



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-2

Time : 3 Hrs. 20 Min.

Answers

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

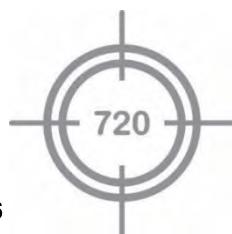
04/04/2024

CODE-A



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-2

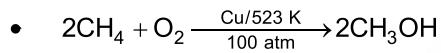
Time : 3 Hrs. 20 Min.

Answers & Solutions

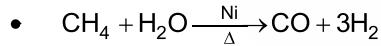
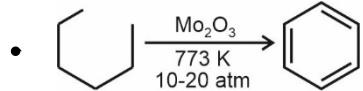
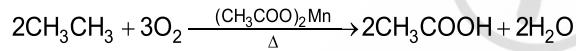
CHEMISTRY

SECTION-A

1. Answer (2)



•



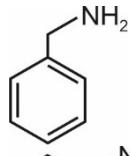
2. Answer (1)

For isomeric alkenes more is the number of α -hydrogen atoms more is the stability of alkene and lesser is the value of heat of hydrogenation.

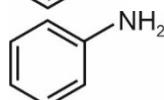
3. Answer (3)

Arginine and Lysine are essential amino acids.

4. Answer (3)



(Benzylamine) is more basic than



(Aniline) because in aniline, the lone

pair of nitrogen is in conjugation with benzene π -electron cloud

5. Answer (2)

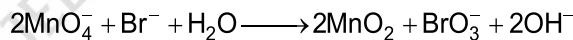
Kjeldahl's method is not applicable for the estimation of nitrogen in case of nitrogen in ring and nitrogen present in nitro and azo groups.

6. Answer (3)

- According to resonance theory, resonance structures (canonical forms) contribute for the actual structure but do not have any real existence.
- Energy of actual structure is less than that of any of the canonical forms.

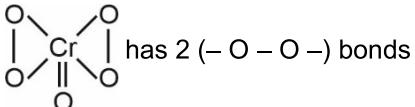
7. Answer (4)

The balanced redox reaction is



$$\therefore x = 2, y = 2, z = 1$$

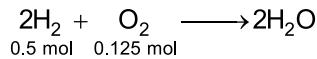
8. Answer (2)



9. Answer (1)

$$\begin{aligned} \text{Number of molecules} &= \frac{2.24}{22.4} \times N_A \\ &= 0.1 N_A \end{aligned}$$

10. Answer (2)



O₂ is limiting reagent

$$\therefore 1 \text{ mol O}_2 \text{ gives } \rightarrow 2 \text{ mol H}_2\text{O}$$

$$\begin{aligned} 0.125 \text{ mol O}_2 \text{ will give } &\rightarrow 0.25 \text{ mol H}_2\text{O} \\ &= 0.25 \times 18 \\ &= 4.5 \text{ g H}_2\text{O} \end{aligned}$$

11. Answer (3)

The reaction follows first order kinetics.

$$t = \frac{2.303}{K} \log \frac{a}{a-x}$$

$$t = \frac{2.303}{1.1515 \times 10^{-3}} \log \frac{100}{10}$$

$$t = 2000 \text{ s}$$

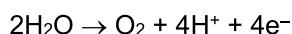
12. Answer (4)

NH_4^+ belongs to zero group of cations.

13. Answer (3)

Ni^{2+} belongs to group-IV cations hence NiS will have higher solubility.

14. Answer (4)



$$\text{Moles of O}_2 \text{ generated} = \frac{10}{4} = 2.5$$

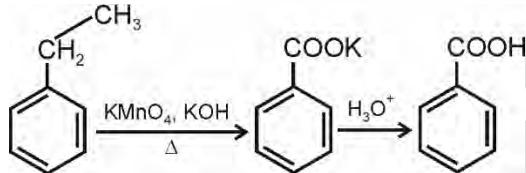
$$\text{Volume of O}_2 \text{ generated at STP} = 2.5 \times 22.4$$

$$56 \text{ L}$$

15. Answer (2)

$[\text{Fe}(\text{SCN})]^2+$ is blood red colour species.

16. Answer (3)



17. Answer (1)

Generally boiling point increases down the group. But due to high electronegativity and small size of nitrogen, NH_3 exhibits hydrogen bonding in solid as well as in liquid state. Because of this it has higher boiling point than that of PH_3 and AsH_3 .

Compound	Boiling point (K)
NH_3	238.5
PH_3	185.5
AsH_3	210.6
SbH_3	254.6
BiH_3	290.0

18. Answer (3)

Lead nitrate on heating gives NO_2 gas.

19. Answer (3)

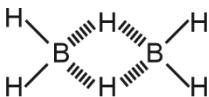
The effect of the following groups in increasing acidity order is



∴ Order of increasing acidity:



20. Answer (1)



In B_2H_6 , there are two bridging hydrogen atom.

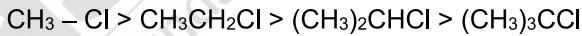
The four terminal $\text{B} - \text{H}$ bonds are regular two centre-two electron bonds.

Therefore, there are two $3\text{c} - 2\text{e}^-$ bonds and four $2\text{c} - 2\text{e}^-$ bonds.

21. Answer (4)

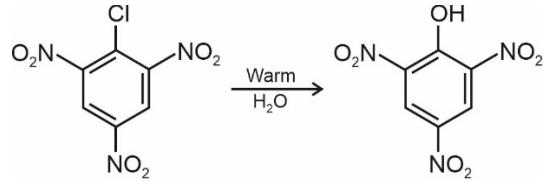
$\text{S}_{\text{N}}2$ mechanism is a single step reaction in which incoming nucleophile and leaving group come and leave simultaneously.

∴ The correct order of $\text{S}_{\text{N}}2$ reaction is



22. Answer (1)

- Presence of electron withdrawing group like $-\text{NO}_2$ at ortho and para positions increases the reactivity of haloarenes.



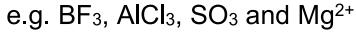
- Phenyl cation is highly unstable due to positive charge on sp^2 hybridised carbon atom.

