growth of this part in a suitable culture medium is called tissue culture.

Pathogen free clones of plants can be obtained through meristem culture. It is possible to produce disease-free plants through meristem culture because viruses move readily in the vascular system, which, in meristems, is absent. A high metabolic activity in the actively dividing meristematic cells does not allow virus replication and a high endogenous auxin level in shoot apices may inhibit virus multiplication

123. Answer (4)

Xerophytes have thick cuticle, Scotoactive stomata in CAM plants and Blubber in seals are all adaptations, seen in various organisms that help them to survive in environment.

While, in humans, binding capacity of haemoglobin decreases at high altitude. The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of haemoglobin and by increasing breathing rate. And this is not considered as adaptation.

124. Answer (2)

Producers capture 1% of energy from sun i.e., 1000 kcal and then 10% law of energy transfer is followed.

According to the 10 percent law, only 10% of the energy is transferred to each trophic level from its lower trophic level. If 1,00,000 kcal of energy is available as sunlight, then only 1000 kcal of energy will be available to the producer and only 100 kcal of energy will be available to the primary consumer(herbivore) and 10 kcal energy will be

available to the secondary consumer (carnivore I). Thus the energy available with the tertiary consumer (carnivore II) will be 1 kcal.

125. Answer (2)

Asexual reproduction does not involve meiosis and all divisions are mitotic. When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is called asexual. As a result, the offspring that are produced are genetically similar to one another but are also exact copies of their parent. Only mitotic division occurs in asexual reproduction. It does not require the production of sex organs. Asexual reproduction has no evolutionary significance, as it involves only one parent.

126. Answer (4)

Central cell is the largest cell of the embryo sac and initially contain two polar nuclei and form binucleate cell of the mature embryo sac.

The two polar nuclei get fused prior to fertilisation to form a diploid secondary nucleus. Hence, the central cell is binucleate. Antipodal cell, Synergid and Egg cell are all haploid.

127. Answer (2)

Dragonfly is used to get rid of mosquitoes. Baculoviruses

Glomus forms symbiotic association with plants. Baculoviruses are pathogens that attack insects and other arthropods and thus have Narrow spectrum insecticidal application. While, *Trichoderma* are free living fungi that are very common in root ecosystem and effective biocontrol agent against several plant pathogens.

128. Answer (2)

Rice plant shows hypogeal germination in which epicotyl grows first and cotyledons remain underground.

Tobacco is a short day plant. Short day plants are the plants which require the exposure of light period much shorter than critical light period. This plant flowers only when photoperiod is below the critical period i.e. uninterrupted long dark period is needed. When these plants are exposed to a photoperiod longer than critical period, they fail to produce flowers.



129. Answer (2)

Stilt roots are the roots that arise from the lower nodes on the stem and they grow downwards in an oblique fashion and penetrate the soil. They provide additional mechanical support to the plant.

130. Answer (3)

Offsets are sub-aerial weak stem. Axillary buds are modified into thorns in some plants. Pneumatophores are respiratory roots. Pulvinus is swollen leaf base.

131. Answer (4)

Annual rings are distinct in plants growing in temperate regions.

One annual ring includes one circle of spring wood and one circle of autumn wood. Late wood is darker in colour and has higher density.

132. Answer (3)

In monocot stem, hypodermis is sclerenchymatous and endodermis is absent. It has a single layer epidermis. The vascular bundles are scattered. Xylem and phloem are present on same radii, and also present side by side. So they are also called collateral and conjoint vascular bundles. In the vascular bundles, cambium is absent between xylem and phloem, So these are closed vascular bundles.

133. Answer (3)

The small circular DNA outside the genomic DNA, i.e., plasmid, is used to monitor bacterial transformation with foreign DNA.

Mesosomes are unique membranous bacterial structures that **actively function in cell injury and physiological cellular processes, such as replication and separation of nucleoids and oxidative phosphorylation.**

Chromatophore is a pigment bearing cell or structure.

Polysomes are ensembles of two or more consecutive ribosomes that translate mRNA into proteins.

134. Answer (3)

One of the most important functions of plasma membrane is the transport of the molecules across

it. The cell membrane acts as a selective barrier for the entry and exit of the material. The proteins present in the cell membrane are specific to the material and they allow the entry or exit of molecules, according to the concentration gradient, for example, channel and carrier proteins or against the concentration gradient through the use of energy, for example, pump proteins.

135. Answer (2)

When the centromere is in the middle forming two equal arms, it is termed as metacentric chromosome. When the centromere is present slightly away from the centre of the chromosome, it is called sub-metacentric chromosome. In case of acrocentric chromosome the centromere is situated close to its end forming one extremely short and one very long arm, whereas the telocentric chromosome has a terminal centromere.

