22/04/2024

CODE-A

Aakash

Medical | IIT-JEE | Foundations

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

AIM – 720

(*Advanced* INTENSIVE *Mastery for* 720)

MM : 720 **CST-I2** **Time : 3 Hrs. 20 Min.**

Answers

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

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AIM – 720

(*Advanced* INTENSIVE *Mastery for* 720)

MM : 720 **CST-12** **Time : 3 Hrs. 20 Min.**

Answers & Solutions

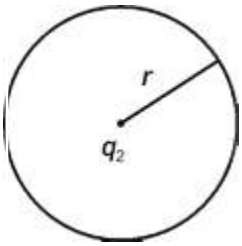
PHYSICS

SECTION-A

1. Answer (4)

Electric field lines originate from positive charge and terminates at negative charge.

2. Answer (3)



$V = \frac{kq_2}{r}$

$W = q\Delta V$

$= 0$

3. Answer (1)

$E = \frac{1}{2}kA^2$

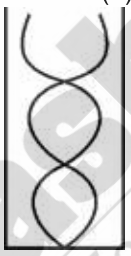
$E_1 = \frac{1}{2}kx^2$

$= \frac{1}{2}k\left(\frac{A}{4}\right)^2$

$= \frac{100}{16}$

$= \frac{25}{4}$

4. Answer (1)



Three node three antinode.

5. Answer (2)

In changing shape of a body only internal forces are involved, thus $\vec{\tau}_{ext} = 0$

Hence, $\vec{L} =$ constant

6. Answer (1)

For a rotational motion, $\vec{\alpha}$ and $\vec{\omega}$ need not to be parallel.

But $\vec{p} = m\vec{v}$

$\therefore$ $\vec{p}$ and $\vec{v}$ are always parallel while its not necessary that $\vec{a}$ and $\vec{v}$ are parallel.

7. Answer (3)

Orbital speed of satellite

$V_0 = \sqrt{\frac{GM}{R}}$

8. Answer (2)

Here, same force is applied to each wire having equal cross-sectional area.

$\therefore$ Stress will be same $\left(\text{Stress} = \frac{F}{A}\right)$

But, Young's modulus of both wires is different

Hence strain = $\frac{\text{Stress}}{Y}$ will be different.

9. Answer (2)

Heat needed for 30°C temperature change

$= mS\Delta T = 500 \times 4.2 \times 30$ J

Energy of one photon = $h\nu$

Number of photons = $\dfrac{500 \times 4.2 \times 30}{6.6 \times 10^{-34} \times 4 \times 10^{10}}$

$= 2386.36 \times 10^{24}$

$= 2.39 \times 10^{27}$

10. Answer (4)

High temperature provide kinetic energy to nuclei to overcome the repulsive electrostatic force between them.

High pressure ensure frequent collision and increases probability of fusion.

11. Answer (4)

The number of electrons in the valence shell of a semiconductor is 4.

12. Answer (2)

In any intrinsic semi-conductor

$n_p = n_e$

13. Answer (3)

$\left|\overrightarrow{OA} + \overrightarrow{OB}\right| = R\sqrt{2}$

$\therefore$ Resultant has magnitude = $R\sqrt{2} - R$

$= R\left(\sqrt{2} - 1\right)$

14. Answer (3)

Let the pickpocket be caught at time 't'.

$\Rightarrow S = \dfrac{1}{2} \times 30 \times t^2 = 15t^2$ and $S + 60 = 50 \times t$

$\Rightarrow S = 50t - 60$

$\Rightarrow 50t - 60 = 15t^2$

$\Rightarrow 15t^2 - 50t + 60 = 0$

$\Rightarrow 3t^2 - 10t + 12 = 0$

Both roots negative.

15. Answer (4)

The time of flight of ball would be = 9 s + 4 s = 13 s.

16. Answer (1)

$f = \dfrac{mv^2}{r}$ and $f \le \mu N$

$\Rightarrow \mu mg \ge \dfrac{mv^2}{r} \Rightarrow v \le \sqrt{\mu rg}$

$v_{max} = \sqrt{\mu rg} = \sqrt{\dfrac{1}{10} \times 5 \times 10} = \sqrt{5}$ m/s

17. Answer (4)

$PV = NK_BT \Rightarrow \dfrac{N}{V} = \dfrac{P}{K_BT}$ i.e. it represents number of molecules per unit volume of gas.

18. Answer (1)

At minimum compression both blocks comes to rest.

19. Answer (2)

$\Delta P = P - 0 = \int_0^3 F\,dt$

$= \left[\dfrac{t^3}{3}\hat{i} + \dfrac{t^2}{2}\hat{j}\right]_0^3$

$mv = \left[9\hat{i} + 9\hat{j}\right]$ kg m s^{-1}

$v = \left(9\hat{i} + 9\hat{j}\right)$ m s^{-1}

KE = $\dfrac{1}{2} \times 1 \times \left(9\sqrt{2}\right)^2 = 81$ J

20. Answer (4)

The emf will be induced which will generate current in coil it oscillates. Due to energy loss the amplitude of oscillation will decrease with time.

21. Answer (3)

At resonance

$I = I_1 + I_2$

$I_{peak} = \dfrac{V_0}{R} + \dfrac{V_0}{R} = \dfrac{2V_0}{R}$

$I_{peak} = \dfrac{2V_0}{R}$

$I_{rms} = \dfrac{\sqrt{2}V_0}{R}$

22. Answer (4)

$\dfrac{E_0}{B_0} = \dfrac{1}{\sqrt{\mu_0\varepsilon_0}} = c$

$\Rightarrow B_0 = E_0\sqrt{\mu_0\varepsilon_0}$

23. Answer (2)

$\beta = \dfrac{\lambda D}{d}$

$\lambda_R > \lambda_V$

24. Answer (2)

$P_{eq} = P_1 + P_2$

$= -3 + 4$

$P_{eq} = +1$ D

$\Rightarrow f_e = +100$ cm

$\Rightarrow$ Converging lens.