23. Answer (1)

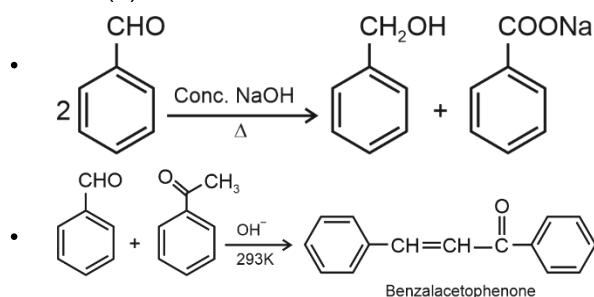
When inert gas is added at constant pressure, the equilibrium will move in the direction which have of more/higher stoichiometry of gases.

24. Answer (3)

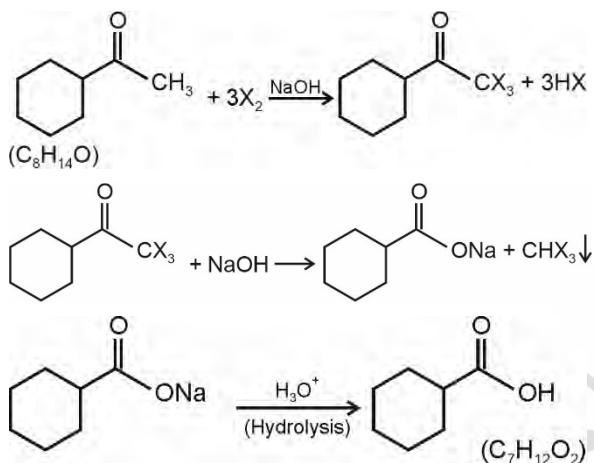
Lewis acids are those compounds which can accept the electron pair.



25. Answer (3)



26. Answer (2)



27. Answer (2)

Substances	$\Delta_{\text{vap}}H^\circ \text{ (kJ mol}^{-1}\text{)}$
H ₂ O	40.79
NH ₃	23.35
HCl	16.15
N ₂	5.59

28. Answer (3)

More is the number of unpaired electrons, more is the spin only magnetic moment.

Species No. of unpaired electrons

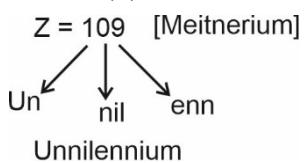
[MnCl ₆] ³⁻	4
[Fe(CN) ₆] ³⁻	1
[FeF ₆] ³⁻	5

29. Answer (3)

For isoelectronic species

$$\text{Size} \propto \frac{1}{Z_{\text{eff}}}$$

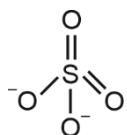
30. Answer (4)



31. Answer (1)

In graphite, each carbon atom in hexagonal ring undergoes sp^2 hybridisation and makes three sigma bonds with three neighbouring carbon atoms. Fourth electron forms a π bond. The electrons are delocalised over the whole sheet. Electrons are mobile and therefore, graphite conducts electricity along the sheet.

32. Answer (1)



$$\text{Bond order} = \frac{\sigma + \pi}{\sigma} = \frac{4 + 2}{4} = 1.5$$

33. Answer (4)



34. Answer (1)

Volume independent concentration terms are temperature independent.

35. Answer (2)

$$\Delta T_f = K_f \times m$$

$$\Delta T_f = \frac{K_f \times W_2 \times 1000}{M \times W_1}$$

$$\Rightarrow M = \frac{1.86 \times 5 \times 1000}{0.46 \times 250} = 80 \text{ g mol}^{-1}$$

SECTION-B

36. Answer (3)

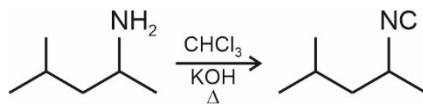
The cyclic species which contains $(4n + 2)\pi$ electrons in conjugation are aromatic species ($n = 0, 1, 2, \dots$).

37. Answer (2)

Cellulose is composed of β -D-glucose units.

38. Answer (1)

Primary amines give positive carbylamine or isocyanide test



39. Answer (2)

(1) For $n = 3$

$$l = 0 \text{ to } (n - 1)$$

$$= 0, 1, 2$$

So, for $l = 2$ minimum value of n has to be 3(2) Energies of the orbitals in the same subshell decrease with increase in the atomic number (Z_{eff}).i.e., $E_{2s}(\text{H}) > E_{2s}(\text{Li}) > E_{2s}(\text{Na}) > E_{2s}(\text{K})$

(3) The energy of the orbitals in hydrogen atom increases as follows:

$$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f$$

(4) $d_{xy}, d_{yz}, d_{zx}, d_{x^2-y^2}$ orbitals have four lobes.Whereas, d_{z^2} has two lobes along z -axis with a ring of high electron density in the xy plane

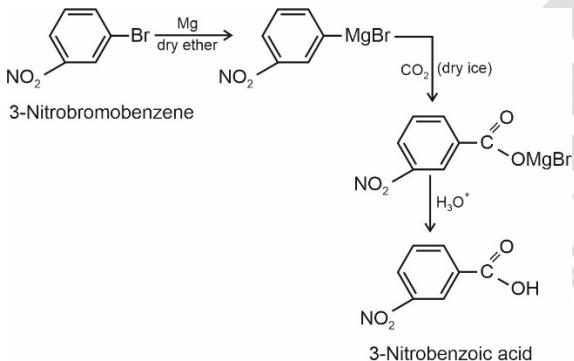
40. Answer (1)

Manganate ion is paramagnetic in nature, due to presence of one unpaired electron.

41. Answer (1)

P–P–P bond angle is P_4 is 60° .

42. Answer (3)



43. Answer (3)

Group reagent for group-IV cations used in qualitative analysis is H_2S in presence of NH_4OH .

