



Aakash

Medical | IIT-JEE | Foundations

Corporate Office: Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456

(Advanced INTENSIVE Mastery for 720)

MM : 720

CST-16

Time : 3 Hrs. 20 Min.

Answers

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

29/04/2024



CODE-A

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Answers & Solutions

PHYSICS

SECTION-A

1. Answer (1)

$$\text{We know, } \omega^2 - \omega_0^2 = 2\alpha\theta$$

$$-(80)^2 = 2\alpha(20)(2\pi)$$

$$\frac{80 \times 80}{80\pi} = \alpha$$

$$\alpha = -\frac{80}{\pi} \text{ rad/ s}^2$$

2. Answer (1)

$$\text{We know, } \vec{\tau} = \vec{r} \times \vec{F}$$

$$\therefore \vec{r} \cdot \vec{\tau} = 0 \text{ and } \vec{F} \cdot \vec{\tau} = 0$$

\therefore Dot product of both will be zero

3. Answer (3)

For hollow sphere

$$V_{\text{in}} = \text{constant} = -\frac{GM}{R} \quad [r = R]$$

$$\text{and, } V_{\text{out}} = -\frac{GM}{r} \quad [r \geq R]$$

4. Answer (2)

$$Y = \frac{F\ell}{Ax}$$

$$\frac{Y_1}{Y_2} = \frac{\left(\frac{F\ell}{Ax}\right)_1}{\left(\frac{F\ell}{Ax}\right)_2}$$

$$\frac{Y_1}{Y_2} = \left[\frac{F(4.9)}{(3 \times 10^{-5})(x)} \right] \left[\frac{4 \times 10^{-5}(x)}{F \times 3.5} \right]$$

$$\frac{Y_1}{Y_2} = \frac{(4)(4.9)}{3(3.5)} \approx 1.9$$

5. Answer (2)

$$P_{\text{eq}} = P_1 + P_2$$

$$= 6 - 4$$

$$P_{\text{eq}} = +2D$$

$$\frac{1}{f_{\text{eq}}} = \frac{2}{100} \text{ cm}$$

$$f_{\text{eq}} = 50 \text{ cm}$$

6. Answer (3)

Focal length of convex mirror $f = \frac{R}{2}$ and it is independent of medium.

7. Answer (1)

$$q = CV$$

$$i = C \frac{dV}{dt}$$

$$= 4 \times 10^{-12} \times 10^{11}$$

$$i = 0.4 \text{ A}$$

8. Answer (2)

For first minima $\Delta x = \lambda$

Angular width of first minima,

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

$$\theta = \frac{4000 \times 10^{-10}}{2 \times 10^{-4}}$$

$$\theta = 2 \times 10^{-3} \text{ radian}$$

9. Answer (3)

Electron volt is a unit of energy.

10. Answer (4)

$$\text{Power} = I \times S$$

$$= 1.5 \times 10^3 \times 6 \times 14$$

$$= 126 \times 10^3 \text{ W} = 126 \text{ kW}$$

$$\text{Solar energy} = P \times t$$

$$= 126 \times 10^3 \times 2 \times 60 \times 60$$

$$= 9072 \times 10^5 \text{ J} = 907.2 \text{ MJ}$$

$$\text{Radiation pressure} = \frac{I}{c} = \frac{1.5 \times 10^3}{3 \times 10^8}$$

$$= 0.5 \times 10^{-5} = 5 \times 10^{-6} \text{ N/m}^2$$

$$\text{Force} = P \times S = 5 \times 10^{-6} \times (6 \times 14)$$

$$= 420 \times 10^{-6}$$

$$= 4.2 \times 10^{-4} \text{ N}$$

11. Answer (3)

$$80 \text{ g of } {}^{240}\text{X will have } \frac{1}{3} \text{ mole of X}$$

$$\text{Number of atom} = \frac{1}{3} \times N_A = \frac{1}{3} \times 6 \times 10^{23}$$

$$= 2 \times 10^{23}$$

$$\text{Energy released} = 2 \times 10^{23} \times 200 \text{ MeV}$$

$$= 4 \times 10^{25} \text{ MeV}$$

12. Answer (4)

$$n_e n_h = n_i^2$$

$$n_e = \frac{n_i^2}{n_h} = \frac{(2.5 \times 10^{16})^2}{7.5 \times 10^{22}}$$

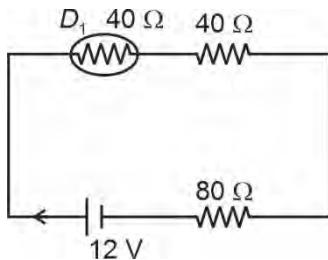
$$= \frac{2.5 \times 2.5 \times 10^{32}}{7.5 \times 10^{22}}$$

$$n_e = 8.3 \times 10^9 / \text{m}^3$$

13. Answer (3)

D_1 is forward biased and D_2 is reverse biased

Equivalent circuit is



$$i = \frac{12}{(80 + 40 + 40)}$$

$$i = \frac{12}{160} = 0.075 \text{ A} = 75 \text{ mA}$$

14. Answer (3)

Resistivity of a semiconductor decreases with increase in temperature because number of charge carriers increases.

15. Answer (1)

Let R be the resistance of each part, then

$$R = \frac{100}{10} = 10 \Omega$$

In parallel combination,

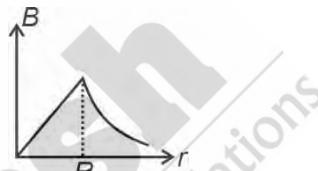
$$\frac{1}{R_{\text{eq}}} = \frac{1}{R} \times 10 \Rightarrow R_{\text{eq}} = \frac{10}{10} = 1 \Omega$$

16. Answer (3)

$$\text{For } r \leq R, B = \frac{\mu_0 i r}{2\pi R^2} \Rightarrow B \propto r$$

$$\text{For } r > R, B = \frac{\mu_0 i}{2\pi r} \Rightarrow B \propto \frac{1}{r}$$

Therefore, the graph of B vs r will be



17. Answer (2)

The universal property of all substances is diamagnetism.