So, object is placed at $2f$ distance so image will also formed at $2f$ distance *i.e.* 200 cm.

25. Answer (3)

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

μ is smaller for greater wavelength

$\lambda\uparrow \ \mu\downarrow \quad \Rightarrow f\uparrow$

$\lambda_R > \lambda_B$

$f_R > f_B$

26. Answer (2)

[Breaking stress] = $[M^1L^{-1}T^{-2}]$

[Relative density] = $[M^0L^0T^0]$

[Relative velocity] = $[M^0L^1T^{-1}]$

27. Answer (2)

The angle of contact is 90°.

28. Answer (2)

We know that

$\gamma_{real} = \gamma_{app} + \gamma_{vessel}$

Also, $\gamma_{vessel} = 3\alpha$

$\therefore \quad \gamma_{real} = \gamma + 3\alpha$

29. Answer (3)

Second law of thermodynamics introduces the concept of entropy and thus applies the limitations on the efficiency of heat engine and on the COP of refrigerator.

30. Answer (3)

Work done by the gas in adiabatic process

$$W = \frac{nR}{\gamma - 1}(T_i - T_f)$$

Helium gas $\Rightarrow \quad \gamma = \frac{5}{3}$

$$W = \frac{2 \times 8.314}{\left(\frac{5}{3} - 1\right)}(280 - 250)$$

$$= \frac{2 \times 8.314 \times 3}{2} \times 30$$

= 748 J

31. Answer (2)

$Q = n\,e \quad \Rightarrow \quad \frac{Q}{t} = \frac{n\,e}{t} = i$

$\frac{n\,e}{t} = 0.32 \quad \Rightarrow \quad n = \frac{0.32}{1.6 \times 10^{-19}} = 2 \times 10^{18}$

32. Answer (4)

Conductance is reciprocal of resistance.

$$R = \frac{\rho l}{A}$$

Since resistance depends on dimensions, temperature and nature of conductor, therefore conductance also depends on these factors.

33. Answer (2)

$\because \quad \vec{F} = q(\vec{v} \times \vec{B}) = m\vec{a}$

$\therefore \quad \vec{a} \perp \vec{B}$ from the property of cross product

$\vec{a} \cdot \vec{B} = 0 \quad \Rightarrow \quad (2\hat{i} + 5\hat{j}) \cdot (3\hat{i} + x\hat{j} - 2\hat{k}) = 0$

$6 + 5x = 0 \Rightarrow \quad x = \frac{-6}{5}$

34. Answer (2)

In a uniform magnetic field, force on a current loop is always zero but torque may or may not be zero.

35. Answer (3)

$$M = \frac{\text{Magnetic moment}}{\text{Volume}} = \frac{15 \times 10^{-5}}{10^{-6}} = 150$$

$$\chi = \frac{M}{H} = \frac{150}{80 \times 10^3} = 1.8 \times 10^{-3}$$

SECTION-B

36. Answer (2)

The magnitude of net force acting on man = 45 × 2 = 90 N

37. Answer (2)

$$\left(\frac{4}{3}\pi r^3\right) \times 64 = \frac{4}{3}\pi R^3$$

$R = 4r$

$$V_1 = \frac{kq_1}{r}$$

$$V_2 = \frac{64kq}{4r}$$

$$= \frac{16kq}{r}$$

$\frac{V_1}{V_2} = \frac{1}{16} \quad \Rightarrow \quad V_2 = 16 \times 200$

= 3200 V

38. Answer (2)

$$\phi = \frac{q_{en}}{\varepsilon_0} = \frac{q}{\varepsilon_0}$$

$$\phi_1 = \frac{\phi}{8}$$

$$= \frac{q}{8\varepsilon_0}$$

39. Answer (2)

According to Bernoulli's principle as fluid speed increases, pressure decreases.

40. Answer (1)

$$\alpha = \frac{\Delta L}{L\Delta T}$$

$$= \frac{0.02}{2 \times 40} = 2.5 \times 10^{-4}/°C$$

41. Answer (3)

$$\frac{1}{\lambda} = R\left(\frac{1}{(3)^2} - \frac{1}{(\infty)^2}\right)$$

$$\frac{1}{\lambda} = \frac{R}{9}$$

$$\lambda = \frac{9}{R}$$

42. Answer (3)

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

43. Answer (4)

$$P_{rms} = V_{rms} \cdot I_{rms} \cos\phi$$

$$P_{rms} = V_{rms} \cdot I_{rms} \frac{R}{Z} = \frac{V_{rms} I_{rms} R}{Z}$$

$$P_{rms} = I_{rms}^2 R$$

$$R = \frac{80}{16} = 5\ \Omega$$

$$Z = \frac{V}{I} = 50\ \Omega$$

$$5^2 + X_L^2 = (50)^2$$

$$X_L^2 = (50)^2 - 5^2$$

$$X_L = \sqrt{(55)(45)}$$

$$X_L = 15\sqrt{11}\ \Omega$$

44. Answer (2)

$$\Delta Q = \frac{\Delta\phi}{R}$$

$\phi(2) = 5(2)^2 - 4(2) + 1$

$\phi(2) = (20 - 8 + 1)$ Wb

= 13 Wb

$\phi(0) = 1$ Wb

$$\Delta Q = \frac{(13 - 1)}{10} \text{ Wb} = 1.2 \text{ C}$$

45. Answer (2)

For first minimum,

$d\sin\theta = \lambda$

$$\sin 30° = \frac{\lambda}{d} \Rightarrow \frac{1}{2} = \frac{\lambda}{d}$$

$\Rightarrow d = 2\lambda$

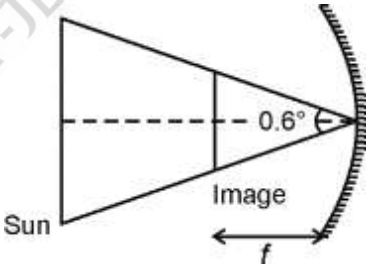
Now, for first secondary maximum

$$d\sin\theta = \frac{3\lambda}{2}$$

$$\Rightarrow 2\lambda\sin\theta = \frac{3\lambda}{2} \Rightarrow \sin\theta = \frac{3}{4}$$