44. Answer (4)

$$(i) K_{\text{sp}} = (\text{A}^+) (\text{X}^-)$$

$$4 \times 10^{-12} = (\text{S}) (\text{S})$$

$$4 \times 10^{-12} = S^2$$

$$S = 2 \times 10^{-6}$$

$$(ii) K_{\text{sp}} = (\text{A}^{2+}) (2\text{X}^-)^2$$

$$1.08 \times 10^{-13} = (\text{S}) (2\text{S})^2$$

$$108 \times 10^{-15} = 4S^3$$

$$S^3 = \frac{108}{4} \times 10^{-15}$$

$$S^3 = 27 \times 10^{-15}$$

$$S = 3 \times 10^{-5}$$

$$(iii) K_{\text{sp}} = (\text{A}^{3+}) (3\text{X}^-)^3$$

$$4.32 \times 10^{-26} = (\text{S}) (3\text{S})^3$$

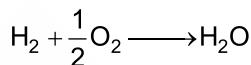
$$4.32 \times 10^{-26} = 27\text{S}^4$$

$$S^4 = \frac{432}{27} \times 10^{-28}$$

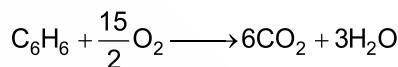
$$S^4 = 16 \times 10^{-28}$$

$$S = 2 \times 10^{-7}$$

45. Answer (1)



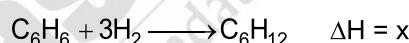
$$\Delta H_1 = -200 \text{ kJ/mol}$$



$$\Delta H_2 = -4000 \text{ kJ/mol}$$



$$\Delta H_3 = -4200 \text{ kJ/mol}$$



$$x = 3\Delta H_1 + \Delta H_2 - \Delta H_3$$

$$x = [3(-200) + (-4000)] - (-4200)$$

$$= -600 - 4000 + 4200$$

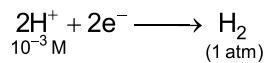
$$= -400 \text{ kJ per mol}$$

46. Answer (1)

$$\text{Spin only magnetic moment} = \sqrt{n(n+2)} \text{ B.M}$$

Here, n = number of unpaired electrons.

47. Answer (3)



$$E_{\text{H}^+/\text{H}_2} = E_{\text{H}^+/\text{H}_2}^{\circ} - \frac{0.0591}{2} \log \left(\frac{(\text{P}_{\text{H}_2})}{(\text{H}^+)^2} \right)$$

$$E_{\text{H}^+/\text{H}_2} = 0 - \frac{0.0591}{2} \log \frac{1}{(10^{-3})^2}$$

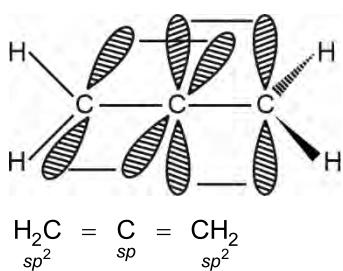
$$E_{\text{H}^+/\text{H}_2} = -\frac{0.0591}{2} \log(10^6)$$

$$E_{\text{H}^+/\text{H}_2} = -0.0591 \times 3$$

$$E_{\text{H}^+/\text{H}_2} = -0.1773 \text{ V}$$

48. Answer (4)

Allene as a whole is non-planar

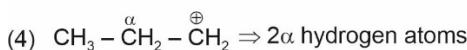
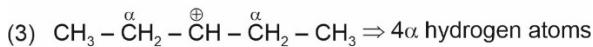
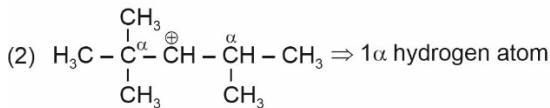
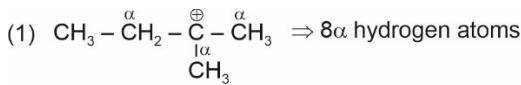


49. Answer (3)

Graph of concentration and time for first order reaction never reaches to zero concentration.

50. Answer (1)

More the number of α -Hydrogen atom, more will be the hyperconjugative structures (i.e., more stability).



BOTANY

SECTION-A

51. Answer (2)

Vessels are absent in gymnosperms. These are the characteristic feature of angiosperms.

52. Answer (1)

Collenchyma is absent in monocotyledonous plants.

It is found in young stem and leaf petiole to provide mechanical support and resist bending of stems and tearing of young leaves.

53. Answer (1)

Gibberellin induces stem elongation in rosette plants such as cabbage, just before the reproductive phase. Elongation in internodes takes place enormously due to this plant hormone known as bolting.

54. Answer (2)

In an angiospermic ovule, chalaza is present opposite to micropylar end representing the basal part of ovule.

55. Answer (1)

Insect pollinated flowers have sticky pollen grains. Foul odoured flowers are pollinated by flies and beetles.

56. Answer (3)

Volvox, *Eudorina*, *Spirogyra* and *Ulothrix* are examples of green algae.

Volvox, *Eudorina* – Colonial forms.

Ulothrix, *Spirogyra* – Filamentous forms.

Mode of reproduction in algae are vegetative, asexual and sexual.

57. Answer (4)

Chlorella is green alga and is a good source of protein.

It is also used as food supplement by space travellers.

58. Answer (3)

Wine and beer are produced without distillation whereas whisky, brandy and rum are produced by distillation of the fermented broth.

59. Answer (4)

Mutualism is the population interaction in which both the interacting species are benefitted.

Interaction	Species A	Species B
Mutualism	+	+
Amensalism	-	0
Commensalism	+	0
Predation	+	-

60. Answer (4)

Anthropogenic ecosystem exhibits the presence of simple food chain. It is not a self-regulatory ecosystem.