18. Answer (3)

$$\text{Magnetic moment (M)} = iA$$

$$M = i \times \pi R^2 \quad \dots(i)$$

$$\text{Magnetic field at the centre of circular coil, } B = \frac{\mu_0 i}{2R}$$

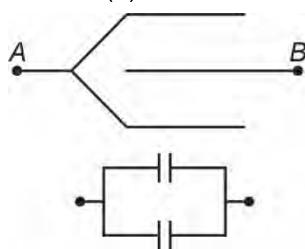
$$\therefore i = \frac{2BR}{\mu_0} \quad \dots(ii)$$

$$M = \frac{2BR}{\mu_0} \times \pi R^2 = \frac{2\pi B R^3}{\mu_0}$$

19. Answer (1)

$F_{\text{net}} = 0$ if electric dipole is in uniform electric field and charge is invariant in nature.

20. Answer (3)



$$C_{AB} = 2C$$

$$C = \frac{A\varepsilon_0}{d}$$

$$C_{AB} = \frac{2A\varepsilon_0}{d}$$

21. Answer (1)

Time taken in two consecutive minima = T

$$T = \frac{1}{f}$$

$$= \frac{1}{2} \text{ s}$$

22. Answer (3)

$$x = a \cos \frac{\pi t}{2}$$

$$T = \frac{2\pi}{\omega}$$

$$= \frac{2\pi}{\frac{\pi}{2}}$$

$$= 4 \text{ s}$$

In one time period displacement of the particle will be zero.

23. Answer (1)

Every object has a certain temperature and when two objects are in thermal equilibrium, their temperature are equal.

24. Answer (2)

$$TV^{\gamma-1} = C$$

$$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$$

$$\gamma = \frac{5}{3}$$

$$\therefore 300(V)^{\frac{2}{3}} = T(2V)^{\frac{2}{3}}$$

$$T = \frac{300}{2^{\frac{2}{3}} 2^{\frac{2}{3}}}$$

$$T = 189 \text{ K}$$

25. Answer (2)

Rate of flow of liquid $Q = AV \Rightarrow$ S.I. unit = m^3/s

26. Answer (2)

$$Q = mL$$

$$= 20 \times 80$$

$$= 1600 \text{ cal}$$

Required to convert complete ice into water

$$160 = m \times 80$$

2 g water, remaining 18 g m ice in final content.

27. Answer (1)

$$|\vec{a}_{\text{sys}}| = \frac{10 \times 10 - 5 \times 10}{10 + 5} = \frac{100 - 50}{15}$$

$$= \frac{50}{15} = \frac{10}{3} = 3.33 \text{ m s}^{-2}$$

28. Answer (3)

$$a = v \frac{dv}{dx} = 5x \times 5 = 25x, a_{\text{at}, x=2} = 50 \text{ m/s}^2$$

29. Answer (2)

Assertion and reason both are individually true but reason is not correct explanation as path of one projectile seen from another is straight line as the relative acceleration is zero.

30. Answer (3)

$$d \propto \sqrt{t} \Rightarrow d = k\sqrt{t} \Rightarrow v = \frac{d}{dt}(k\sqrt{t}) = \frac{k}{2}(t)^{\frac{-1}{2}}$$

$$a = \frac{dv}{dt} = \frac{k}{2} \times \left(-\frac{1}{2}\right) \times (t)^{\frac{-3}{2}}$$

$$a = -\frac{k}{4} \left[(t)^{\frac{-1}{2}}\right]^3 \Rightarrow a \propto v^3$$

31. Answer (3)

$$V_{\text{avg}} = \frac{V_1 + V_2 + V_3 + V_4 + V_5}{5} = \frac{28}{5} = 5.6 \text{ m s}^{-1}$$

32. Answer (1)

$$KE = \frac{1}{2} m(\vec{v}_x + \vec{v}_y)^2$$

$$KE = \frac{1}{2} m \left(\sqrt{v^2 + g^2 t^2} \right)^2$$

$$KE = \frac{1}{2} mv^2 + \frac{1}{2} mg^2 t^2$$

33. Answer (2)

$$\frac{dKE}{dt} = 2t$$

$$KE = \frac{1}{2} mv^2 = t^2 \Rightarrow v = \sqrt{\frac{2}{m} \cdot t}$$

$$\frac{dKE}{dt} = mv \frac{dv}{dt} = 2t$$

$$m \sqrt{\frac{2}{m}} t \frac{dv}{dt} = 2t$$

$$\frac{mdv}{dt} = 2\sqrt{\frac{m}{2}}$$

$$F = \sqrt{2m}$$

34. Answer (4)

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{\frac{1}{2}(32 \times 10^{-6})}}$$

$$\omega_0 = \frac{1000}{4} \text{ rad/s}$$

$$= 250 \text{ rad/s}$$

35. Answer (4)

$$E = B\ell v$$

$$= \frac{1}{2} \times 0.4 \times 7$$

$$= 1.4 \text{ volt}$$

SECTION-B

36. Answer (2)

$$\text{We know, } \omega_i = \frac{10(2\pi)}{60} = \frac{\pi}{3} \text{ rad/s}$$

$$\omega_f = \frac{5\pi}{3} \text{ rad/s}$$

$$\omega = \Delta KE = \frac{1}{2} I (\omega_f^2 - \omega_i^2)$$

$$= \frac{1}{2} (10) \left[\left(\frac{5\pi}{3} \right)^2 - \left(\frac{\pi}{3} \right)^2 \right] = 5 \left[\frac{250}{9} - \frac{10}{9} \right]$$

