



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-10

Time : 3 Hrs. 20 Min.

Answers

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

18/04/2024



CODE-A



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Answers & Solutions

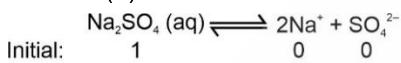
CHEMISTRY

SECTION-A

1. Answer (2)

 NaCl , 100% dissociation $\rightarrow i = 2$ CaCl_2 , 25% dissociation $\rightarrow i = 1.5$ Na_3PO_4 , 100% dissociation $\rightarrow i = 4$ AlCl_3 , 50% dissociation $\rightarrow i = 2.5$

2. Answer (3)



$$i = 1 - \alpha + 2\alpha + \alpha = 1 + 2\alpha$$

$$i = 1 + 2 \times 0.9 = 2.8$$

$$\pi = iCRT$$

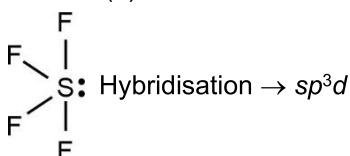
$$= 2.8 \times 0.02 \times 0.082 \times 300 = 1.38 \text{ atm}$$

3. Answer (2)

$$\text{Bond Order} = \frac{\text{N}_b - \text{N}_a}{2}$$

 O_2^+ has bond order = 2.5

4. Answer (1)

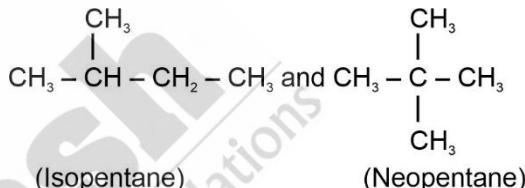


Shape – see-saw.

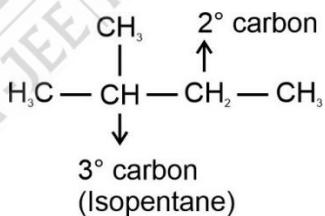
5. Answer (3)

σ -nitrophenol is steam volatile while p -nitrophenol is not. So, steam distillation method is used for their separation.

6. Answer (1)



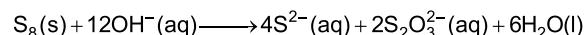
Both have same molecular formula but different carbon skeletons.



7. Answer (1)

Ge, Sn and Pb are the heavier members of group 14 and due to inert pair effect (inability to use ns^2 electrons of valence shell). The heaviest member lead has maximum tendency to show +2 oxidation state because of the same reason.

8. Answer (1)



9. Answer (4)

CO, NO and N_2O are neutral oxides.

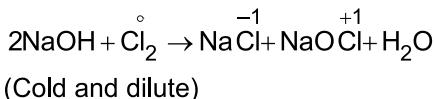
10. Answer (3)

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

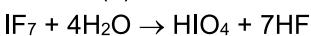
$$\frac{1}{\lambda} = R_H \left(\frac{1}{3^2} - \frac{1}{4^2} \right)$$

$$\frac{1}{\lambda} = R_H \left(\frac{16-9}{144} \right) = \frac{7}{144} R_H$$

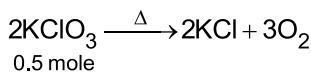
11. Answer (1)



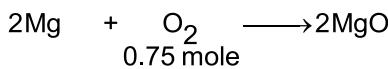
12. Answer (3)



13. Answer (3)



2 moles of KClO_3 , produced 3 moles of O_2 .
0.5 mole of KClO_3 , produced moles of $\text{CO}_2 = \frac{3}{2} \times 0.5 = 0.75$ mole



0.75 mole of O_2 will produce 1.5 mole of MgO

14. Answer (1)

1 molal aqueous solution of NaOH means 1 mole of NaOH is present in 1000 g of H_2O .

$$\text{Number of moles of H}_2\text{O} = \frac{1000}{18} = 55.55$$

$$\text{Mole fraction of NaOH} = \frac{55.55}{1+55.55} = \frac{55.55}{56.55} = 0.98$$

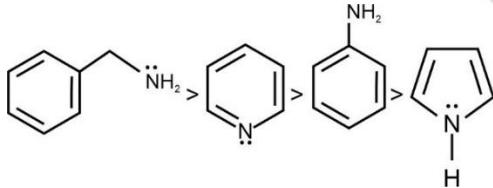
15. Answer (3)

In $[\text{FeF}_6]^{3-}$ complex ion, Fe^{3+} is sp^3d^2 hybridised and has five unpaired electrons due to weak field ligand F^- .

16. Answer (4)

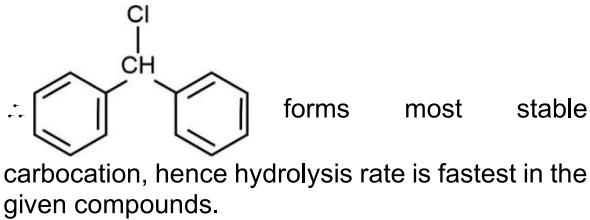
Basic nature of amines depends on the availability of lone pair on nitrogen atom

The correct order of basic strength of amines is

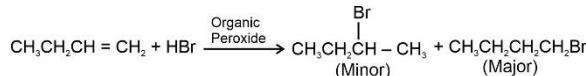


17. Answer (2)

In aqueous medium, more easily the carbocation is formed, faster is the hydrolysis.



18. Answer (1)



19. Answer (3)

In trivalent lanthanoid ions, only two elements with f^0 and f^{14} type configuration are colourless, rest all are coloured.