61. Answer (1)

The DNA fingerprinting technique involves Southern blot hybridisation using radiolabelled VNTR as a probe. It includes

- (i) Isolation of DNA
- (ii) Digestion of DNA by restriction endonucleases
- (iii) Separation of DNA fragments by electrophoresis
- (iv) Transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon
- (v) Hybridisation using labelled VNTR probe
- (vi) Detection of hybridised DNA fragments by autoradiography

62. Answer (2)
As *lac y* gene codes for permease, which allows the entry of lactose into the cell. Lactose acts as an inducer which blocks the repressor and allows the expression of structural genes. As there is non-sense mutation in the *lac y* gene, permease enzyme will not be produced and thus lactose would not be able to enter the cell and it will not be catabolized.
63. Answer (3)
DNA → 5' – ATGCTGACCCGAAGGCCACGTAA – 3'
RNA → 5' – AUGCUUGACCCGAAGGCCACGUAA – 3'
Protein → Met-Leu-Asp-Pro-Lys-Ala-Thr
64. Answer (4)
Polymerisation of nucleotides by DNA polymerase is template dependent.
65. Answer (2)
Cyclic photophosphorylation occurs under low light intensity and anaerobic conditions. It also occurs when only light of wavelengths beyond 680 nm are available for excitation.
66. Answer (1)
Chlorophyll a is the chief pigment associated with photosynthesis.
67. Answer (4)
Mitochondria have 70S type of ribosomes. Subunits of 70S type of ribosomes are 50S and 30S.
68. Answer (2)
Inner membrane of mitochondria forms a number of infoldings called cristae. Golgi apparatus consist of small-disc shaped structures called cisternae. A number of organised flattened membranous sacs called the thylakoids, are present in stroma. Flat membranous tubules called the stroma lamellae connect the thylakoids of the different grana.
69. Answer (3)
Extremities or ends of chromosomes are called telomeres.
70. Answer (4)
Chloroplast duplication occurs in G₂ phase of the cell cycle.
71. Answer (1)
In Anaphase I, the homologous chromosomes separate, start moving towards the poles, while sister chromatids remain associated at their centromere. During mitotic anaphase and anaphase II of meiosis, the centromeres split and the chromatids start moving towards the opposite poles.
72. Answer (3)
Nucleolus, golgi complex and ER reform during telophase.
73. Answer (3)
The order of Man, Mango and Potato are Primata, Sapindales and Polymoniales respectively.
74. Answer (4)
In diatoms, the walls are embedded with silica and thus have indestructible walls.
75. Answer (4)
M.W. Beijerinck demonstrated that the extract of the infected plants of tobacco could cause infection in healthy plants and called the fluid as *Contagium vivum fluidum*.
76. Answer (3)
Calyx and corolla are first and the second whorls of a flower and individual members of them are called sepals and petals respectively.
77. Answer (4)
Staminode represents sterile stamen. When stamens get attached to petals (corolla) it is termed as epipetalous condition of stamen.
78. Answer (4)
Brinjal comes under Solanaceae family which is also called as potato family. Some of the floral characters of Solanaceae are actinomorphic, hypogynous and valvate aestivation in both calyx and corolla.
79. Answer (3)
Gregor Mendel conducted hybridisation experiment on garden pea for seven years from 1856 to 1863, during the mid-nineteenth century. Pea was selected by Mendel because it has many distinct alternative traits.
Mendel selected 7 characters in pea plant for carrying out hybridisation experiment.
80. Answer (2)
Experimental verification of the chromosomal theory of inheritance was done by T.H. Morgan.
81. Answer (4)
Decarboxylation process does not occur during glycolysis.
82. Answer (2)
Phenylketonuria is an autosomal recessive trait. Colour blindness is a sex-linked recessive disorder.
Turner's syndrome is a result of aneuploidy.
Myotonic dystrophy is an autosomal dominant trait.
83. Answer (4)
The historic Convention on Biological Diversity (The Earth Summit) was held in Rio de Janeiro in 1992.
84. Answer (2)
The increasing order of species diversity of birds among different countries is as follows.
Greenland < New York < India < Columbia.

85. Answer (3)

Law of Independent Assortment is based on the observation of dihybrid cross conducted by Mendel.

SECTION - B

86. Answer (1)

Cambium ring is actively cut off cells on the inner side towards pith mature into secondary xylem and on the outer side (towards periphery) mature into secondary phloem.

Amount of secondary xylem produced is more than secondary phloem.

Secondary medullary rays are narrow bands of parenchyma pass through secondary xylem and phloem in radial direction.

All tissues outside vascular cambium constitute bark.

87. Answer (2)

Abscisic acid is a carotenoid derivative.

Auxins are indole compounds.

Ethylene is a gaseous hormone.

Kinetin is adenine derivative plant growth regulator.

88. Answer (1)

In Pea and Beans, endosperm is completely consumed during embryo development, so called non-endospermic seeds.

In angiosperms, each division is followed by wall formation in cellular mode of development of endosperm.

89. Answer (2)

Porphyra, *Gelidium* and *Gracilaria* are the examples of red algae and they have floridean starch as stored food.

90. Answer (2)

Cyclosporin A is used as an immunosuppressive agent in organ-transplant patients and is produced by *Trichoderma polysporum*.

91. Answer (3)

Female wasp uses the fig fruit as an oviposition site (egg laying) and in return, fig gets pollinated. So here both are benefited which represents mutualism.

92. Answer (4)

Stratification is the structural aspect of an ecosystem.

93. Answer (3)

The RNA polymerase II transcribes the precursor of mRNA i.e., hnRNA.

94. Answer (4)

The debate between proteins versus DNA as the genetic material was unequivocally resolved from Hershey-Chase experiment.

95. Answer (3)

Meiosis is a reductional division whereas mitosis is an equational division. Gametic chromosome number would be equal to that of mother cell if they are formed through mitotic division.

96. Answer (4)

Plasma membrane helps in transport of molecules across it.

97. Answer (3)

Mycoplasma can pass through bacteriological filters and lack cell wall. They are the smallest living cells known.

98. Answer (3)

Axile placentation is shown by lemon, tulip, Asparagus, chilli, onion, tobacco and *Colchicum*.

99. Answer (3)

Ubiquinone receives electrons from complex I and complex II.

100. Answer (2)

Thalassemia is a recessive autosomal trait therefore it can be transmitted from parents to the offspring when both male and female individuals are carriers for the gene.

ZOOLOGY

SECTION-A

101. Answer (2)

Connective tissues are most abundant and widely distributed in the body of complex animals. They are named connective tissues because of their special function of linking and supporting other tissues/organs of the body.

102. Answer (3)

S.L. Miller created discharge in a closed flask containing CH₄, NH₃, H₂ and water vapour at

800°C. He observed the formation of amino acids. In similar experiments, others observed formation of sugars, nitrogenous bases, pigments and fats.

103. Answer (3)

After 500 million years of formation of Earth, life appeared on this planet.