$$\omega = 5 \left(\frac{240}{9} \right) = 133.3 \text{ J}$$

37. Answer (2)

$$\text{Force on 1 kg mass } F_1 = \frac{GM(1)}{R^2} = 10 \text{ N}$$

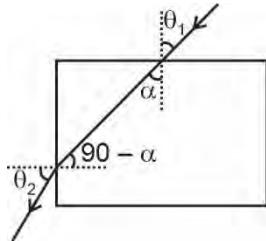
$$\text{Force on satellite } F_2 = \frac{GM \times (200)}{\left(\frac{3}{2}R\right)^2} = \frac{GM(800)}{9R^2}$$

$$\frac{F_2}{F_1} = \frac{800}{9}$$

$$\therefore F_2 = \frac{800}{9} (F_1) = \left(\frac{800}{9} \right) (10) = 888.88 \text{ N}$$

$$\therefore F_2 \approx 889 \text{ N}$$

38. Answer (3)



If θ_1 increases, then α also increases.

So, $90 - \alpha$ decreases so, θ_2 also decreases.

39. Answer (1)

$$I = 4I_0 \cos^2 \left(\frac{\Delta\phi}{2} \right)$$

$$2I_0 = 4I_0 \cos^2 \left(\frac{\Delta\phi}{2} \right)$$

$$\Rightarrow \frac{1}{\sqrt{2}} = \cos \left(\frac{\Delta\phi}{2} \right)$$

$$\frac{\Delta\phi}{2} = \frac{\pi}{4} \Rightarrow \Delta\phi = \frac{\pi}{2}$$

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

$$\Delta x = \frac{\lambda}{4}$$

$$\Rightarrow y = \frac{\Delta x D}{d} = \frac{\lambda D}{4d} = \frac{500 \times 10^{-9} \times 4}{4 \times 10^{-3}} = 5 \times 10^{-4} \text{ m}$$

40. Answer (4)

$$\bullet [v] = [LT^{-1}] = [a][T]$$

$$\therefore [a] = [LT^{-2}] \quad \dots(i)$$

$$\bullet [c] = [T^2] \quad \dots(ii)$$

$$\bullet [b] = [v][T^2] = [LT^{-1}][T^2]$$

$$= [LT] \quad \dots(iii)$$

$$\text{Hence } [abc] = [LT^{-2}][T^2][LT]$$

$$= [L^2T]$$

41. Answer (3)

Nuclear density is independent of mass number, so the ratio will be 1 : 1.

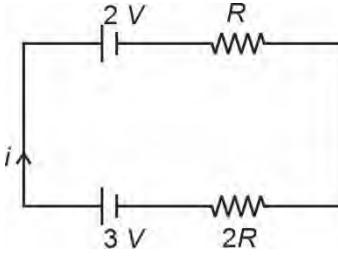
42. Answer (4)

For NOR gate

$$Y = \overline{A + B}$$

43. Answer (1)

At steady state, capacitor will act as an open wire



$$i = \frac{3V - 2V}{2R + R} = \frac{V}{3R}$$

44. Answer (2)

$$U = -\frac{k2qQ}{a} + \frac{2kq^2}{a} - \frac{kQq}{a}$$

$$U = 0$$

$$-2Q + 2q - Q = 0$$

$$Q = \frac{2q}{3}$$

45. Answer (4)

$$F_{\text{net}} = \frac{kq_1q_2}{1^2} + \frac{kq_1q_2}{2^2} + \frac{kq_1q_2}{4^2} + \frac{kq_1q_2}{8^2} + \dots$$

$$F_{\text{net}} = 9 \times 10^9 \times 4 \times 10^{-6} \left(\frac{1}{1} + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \dots \right)$$

$$= 36 \times 10^3 \left(\frac{1}{1 - \frac{1}{4}} \right)$$

$$= 48000 \text{ N}$$

46. Answer (2)

$$mg \sin 53^\circ = \eta A \frac{\Delta v}{\Delta y}$$

$$(\ell^3 \times \rho) g \times \frac{4}{5} = \eta \ell^2 \times \frac{v}{t}$$

$$\eta = \frac{4}{5} \times \frac{\ell^3 \rho g \times t}{\ell^2 \times v}$$

$$\eta = \frac{4}{5} \times \frac{\ell \rho g \times t}{v}$$

$$= \frac{4}{5} \times \frac{\ell \times \rho g \times t}{2}$$

$$\eta = \frac{2}{5} \rho \ell g t$$

47. Answer (2)

The amount of heat required to raise the temperature of the body by 1°C is called heat capacity.

48. Answer (4)

$$|\vec{F}| = \frac{dp}{dt} = 10t + 6, \text{ at } t = 1 \text{ s}, |\vec{F}| = 16 \text{ N}$$

49. Answer (2)

$$V_2 = 100 \times 5 = 500 \text{ V}$$

$$\frac{V_2}{V_1} = \frac{5}{1}$$

$$V_1 = \frac{V_2}{5} = \frac{500}{5} = 100 \text{ V}$$

50. Answer (3)

Induced emf in a coil is

$$\epsilon = -\frac{Ldi}{dt}$$

BOTANY

SECTION-A

51. Answer (1)

Satellite DNA shows high degree of polymorphism and form the basis of DNA fingerprinting since DNA from every tissue from an individual shows the same degree of polymorphism.

52. Answer (2)

Expression of *lac i* gene is constitutive and binds to the operator region in the absence of lactose.

53. Answer (3)

During DNA replication, the discontinuously synthesised fragments are later joined by the enzyme DNA ligase.

54. Answer (2)

H. Temin and D. Baltimore independently discovered reverse transcription which can synthesize DNA over RNA template.

55. Answer (3)

Regeneration of the CO_2 acceptor molecule RuBP (5C ketose sugar) is crucial if the cycle is to be continue uninterrupted.