$$\theta = \sin^{-1}\left(\frac{3}{4}\right)$$

46. Answer (1)



$d = f\theta$

$$= 4 \times 0.6 \times 100 \times \frac{\pi}{180}$$

$d = 4.19$ cm

47. Answer (2)

- Any physical quantity is given by $Q = nu$

  Where $n \rightarrow$ numerical value/magnitude

  $u \rightarrow$ unit

  Hence, $Q = n_1u_1 = n_2u_2 = n_3u_3$ = constant
- A unitless quantity will always be dimensionless while the converse is not true.

48. Answer (2)

For disk (about diameter) $I_1 = \frac{MR^2}{4}$

For hollow cylinder $I_2 = MR^2$

For solid cylinder $I_3 = \frac{MR^2}{2}$

For sphere $I_4 = \frac{2}{5}MR^2$

49. Answer (3)

$$T = 2\pi\sqrt{\frac{R^3}{GM}}$$

$$T_1 = 2\pi\sqrt{\frac{(3R)^3}{GM}}$$

$$T_1 = 3\sqrt{3}\,T$$

50. Answer (1)

$$I = neAv_d$$

$$2I = ne \times 2A \times v_d'$$

$$\frac{I}{2I} = \frac{ne\ A \times v}{ne\ 2A \times v'} \Rightarrow v' = v$$

BOTANY

SECTION - A

51. Answer (3)

Law of segregation is based on the fact that the alleles do not show any blending and that both the characters are recovered as such in the F_2 generation though one of these is not seen at the F_1 stage.

52. Answer (4)

Sickle cell anaemia is caused by the substitution of glutamic acid by valine at the sixth position of the beta globin chain of the haemoglobin molecule. It occurs due to the single base substitution at the sixth codon of the beta globin gene from GAG to GUG.

53. Answer (2)

Tropical regions show relatively more constant and predictable changes and it promotes niche specialisation and lead to a greater species diversity. As compared to tropical region, temperate region receives less solar energy and hence has less biodiversity.

54. Answer (3)

Biodiversity term was popularised by Edward Wilson to describe the combined diversity at all the levels of biological organisation.

55. Answer (3)

Gaseous exchange in the plant is facilitated by loose packing of parenchyma cells in leaves, stems and roots, which provide interconnected network of air spaces.

56. Answer (1)

Haemophilia is a sex linked recessive trait.

57. Answer (4)

In each pregnancy there is always 50% probability of either a male or female child.

58. Answer (3)

Cats belong to the family Felidae, while dogs belong to the family Canidae.

59. Answer (4)

Few members of Kingdom Plantae are partially heterotrophic such as the insectivorous plants or parasites. Morels and truffles are ascomycetes which are edible and are considered delicacies.

60. Answer (3)

Mycelium of deuteromycetes is septate and branched.

61. Answer (2)

Entire inflorescence participate in multiple or composite fruit formation.

62. Answer (4)

Biological name of makoi is *Solanum nigrum* which belongs to family Solanaceae.

In Solanaceae, calyx have five sepals, united and persistent and shows valvate aestivation.

63. Answer (2)

Piper nigrum (Black pepper) has perispermic seeds. *Helianthus tuberosus* (Jerusalem artichoke) forms tuber. *Dianthus* and *Primrose* shows free central placentation. Pitcher of *Nepenthes* is a leaf modification.

64. Answer (4)

The male gamete fuses with the diploid secondary nucleus to produce the triploid primary endosperm nucleus in angiosperm.

65. Answer (4)

Cycas has small specialised roots called coralloid roots which are associated with nitrogen fixing cyanobacteria.

66. Answer (4)

Biocontrol refers to the use of biological method for controlling plant disease and pests.

67. Answer (3)

Tropical forest has maximum rainfall.

68. Answer (4)

Primary succession starts in areas where no living organisms ever existed.

69. Answer (1)

Phloem fibres (bast fibres) are made up of sclerenchymatous cells.

70. Answer (2)

In dicot leaf, stomata are usually more in number on lower epidermis, vascular bundles differ in size and bulliform cells are absent. Leaf type is dorsiventral.

In monocot leaf, stomata are equal in number on lower and upper epidermis, vascular bundles are nearly similar in size and bulliform cells are present. Leaf type is isobilateral.

71. Answer (3)

Gibberellins promote seed germination. Presence of chemical inhibitors such as abscisic acid, phenolic acids, para-ascorbic acid are one of the reasons which causes seed dormancy.

72. Answer (2)

A typical angiospermic anther is bilobed and tetrasporangiate.

73. Answer (3)

In the given figure of L.S. of an embryo of grass:

Label A is scutellum

Label B is epiblast

74. Answer (2)

The mitochondrial matrix possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the components required for the synthesis of proteins.

75. Answer (3)

Chloroplast, mitochondria and nucleus are double membrane bound organelles. Vacuole is surrounded by a single membrane known as tonoplast.