104. Answer (4)

The body cavity of frogs accommodate different organ systems such as digestive, circulatory, respiratory, etc.

<p>The digestive system consists of alimentary canal and digestive glands. Digested food is absorbed by the numerous finger-like folds in the inner wall of intestine called villi and microvilli. The undigested solid waste moves into the rectum and passes out through cloaca.</p> <p>105. Answer (2)</p> <p>Each restriction endonuclease recognises a specific palindromic nucleotide sequence in the DNA.</p> <p>Palindromes are groups of letters that form the same words when read both forward and backward when orientation of reading is kept same.</p> <p>106. Answer (4)</p> <p>Using conventional methods of diagnosis (serum and urine analysis, etc.) early detection of diseases is not possible.</p> <p>107. Answer (4)</p> <p>Cranial bones – 8 Facial bones – 14 Skull bones – 29 Ribs – 24</p> <p>108. Answer (3)</p> <p><i>Pteranodon</i> is an extinct flying reptile.</p> <p><i>Brachiosaurus</i> were early long necked plant eaters and <i>Stegosaurus</i> had plated back and spikes at the end of the tail.</p> <p>109. Answer (2)</p> <p>In our body, the neural system and the endocrine system jointly coordinate and integrate all the activities of organs so that they function in a synchronised fashion.</p> <p>The neural system provides an organised network of point-to-point connections for a quick coordination. The endocrine system provides chemical integration through hormones.</p> <p>110. Answer (4)</p> <p>During each cardiac cycle, two prominent sounds are produced which can be easily heard through a stethoscope. The first heart sound (lub) is associated with the closure of tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of semilunar valves.</p>	<p>111. Answer (2)</p> <p>Our lungs remove 200 mL CO₂ per minute under normal physiological conditions. $\therefore 60 \times 200 \text{ mL} = 12000 \text{ mL/hour}$ $= 12 \text{ L/hour.}$</p> <p>112. Answer (2)</p> <p><i>Salamandra</i> is an amphibian and amphibians have a three-chambered heart with two atria and a single ventricle. Four-chambered heart is present in crocodiles, birds and mammals.</p> <p>113. Answer (2)</p> <p>Blood is a fluid connective tissue containing plasma, red blood cells (RBCs), white blood cells (WBCs) and platelets. Fibroblasts are absent in blood. It is the main circulating fluid in our body that helps in the transport of various substances.</p> <p>114. Answer (1)</p> <ul style="list-style-type: none"> • Flagellar movement helps in the swimming of spermatozoa, maintenance of water current in the canal system of sponges and in locomotion of protozoans like <i>Euglena</i>. • Ciliary movement assists in passage of ova through the female reproductive tract. • Leucocytes in blood exhibit amoeboid movement. <p>115. Answer (4)</p> <ul style="list-style-type: none"> • Animals that have had their DNA manipulated to possess and express an extra gene are known as transgenic animals. • Transgenic rats, rabbits, pigs, sheep, cows and fishes have been produced, although over 95 per cent of all existing transgenic animals are mice. <p>116. Answer (3)</p> <p>Better awareness about sex related matters, increased number of medically assisted deliveries and better post-natal care lead to decreased maternal and infant mortality rates.</p> <p>117. Answer (2)</p> <p><i>Spongilla</i> is a fresh water invertebrate.</p> <p>118. Answer (4)</p> <p>Fusion of male and female gametes is called fertilization, leading to formation of zygote. This is followed by formation and development of blastocyst and its attachment to the uterine wall called implantation.</p>
---	--

119. Answer (2)

- ↑ Growth hormone – Acromegaly
- ↓ Thyroxine – Cretinism
- ↓ Anti-diuretic hormone – Diabetes insipidus
- ↓ Insulin – Diabetes mellitus

120. Answer (3)

The immature male germ cells (spermatogonia) produce sperms by spermatogenesis that begins at puberty in following sequence:

Spermatogonia → Primary spermatocytes → Secondary spermatocytes → Spermatics → Spermatozoa (sperms)

121. Answer (2)

ori is a sequence from where replication starts. This sequence is also responsible for controlling the copy number of linked DNA.

Selectable markers help in identifying and eliminating non-transformants and selectively permitting the growth of transformants.

122. Answer (2)

The host cell can be made competent to take up rDNA by treatment with calcium ions.

123. Answer (3)

In ctenophores, reproduction takes place by sexual means only.

In cnidarians, cnidoblasts (stinging cells) are present.

124. Answer (4)

To legally check the increasing menace of female foeticide, there is statutory ban on amniocentesis, in India. Amniocentesis is used to test for the presence of certain genetic disorders such as down syndrome, haemophilia, etc.

125. Answer (4)

Three kinds of co-factors may be identified as prosthetic groups, co-enzymes and metal ions. Prosthetic groups are organic compounds and are distinguished from other co-factors in that they are tightly bound to the apoenzyme.

The essential components of many co-enzymes are vitamins.

126. Answer (4)

Component	% of the total cellular mass
Water	70-90
Proteins	10-15
Carbohydrates	3
Lipids	2
Nucleic acids	5-7
Ions	1

127. Answer (2)

In cockroaches, forewings are called tegmina.

Tegmina arises from the mesothorax and they are not present in the abdomen.

128. Answer (4)

The parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex. This triggers the release of oxytocin from maternal pituitary for stronger uterine contractions for childbirth.

129. Answer (1)

Since DNA fragments are negatively charged molecules, they can move towards the anode under an electric field through a medium.

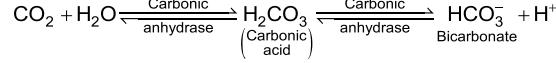
130. Answer (3)

Plasmids and bacteriophages have the ability to replicate within bacterial cells independent of the control of chromosomal DNA.

131. Answer (2)

The maximum volume of air a person can breathe in after a forced expiration is vital capacity. This includes TV + ERV + IRV.

132. Answer (4)



Carbonic anhydrase is the enzyme which catalyses the breakdown of carbonic acid. Zn^{+2} is the co-factor of this enzyme. This enzyme is present in very high concentration in RBCs. This enzyme accelerates the reaction rate by about 10 million times.