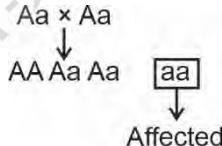
56. Answer (1)

PSII is involved in light reaction. Fixation of CO_2 occurs during dark reaction of photosynthesis.

57. Answer (2)

In pleiotropy, a single gene product may produce more than one effect or control several phenotypes depending on its position.

58. Answer (4)



Thalassemia is an autosomal recessive trait and can be transmitted from parents to the offspring when both the partners are unaffected carriers for the gene. Here, only 25% of their offspring will be affected.

59. Answer (3)

♀	I^A	i
	I^B	
♂	I^A	$\text{I}^A \text{I}^B$
	I^B	$\text{I}^B \text{I}^B$

Phenotypes of blood group obtained are A, B and AB.

60. Answer (2)

Chromosomal theory of inheritance was proposed independently by Walter Sutton and Theodore Boveri.

61. Answer (4)
 α -ketoglutaric acid is a 5C compound.
 Oxaloacetic acid, fumaric acid and succinic acid are 4C containing compounds.
62. Answer (2)
 Species-Area relationship was given by Alexander von Humboldt and he found that species richness increased with increasing explored area but only upto a limit. It is expressed as $\log S = \log C + Z \log A$.
63. Answer (3)
 National parks are *in-situ* conservation strategy.
 Botanical garden, zoological parks and wildlife safari parks are *ex-situ* conservation strategy of biodiversity conservation.
64. Answer (3)
 Mammalia, dicotyledonae and insecta represents taxa at same level that is class.
65. Answer (4)
 Sexual spores are called ascospores, produced endogenously in sac like ascii.
66. Answer (2)
 Diatoms are found in fresh water as well as in marine environments. They are microscopic and float passively in water currents. Their walls are embedded with silica. Dinoflagellates are mostly marine and photosynthetic. The cell wall has stiff cellulose plates on the outer surface. Cyanobacteria are photosynthetic autotrophs, which can fix atmospheric nitrogen in heterocysts. Slime moulds are saprophytic protists and they form an aggregation called plasmodium under suitable conditions.
67. Answer (3)
 In pea, bean and gram endosperm is not present in mature seeds and such seeds are called non-endospermous.
68. Answer (1)
 Family Gramineae (Poaceae) have monocarpellary, superior, unilocular ovary with basal placentation. Stigma is feathery. Inflorescence is spike of spikelets (*Triticum*).
69. Answer (3)
 If sepals or petals in a whorl just touch one another at the margin, without overlapping, as in *Calotropis* and in most members of Solanaceae called valvate aestivation
70. Answer (3)
 Nucleus contains the chromosomes which in turn contain the genetic material, dsDNA.
71. Answer (2)
 Cell membrane is mainly composed of lipids and proteins. Later biochemical investigation clearly revealed that the cell membrane also possess carbohydrate.
72. Answer (2)
 Polar molecules require a carrier protein of the membrane to facilitate their transport across the membrane. Neutral solutes may move across the membrane by the process of simple diffusion.
73. Answer (1)
 Meiosis brings genetic variability, hence offspring do not resemble each other, when produced as a result of meiosis.
 Recombination occurs during pachytene stage of prophase I.
74. Answer (2)
 Meiosis is a reductional division. Meiosis involves two sequential cycles of nuclear and cell division but only a single cycle of DNA replication.
75. Answer (3)
 The complex formed by a pair of synapsed homologous chromosomes is called a bivalent. Process of association of homologous chromosomes is called synapsis. Recombination nodule is the site at which crossing-over occur. The point of attachment between the homologous chromosomes after dissolution of synaptonemal complex is called chiasmata.
76. Answer (1)
 In natural system of classification, organisms are classified on the basis of natural affinities and consider not only external but also internal features.
 This classification was given by Bentham and Hooker.
77. Answer (4)
 In algae zygote undergoes meiosis to form haploid spores.
 Bryophytes are the first embryophytes.
78. Answer (4)
 Baculoviruses are pathogens that attack insects and other arthropods.
 They have no negative impacts on plants, mammals, birds, fish or even on non-target insects.
79. Answer (3)
 A hypersaline lagoon is a landlocked body of water that contains significant concentration of salts.

80. Answer (2)
Standing crop is the amount of living material present in different trophic levels at a given time.
81. Answer (3)
Radial vascular bundles are found in the roots of dicots and monocots.
82. Answer (3)
In the given figure, label 'A' represents complementary cells and label 'B' represents secondary cortex.
83. Answer (2)
2,4-D is used to prepare weed-free lawns by gardeners.
84. Answer (2)
During double fertilization event, one male gamete fuses with egg and the other male gamete fuses with secondary nucleus produce triploid primary endosperm nucleus.
85. Answer (4)
The coconut water from tender coconut is free nuclear endosperm and surrounding white kernel is the cellular endosperm.
- Persistent nucellus is the perisperm
 - Double fertilization is an event unique to angiosperms.
- SECTION-B**
86. Answer (4)
Nitrogenous base is linked to the OH of 1'C pentose sugar through a N-glycosidic linkage to form a nucleoside. Purine nucleosides have 1'-9 N-glycosidic linkage.
87. Answer (4)
Base ratio $\frac{A+T}{G+C}$ is specific for species.
88. Answer (3)
The direct synthesis of ATP from metabolites is called substrate level phosphorylation. It occurs only once in TCA cycle and twice in glycolysis.
89. Answer (4)
Female birds contain heteromorphic sex chromosome
Male grasshopper have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes.
Male butterfly produce homomorphic sex chromosomes.
Male honey bee produce sperms by mitosis.
90. Answer (1)
In Kingdom Monera sole members are bacteria, and as a group they show the most extensive metabolic diversity i.e., they can be autotrophic, heterotrophic, saprophytic or parasitic.
91. Answer (2)
In axile placentation, the placenta is axial and the ovules are attached to it in a multilocular ovary.
Eg:- *Colchicum, Aloe, Chilli, Lemon, China rose, Tomato.*
92. Answer (2)
The endoplasmic reticulum bearing ribosomes on their surface is called rough endoplasmic reticulum (RER).
93. Answer (4)
Meiocyte undergoes meiosis (reductional division). Hence, number of chromosomes in a meiotic product (daughter cell) will be half that is 24.
94. Answer (4)
The members of chlorophyceae are commonly called green algae. *Spirogyra* is an example of green algae.
95. Answer (1)
Cyclosporin A is used as an immunosuppressive agent in organ-transplant patients.
96. Answer (2)
Emigration is the number of individuals of the population who had left the habitat and gone elsewhere during the time period under consideration.
97. Answer (1)
Sulphur cycle is the example of sedimentary cycle.
98. Answer (2)
Vessel cells are dead, each vessel member has lignified cell wall and a large central cavity for facilitating water transport. The end walls of vessel cells are generally oblique and are called as perforation plates.
99. Answer (2)
Ethylene promotes female flowers in cucumbers, and also promotes root growth and root hair formation.
100. Answer (3)
 - Groundnut and pea are examples of non-albuminous seeds.
 - The micropyle remains as a small pore in the seed coat facilitating entry of oxygen and water into the seed during germination.