The lanthanoid ions other than the f^0 type and the f^{14} type are all paramagnetic.

20. Answer (2)

$$\Delta H = \Delta U + P\Delta V$$

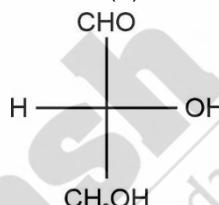
$$\Delta H = \Delta U + \Delta n_g RT$$

$$-a \text{ J/mol} = \Delta U + \frac{1}{2} \times 8.314 \times T \quad [\Delta n_g = 1 - \frac{1}{2} = \frac{1}{2}]$$

$$-a - \left(\frac{1}{2} \times 8.314 \times T \right) = \Delta U$$

$$\Delta U = -(a + 4.157 T) \text{ J/mol}$$

21. Answer (4)



(+) – Glyceraldehyde

D-Configuration

22. Answer (1)

Alkanes with odd number of carbon atoms are not obtained in good yield by Wurtz reaction.

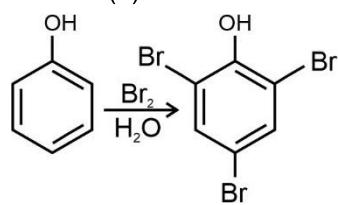
23. Answer (1)

Lesser is the stability of alkene more is the energy released on hydrogenation

24. Answer (1)

- Electron withdrawing group increases acidity of substituted phenols.
- Electron donating group decreases acidity of substituted phenols.

25. Answer (4)



26. Answer (2)

Element	$\Delta_{eg}H \text{ (kJmol}^{-1}\text{)}$
Li	-60
Na	-53

27. Answer (1)

- Noble gases have large positive electron gain enthalpies because electron has to enter the next higher principal quantum level leading to a very unstable electronic configuration.
- $F(g) + e^- \rightarrow F^-(g); \Delta_{eg}H$
 $F^-(g) \rightarrow F(g) + e^-; \Delta_{IE}H$
 $\Delta_{eg}H = -\Delta_{IE}H$

28. Answer (2)

$$K_p = K_c (RT)^{\Delta n_g}$$

$K_p > K_c$ for $\Delta n_g > 0$



$$\Delta n_g > 0.$$

29. Answer (3)

$$pH = 3, [H^+]_1 = 10^{-3}$$

$$pH = 4, [H^+]_2 = 10^{-4}$$

Equal volume mixed

$$[H^+]_f = \frac{10^{-3} \times V + 10^{-4} \times V}{2V}$$

$$[H^+]_f = \frac{11 \times 10^{-4}}{2}$$

$$= 5.5 \times 10^{-4} M$$

$$pH = -\log[H^+] = -\log(5.5 \times 10^{-4})$$

$$pH = 4 - \log(5.5)$$

$$= 4 - 0.74$$

$$= 3.26$$

30. Answer (2)

Ions	$\lambda^\circ(S \text{ cm}^2 \text{ mol}^{-1})$
OH^-	199.1
SO_4^{2-}	160.0
Cl^-	76.3
Br^-	78.3

31. Answer (4)

- Unit of rate constant of zero order reaction is $\text{mol L}^{-1} \text{s}^{-1}$.
- All natural and artificial radioactive decay of unstable nuclei take place by first order kinetics.

32. Answer (3)

Etard reaction is a method of preparation of benzaldehyde from aromatic hydrocarbon.

33. Answer (2)

Both aliphatic and aromatic aldehydes give positive Tollen's reagent test, while only aliphatic aldehyde gives Fehling's test.

34. Answer (2)

When dimethyl glyoxime is added to the aqueous solution of nickel chloride and is made alkaline by adding NH_4OH solution, a brilliant red precipitate is obtained.

35. Answer (1)

$PbCrO_4$ is yellow colour salt.

SECTION-B

36. Answer (4)



is most stable because of resonance and hyperconjugation effects.

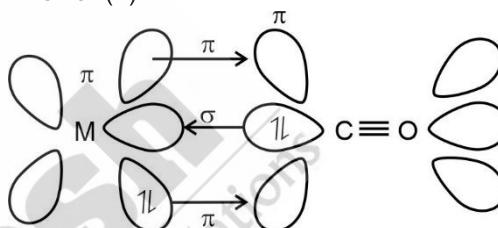
37. Answer (3)

The shape of d_{xy} , d_{yz} , d_{xz} and $d_{x^2-y^2}$ are similar to each other whereas that of d_{z^2} is different from others.

38. Answer (2)

Compounds	$\Delta_fH(\text{kJ mol}^{-1})$
H_2O	-286
H_2S	-20
H_2Se	73
H_2Te	100

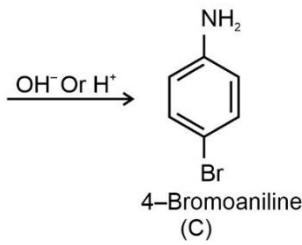
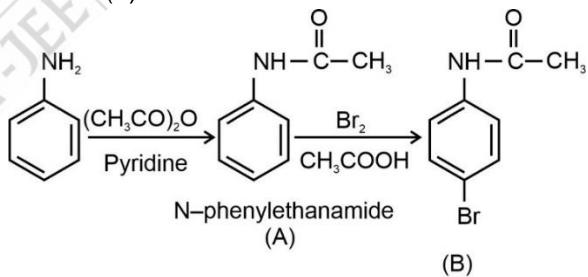
39. Answer (1)



Synergic bonding

The metal-carbon bond in metal carbonyls possess both σ and π character.