133. Answer (1)

The myelinated nerve fibres are enveloped with Schwann cells, which form a myelin sheath around axon. The gap between two adjacent myelin sheaths is called node of Ranvier. Myelinated nerve fibres are found in spinal and cranial nerves. Unmyelinated nerve fibre is enclosed by a Schwann cell that does not form a myelin sheath around the axon, and is commonly found in autonomous and somatic neural systems.

134. Answer (4)

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

135. Answer (1)

Diseases which are easily transmitted from one person to another are called infectious diseases. Polio, diphtheria and pneumonia are infectious diseases. Polio is a viral disease. Diphtheria and pneumonia are bacterial diseases. Among non-infectious diseases, cancer is the major cause of death.

SECTION-B

136. Answer (4)

Enzymes are divided into 6 classes each with 4-13 sub classes and named accordingly by a four-digit number.

137. Answer (2)

Parathyroid hormone stimulates reabsorption of Ca^{2+} by the renal tubules and increases Ca^{2+} absorption from the digested food.

PTH is a hypercalcemic hormone i.e., it increases the blood Ca^{2+} levels.

Thyrocalcitonin is hypocalcemic hormone so along with PTH it plays a significant role in calcium balance in the body.

138. Answer (2)

AIDS is a sexually transmitted infection. Down's syndrome, haemophilia, sickle-cell anemia, etc. are genetic disorders. Cancer is non-genetic and non-infectious disease.

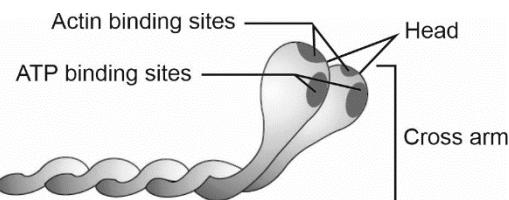
139. Answer (3)

In 1900, the world population was around 2000 million. In the year 1947, the population of India was approximately 350 million and reached to the billion mark by 2000 and crossed 1.2 billion in May 2011.

140. Answer (1)

ELISA is based on the principle of antigen-antibody interaction.

141. Answer (2)



142. Answer (2)

The thorn of *Bougainvillea* and tendril of *Cucurbita* represent homology. Homology is based on divergent evolution. Homology indicates common ancestry.

143. Answer (2)

Monocytes, Neutrophils and Macrophages are phagocytic cells.

Macrophages are derived from monocytes.

144. Answer (1)

Lactation helps the mother in feeding the new-born. The milk produced during the lactation contains several antibodies absolutely essential to develop resistance for the new-born babies. So, breast-feeding during the initial period of growth of infant is recommended by doctors for bringing up a healthy baby.

145. Answer (4)

- Innate immunity is a non-specific type of defence, which is provided by different types of barriers. These barriers prevent the entry of the foreign agents into our body.

- There are 4 types of barriers:

1. **Physical barriers** – Skin on our body and mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts.

2. **Physiological barriers** – Acid in the stomach, saliva in mouth, tears from the eyes-all prevent microbial growth.
3. **Cellular barriers** – Certain types of leukocytes (WBCs) of our body like neutrophils (PMNLs), monocytes and natural killer cells in the blood as well as macrophages in tissues can phagocytose and destroy microbes.
4. **Cytokine barriers** – Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

146. Answer (2)

Frogs respire on land and in the water by two different methods. In water, skin acts as aquatic respiratory organ. On land, the buccal cavity, skin and lungs act as the respiratory organs.

During aestivation and hibernation of frogs, gaseous exchange takes place through skin.

147. Answer (4)

Asthma may be attributed to allergic reaction of the mast cells in the lungs.

148. Answer (2)

Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration. An excessive loss of fluid from the body can activate these receptors which stimulate the hypothalamus to release antidiuretic hormone or vasopressin from the neurohypophysis.

149. Answer (3)

Neural system of all animals is composed of highly specialised cells called neurons which can detect, receive and transmit different kinds of stimuli. Neural system is present from aschelminths to chordates. Neurons are absent in porifers. Coelenterates have tissue level of organisation and Platyhelminthes show organ level of body organisation.

150. Answer (1)

A = Urochordata

B = Cephalochordata

In Urochordata, notochord is present only in larval tail, while in Cephalochordata, it extends from head to tail region.

PHYSICS

SECTION-A

151. Answer (4)

In vacuum, all have same velocity equal to c .

152. Answer (2)

$$\frac{1}{f_1} = (\mu_L - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{20} = \left(\frac{3}{2} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) = \frac{1}{2} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{R_1} - \frac{1}{R_2} = \frac{1}{10} \quad \dots(1)$$

Now

$$\frac{1}{f_2} = \left(\frac{\mu_L}{\mu_m} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) = \left(\frac{3}{2} - 1 \right) \left(\frac{1}{10} \right)$$

$$\frac{1}{f_2} = -\frac{2}{5} \times \frac{1}{10} \Rightarrow f_2 = -25 \text{ cm}$$

153. Answer (3)

$$\delta = (\mu - 1) A$$

$$\text{So, } \delta_3 > \delta_2 > \delta_1$$

154. Answer (4)

$$d = 1 \text{ mm} = 10^{-3} \text{ m}$$

$$D = 1 \text{ m}$$

$$\beta = 2 \times 10^{-4} \text{ m}$$

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

$$\Rightarrow \lambda = \frac{\beta d}{D} = \frac{2 \times 10^{-4} \times 10^{-3}}{1}$$

$$= 2 \times 10^{-7} \text{ m}$$

$$= 2000 \text{ \AA}$$

155. Answer (3)

$$a = \frac{(5-2)g}{5+2} = \frac{3g}{7}$$

156. Answer (2)

$$a_c = \frac{v^2}{r} = \frac{4 \times 4}{4} = 4 \text{ m/s}^2 \quad \text{and} \quad \text{tangential acceleration would be zero for uniform circular motion.}$$

157. Answer (2)

According to Galileo's ratio distance covered in consecutive second = 1 : 3 : 5 : 7

Distance covered in 1st second = $H/9$

Distance covered in 2nd second = $3H/9$

Distance covered in 3rd second = $5H/9$

where H is total height. Hence total time of fall is 3 sec.