76. Answer (2)

In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradients into the vacuole. Vacuoles in animal cells are small and temporary.

77. Answer (2)

Number of meiotic divisions to produce 64 pollens

$= \frac{64}{4} = 16$

78. Answer (1)

Spindle fibres attach to kinetochores of chromosomes during metaphase.

79. Answer (1)

DNA synthesis occurs only in S-phase of cell cycle. Cell growth in terms of cytoplasmic increase is a continuous process.

80. Answer (1)

Tailing occurs in a template independent manner. Peptide bond formation occurs between charged tRNA. In prokaryotes, control of the rate of transcriptional initiation is the predominant site for control of gene expression.

81. Answer (2)

If repressor protein coded by *lac i* gene irreversibly bind to operator then structural genes would not be able to express itself.

82. Answer (1)

If both strands acts as a template, they would code for RNA molecule with different sequences and in turn if they code for proteins, the sequence of amino acids in the proteins will be different.

83. Answer (2)

VNTRs belong to mini-satellite and their size vary from 0.1 to 20 kb. It shows high degree of polymorphism and its copy number varies from chromosome to chromosome in an individual.

84. Answer (2)

PS II is found only in grana lamellae. It is involved only in non-cyclic flow of electrons. It is associated with splitting of water and release of O_2.

85. Answer (2)

Chemiosmosis process requires a membrane, a proton pump, a proton gradient and ATP synthase enzyme.

SECTION - B

86. Answer (3)

In dominant trait disorder, children are affected when one or both the parents are affected.

87. Answer (3)

Respiratory quotient is the ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration, and it depends upon the type of respiratory substrate used.

88. Answer (1)

Prions does not contain any outer covering. They are abnormally folded proteins which cause certain neurological diseases.

89. Answer (1)

Seeds of orchids are non-endospermic. Monocot seeds have one shield shaped cotyledon.

90. Answer (3)

In bryophytes, zygote do not undergo reduction division immediately instead they undergo mitotic division to form the embryo.

91. Answer (2)

Bread is prepared by using baker's yeast. Puffed-up appearance of dough is due to production of CO_2 during fermentation.

92. Answer (3)

Prey species have evolved various defenses to minimise or challenge the impact of predation.

Mimicry is the resemblance of one organism to another or to the natural objects among which it lives.

93. Answer (4)

Carbon cycle in the ecosystem is a gaseous cycle.

94. Answer (2)

When bulliform cells are turgid, the leaf surface is exposed. When they are flaccid due to water stress, leaves curl inwards.

95. Answer (3)

F.W. Went isolated auxin from tips of coleoptiles of oat seedlings E. Kurosawa (1926) reported the appearance of symptoms of disease (which was caused by fungus) in rice seedlings when they were treated with sterile filtrates of fungus. The active substances were later identified as gibberellic acid.

96. Answer (4)

In papaya, male and female flowers are present on different plants, *i.e.*, dioecious condition.

Dioecious condition prevents both autogamy and geitonogamy.

97. Answer (1)

Leucoplasts are colourless plastids. Amyloplast and aleuroplast are the types of leucoplast. Chloroplasts are greenish plastids which possess photosynthetic pigments, chlorophylls and carotenoids and take part in food synthesis.

98. Answer (2)

Centrosome duplication occurs during S phase of interphase.

99. Answer (3)

Stop codons aids in the termination of translation. These are UAA, UAG and UGA.

100. Answer (4)

Griffith gave the transforming principle.

ZOOLOGY

SECTION - A

101. Answer (2)

If a protein is imagined as a straight line then the left end is represented by the first amino acid and the right end is represented by the last amino acid.

102. Answer (2)

Annelids, arthropods and chordates are metamerically segmented.

103. Answer (2)

Nereis is an annelid and *Anopheles* is an arthropod.

The habitat of *Nereis* is marine.

Annelids and arthropods are coelomates.

104. Answer (4)

Cuboidal epithelium is composed of a single layer of cube-like cells. This is commonly found in ducts of glands and tubular parts of nephrons in kidneys and its main functions are secretion and absorption.

105. Answer (2)

SA node is the pacemaker of the human heart.

AV node is the pacesetter of human heart.

106. Answer (2)

In adult human beings, the skeletal system is made up of 206 bones and a few cartilages. It is grouped into two divisions – the axial and the appendicular skeleton. Axial skeleton comprises of 80 bones that is distributed along the main axis of the body.

107. Answer (2)

PTH along with TCT play a significant role in maintenance of calcium balance in the body.

Also, the glucose homeostasis in blood is maintained jointly by the two hormones *i.e.* insulin and glucagon.

108. Answer (2)

In molluscs, the space between hump and mantle is called the mantle cavity in which feather-like gills are present.

The mouth contains file-like rasping organ for feeding. The anterior head region has sensory tentacles.

109. Answer (1)

Over secretion of GH stimulates abnormal growth of the body leading to gigantism.

Graves' disease is a form of hyperthyroidism.

110. Answer (1)

Recombinant DNA technology, PCR and Enzyme Linked Immuno-sorbent Assay (ELISA) are some of the techniques that serve the purpose of early diagnosis of diseases. Transgenic animals are beneficial in terms of producing useful biological products, for testing safety of drugs or vaccines *etc*.

111. Answer (3)

Uracil $\rightarrow$ Nitrogenous base

Adenylic acid, thymidylic acid, guanylic acid, uridylic acid and cytidylic acid are nucleotides.

112. Answer (4)

The separated DNA fragments *via* gel electrophoresis can be visualised only after staining the DNA with ethidium bromide followed by exposure to UV rays.

113. Answer (3)

The midbrain of frog is characterised by a pair of optic lobes. Their hind brain consists of cerebellum and medulla oblongata. They do not have pons in their hind brain like humans.