40. Answer (2)



41. Answer (2)

Standard enthalpy of formation, Δ_fH° of element in its reference state is taken as zero

$$\Delta_fH^\circ \text{ for KCl(s)} = -436.75 \text{ kJ mol}^{-1}$$

42. Answer (1)

Down the group effective nuclear charge increases hence basicity of hydroxides of lanthanoid ions decreases.

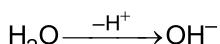
43. Answer (4)
Insulin and albumins are globular proteins
44. Answer (3)
Eclipsed conformation is most unstable conformation of n-butane because of torsional strain.
45. Answer (3)
Ether does not liberate H₂ gas on reaction with sodium.
46. Answer (4)

$$K = \frac{1}{R} \cdot \frac{I}{A}$$

$$0.008 = \frac{1}{80} \cdot \frac{I}{A}$$

$$\frac{I}{A} = 0.64 \text{ cm}^{-1}$$
47. Answer (3)

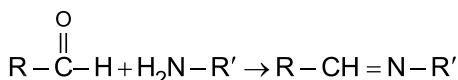
$$\text{HPO}_4^{2-} \xrightarrow{+H^+} \text{H}_2\text{PO}_4^-$$
 Base Conjugate acid



Acid Conjugate base

48. Answer (4)
- $$t = \frac{2.303}{k} \log \frac{a}{a-x}$$
- $$t = \frac{2.303}{1.8424 \times 10^{-4}} \log \frac{100}{80}$$
- $$t = 1.25 \times 10^4 [\log 10 - 3 \log 2]$$
- $$t = 1.25 \times 10^4 [1 - 0.9] = 1250 \text{ s}$$

49. Answer (2)



Schiff's base

50. Answer (1)
 $\text{XeF}_2 \rightarrow$ Linear
 $\text{H}_2\text{O} \rightarrow$ Bent
 $\text{PCl}_5 \rightarrow$ Trigonal bipyramidal
 $\text{ClF}_3 \rightarrow$ T-shape

BOTANY

SECTION-A

51. Answer (4)
DNA dependent RNA polymerase facilitates the opening of the helix during transcription. AUG has dual functions, as it codes for methionine and also acts as start codon.
52. Answer (2)
Direction of synthesis of both DNA and RNA during replication and transcription is 5' → 3'.
53. Answer (3)
Satellite DNA shows high degree of polymorphism which is heritable from parents to children and thus helpful in paternity testing in case of disputes.
54. Answer (4)
The correct increasing order of organisation of given materials is nucleotide → gene → chromosome → genome.
55. Answer (2)
Photosynthetic number or assimilation number shows a relationship between the chlorophyll and photosynthesis.
56. Answer (1)
Jan Ingenhousz showed that in the presence of sunlight it is only the green parts of the plants that could release oxygen.
57. Answer (2)
Nucleolus is a spherical structure present in the nucleoplasm. Its content is continuous with the rest of the nucleoplasm.

58. Answer (3)
The fluid nature of the membrane is important from the point of view of functions like cell growth, formation of intercellular junctions, secretion, endocytosis, cell division etc.
59. Answer (3)
Prokaryotes have 70S ribosomes that are made up of 50S and 30S subunits.
60. Answer (3)
The complete disintegration of the nuclear envelope marks the start of the second phase of mitosis, hence the chromosomes are spread through the cytoplasm of the cell.
61. Answer (2)
Mitosis is an equational division, so number of chromosomes will be same in parent and daughter cell.
62. Answer (3)
The interphase lasts more than 95% of the duration of cell cycle.
63. Answer (3)
Some recent extinction include Quagga from Africa, Thylacine from Australia, Dodo from Mauritius and Steller's sea cow from Russia.
64. Answer (4)
For one pyruvic acid molecule in aerobic respiration, there are three steps, which involve release of CO₂ molecule. One during link reaction and two during Krebs cycle.