158. Answer (3)

In uniform circular motion the acceleration of particle is varying but its speed remains constant.

159. Answer (3)

Translational kinetic energy of n moles of monoatomic gas = $n \times \frac{3}{2}RT = \frac{3}{2}nRT$.

160. Answer (4)

We know,

$$P = \vec{\tau} \cdot \vec{\omega} = (10)(4) = 40 \text{ W}$$

161. Answer (2)

Radius of gyration is radius i.e., length

\therefore CGS unit is centimetre (cm).

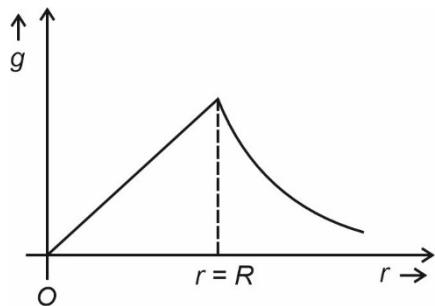
162. Answer (3)

Larger plastic region signifies better malleability of a material.

A body regains its original shape and size after removal of deforming forces only within elastic region.

163. Answer (1)

Variation of g with distance from centre of earth (r) can be presented as



Also, due to rotation of earth value of ' g ' varies as $g' = g - R\omega^2 \cos^2 \theta$

(where, θ is the latitude angle)

164. Answer (3)

$$\text{Relative density} = \frac{\text{density of substance } A}{\text{density of substance } B}$$

$$R.D = [M^0 L^0 T^0]$$

165. Answer (2)

$$\lambda_{\max} = \frac{12400}{\Phi(\text{in eV})} \text{ Å}$$

$$= \frac{12400}{2.48} \text{ Å} = 5000 \text{ Å}$$

$$= 500 \text{ nm}$$

166. Answer (2)

In nuclear fission energy is released .

When a nucleus is broken into two or more smaller nuclei it is called fission.

167. Answer (1)

When trivalent impurity is added to silicon then resulting material is p-type semiconductor.

168. Answer (3)

D_1 , D_3 & D_4 is forward biased and D_2 is reverse biased

Equivalent resistance for D_1 , D_3 & D_4 branch =

$$\frac{2 \times 2}{2+2} + 4 = 5 \Omega$$

$$\text{Net equivalent resistance} = \frac{5 \times 10}{5+10} = \frac{50}{15} = \frac{10}{3} \Omega$$

$$\text{Current } i = \frac{10}{\frac{10}{3}} = 3 \text{ A}$$

169. Answer (2)

$$R = \frac{\rho \ell}{A}; \text{ volume}(V) = A \times \ell$$

$$\therefore R = \frac{\rho \ell^2}{V}$$

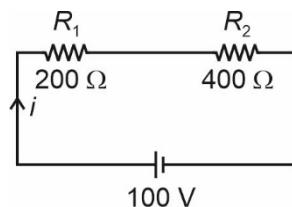
$$\frac{\Delta R}{R} \times 100 = \frac{2\Delta \ell}{\ell} \times 100$$

$$\begin{aligned} \text{Percentage increase in resistance} &= 2 \times 0.2\% \\ &= 0.4\% \end{aligned}$$

170. Answer (4)

$$P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P}$$

$$R_1 = \frac{(100)^2}{50} = 200 \Omega, R_2 = \frac{(100)^2}{25} = 400 \Omega$$



$$i = \frac{V}{R_{eq}} \Rightarrow i = \frac{100}{600} = \frac{1}{6} A$$

$$\text{Total power} = P_1 + P_2 = i^2 R_1 + i^2 R_2$$

$$P_T = \left(\frac{1}{6}\right)^2 \times (200 + 400) \\ = \frac{600}{6 \times 6} = \frac{50}{3} W$$

171. Answer (1)

The resistance of an ideal voltmeter is infinite.

172. Answer (2)

Formula for radius of circle in magnetic field is

$$\text{given by } R = \frac{mv}{qB}$$

For proton: mass m_0 , charge q_0

For alpha particle: mass $4m_0$, charge $2q_0$.

$$\frac{R_P}{R_\alpha} = \frac{m_P}{q_P} \times \frac{q_\alpha}{m_\alpha}$$

$$\frac{R_P}{R_\alpha} = \frac{m_0}{q_0} \times \frac{2q_0}{4m_0} = \frac{1}{2}$$

$$\therefore R_P = \frac{r}{2}$$

173. Answer (2)

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

$$\vec{\tau} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 0 \\ 1 & 2 & -3 \end{vmatrix} = \hat{i}(3-0) - \hat{j}(-3) + \hat{k}(2+1)$$

$$\vec{\tau} = 3\hat{i} + 3\hat{j} + 3\hat{k}$$

$$|\vec{\tau}| = \sqrt{3^2 + 3^2 + 3^2} = 3\sqrt{3} \text{ N m}$$

174. Answer (2)

For any type of collision the kinetic energy may or may not be conserved but linear momentum is conserved.

175. Answer (4)

Linear momentum is conserved

$$mv = mv' + \frac{mv}{4}$$

$$\frac{3}{4}v = v'$$

Loss of kinetic energy = Gain in elastic potential energy

$$\frac{1}{2}mv^2 - \frac{1}{2}m\left(\frac{v}{4}\right)^2 - \frac{1}{2}m\left(\frac{3v}{4}\right)^2 = \frac{1}{2}K x^2$$

$$\frac{1}{2}mv^2 - \frac{1}{32}mv^2 - \frac{9}{32}mv^2 = \frac{1}{2}K x^2$$

$$\frac{16-10}{32}mv^2 = \frac{1}{2}K x^2$$

$$\frac{3}{16}mv^2 = \frac{1}{2}K x^2$$

$$x = v \sqrt{\frac{3m}{8K}}$$

176. Answer (1)

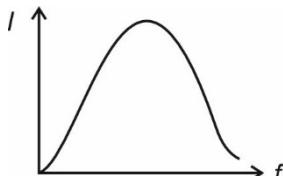
$$\varepsilon = -L \frac{di}{dt}$$

$$40 = L \times \frac{(6A - 2A)}{0.1}$$

$$L = \frac{4}{4} H$$

$$L = 1 H$$

177. Answer (2)



$$I_0 = \frac{V_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

178. Answer (1)

When angle of contact is acute then liquid wets the solid.