ZOOLOGY**SECTION-A**

101. Answer (4)

Chemicals called neurotransmitters are involved in the transmission of impulses at the chemical synapses as well as at the neuro-muscular junctions.

102. Answer (1)

Red muscles contain a red coloured oxygen storing pigment called myoglobin. Myoglobin content is high in these muscles which gives a reddish appearance. White muscle fibres possess less quantity of myoglobin and therefore, appear pale or whitish.

103. Answer (2)

Loose connective tissue : Areolar, adipose

Dense connective tissue : Ligaments, tendons

Neural tissue : Neurons, neuroglial cells

104. Answer (1)

In a polypeptide or protein, the amino acids are linked by a peptide bond. This bond is formed by the dehydration reaction (Elimination of water moiety).

105. Answer (2)

Protein – Polymer of amino acids

Cellulose – Polymer of glucose

Deoxyribonucleic acid - Polymer of nucleotides

Protein, cellulose and deoxyribonucleic acid are present in the acid-insoluble fraction obtained upon chemical analysis of a living tissue.

106. Answer (2)

In human females, meiosis in secondary oocyte is completed during fertilization in ampulla region of the fallopian tube.

107. Answer (4)

Rhynia-type plants are ancestors of *Psilophyton* while Ginkgos, Gnetales and conifers are descendants of *Psilophyton*.

108. Answer (1)

Functional Residual Capacity (FRC) : Volume of air that will remain in the lungs after a normal expiration. This includes ERV + RV.

109. Answer (3)

Presence of more than one recognition sites within the vector will generate several DNA fragments, which will complicate the process of gene cloning.

So, if we want to recover many copies of the target DNA, then it should be cloned in a vector whose origin supports high copy number.

110. Answer (4)

The labia minora are paired folds of tissue under the labia majora. Clitoris, hymen and mons pubis are also included in external genitalia of females.

111. Answer (2)

Prolonged hyperglycemia leads to a complex disorder called diabetes mellitus which is associated with the loss of glucose through the urine and formation of harmful compounds known as ketone bodies.

Diabetes insipidus is a condition of diminished ability of the kidney to conserve water as synthesis and release of ADH is affected. This leads to water loss and dehydration.

112. Answer (2)

Pinctada (Pearl oyster) and *Apis* (Honeybee) are economically beneficial organisms.

Pinctada is a mollusc and possesses an unsegmented body.

Locusta is an economically harmful organism.

Chitinous exoskeleton is the characteristic feature of arthropods.

113. Answer (4)

The acid soluble pool represents roughly the cytoplasmic composition. The macromolecules from cytoplasm and organelles become the acid-insoluble fraction.

114. Answer (2)

In directional selection, more individuals acquire value other than the mean character value.

In industrial melanism, the number of dark-winged moths increased after industrialisation.

115. Answer (3)

In frogs, the digestive system consists of alimentary canal and digestive glands.

The mouth opens into the buccal cavity that leads to the oesophagus through pharynx. Oesophagus is a short tube that opens into the stomach which in turn continues as the intestine, rectum and finally opens outside by the cloaca.

116. Answer (2)

In amphibians and reptiles (except crocodile), the left atrium receives oxygenated blood from the gills/lungs/skin and the right atrium gets the deoxygenated blood from the other body parts. They get mixed up in the single ventricle which pumps out mixed blood (incomplete double circulation).

117. Answer (2)

Hugo deVries based on his work on evening primrose brought forth the idea of mutations.

118. Answer (3)

Cellulose is a polysaccharide which contains monomeric units of glucose joined together by glycosidic bonds.

119. Answer (1)

Globulins are primarily involved in the defense mechanisms of the body and albumins help in the osmotic balance.

120. Answer (4)

Presence of glucose (Glycosuria) and ketone bodies (Ketonuria) in urine is indicative of diabetes mellitus.

121. Answer (3)

IUDs increase phagocytosis of sperms within the uterus. Progestasert and LNG-20 are hormone releasing IUDs. The hormone releasing IUDs in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms.

Barrier methods of contraception prevent the physical meeting of ovum and sperms.

Saheli; a non steroidal pill which block estrogen receptors in the uterus, prevents egg from getting implanted.

122. Answer (4)

Neural signals from the pneumotaxic centre can alter the respiratory rate by reducing the duration of inspiration.