114. Answer (2)

The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

115. Answer (4)

The considered grounds for the termination of pregnancies are:

1. The continuation of pregnancy would involve a risk to the life of the pregnant woman or of grave injury to physical or mental health, or
2. There is substantial risk that if the child were born, would suffer from such physical or mental abnormalities to be seriously handicapped.

116. Answer (4)

Pigments	Carotenoids, Anthocyanins, *etc*.
Alkaloids	Morphine, Codeine, *etc*.
Terpenoids	Monoterpenes, Diterpenes *etc*.
Essential oils	Lemon grass oil, *etc*.
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, curcumin, *etc*.
Polymeric substances	Rubber, gums, cellulose

117. Answer (2)

At resting state, the axoplasm inside axon contains high concentration of K^+ and of negatively charged proteins and low concentration of Na^+.

118. Answer (3)

The blood concentration of glucose in a normal healthy individual is 4.2 m mol/L – 6.1 m mol/L.

119. Answer (3)

Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. Sometimes called congestive heart failure because congestion of lungs is one of the main symptoms of this disease.

Cardiac arrest is when heart stops beating.

120. Answer (3)

Palmitic acid has 16 carbon atoms including the carboxyl carbon whereas arachidonic acid has 20 carbon atoms including the carboxyl carbon.

121. Answer (3)

Several genes called cellular oncogenes (*c-onc*) or proto oncogenes have been identified in normal cells which when activated under certain conditions, could lead to oncogenic transformation of the cells.

122. Answer (2)

The flower tops, leaves and the resin of *Cannabis* plant are used in various combinations to produce marijuana, hashish, charas and ganja.

123. Answer (3)

Early Greek thinkers thought units of life called spores were transferred to different planets including Earth. 'Panspermia' is still a favourite idea for some astronomers.

124. Answer (1)

Testes in males and ovaries in females are considered as primary sex organs. Other parts of the body which help in meeting of gametes are considered as secondary sex organs.

125. Answer (1)

S. L. Miller observed formation of amino acids in his experiment. In similar experiments other observed, formation of sugars, nitrogen bases, pigment and fats. Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space.

126. Answer (4)

In order to cut the DNA with restriction enzymes, it needs to be in pure form, free from other macro-molecules. Since the DNA is enclosed within the membranes, we have to break the cell open to release DNA along with other macromolecules such as RNA, proteins, polysaccharides and also lipids. This can be achieved by treating the bacterial cells/plant or animal tissue with enzymes such as lysozyme (bacteria), cellulase (plant cells), chitinase (fungus).

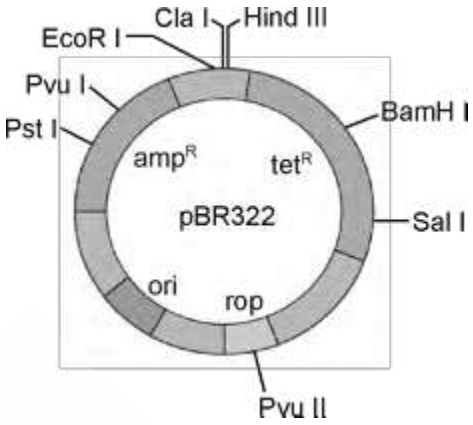
127. Answer (3)

Undetected and/or untreated STIs could lead to complications which include pelvic inflammatory disease (PID), abortions, still-births, ectopic pregnancies, infertility or even cancer of reproductive tract.

128. Answer (4)

Flying squirrel is a placental mammal while sugar glider, bandicoot and wombat are Australian marsupials.

129. Answer (1)



130. Answer (2)

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

131. Answer (2)

The cavity of cervix is called cervical canal which along with vagina forms the birth canal responsible for passage of foetus during child birth.

132. Answer (3)

Muscle tissue has muscle fibres which show contraction in response to a stimulus and then relax and return to their uncontracted state in a coordinated fashion.

133. Answer (2)

Genetic Engineering Approval Committee is an organisation which makes decision regarding the validity of GM research and the safety of introducing GM-organisms for public services.

134. Answer (4)

ICSI is a specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

GIFT is transfer of an ovum collected from a donor into the fallopian tube of female who cannot produce one but can provide suitable environment for fertilisation and further development.

135. Answer (4)

In 1997, an American company got patent rights on Basmati rice through the US Patent and Trademark Office.

SECTION - B

136. Answer (3)

Whales, bats, cheetah and humans share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals. They have similar anatomical structures – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Hence, in these animals, the same structure developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologous.

137. Answer (3)

A bundle of nodal fibres, atrio-ventricular bundles (AV bundle) continues from the AVN which passes through the atrio-ventricular septa to merge on the top of the inter-ventricular septum and immediately divides into a right and left bundles.

138. Answer (3)

Agrobacterium is a pathogen of several dicot plants. It is able to deliver T-DNA into normal plant cells to transform them into tumor.

139. Answer (2)

- AIDS has no cure, prevention is the best option.
- AIDS stands for Acquired Immuno Deficiency Syndrome.

140. Answer (3)

Sperms are not components of seminal plasma. Seminal plasma is rich in fructose, calcium and certain enzymes.

141. Answer (3)

Mouth is ventrally located in chondrichthyes and *Scoliodon* belongs to the class Chondrichthyes.

142. Answer (3)

The opening of vagina is often covered partially by a membrane called hymen. Mons pubis is a cushion of fatty tissue covered by skin and pubic hair. Clitoris is a tiny finger-like structure which lies at upper junction of two labia minora. Myometrium is the thick middle layer of uterus formed by smooth muscles.