65. Answer (2)
 β -thalassemia is controlled by a single gene HBB on chromosome 11 of each parent and occur due to mutation of one or both the genes.
 α -thalassemia is controlled by two closely linked genes present on chromosome 16.
66. Answer (2)
The experiment by T.H. Morgan on *Drosophila* was conducted to study genes that were sex linked. Morgan observed that the two genes, responsible for eye colour and body colour, did not segregate independently of each other and F_2 ratio deviates very significantly from 9 : 3 : 3 : 1 ratio.
67. Answer (4)
Turner's syndrome is caused due to absence of one of the X-chromosome i.e., 45 with X0. Such females are sterile as their ovaries are rudimentary.
68. Answer (1)
Tribal people are integral component of biosphere reserve.
69. Answer (3)
When cross is performed involving single pair of contrasting traits of a character, it is known as monohybrid cross, e.g., PPQQRr \times PPQQRr.
70. Answer (3)
In monocot root and monocot stem, cambium is absent. In Dicot leaf, vascular bundles do not possess cambium.
71. Answer (4)
In heartwood, tyloses or tracheal plugs are found which make them non-functional for conduction of water.
Tyloses are balloon like swellings of xylem parenchyma cells into the lumen of vessels.
72. Answer (4)
Sugarbeet is a long day plant.
73. Answer (3)
Anatropous ovule is most common ovule and found in 82% of angiosperm families.
74. Answer (3)
Protandrous condition is found in Sunflower and Cotton.
Protogynous condition is found in *Ficus* and *Aristolochia*.
75. Answer (1)
Most of the green algae have one or more storage bodies called pyrenoids located in the chloroplasts.
Pyrenoids contain protein besides starch.
76. Answer (4)
Adiantum is a pteridophyte and it belongs to class Pteropsida.
77. Answer (4)
BOD (Biochemical oxygen demand) is a measure of the organic matter present in the water.
The greater the BOD of waste water, more is its polluting potential.
78. Answer (3)
Commensalism is the interaction in which one interacting species is benefited and other is neither harmed nor benefited, e.g., clown fish and sea-anemone.
79. Answer (4)
Pioneer communities established on a bare rock are lichens. They accelerates the process of soil formation.
The key functional aspects of the ecosystem are
(i) Productivity
(ii) Decomposition
(iii) Energy flow
(iv) Nutrient cycling
Standing state is the amount of all the inorganic substances present in an ecosystem per unit area at a given time.
80. Answer (3)
Family, has a group of related genera with still less number of similarities as compared to genus and species.
81. Answer (3)
 - The viruses are non-cellular structures that are characterised by having an inert crystalline structure outside the living cell.
 - M.W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called this fluid as *Contagium vivum fluidum*.
 - Occurrence of certain enzymes like neuraminidase and transcriptase shows living nature of virus.
82. Answer (2)
The body of chrysophytes are enclosed in cell wall.
83. Answer (3)
Hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.
84. Answer (3)
Rhizome is an underground stem modification of ginger. Runner can be seen in *Oxalis*. Offset is found in *Eichhornia*. Phylloclade is found in *Euphorbia*.
85. Answer (1)
In Liliaceae, the type of fruit is capsule and rarely berry.

SECTION-B

86. Answer (3)
200 bp are wrapped around one histone octamer to form a nucleosome.
87. Answer (2)
AUG codes for methionine.
88. Answer (3)
Rudolf Virchow (1855) first explained that cells divide and new cells are formed from pre-existing cells, i.e., *Omnis cellula-e cellula*.
89. Answer (2)
In animal cells, cytokinesis is achieved by formation of a furrow. The furrow in the plasma membrane of the cell deepens gradually. It moves centripetally and ultimately joins in the centre dividing the cell cytoplasm into two daughter cells.
90. Answer (4)
Link reaction of aerobic respiration require Mg^{2+} .
91. Answer (3)
-
- The sequence of genes on a linear chromosome will be p, r, q, s
92. Answer (1)
 - In monocot root, hypodermis is absent, vascular bundles are radial type and endodermis is very distinct made up of barrel shaped cells having caspian strips. Pericycle is also very distinct.
 - In dicot stem, hypodermis is collenchymatous (consists of 3 to 5 layers), vascular bundles are conjoint, open and with endarch protoxylem. Pericycle is present in the form of patches(semilunar) shape.
93. Answer (2)
 GA_3 is used to speed up the malting process in brewing industry.

ZOOLOGY**SECTION-A**

101. Answer (2)
AIDS stands for Acquired Immuno Deficiency Syndrome.
It was first reported in the year 1981.
102. Answer (1)
An adult frog excretes urea, thus it is an ureotelic animal.
The tadpoles are ammonotelic in nature.
103. Answer (3)
In human females, the ovarian stroma is divided into two zones i.e., a peripheral cortex and an inner medulla.

94. Answer (2)
 - Seed of *Lupinus arcticus* excavated from Arctic Tundra, germinated and flowered after an estimated record of 10,000 years of dormancy.
 - During an archaeological excavation at King Herod's Palace near the Dead sea, a 2000 years old viable seed of date palm, *Phoenix dactylifera* was found.
95. Answer (1)
Sphagnum often grows in acidic marshes. The older dead parts of moss and other marshy plants got slowly carbonised, compressed and fossilised over thousands of years and have produced a dark spongy mass called peat.
96. Answer (1)
Statins are produced by yeast *Monascus purpureus*.
Statins are used as blood cholesterol lowering agent.
97. Answer (1)
 - Emigration – It is the number of individuals of the population who had left the habitat.
 - Mortality – It is the number of deaths in the population during a given period.
98. Answer (4)
Hydrarch succession starts in aquatic habitat.
Xerarch succession takes place in dry areas like rock (Lithosere), sand (Psammosere).
99. Answer (4)
In fungi such as ascomycetes and basidiomycetes, an intervening dikaryotic stage ($n + n$, i.e., two nuclei per cell) occurs; such a condition is called a dikaryon and the phase is called dikaryophase. One of the examples is *Agaricus*.
100. Answer (1)
Trifolium is used as fodder and belongs to family Fabaceae.

104. Answer (1)

The atrial wall of our heart secretes a peptide hormone called atrial natriuretic factor (ANF) which decreases blood pressure. Erythropoietin stimulates erythropoiesis and is secreted by kidneys.

105. Answer (1)

The pitch of the B-DNA is 34 Å. The rise per base pair would be 3.4 Å. At each step of ascent, the strand turns 36°.