123. Answer (4)

Selection of recombinants due to inactivation of antibiotic resistance genes present in pBR322 is a cumbersome process because it requires simultaneous plating on two plates having different antibiotics.

124. Answer (3)

After getting into the body of the person, the HIV enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA gets incorporated into host cells' DNA and directs the infected cells to produce virus particles. The macrophage continues to produce viruses and in this way acts like a HIV factory.

125. Answer (1)

Progestasert and LNG-20 are hormone releasing IUDs.

126. Answer (3)

Erythrocytes, leucocytes and platelets are collectively called formed elements and they constitute nearly 45 per cent of the human blood.

127. Answer (4)

Very low concentration of bacteria or virus can be detected by amplification of their nucleic acid by the method of PCR.

128. Answer (4)

Agrobacterium tumefaciens is the natural genetic engineer of dicot plants.

Retroviruses are suitable for animals.

129. Answer (1)

Infertility cases either due to inability of the male partner to inseminate the female or due to the very low sperm counts in the ejaculate, could be corrected by artificial insemination (AI) technique. In this technique, the semen collected from the husband/healthy donor is artificially introduced either into the vagina or into the uterus (IUI – Intra Uterine Insemination) of the female.

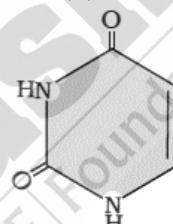
130. Answer (2)

Monoecious – *Taenia*

Indirect development – *Aedes, Nereis*

Internal fertilisation – *Aedes, Pila, Taenia*

131. Answer (4)



Uracil (Pyrimidine)

132. Answer (3)

Many fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for ringworms.

Appearance of dry scaly lesions on various parts of the body such as skin, nails and scalp are the main symptoms of this disease. These lesions are accompanied by intense itching.

133. Answer (2)

The ascending limb of loop of Henle is impermeable to water but allows transport of electrolytes actively or passively.

134. Answer (2)

In humans, the midbrain is present between thalamus/ hypothalamus of the forebrain (containing centres for thermoregulation, urge for eating and drinking) and pons of the hindbrain (containing pneumotaxic centre). Centres controlling respiration and cardiovascular reflexes are present in the medulla oblongata of the hindbrain.

135. Answer (2)

A single stranded DNA or RNA tagged with a radioactive molecule called probe is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography.

SECTION-B

136. Answer (3)

The wall of the uterus consists of three layers. From outside to inside, these layers are arranged as perimetrium, myometrium and endometrium.

137. Answer (2)

Several attempts have been made to patent uses, products and processes based on the Indian traditional herbal medicines, e.g., turmeric and neem.

138. Answer (4)

The exaggerated response of the immune system to certain antigens present in the environment is called allergy.

The use of drugs like anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy.

Allergy is caused due to the release of chemicals like histamine and serotonin from the mast cells.

139. Answer (1)

Thyroid gland – On either side of the trachea

Pineal gland – On the dorsal side of the forebrain

Thymus gland – Between lungs behind the sternum on the ventral side of the aorta

Adrenal gland – Anterior part of the kidney

140. Answer (1)

Cartilage is present between adjacent vertebrae and it possesses slightly pliable matrix due to the presence of chondroitin salts.

Tibia possesses a very hard matrix due to the presence of calcium salts in it.

141. Answer (4)

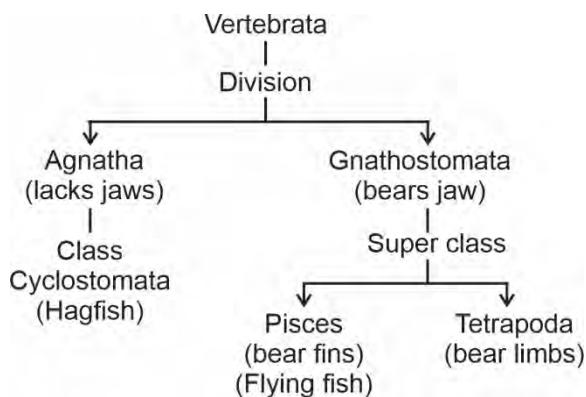
During annealing, the primers bind to their complementary sequences on the single-stranded DNA templates.

The DNA polymerase then add nucleotides to the primer in the primer extension step of PCR.

142. Answer (2)

Branchial respiration is the process of respiration through gills. Aquatic arthropods, molluscs, hemichordates and fishes respire through this. *Pleurobrachia* belongs to the phylum Ctenophora and they respire through their body surface. Buccopharyngeal respiration is shown by *Rana*.

143. Answer (4)



Amphioxus is a cephalochordate and devil fish is an invertebrate.

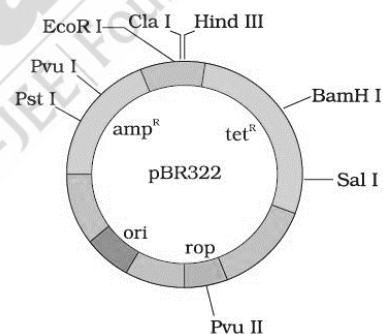
144. Answer (3)

In the male reproductive system of cockroach, a pair of testes are present one on each lateral side in the 4th-6th abdominal segments.

145. Answer (2)

All the cells are not excitable in the neural tissues. Neuroglial cells are non-excitable cells which constitute more than one half of the volume of the neural tissue. They protect and support neurons.

146. Answer (4)



147. Answer (2)

In human females, estrogen attains two peak levels during the menstrual cycle i.e., the first peak occurs during ovulation and the second peak occurs in the luteal phase. Both estrogen and progesterone remain at their minimum levels in the blood plasma at the onset of menstrual phase of the cycle.

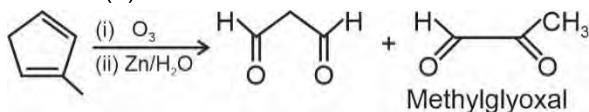
148. Answer (2)

'Saheli' is a non-steroidal contraceptive. It is "Once a week" pill. Saheli blocks the estrogen receptors in the uterus and thereby prevents implantation of blastocyst in the endometrium of the uterus.