143. Answer (2)

Based on number of amino and carboxyl groups there are acidic (*e.g.*, glutamic acid), basic (lysine) and neutral (valine) amino acids. Similarly, aromatic amino acids are tyrosine, phenylalanine, tryptophan.

144. Answer (4)

The reasons for the infertility in humans could be physical, congenital diseases, drugs, immunological or psychological.

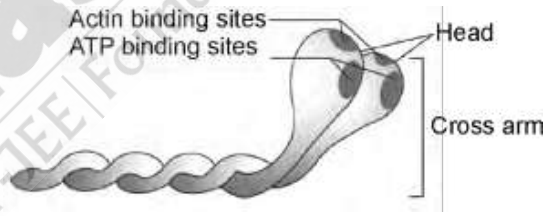
145. Answer (3)

The gene isolated from marrow cells producing ADA introduced into cells at early embryonic stages, could be a permanent cure for genetic defect "ADA deficiency".

146. Answer (4)

In female cockroaches, the 7th sternum is boat shaped and together with the 8th and 9th sterna forms a brood or genital pouch whose anterior part contains female gonopore, spermathecal pores and opening of ducts of colleterial glands.

147. Answer (1)



148. Answer (3)

Ammonia is the most toxic form and requires large amount of water for its elimination, whereas uric acid, being the least toxic, can be removed with a minimum loss of water.

149. Answer (4)

Inner parts of cerebral hemispheres and a group of associated deep structures form a complex structure called limbic system which is concerned with olfaction, autonomic responses, regulation of sexual behaviour, expression of emotional reactions and motivation. Centre for controlling gastric secretions is present in medulla oblongata.

150. Answer (3)

Peptide, polypeptide, protein hormone $\rightarrow$ Insulin, glucagon, pituitary hormones, hypothalamic hormones, *etc*.

CHEMISTRY

SECTION - A

151. Answer (4)

Element	Group number
Z = 35 (Br)	17
Z = 49 (In)	13
Z = 59 (Pr)	3
Z = 37 (Rb)	1

152. Answer (3)

The anomalous behaviour of 1st members of the group is attributed to their small size, large charge/radius ratio and high electronegativity.

153. Answer (2)

$pH = pK_a + \log\left(\frac{salt}{acid}\right)$

$pH = 4.76 + \log\left(\frac{0.5}{0.1}\right)$

pH = 4.76 log (5)

pH = 4.76 + 0.7

pH = 5.46

154. Answer (3)

$2X(g) + Y_2(g) \rightleftharpoons 2XY(g)$; K_1

Reversing the reaction will change the equilibrium constant to $\frac{1}{K_1}$

$2XY_{(g)} \rightleftharpoons 2X_{(g)} + Y_{2(g)}$

Dividing the reaction with 2 we get

$XY(g) \rightleftharpoons X(g) + \frac{1}{2}Y_2(g)$

$K_{(final)} = \sqrt{\frac{1}{K_1}}$

155. Answer (1)

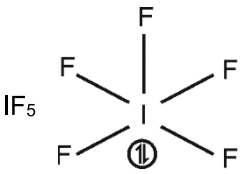
$$\frac{w(O_2)}{Eq.\ wt(O_2)} = \frac{w(Ag)}{Eq.\ wt(Ag)}$$

$$\frac{11200 \times 32}{22400 \times 8} = \frac{w(Ag)}{108}$$

$$\frac{108 \times 0.5 \times 32}{8} = w(Ag)$$

w = 216 g

156. Answer (1)



IF_5

Hybridisation $\rightarrow sp^3d^2$

Shape $\rightarrow$ Square pyramidal

157. Answer (3)

In N_2 molecule, 10 bonding electrons are there so, 5 bonding electron pairs are present.

158. Answer (2)

$$M = \frac{1000 \times K_f \times w_1}{\Delta T_f \times w_2}$$

$$= \frac{1000 \times 1.86 \times 10}{1.2 \times 100}$$

= 155 g mol^{-1}

159. Answer (3)

'i' is same for NaCl and KCl so at same concentration and temperature both are isotonic solution.

160. Answer (2)

- Hybridisation of Cr in CrO_4^{2-} ions is sp^3.
- $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow \underset{\text{Deep blue solution}}{2CrO_5} + K_2SO_4 + 5H_2O$
- Gun metal contains 80% Cu, 10% Sn, 2% Zn.
- $K_2Cr_2O_7$ is coloured due to charge transfer.

161. Answer (2)

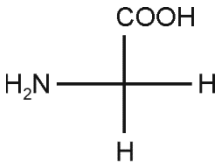
For both reversible and irreversible process, $\Delta U = 0$ (Isothermal process)

$\Delta S = 0$ For (Reversible process)

$\Delta S \neq 0$ For (Irreversible process)

162. Answer (2)

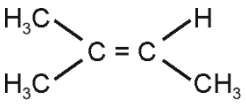
Glycine is optically inactive amino acid



163. Answer (1)

Ethanol is more acidic in nature than acetylene.

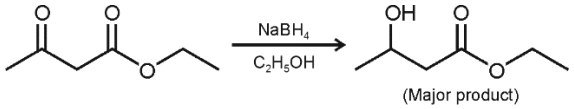
164. Answer (3)



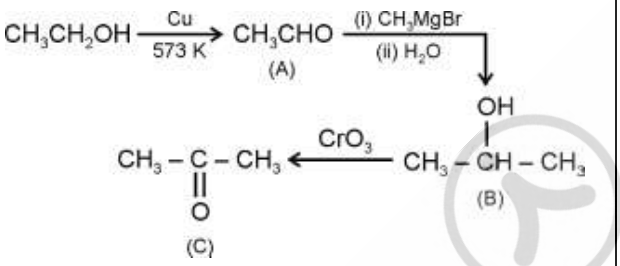
It does not show geometrical isomerism.