179. Answer (1)

$$K_{eq} = \frac{2K_1 K_2}{K_1 + K_2}$$

$$= \frac{2 \times (3 \times 6) K^2}{(3+6)K} = 4 K$$

$$= 4 K$$

180. Answer (3)

$$PV = nRT$$

For isochoric process $V = \text{constant} \Rightarrow P \propto T$.

181. Answer (2)

Work done by gas = Area under P – V graph

$$= \frac{1}{2} \times [(8 \times 10^5) + (12 \times 10^5)] \times (0.3)$$

$$= \frac{1}{2} \times 20 \times 10^5 \times 0.3$$

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

182. Answer (3)

Total energy of a particle executing SHM is constant.

183. Answer (2)

$$6 \times \frac{\lambda}{2} = 3$$

$$\lambda = 1 \text{ m}$$

Distance between two adjacent node and antinode

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

$$= \frac{1}{4}$$

$$= 0.25 \text{ m}$$

184. Answer (3)

Due to electrostatic repulsion and absence of gravity, between the balls, angle between the string will be π rad.

185. Answer (2)

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

$$V = \frac{q}{4\pi\epsilon_0 a}$$

SECTION-B

186. Answer (4)

For pure rolling $v = R\omega$ and $v_{TOP} = 2v_{COM}$

$$\text{Also, K.E} = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$= \frac{1}{2}mv_0^2 + \frac{1}{2} \frac{mR^2}{2} \left(\frac{v_0^2}{R^2} \right)$$

$$\text{K.E} = \frac{3}{4}mv_0^2$$

187. Answer (1)

$$F_{ext} = 0$$

$\therefore \vec{p} = \text{constant i.e., } \vec{p}_i = \vec{p}_f$

$$\text{or, } 4(4) + 10(v) = 0$$

$$\therefore v = -1.6 \text{ m/s}$$

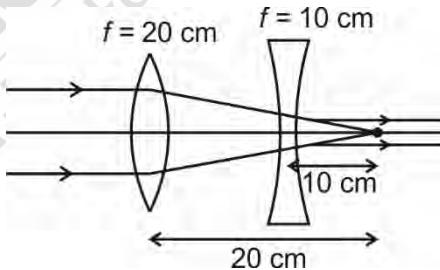
Hence, speed = 1.6 m/s

188. Answer (1)

$$\tan 37^\circ = \frac{3}{4} = 0.75 \text{ and } \mu = 0.9 \Rightarrow \text{block will not slide}$$

$$\text{Contact force} = \sqrt{(mg \cos \theta)^2 + (mg \sin \theta)^2} = mg$$

189. Answer (2)



$$d = 10 \text{ cm}$$

190. Answer (2)

$$\frac{I_1}{I_2} = \frac{25}{9}$$

$$\frac{I_{max}}{I_{min}} = \frac{(\sqrt{25} + \sqrt{9})^2}{(\sqrt{25} - \sqrt{9})^2} = \frac{64}{4} = 16$$

191. Answer (3)

$$LC = 1 \text{ MSD} - 1 \text{ VSD}$$

$$= 0.2 - \frac{29}{30} \times 0.2$$

$$= \frac{0.2}{30} = \frac{1}{150} \text{ mm}$$

192. Answer (3)

$$K.E = -(\text{Total energy})$$

$$= 1.51 \text{ eV}$$

$$P.E = 2 \text{ (Total energy)}$$

$$= 2(-1.51 \text{ eV}) = -3.02 \text{ eV}$$

193. Answer (2)

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

$$y = (0 + 1) \cdot \bar{0}$$

$$y = 1.1 = 1$$

194. Answer (1)

Gauge pressure = absolute pressure-atmospheric pressure = ρgh

$$= 1.03 \times 10^3 \times 10 \times 2000$$

$$= 206 \times 10^5 \text{ Pa}$$

$$\approx 206 \text{ atm}$$

195. Answer (4)

$$\alpha = \frac{\Delta L}{L_0 \Delta T}, \beta = \frac{\Delta A}{A_0 \Delta T}, \gamma = \frac{\Delta V}{V_0 \Delta T}$$

196. Answer (4)

After long time capacitor will be fully charged, hence no current will pass through it.

$$\therefore i = \frac{V}{R_{\text{eq}}} = \frac{V}{2R + R} = \frac{V}{3R} \quad \dots(i)$$

Potential across capacitor = $i \times R$

$$V_c = \frac{V}{3R} \times R = \frac{V}{3} \quad \dots(ii)$$

Charge on the capacitor

$$Q = CV \Rightarrow Q = C \times \frac{V}{3} = \frac{CV}{3}$$

197. Answer (3)

$$E = \frac{\sigma}{2\epsilon_0}$$

$$\frac{dV}{dr} = \frac{\sigma}{2\epsilon_0}$$

$$dr = \frac{\epsilon_0 dV \times 2}{\sigma}$$

$$= \frac{8.8 \times 10^{-12} \times 100 \times 2}{4 \times 10^{-7}}$$

$$= 2.2 \times 10^{-3} \text{ m} \times 2$$

$$= 4.4 \text{ mm}$$

198. Answer (1)

$$E = \frac{P}{4\pi\epsilon_0 r^3}$$

$$E \propto P$$

$$E \propto r^3$$

199. Answer (4)

$$\frac{V_S}{V_P} = \frac{N_S}{N_P} = 10$$

$$V_S = 10 \times V_P = 10 \times 100$$

$$V_S = 1000 \text{ V}$$

$$\frac{P_o}{P_{\text{in}}} = 0.8$$

$$P_o = 0.8 P_{\text{in}}$$

$$V_S I_S = 0.8 V_P I_P$$

$$1000 \times I_S = 0.8 \times 2 \text{ A} \times 100$$

$$I_S = \frac{1.6 \times 100}{1000} = 0.16 \text{ A}$$

200. Answer (2)

$$\varepsilon = \frac{1}{2} B \omega L_{\text{eff}}^2 = \frac{1}{2} B \omega L^2$$