So, as per the question, the correct answer is "submetacentric and acrocentric"

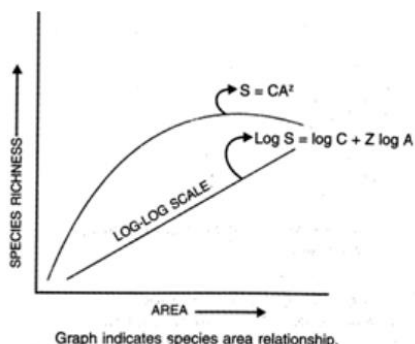
SECTION-B

136. Answer (2)

The sequence of chromosome 1 was completed only in May 2006. Chromosome 1 has most genes (2968) and the Y has fewest (231). Chromosome 1 is designated as the largest human chromosome.

137. Answer (4)

This relationship curve for most of the species is a rectangular hyperbola. Such species with rectangular hyperbolic curves include angiosperm plants, birds, bats, and freshwater fishes. If a graph was plotted, the relationship is a straight line represented by the equation $\log S = \log C + Z \log A$ where, S is the species richness, A is the area of habitat, Z is the slope of the line (regression coefficient) and C is the Y-intercept. The slope of the line is much steeper and ranges between two.



Value of Z is 1.15 for frugivorous birds and mammals in tropical forests of different continents.

138. Answer (4)

Polyblend was developed by Ahmed Khan and his company. Polyblend is a fine powder of recycled modified plastic. The binding property of plastic makes the road last longer besides giving strength to withstand more loads when mixed with bitumen. Polyblend lowers moisture absorption capacity due to the coating of plastics at the surface.

139. Answer (4)

Phenylketonuria is a rare inherited disorder that causes an amino acid called phenylalanine to build up in the body. It is caused by a defect in the gene that helps create the enzyme needed to break down phenylalanine.

Myotonic dystrophy is an autosomal dominant disorder which is typically inherited from a person's parents.

Sickle-cell anemia is caused by a point mutation in the β -globin chain of hemoglobin, causing the hydrophilic amino acid glutamic acid to be replaced with the hydrophobic amino acid valine at the sixth position. The genes for red-green colorblindness are passed down on the X chromosome. Since it's passed down on the X chromosome, red-green colorblindness is more common in men.

140. Answer (4)

Dinoflagellates are mostly found in marine habitat. They are eukaryotes and reproduce sexually. Since dinoflagellates both make and ingest food,

they are considered to be autotrophs as well as heterotrophs.

141. Answer (3)

Symplastic pathway consists of living parts of plant body. The symplastic system is the system of interconnected protoplasts neighboring cells are connected through cytoplasmic strands that extend through plasmodesmata. Symplast cells have more than one nucleus and transport water very fast.

During the symplastic moment, water travels through the plasmodesmata.

As the symplastic system is the system of interconnected protoplast, it is directly affected by metabolic state of root

142. Answer (1)

Roots in gymnosperms are tap roots. Only naked seeds are produced and double fertilization cannot occur, as they are non-flowering plants. Gymnosperms are characterised by a lack of outer covering to seeds, lack of flowers and fruit. Unlike bryophytes and pteridophytes, in gymnosperms, the male and the female gametophytes do not have an independent free-living existence. They remain within the sporangia, retained on the sporophytes.

143. Answer (3)

Decomposition is the process of breaking of complex organic matter into simpler inorganic matter.

Good aeration increases the rate of decomposition of detritus. Decomposition of detritus is affected by the abiotic factors like, Availability of oxygen, pH, Nitrogen, Temperature, Soil substratum.

144. Answer (1)

'+' is positive interaction '-' is negative interaction. ('+ -') is parasitism where parasite is benefitted and host is harmed.

Commensalism refers to relationship wherein one organism is benefitted while other remains unaffected and is denoted by + 0.



Amensalism refers to association wherein one partner is inhibited while other remains nearly unaffected and is denoted by - 0.

Mutualism is association of organisms wherein both are benefitted and is denoted by + +.

145. Answer (3)

Whisky, Brandy and Rum are produced by the distillation of the fermented broth. Hard liquors such as gin, whisky, sake, arrak, brandy or rum are obtained by distillation of fermented broth. Wine and beer are produced without distillation of the fermented broth.

146. Answer (2)

Pollen grains can be stored for years in liquid nitrogen at -196°C .

In majority of angiosperms, pollen grains are shed at 2-celled stage. Pollen grains are male gametophytes of flowering plants which produce the male gametes.