165. Answer (3)

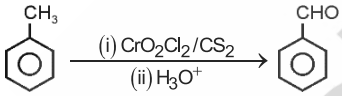
$NaBH_4$ does not reduce ester, while it reduces $-\overset{O}{\overset{\|}{C}}-$ group easily.



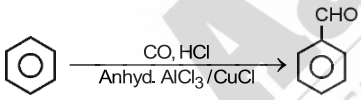
166. Answer (3)



167. Answer (3)

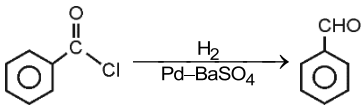
Etard reaction → 

Gattermann-Koch reaction →



Stephan reaction → RCN $\xrightarrow[(ii)\ H_3O^+]{(i)\ SnCl_2+HCl}$ RCHO

Rosenmund reduction →



168. Answer (4)

Due to steric inhibition in resonance carboxylate part is not involved in resonance with benzene ring which will result in more acidic nature of ortho-substituted benzoic acid.

169. Answer (3)

Reactant that gets completely consumed in reaction is limiting reagent and it decides yield of product.

$$\underset{2g}{2H_2} + \underset{8g}{O_2} \rightarrow 2H_2O$$

$$\underset{1\,mol}{} \quad \underset{0.25\,mol}{}$$

O_2 will be limiting reagent

1 mol O_2 gives → 2 mol H_2O

0.25 mol O_2 will give → 0.5 mol H_2O = 9 g H_2O

170. Answer (1)

Group IV cations are Ni^{2+}, Zn^{2+}, Co^{2+}, Mn^{2+}.

171. Answer (3)

$$2K_2HgI_4 + NH_3 + 3KOH \rightarrow \underset{\substack{\text{Basic mercury (II)}\\ \text{amido–iodine}\\ \text{(Brown precipitate)}}}{HgO\cdot Hg(NH_2)I} + 7KI + 2H_2O$$

172. Answer (4)

$$\nu = \frac{c}{\lambda} = \frac{3\times10^8\ ms^{-1}}{5800\times10^{-10}\ m} = \frac{3\times10^{16}}{58}\ Hz$$

$= 5.17 \times 10^{14}\ s^{-1}$

$\simeq 5.2 \times 10^{14}\ s^{-1}$

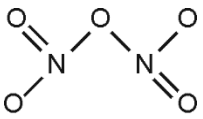
173. Answer (2)

N_2O_5

$2x + 10 = 0$

$x = 5$

Oxidation state is +5



As N has four bonds So, its covalency is 4.

174. Answer (2)

The order of bond dissociation enthalpy is

$Cl_2 > Br_2 > F_2 > I_2$

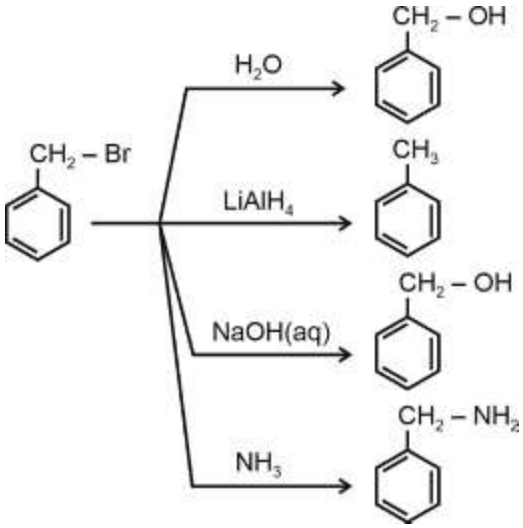
175. Answer (3)

In the aqueous phase, the substituted ammonium cations get stabilised not only by electron releasing effect of the alkyl group (+I) but also by solvation with water molecules.

∴ The order of basic strength in case of ethyl substituted amines in aqueous solution is

$(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

176. Answer (2)



177. Answer (2)

Enantiomers possess same physical properties namely, melting point, boiling point etc. Enantiomers differ only with respect to the rotation of plane polarised light.

178. Answer (4)

The correct IUPAC name of $[NiCl_2(PPh_3)_2]$ is dichloridobis(triphenylphosphine)nickel(II).

179. Answer (4)

Zeros between two non-zero digits are significant.

$\therefore$ 4.005×10^4 has four significant figure.

180. Answer (1)

$$\text{Molarity} = \frac{\text{No. of moles}}{\text{Volume of solution (L)}}$$

$$0.5 = \frac{w_{NaOH} \times 1000}{40 \times 500}$$

w_{NaOH} = 10 g

181. Answer (3)

$$\overset{0}{S_8} + 12OH^- \longrightarrow 4S^{2-} + 2\overset{+2}{S_2}O_3 + 6H_2O$$

Oxidation state of sulphur in $S_2O_3^{2-}$ is +2.

182. Answer (2)

Species		Oxidation state of N
NO	$\rightarrow$	+2
NH_3	$\rightarrow$	–3
HNO_3	$\rightarrow$	+5
HNO_2	$\rightarrow$	+3

183. Answer (4)

The correct order of atomic radii for group 13 element is

In > Al > Ga > B

Element	Atomic Raidus (pm)
B	88
Al	143
Ga	135
In	167

184. Answer (1)

Hyperconjugation is a permanent effect while electromeric effect is a temporary effect.

185. Answer (2)

Liquids having sufficient difference (more than 25 K) in their boiling points can be separated by simple distillation. Chloroform (b.p. 334 K) and aniline (b.p. 457 K) have sufficient difference in their boiling points.

