

**AIM - 720***(Advanced INTENSIVE Mastery for 720)*

MM : 720

CST-7

Time : 3 Hrs. 20 Min.

Answers

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

13/04/2024



CODE-A



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(Advanced INTENSIVE Mastery for 720)

MM : 720

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Time : 3 Hrs. 20 Min.

Answers & Solutions

BOTANY

SECTION-A

1. Answer (3)

Genetic diversity of a species shows high diversity at the genetic level over its distributional range. The genetic variation shown by *Rauwolfia vomitoria* grow in different Himalayan ranges, might be in terms potency and concentration of the active chemical.

2. Answer (2)

In the test cross, an individual with homozygous recessive genotype is crossed with individual with dominant phenotype. This cross is done to identify the genotype of organism with dominant phenotype. In snapdragon plant, flower colour show incomplete dominance. So for this plant, if plant is showing red coloured flowers it means plant is homozygous dominant for red colour.

3. Answer (1)

Drosophila and garden pea both have short life span. Both of them can produce large number of progenies in a single mating.

4. Answer (3)

Endemic species are confined to a particular geographical area and not found anywhere else.

5. Answer (4)

In lactic acid fermentation, no carbon dioxide is released.

6. Answer (2)

Sickle cell anaemia is caused due to transversion mutation.

7. Answer (1)

AB blood groups in human is a good example of co-dominance. When both I^A and I^B are present in a person, both enzymes or sugars thus both antigens A and B are produced.

8. Answer (1)

Lactose is the substrate for the enzyme beta-galactosidase and it regulates switching on and off of the operon.

9. Answer (2)

Initiator t-RNA will recognize the codon 5'AUG3' with the help of anticodon 3'UAC5'

10. Answer (3)

$$A + T + G + C = 100\%$$

$$20 + 20 + x + x = 100 \quad [\text{As } A = T \text{ and } G = C]$$

$$40 + 2x = 100$$

$$2x = 60$$

$$x = 30$$

11. Answer (2)

The genetic material should be chemically and structurally stable, provide the scope for slow changes and be able to express itself in the form of Mendelian characters.

12. Answer (1)

In both C_3 and C_4 plants primary CO_2 fixation occurs in mesophyll cells.

13. Answer (2)

Light reaction produces ATP, O_2 and $NADPH+H^+$.

14. Answer (2)
Sclereids are spherical, oval or cylindrical cells with highly thickened cell wall and are also the dead cells. The gritty texture of guava and pear is due to the presence of sclereids in their pulp.
15. Answer (4)
 - All tissues on the inner side of the endodermis such as pericycle, vascular bundles and pith constitute the stele.
 - Endodermis in roots comprises a single layer of barrel shaped cells having suberin thickenings in their radial as well as tangential walls, called caspary strips.
16. Answer (4)
 - F.W. Went isolated the plant hormone 'Auxin' from the tips of coleoptiles of oat seedlings.
 - Charles and Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards light source.
17. Answer (1)
Hilum is the junction between ovule and funicle. One or more protective envelopes surrounding the body of ovule are integuments. Micropyle is the pore present at the tip of ovule where integument is absent. Nucellus is the parenchymatous mass of tissue enclosed within integuments.
18. Answer (1)
 - Barley plant has albuminous seeds.
 - The wall of the ovary forms the wall of fruit which is called pericarp.
 - Cashew is a false fruit.
19. Answer (1)
Class is a group of related orders for example, plants order like Sapindales and Polymoniales are included in class Dicotyledonae.
20. Answer (3)
Lichen is a mutualistic association between a fungal partner (mycobiont) and an algal partner (phycobiont).
21. Answer (2)
In ascomycetes ascus is the site of karyogamy and meiosis where 4 to 8 haploid meiospores named ascospores are produced endogenously in each ascus. Eg – *Claviceps*
22. Answer (1)
The arrangement of sepals or petals in floral bud with respect to other member of same whorl is known as aestivation. Main types of aestivation are valvate, twisted, imbricate and vexillary.
23. Answer (2)
In monocotyledons the leaf base expand into a sheath covering the stem partially or wholly.
Flowers with bracts-reduced leaf found at the base of pedicel are called bracteate and those without bracts are termed as ebracteate.
24. Answer (1)
The plumule are enclosed in sheaths which are called coleoptile while radicle are enclosed in coleorhiza.
25. Answer (4)
Algae may be filamentous and colonial. Filamentous algae are *Ulothrix*, *Spirogyra*. etc. *Volvox* is a colonial algae.
26. Answer (4)
In pteridophytes antherozoids represents motile male gametes produced in antheridia found on gametophyte.
27. Answer (1)
Greater the BOD of waste water, more is its polluting potential.
28. Answer (3)
In commensalism one species is benefitted and other is neither harmed nor benefited. Barnacles growing on the back of whale benefits in the form of shelter where whale remains unaffected.
29. Answer (4)
Most productive ecosystem are coral reef, tropical rain forest, sugarcane field etc.
30. Answer (1)
Sometimes a few chromosomes have non-staining secondary constrictions at a constant location, gives the appearance of small fragment called satellite.
31. Answer (4)
Nucleolus is the site for active ribosomal RNA synthesis.
32. Answer (2)
Cell membrane is a mosaic or composite of diverse lipids and proteins and it shows fluid behaviour.