Pollen grain has a two layered wall. The outer hard wall is called exine and the inner thin wall is called intine.

Exine is made up of a very resistant material called sporopollenin which can withstand high temperatures, strong alkali and acids. It cannot be degraded by any enzyme.

147. Answer (3)

Auxin promote the apical dominance whereas this effect is counteracted by cytokinin. These hormone act antagonistically.

Presence of cytokinin in an area causes preferential movement of nutrients towards it.

When applied to lateral buds, they help in their growth despite the presence of apical bud. They thus act antagonistically to auxin which promotes apical dominance. Therefore cytokinin can overcome apical dominance, caused by auxins.

148. Answer (3)

A sterile stamen is called staminode. It is an often rudimentary, sterile or abortive stamen, which means that it does not produce pollen. Staminodes are frequently inconspicuous and stamen-like, usually occurring at the inner whorl of the flower, but are also sometimes long enough to protrude from the corolla. The only function of staminode is to prevent self pollination.

149. Answer (2)

Pericycle is the layer which separates the endodermis and vascular tissues from each other. Its main function is support, protection of the plant, also helps the plants to stand upright as it protects xylem and phloem tissues of plants. They do not have sclerenchymatous cells as they never perform the function of mechanical strength and are simply for protection of vascular bundles. Cells of endodermis and not pericycle, adjust the quantity and type of solutes that reach the xylem.

150. Answer (4)

When the chromosomes are condensing to undergo mitosis, the centrioles form the areas that mitotic spindle forms from.

The axonemal core of motile cilia and flagella consists of nine doublet microtubule surrounding two central single microtubules. Spindle fibres are made up of tubulin proteins which are non-contractile.

SECTION-A

151. Answer (1)

In humans, lungs are enclosed by double layered pleura, with pleural fluid between them. Outer parietal pleura and inner visceral pleura is present. It reduces friction on the lung surface.

152. Answer (3)

Liver produces a protein called angiotensinogen. Angiotensinogen is converted into angiotensin I by the action of renin. The angiotensin I is further converted into angiotensin II by ACE (Angiotensin Converting Enzyme). The angiotensin II, then stimulates the adrenal cortex to release aldosterone.

153. Answer (2)

The vertebral ribs or floating ribs refers to the two lowermost, 11th and 12th pair of ribs because they are attached to the vertebrae only.

154. Answer (4)

Saddle joint is present between carpal and metacarpal of thumb. It is a type of joint where one of the bones forming the joint is shaped like a saddle with the other bone resting on it like a rider on a horse. Pivot joint is present between the atlas and axis.

155. Answer (2)

Bee-keeping is not labour-intensive work.

156. Answer (4)

The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services is known as biotechnology. In vitro fertilization leads to a test-tube baby, DNA vaccine is synthesised and defective gene can be corrected.

157. Answer (4)

The convention for naming restriction enzymes is the first letter of the name which comes from the genus and the second two letters come from the species of the prokaryotic cell from which they were isolated.

158. Answer (1)

Some plasmids may have only one or two copies per cell whereas others may have 15-100 copies per cell.

159. Answer (3)

According to Oparin-Haldane hypothesis, the first form of life could have come from pre-existing non-living organic molecules.

160. Answer (1)

Gene migration, genetic drift, mutation, genetic recombination and natural selection affect Hardy-Weinberg equilibrium.

161. Answer (3)

<i>Australopithecines</i>	–	Not taller than 4 feet but walked upright
<i>Homo habilis</i>	–	650-800 cc cranial capacity
<i>Homo erectus</i>	–	900 cc cranial capacity
<i>Homo sapiens neanderthalensis</i>	–	Lived in near East and Central Asia between 1,00,000-40,000 years ago

162. Answer (2)

Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their defence action.

Scents and pigments are secondary metabolites.

163. Answer (4)

A ribozyme is an enzyme made up of RNA rather than protein.

164. Answer (4)

Lecithin is a phospholipid found in cell membrane.

Fatty acids are esterified with glycerol.

The structure of amino acids changes in solutions of different pH. Ribose sugar is absent in DNA.

165. Answer (1)

Mucus coating of epithelium lining the respiratory, GIT and urinogenital tracts are physical barriers.



Acid in stomach is a physiological barrier of innate immunity.

166. Answer (4)

Psoriasis is an immune mediated disease that causes red, scaly patches on the skin.

167. Answer (4)

Hormones are target-specific *i.e.* they show their effect on the specific target organs only.

168. Answer (1)

Spermathecal pores and collateral glands are associated with genital pouch of female cockroaches. In male cockroach, genital pouch contains dorsal anus, ventral genital pore and gonapophysis.