SECTION-B

186. Answer (2)

- Mercury cell has constant cell potential of 1.35 V as its overall reaction does not involve any ion in solution.
- 38% solution of H_2SO_4 is used as an electrolyte in lead storage battery.
- In Dry cell

  Anode: $Zn(s) \rightarrow Zn^{2+} + 2e^-$

  Cathode: $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$

187. Answer (1)

In a group for an acid (HA) as the size of A increases down the group, H-A bond strength decreases so the acid strength increases.

188. Answer (2)

C with triple bond is *sp* hybridised.

C with 1 double bond is sp^2 hybridised.

C with 4 single bond is sp^3 hybridised.

$C_1 \rightarrow sp$

$C_3 \rightarrow sp^3$

$C_5 \rightarrow sp^2$

$C_6 \rightarrow sp^3$

189. Answer (2)

Enthalpy of neutralisation is when 1 g eq of an acid is neutralised by 1 g eq of base or vice versa (in dilute solutions). Since moles of acid and base are still same in 3 mL of each acid and base, temperature will also be same.

As temperature is an intensive property.

190. Answer (4)

Thorium (Th) exhibits only +4 oxidation state, while U, Np and Am exhibits more than one oxidation states.

191. Answer (3)

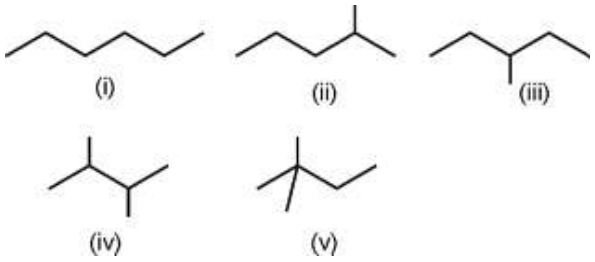
Relative ease of dehydration of alcohols follows the order:

Tertiary > Secondary > Primary

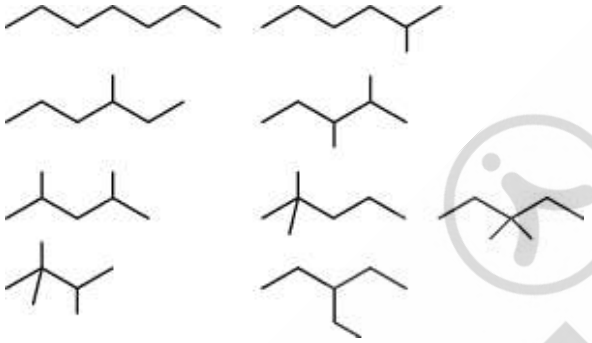
192. Answer (3)

Reducing sugar show mutarotation. Sucrose is non-reducing sugar.

193. Answer (2)



Structural isomers of C_6H_{14}



Structural isomers of C_7H_{16}

194. Answer (3)

$r = k[A]^x [B]^y$ …(i)

$2r = k[2A]^x [B]^y$ …(ii)

$r = k[2A]^x [2B]^y$ …(iii)

(i) ÷ (ii)

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x$$

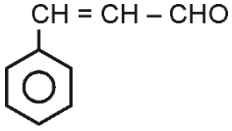
x = 1

(ii) ÷ (iii)

$$2 = \left(\frac{1}{2}\right)^y$$

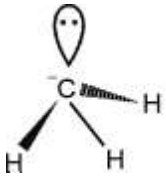
y = –1

195. Answer (2)

Cinnamaldehyde is 

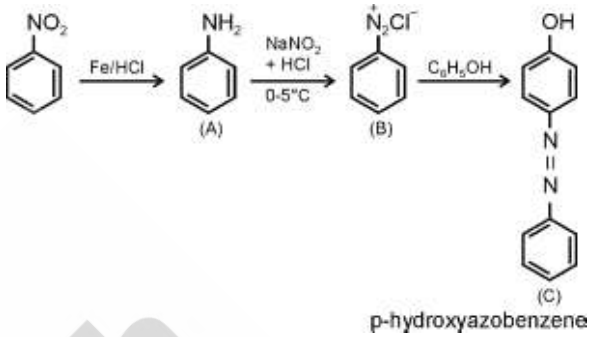
196. Answer (4)

Presence of alkyl group on the carbanion decreases its stability due to the +I effect.



sp^3 hybridisation ⇒ pyramidal in shape.

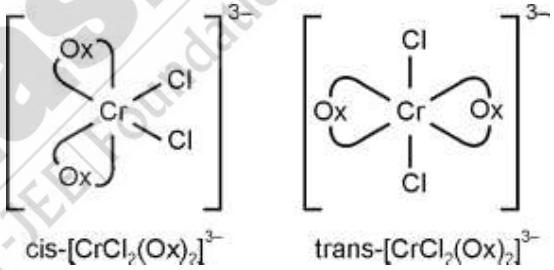
197. Answer (1)



p-hydroxyazobenzene

198. Answer (2)

$[CrCl_2(Ox)_2]^{3-}$ shows geometrical isomerism.



cis-$[CrCl_2(Ox)_2]^{3-}$ trans-$[CrCl_2(Ox)_2]^{3-}$

Out of the two, cis-$[CrCl_2(Ox)_2]^{3-}$ is optically active.

199. Answer (1)

$$\text{Number of spectral lines} = \frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$$

$$5^{th} \text{ excited state} = \frac{(6-1)(6-1+1)}{2}$$

$$\text{Means } 6^{th} \text{ shell} = \frac{5(6)}{2} = 15$$

200. Answer (1)

Iron reacts with HCl to form ferrous chloride.

$Fe + 2HCl \rightarrow FeCl_2 + H_2$

Liberation of hydrogen prevents the formation of ferric chloride.

❑ ❑ ❑