106. Answer (4)
 Adenine = Nitrogenous base
 Adenosine = Nucleoside (Pentose sugar + Adenine)
 Adenylic acid = Nucleotide (Pentose sugar + Adenine + Phosphate group)
107. Answer (1)
 Chemical safety testing is same as toxicity testing of drugs. Transgenic animals are made that carry genes which make them more sensitive to toxic substances than non-transgenic animals.
108. Answer (3)
 The compound epithelium covers the dry surface of the skin, the moist surface of the buccal cavity, pharynx and inner lining of pancreatic ducts.
109. Answer (1)
 Columnar epithelium is composed of a single layer of tall and slender cells. Their nuclei are located at the base.
110. Answer (1)
 Two disulfide bonds are present between A chain and B chain of a mature insulin.
111. Answer (1)
 Different types of ion channels are present on the neural membrane. These ion channels are selectively permeable to different ions.
112. Answer (4)
 Centre for cardiovascular reflexes is present in medulla oblongata. Hypothalamus contains a number of centres which control body temperature, urge for eating and drinking.
113. Answer (3)
 - Spleen is a large bean-shaped organ and it acts as a filter of the blood by trapping blood-borne microorganisms.
 - Lymph nodes are secondary lymphoid organs.
 - There is lymphoid tissue also located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called Mucosa Associated Lymphoid Tissue (MALT).
114. Answer (2)
 In humans, endometrium undergoes cyclical changes during menstrual cycle while myometrium exhibits strong contractions during delivery of the baby, called parturition.
115. Answer (3)
 Ovary is the primary sex organ in human females. Penis is the external genitalia of human male. Mons pubis, labia majora, labia minora, hymen and clitoris are external genitalia in human females.
116. Answer (2)
 In India, the marriageable age of human male and female are 21 years and 18 years respectively.
117. Answer (2)
 Except for hepatitis-B, genital herpes and HIV infections, other venereal diseases are completely curable if detected early and treated properly.
118. Answer (4)
 Vasectomy is a surgical method of contraception for male. This surgical intervention blocks gamete transport thereby prevent conception. It is highly effective but its reversibility is very poor.
119. Answer (4)
 The skull is composed of two sets of bones – cranial and facial, that totals to 22 bones, but ear ossicles and hyoid are also included in skull. Ischium is the part of pelvic bone..
120. Answer (4)
 Arthropods have open circulatory system whereas annelids have closed circulatory system.
121. Answer (4)
 Numbat is an Australian marsupial which shows convergent evolution with placental anteater.
122. Answer (1)
 The rate of appearance of new forms is linked to the life cycle or the life span. Microbes that divide fast have the ability to multiply and become millions of individuals within hours.
123. Answer (1)
 Alfred Wallace, a naturalist who worked in Malay Archipelago came to similar conclusions around the same time as Charles Darwin.
 Hugo deVries gave the mutation theory.
124. Answer (2)

Thrombocytes	1,500,00-3,500,00/mm ³ of blood
Erythrocytes	5-5.5 million/mm ³ of blood
Leucocytes	6000-8000/mm ³ of blood
Haemoglobin	12-16 gms in 100 mL of blood
125. Answer (3)
 A patch of nodal tissue is present in the right upper corner of the right atrium called Sino-Atrial Node(SAN).
 The SAN can generate maximum number of action potentials and is also called the pacemaker of heart as it is responsible for initiating and maintaining the rhythmic contractile activity of the heart.
126. Answer (3)
Scoliodon belongs to the class Chondrichthyes. Most of the cartilaginous fishes are viviparous. Rest all mentioned in options are oviparous.
127. Answer (1)
 A sigmoid curve is obtained when percentage saturation of haemoglobin with O₂ is plotted against pO₂ in humans.
128. Answer (1)
 When pCO₂ is high and pO₂ is low as in the tissues, more binding of carbon dioxide with Hb occurs to form carbamino-haemoglobin.

129. Answer (3)

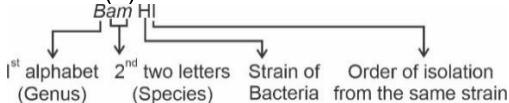
Reptiles, birds, land snails and insects excrete nitrogenous wastes as uric acid in the form of pellet or paste with a minimum loss of water and are called uricotelic animals.

Platypus is ureotelic and *Clarias* is ammonotelic.

130. Answer (2)

Pure DNA fragments cannot be seen in the visible light. DNA fragments are forced to move towards anode.

131. Answer (3)



132. Answer (2)

Today we know more than 900 restriction enzymes that have been isolated from over 230 strains of bacteria.

133. Answer (3)

Molluscs are unsegmented and are triploblastic. Annelids and chordates are segmented organisms. Coelenterates are diploblastic invertebrates.

134. Answer (3)

The biological name of tapeworm is *Taenia*. *Asterias* is an echinoderm and *Sepia* is a mollusc.

135. Answer (1)

If a foreign DNA is ligated at *Sal I* site of pBR322, then recombinant plasmids will lose tetracycline resistance.

All transformants will be ampicillin resistant and can be selected from non-transformants as they will grow in ampicillin containing medium.

SECTION-B

136. Answer (2)

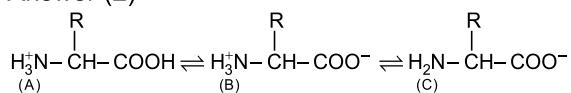
The acid-insoluble fraction has only four types of organic compounds, i.e., proteins, nucleic acids, polysaccharides and lipids.

Amino acids, nucleotides and monosaccharides come under acid-soluble fraction.

137. Answer (3)

Thyroxine is the iodothyronine, not a steroid. It interacts with intracellular receptors and regulate gene expression or chromosome function.

138. Answer (2)



B form is the zwitterionic form.

139. Answer (4)

Plasmodium enters the human body as sporozoites (infectious form) through the bite of an infected female *Anopheles* mosquito.