169. Answer (4)

Diarrhoea	:	Abnormal frequency of bowel movements and increased liquidity of faecal discharge
Indigestion	:	Caused due to inadequate enzyme secretion
Constipation	:	Faeces are retained within the colon
Kwashiorkar	:	Protein-energy malnutrition

170. Answer (2)

Steapsin is a pancreatic lipase.

171. Answer (4)

In chordates (dog fish), pharynx is perforated by gill slits. Star fish, devil fish and cuttle fish are non-chordates.

172. Answer (3)

In ctenophores, body bears eight external rows of ciliated comb plates, which help in locomotion.

173. Answer (3)

<i>Pleurobrachia</i>	–	Paired tentacles
<i>Fasciola</i>	–	Oral sucker
<i>Spongilla</i>	–	Collar cells
<i>Saccoglossus</i>	–	Collar

174. Answer (4)

Whatever be the life span, death of every individual organism is a certainty. So, no individual is immortal except single-celled organisms as there is no natural death in single-celled organisms. *Planaria* is a platyhelminth and multicellular organism.

175. Answer (3)

During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms.

176. Answer (4)

Fertilisation occurs only when both sperms and ovum reach simultaneously at ampullary isthmic junction.

177. Answer (3)

In human beings, after one month of pregnancy, the embryo's heart is formed. The first sign of growing foetus may be noticed by listening to the heart sound carefully through the stethoscope.

178. Answer (2)

Oviduct	–	Isthmus, ampulla, infundibulum
Uterus	–	Fundus and cervix
Mammary gland	–	Ampulla and areola
Sperm	–	Head, neck and tail

179. Answer (2)

Some reptiles are viviparous. Reptiles exhibit internal fertilisation and direct development without a larval stage.

180. Answer (3)

Blood from pulmonary veins and vena cava flows into the left and the right ventricles respectively.

181. Answer (4)

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	Anti-B	A, O
B	B	Anti-A	B, O
AB	A, B	Nil	AB, A, B, O
O	Nil	Anti-A, B	O



182. Answer (2)

The hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation.

183. Answer (1)

Priya's pregnancy is within the first 12 weeks, hence the opinion of one registered medical practitioner is required for the termination of her pregnancy.

184. Answer (3)

'Nirodh' is a popular brand of condom for the males only.

185. Answer (1)

Eli Lilly was the pioneer of producing human insulin by rDNA technology.

SECTION-B

186. Answer (1)

Hooks and suckers are peculiar features of parasitic flatworms. In tapeworms, alimentary canal is absent, and they absorb nutrients directly from hosts through their body surface.

187. Answer (3)

Veins carry blood from different organs and deliver it to the heart.

188. Answer (3)

Entamoebahistolytica is a protozoan parasite in the large intestine of human which causes Amoebiasis.

Ascaris is an intestinal parasite causing ascariasis.

189. Answer (2)

There is 1000 mmol in 1 mole.

The blood glucose concentration in a normal healthy human is 4.2 mmol/L – 6.1 mmol/L.

190. Answer (2)

In the given case, one antibiotic resistance gene helps in selecting the transformants, whereas the other antibiotic resistance gene which gets inactivated due to insertion of alien DNA helps in the selection of recombinants.

191. Answer (1)

Both exonucleases and endonucleases break phosphodiester bonds or sugar-phosphate backbones of DNA.

192. Answer (1)

The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography is called adaptive radiation. When the same structure in different animals develop along different directions due to adaptations to different needs is known as divergent evolution. Co-evolution occurs when two or more species reciprocally affect each other's evolution through the process of natural selection.

193. Answer (2)

The capability of concentrating the urine is largely related to the length of the loop of Henle.

194. Answer (4)

Respiratory rhythm centre is situated in the medulla oblongata region of the brain.

195. Answer (3)

The mode of action of injectables, implants and oral contraceptive pills is similar. Effect of ovulation and effect of implantation is also similar.

196. Answer (2)

Golden rice is a vitamin A enriched genetically modified crop.

197. Answer (2)

The hindbrain consists of pons, cerebellum and medulla oblongata.

198. Answer (1)

Myelin sheath, if present, is present on the axons. The gaps between two adjacent myelin sheaths are called Nodes of Ranvier.

199. Answer (2)

The function of cilia is to move particles or mucus in a specific direction over the epithelium.

200. Answer (1)

Adrenal cortex is divided into three layers i.e. zona reticularis (inner layer), zona fasciculata (middle layer), zona glomerulosa (outer layer).