165. Answer (3)

Phenol is more acidic in nature than ethanol hence pK_a of phenol is less than ethanol.

166. Answer (3)



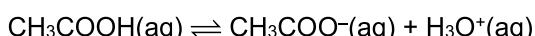
167. Answer (1)

The value of equilibrium constant depends on temperature.

168. Answer (1)



Strong electrolyte 100% dissociation



Weak electrolyte equilibrium is established

169. Answer (4)

Element	Electron gain enthalpy/kJ mol ⁻¹
F	-333
Cl	-349
Br	-325
I	-296

170. Answer (2)

Correct order of atomic radius is

Al < Na < K < Rb

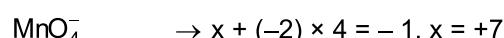
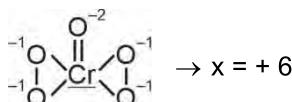
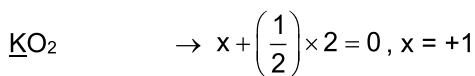
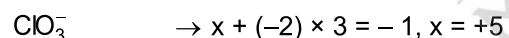
171. Answer (1)

$$\frac{W_1}{E_1} = \frac{W_2}{E_2}$$

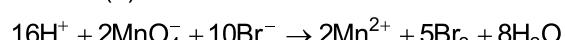
$$\frac{10.8}{108} = \frac{W_2}{31.75}$$

$$W_2 = 3.175 \text{ g}$$

172. Answer (3)



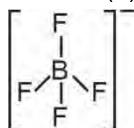
173. Answer (2)



For 10 mol of Br⁻ ≡ 2 mol of KMnO₄ is needed

$$\therefore \text{For 2 mol of Br}^- \equiv \frac{2}{10} \times 2 = \frac{2}{5} \text{ mol of KMnO}_4 \text{ is needed}$$

174. Answer (1)



sp^3 hybridisation and tetrahedral geometry.

$$5\text{B} = 1s^2 2s^2 2p^1$$

Due to absence of d orbitals (in 2nd shell), B cannot exceed its covalency beyond four.

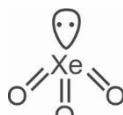
175. Answer (2)

Orbital angular momentum

$$(L) = \sqrt{\ell(\ell+1)\hbar} \\ = \sqrt{1(1+1)\hbar} \\ = \sqrt{2}\hbar$$

176. Answer (3)

XeO₃ has pyramidal structure.

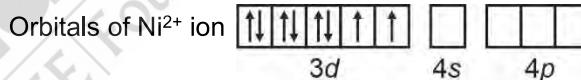


177. Answer (1)

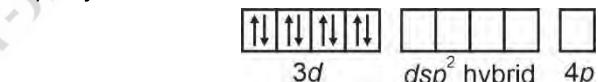


Chlorine from zero oxidation state is changed to -1 and +5 oxidation states.

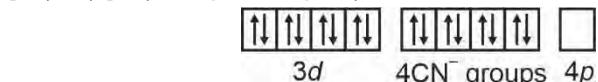
178. Answer (2)



dsp^2 hybridised orbitals of Ni²⁺



[Ni(CN)₄]²⁻ (low spin complex)



[Ni(CN)₄]²⁻ is square planar complex and is diamagnetic.

179. Answer (4)

0.023 has 2 significant figures as zeros preceding to first non-zero digit are not significant.

180. Answer (4)

$$0.3 = \frac{n \times 1000}{200}$$

$$n = \frac{0.3}{5}$$

$$n = 0.06$$

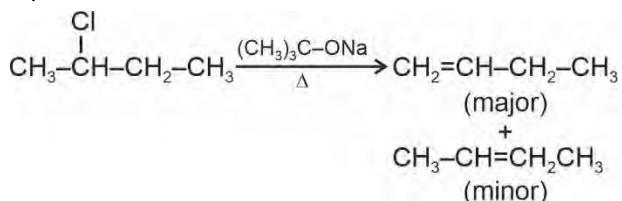
$$\begin{aligned} \text{Number of molecules} &= 0.06 \times 6.022 \times 10^{23} \\ &= 0.36 \times 10^{23} \\ &= 3.6 \times 10^{22} \end{aligned}$$

181. Answer (3)

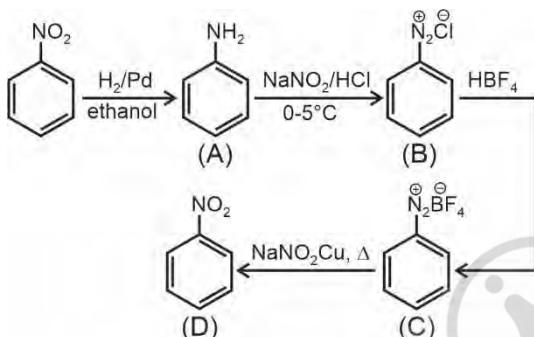
Due to partial double bond nature between carbon and halogen, haloarenes are less reactive towards nucleophilic substitution reaction.

182. Answer (2)

In presence of Bulky base Hoffman alkene is major product.



183. Answer (3)



184. Answer (1)

H is a state function because it depends on U, P and V, all of which are state functions. Therefore, ΔH is independent of path.

ΔH is negative for exothermic reactions which evolve heat during the reaction.

185. Answer (4)

With increasing atomic number, the atomic radius of lanthanoids decreases.