Aedes mosquitoes cause dengue and chikungunya.

140. Answer (1)

The heart of a frog is myogenic in nature. It means that their heart is independent of the neurological system to excite itself. Their heart is autoexcitable, thus it keeps beating for some time.

141. Answer (2)

- | | |
|------------------|-----------------------|
| Rosie | - A transgenic cow |
| Eli Lilly | - An American company |
| <i>cry II Ab</i> | - Cotton bollworms |
| Mature insulin | - Lacks C-peptide |

142. Answer (4)

The ionic gradients for Na^+ and K^+ are maintained by the active transport of these ions by the $\text{Na}^+ - \text{K}^+$ pump which transports 3 Na^+ outwards for 2 K^+ into the cell. As a result, the outer surface of the axonal membrane possesses a positive charge while its inner surface becomes negatively charged and therefore is polarised.

143. Answer (4)

Male reproductive system is located in the pelvic region. Testis is covered by a dense covering but ovary is covered by a thin epithelium. Testis is oval in shape.

144. Answer (3)

The figure given is of implants. Progestogens alone or in combination with estrogen are used by females as injections or implants under the skin. Implants inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

IUDs increase phagocytosis of sperms within the uterus. Condoms made of rubber/latex sheath, prevent the users from contracting STIs and AIDS.

145. Answer (2)

Reptiles lay thick shelled eggs which do not dry up in sun unlike those of amphibians.

Small sized reptiles of era in which dinosaurs existed still exist today.

146. Answer (3)

Some specialised cells in our body like macrophages and leucocytes exhibit amoeboid movement. It is effected by pseudopodia formed by the streaming of protoplasm (as in Amoeba).

147. Answer (1)

Production of body heat is not the function of skeletal system in humans. Heat is produced during exercise due to muscle contraction and in catabolic reactions.

148. Answer (3)

Volume of air inspired or expired during a normal respiration is called tidal volume. It is approx. 500 mL i.e., a healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute.

149. Answer (2)

In human excretory system, paired structures are kidneys and ureters, while unpaired structures are urinary bladder and urethra.

150. Answer (2)

Microinjection – Recombinant DNA is directly injected into the nucleus of an animal cell.

Gene gun or biolistics is suitable for plants.

PHYSICS

SECTION-A

151. Answer (3)

Convex lens is behaving as a diverging lens.

Hence, $n_2 < n_1$

152. Answer (1)

Due to refraction, bottom of container filled with liquid appears to be raised.

153. Answer (2)

Distance between successive maxima or minima is called fringe width

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

154. Answer (4)

$$E = E_0 \sin(\omega t - kx)$$

Energy density in form of electric field

$$\frac{dU_E}{dV} = \frac{1}{2} \epsilon_0 E_0^2 \sin^2(\omega t - kx)$$

$$\left(\frac{dU_E}{dV} \right)_{\text{avg}} = \frac{1}{4} \epsilon_0 E_0^2$$

155. Answer (4)

The average velocity vector of nitrogen molecules is zero as all the random velocities vector sum up to zero.

156. Answer (1)

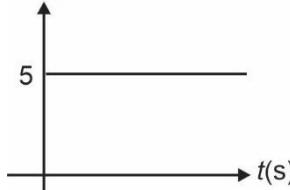
$$T = Mg + \frac{m}{I} xg \Rightarrow T = Mg + \frac{mxg}{I}$$

157. Answer (2)

$$V = 5t - 3$$

$$a = \frac{dv}{dt} = 5 \text{ m s}^{-2} \text{ i.e. it does not vary with time}$$

$$a(\text{m s}^{-2})$$



158. Answer (2)

Since the particle passes the same height at $t = 1 \text{ s}$ and 5 s hence the time of flight is 6 s

159. Answer (3)

At highest point of the trajectory, only horizontal component of velocity is present.;

$$\therefore v = 6 \text{ m s}^{-1}$$

160. Answer (2)

Self-inductance of a coil

$$L = \mu_0 \frac{N^2 A}{l}$$

161. Answer (1)

$$P = VI \Rightarrow I = \frac{P}{V} = \frac{120}{240} = \frac{1}{2} \text{ A}$$

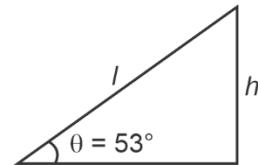
$$I_{\text{max}} = \sqrt{2} I = \frac{1}{\sqrt{2}} \text{ A}$$

162. Answer (2)

$$v = \sqrt{2gh}$$

$$v = \sqrt{2gl \sin \theta}$$

$$F = mg \sin \theta$$



$$\text{Power} = mg \sin \theta \sqrt{2gl \sin \theta}$$

$$= \sqrt{2m^2 g^3 / \sin^3 \theta}$$

$$= \sqrt{2 \times 4 \times 10 \times 10 \times 10 \times 2 \times \frac{64}{125}}$$

$$= \sqrt{2 \times 4 \times 2 \times 2 \times 2 \times 2 \times 64}$$

$$P = 2 \times 2 \times 2 \times 8\sqrt{2} \text{ W} = 64\sqrt{2} \text{ W}$$

163. Answer (1)

$$\frac{dU}{dx} = -2 \Rightarrow F_x = 2 \text{ N}$$

$$\frac{dU}{dy} = 2 \Rightarrow F_y = -2 \text{ N}$$

$$\vec{F} = (2\hat{i} - 2\hat{j})$$

$$|\vec{F}| = \sqrt{2^2 + 2^2}$$

$$= 2\sqrt{2} \text{ N}$$

164. Answer (1)

$$V = \frac{\omega}{k} = \frac{16}{4} = 4 \text{ m/s}$$

165. Answer (3)

Frequency of oscillation

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = n$$

$$f_1 = \frac{1}{2\pi} \sqrt{\frac{k}{4m}}$$

$$f_1 = \frac{n}{2}$$

166. Answer (2)

Charge on the isolated capacitor will be same.