SECTION-B

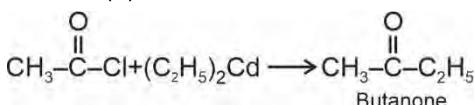
186. Answer (2)

The reaction is zero or I

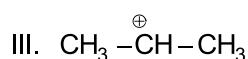
$$[B] = kt = 2.5 \times 10^{-3} \times 5 \times 60$$

$$[B] = 0.75 \text{ M}$$

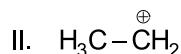
187. Answer (4)



188. Answer (3)



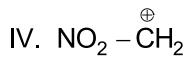
6- α -hydrogen atoms



3- α -hydrogen atoms



No hyperconjugation but more reactive than IV



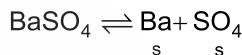
Presence of $-\text{NO}_2$ (-I group), decreases electron density on positively charged carbon and decreases stability.

189. Answer (2)

$$\wedge_m = K \times \frac{100}{M}$$

$$1.53 = \frac{3.06 \times 10^{-6} \times 10^3}{M}$$

$$M = 2 \times 10^{-3} \text{ M} = s$$



$$k_{sp} = s^2$$

$$k_{sp} = (2 \times 10^{-3})^2$$

$$k_{sp} = 4 \times 10^{-6}$$

190. Answer (3)

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$\log \left(\frac{9}{4.5} \right) = \frac{E_a}{2.303R} \left(\frac{1}{900} - \frac{1}{1000} \right)$$

$$\log(2) = \frac{E_a \times 10^2}{2.303R \times 9 \times 10^5}$$

$$\log(2) = \frac{E_a}{2.303R \times 9 \times 10^3}$$

$$E_a = 2.303R \times 9 \times 10^3 \log(2)$$

$$E_a = +20.727R \log(2) \text{ kJ/mol}$$

191. Answer (3)

$$\% \text{ ionic character} = \frac{\mu_{\text{exp}}}{\mu_{\text{cal}}} \times 100$$

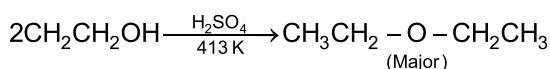
$$= \frac{1.8 \times 10^{-18} \text{ esu-cm}}{0.94 \times 10^{-8} \text{ cm} \times 4.8 \times 10^{-10} \text{ esu}}$$

$$= 39.89\%$$

192. Answer (3)

Maltose is a reducing sugar.

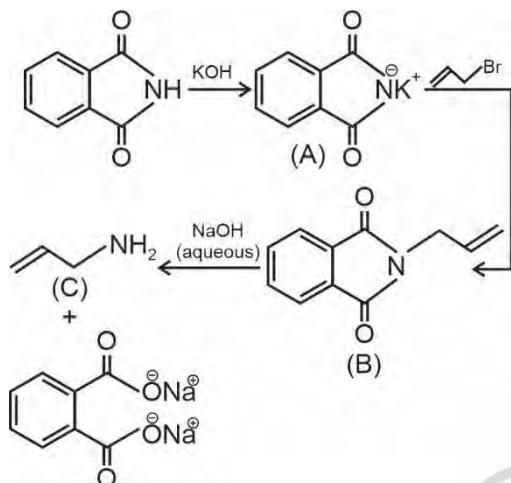
193. Answer (1)



194. Answer (1)

Benzene does not undergo addition reaction at ordinary conditions.

195. Answer (3)



196. Answer (2)

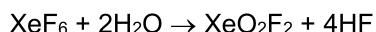
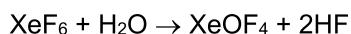
$$E_n = -\frac{13.6z^2}{n^2} \text{ eV}$$

$$E_3 = -\frac{13.6(3)^2}{(3)^2} \text{ eV}$$

$$= -13.6 \text{ eV}$$

$$\begin{aligned} \text{Kinetic energy} &= -(-E_3) \\ &= 13.6 \text{ eV} \end{aligned}$$

197. Answer (3)

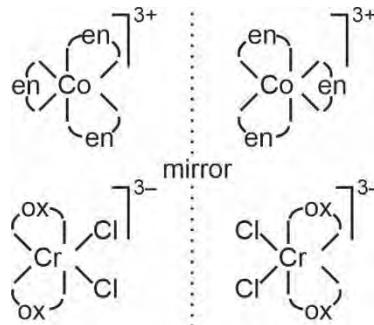


Partial hydrolysis of XeF_6 gives oxyfluorides,



198. Answer (3)

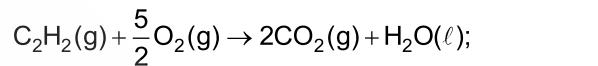
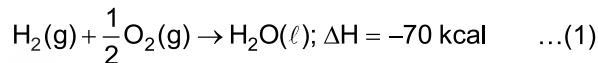
Optical isomers are non-superimposable mirror images.



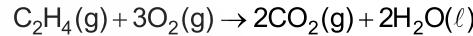
199. Answer (2)

Heat of reaction at constant volume = ΔU

Reaction, $\text{C}_2\text{H}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_4(\text{g})$; $\Delta U = ? \dots (4)$



$$\Delta H = -300 \text{ kcal} \dots (2)$$



$$\Delta H = -340 \text{ kcal} \dots (3)$$

(equation 1 + 2 - 3)

$$\Delta_r H = [-70 + (-300)] - [-340]$$

$$= -370 + 340 = -30 \text{ kcal}$$

$$\Delta U = ?$$

$$\Delta H = \Delta U + \Delta_{ng}RT$$

$$-30 = \Delta U + (-1) \times 2 \times 10^{-3} \times 298$$

$$\Delta U = -30 - (-1 \times 2 \times 10^{-3} \times 298)$$

$$= -30 + (2 \times 10^{-3} \times 298)$$

$$= -30 + (0.596)$$

$$\boxed{\Delta U = -29.4 \text{ kcal}}$$

200. Answer (2)

Because the transition metal ions can change their oxidation states, they become more effective as catalysts.

Catalytic action of Fe^{3+}