167. Answer (3)

Dipole is arrangement of equal and opposite charge and like charge repel each other.

168. Answer (3)

$$E = \phi_0 + 0.6 \quad \dots(i)$$

$$1.3 E = \phi_0 + 0.9 \quad \dots(ii)$$

$$(ii) - (i)$$

$$0.3E = 0.3$$

$$E = 1 \text{ eV}$$

$$\phi_0 = 1 - 0.6 = 0.4 \text{ eV}$$

169. Answer (1)

Nuclear force is strongest force in nature and they are short range forces.

170. Answer (4)

Both diodes are forward biased

$$\text{Equivalent resistance} = \frac{6 \times 4}{6+4} + 1.6 = 4 \Omega$$

$$\text{Current through } R_1 = \frac{20}{4} = 5 \text{ A}$$

171. Answer (4)

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

$$Y = \overline{A+B} + (\bar{A} \cdot \bar{B})$$

$$= \overline{A+B} + A \cdot \bar{B}$$

$$= \bar{A} \cdot \bar{B} + A \cdot \bar{B} = \bar{B}(\bar{A} + A) = \bar{B}$$

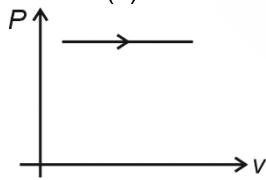
172. Answer (2)

K for insulator = 0

173. Answer (1)

First law of thermodynamics is based on conservation of energy.

174. Answer (1)



Isobaric process

175. Answer (2)

Ideal fluid is non-viscous.

176. Answer (2)

[Torque] = [ML² T⁻²]

[Energy density] = $\left[\frac{\text{Energy}}{\text{Volume}} \right] = [\text{ML}^{-1}\text{T}^{-2}]$

[Angular momentum] = [ML²T⁻¹]

[Specific heat] = [M⁰L²T⁻²K⁻¹]

177. Answer (4)

If \vec{L} is conserved about origin

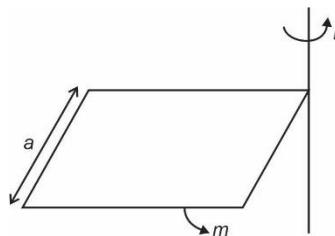
then $\vec{\tau}$ (about origin) = 0

Or, $\vec{r} \times \vec{F} = 0$

Thus $\vec{r} \parallel \vec{F}$

$$\frac{\alpha}{2} = \frac{3}{-6} \Rightarrow \boxed{\alpha = -1}$$

178. Answer (4)



According to perpendicular axis theorem

$$I = \frac{ma^2}{3} + \frac{ma^2}{3} = \frac{2ma^2}{3}$$

179. Answer (1)

We know, intensity of gravitational field inside a solid sphere

$$I_g = \frac{GM}{R^3} x$$

$$\therefore I_g \propto x$$

Thus it is variable inside the sphere and proportional to the distance from centre

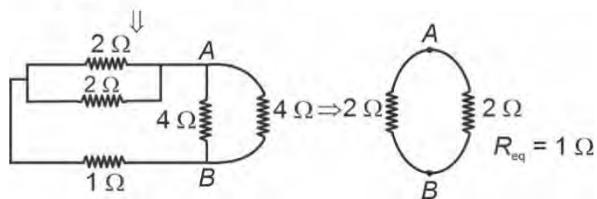
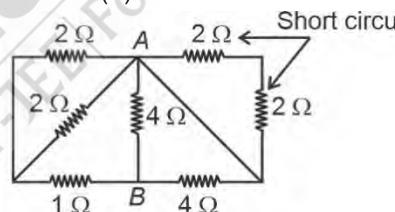
180. Answer (2)

$$\text{Change in volume of cube} \frac{\Delta V}{V} = \frac{3\Delta l}{l}$$

$$= 3 \times \frac{1}{100}$$

$$= 0.03$$

181. Answer (1)



182. Answer (2)

$$Q = \int i dt \quad (\text{Area under } i-t \text{ graph})$$

$$Q = \frac{1}{2} \times 3 \times 2 = 3 \text{ C}$$

183. Answer (2)

$$\text{Lorentz force } \vec{F} = q\vec{E} + q(\vec{v} \times \vec{B})$$

Particle is not deflected i.e. $\vec{F} = 0$

$$q\vec{E} + q(\vec{v} \times \vec{B}) = 0$$

$$\vec{v} \times \vec{B} = -\vec{E} \text{ or } \vec{B} \times \vec{v} = \vec{E}$$

184. Answer (2)

$$B = \mu_0 n i$$

n = Number of turns per unit length

$$n = \frac{1200}{2\pi \times \frac{1}{2}} = \frac{1200}{\pi}$$

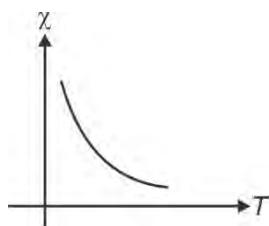
$$B = \mu_0 \times \frac{1200}{\pi} \times 1 = \frac{4\pi \times 10^{-7} \times 1200}{\pi}$$

$$= 4.8 \times 10^{-4} \text{ T}$$

185. Answer (3)

$$\mu_r = 1 + \chi$$

For paramagnetic substance $\chi = \frac{C}{T}$, i.e. magnetic susceptibility decreases with temperature as shown below



Therefore, graph for μ_r vs T also remains same in nature

SECTION-B

186. Answer (1)

$$20 - 2 - 10 - 10 \frac{di}{dt} - 3 = 10$$

$$\Rightarrow -10 \frac{di}{dt} = 5$$

$$\frac{di}{dt} = -\frac{1}{2} \text{ A s}^{-1}$$

187. Answer (3)

$$X_L = \omega L$$

$$= 2000 \times 3 \times 10^{-3}$$

$$X_L = 6 \Omega \text{ and } z = \sqrt{R^2 + X_L^2} = \sqrt{6^2 + 8^2} = 10 \Omega$$

$$I_0 = \frac{V_0}{z} = \frac{5}{10} = \frac{1}{2}$$

188. Answer (3)

To reflected back after reflection light ray fall perpendicular on mirror.

So, $r = 30^\circ$

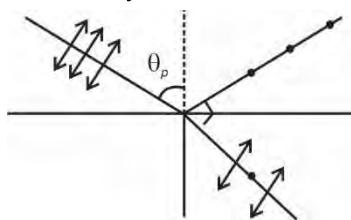
Now, applying Snell's law

$$1 \cdot \sin i = \mu \sin r$$

$$\Rightarrow \mu = \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{1 \times 2}{\sqrt{2} \times 1} = \sqrt{2}$$

189. Answer (1)

At polarizing angle, reflected ray is perpendicular to refracted ray



190. Answer (2)

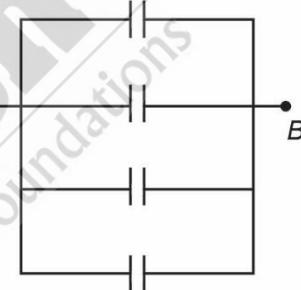
$$F = \frac{kq_1 q_2}{r^2}$$

$$F = \frac{k5q^2}{r^2}$$

$$F_1 = \frac{k4q^2}{r^2}$$

$$F_1 = \left(\frac{4F}{5} \right)$$

191. Answer (1)



$$C_{AB} = C + C + C + C = 4C$$

192. Answer (4)

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

$$\frac{E_1}{E_2} = \left(\frac{n_2}{n_1} \right)^2 = \left(\frac{4}{3} \right)^2 \Rightarrow \frac{E_1}{E_2} = \frac{16}{9}$$

193. Answer (3)

→ Zener diode works as a voltage regulator in reverse biased condition.

→ With increase in temperature, electron in valence band get sufficient energy to go to conduction band.

194. Answer (3)

Final temperature is 0°C

$$\Rightarrow m_{ice} L = m_w S \Delta T$$

$$\Rightarrow m_{ice} = \frac{100 \times 1 \times 20}{80}$$

$$= 25 \text{ g}$$

195. Answer (2)

Applying Bernoulli's theorem between the two points at wider & narrow section

$$P_1 + \frac{1}{2} \rho v_1^2 = P_2 + \frac{1}{2} \rho v_2^2$$

$$\frac{1}{2} \rho (v_2^2 - v_1^2) = P_1 - P_2$$

$$\frac{1}{2} \rho (v_2^2 - v_1^2) = \rho g h$$

$$v_2^2 = v_1^2 + 2gh$$

$$v_2^2 = 16 + 2 \times 10 \times 45 \times 10^{-2}$$

$$v_2^2 = 25$$

$$v_2 = 5 \text{ m/s}$$

196. Answer (3)

Here At and $\frac{t}{B}$ must have dimension of distance.

$$\text{So } [At] = [L]$$

$$\Rightarrow [A] = [LT^{-1}]$$

$$\text{Similarly } \left[\frac{t}{B} \right] = [L]$$

$$[B] = [L^{-1}T]$$

197. Answer (1)

We know,

$$I = \sum_{i=1}^n m_i r_i^2$$

$$\text{Also, } I = mk^2$$

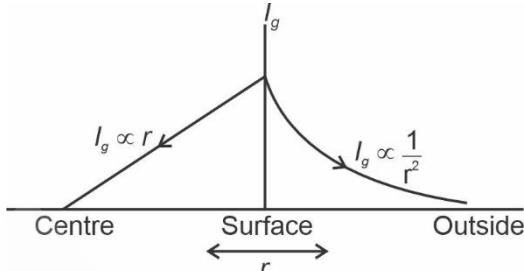
$$\therefore k = \sqrt{\frac{I}{m}}$$

$$\text{and } \vec{L} = 2m \left(\frac{d\vec{A}}{dt} \right)$$

$$\vec{\tau} = \vec{r} \times \vec{F}$$

198. Answer (4)

Variation of gravitational intensity from surface varies as



Thus both decrease but not at same rate.

199. Answer (4)

On increasing temperature, resistivity of conductor increases but resistivity of semiconductor and insulator decreases.

200. Answer (1)

For the rocket to rise from ground $Mg = \frac{dm}{dt} \times v_0$

$$\Rightarrow \frac{dm}{dt} = \frac{Mg}{v_0}$$