33. Answer (2)
M phase is the most dramatic period of cell cycle
34. Answer (1)
Prophase is marked by the initiation of chromosomal material. Decondensation of chromosomal material and reformation of ER and nucleolus occur in telophase. DNA duplication occurs in S-phase of interphase.
35. Answer (4)
In oocytes of some vertebrates, diplotene can last for months or years.
- SECTION-B**
36. Answer (3)
Formula to calculate number of different types of gametes produced is $= 2^n$.
Here $n = 3$, where n = number of heterozygote
Hence, $2^n = 2^3 = 8$
The given genotype will produce eight different types of gametes.
37. Answer (3)
Fermentation can occur in both prokaryotes and eukaryotes.
38. Answer (2)
Post transcriptional modifications include capping, tailing and splicing. Aminoacylation of t-RNA occurs during translation
39. Answer (3)
All the genes that are expressed as RNA are referred to as EST.
40. Answer (2)
 - Meristematic cells have dense cytoplasm with conspicuous nucleus.
 - Lateral meristems appear later in life and are cylindrical meristems which are responsible for increase in girth of stem and produces secondary tissues.
 - Interfascicular cambium is an example of lateral meristem.
41. Answer (4)
2, 4-D (2, 4-Dichlorophenoxyacetic acid) is a synthetic auxin, widely used to kill dicotyledonous weeds and does not affect mature monocotyledonous plants.

42. Answer (3)
Wind pollination is quite common in grasses, for example— Maize, Wheat. Wind pollinated flowers have light and non-sticky pollen grains, large feathery stigma and single ovule in each ovary but not mucilaginous covering in pollen grains.
 - Light, unwettable pollen grains surrounded by mucilaginous covering which protects from wetting found in water-pollinated flowers.
43. Answer (4)
Mycoplasma completely lacks cell wall and are the smallest living cells known and can survive without oxygen i.e., facultative anaerobe. Many *mycoplasmas* are pathogenic in animals and plants.
44. Answer (2)
The floral formula of Poaceae (grass family) is
 $\% \vec{P}_0 \text{ or } 2 \text{ or } 3 \text{ (Lodicules)} A_3 \text{ or } 6 G_1$
45. Answer (1)
Selaginella, Lycopodium belong to the class Lycopsida.
46. Answer (2)
Cyclosporin A is used as immunosuppressive agent in organ-transplant patients. It is produced by fungus *Trichoderma polysporum*.
47. Answer (4)
Urn-shaped age-pyramid shows a declined growth (negative growth) as there are fewer individuals in pre-reproductive group, the population size will decline with time.
48. Answer (3)
Decomposition is the breakdown of complex organic matter to inorganic raw material like CO_2 , H_2O and various nutrients by decomposers.
Humus is dark colored, amorphous substances which is slightly acidic and function as reservoir of nutrients.
49. Answer (1)
Ribosomes are the sites of protein synthesis and have subunits 50S and 30S in prokaryotes.
50. Answer (4)
Bivalent appears as tetrad in pachytene stage. Daughter cells produced after equational division are same to each other and as well as the parent cell.

ZOOLOGY

SECTION-A

51. Answer (2)

Endocrine glands lack ducts and are hence, called ductless glands. Their secretions are called hormones. Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.

52. Answer (1)

	DNA	RNA
Purines	Adenine, Guanine	Adenine, Guanine
Pyrimidines	Thymine, Cytosine	Uracil, Cytosine

53. Answer (2)

- | | |
|---------------------------------|--|
| Glucosamine | – Amino sugar |
| Secondary structure of proteins | – Only right handed helices are observed |
| Inulin | – Polymer of fructose |
| Collagen | – Most abundant protein in animals |

54. Answer (3)

- The alimentary canal of a frog is short because they are carnivores.
- Oesophagus is a short tube that opens into the stomach which in turn continues as the intestine, rectum and finally opens outside by the cloaca.
- Partially digested food called chyme is passed from stomach to the first part of the small intestine.
- Final digestion takes place in the intestine.

55. Answer (1)

Hydra belongs to the phylum Coelenterata and has only tissue level of body organisation. It has neural tissue composed of a network of neurons. The vertebrates have a well developed neural system.

56. Answer (2)

The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2-2.5°C lower than the normal internal body temperature) necessary for spermatogenesis.

57. Answer (3)

Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.

58. Answer (2)

B. thuringiensis forms protein crystals during a particular phase of their growth. These crystals contain a toxic insecticidal protein. These proteins are called Bt toxins.

59. Answer (2)

Fossils discovered in Java in 1891 revealed *Homo erectus*. *Homo erectus* had a large brain around 900cc.

60. Answer (1)

Pneumotaxic centre present in the pons region of the brain can moderate the functions of the respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate.

61. Answer (4)

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

62. Answer (2)

In humans, each testicular lobule contains one to three highly coiled seminiferous tubules. So, the approximate number of seminiferous tubules in 100 testicular lobules is 100 to 300.

63. Answer (2)

An alarming increase in growth rate of human population could lead to an absolute scarcity of even the basic requirements, i.e., food, shelter and clothing, in spite of significant progress made in those areas.

64. Answer (2)

Pills, injections and implants contain progestogens only or progestogen-estrogen combinations. The mode of action of pills, injections and implants are similar. They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard the entry of sperms.

65. Answer (3)

Vasectomy and tubectomy are surgical methods of contraception for human male and female respectively. Condoms are barriers used by both males and females. Multiload-375 is a copper releasing IUD.

66. Answer (3)

The human immune system consists of lymphoid organs which are of two types, primary and secondary lymphoid organs.

After maturation in primary lymphoid organs, the lymphocytes migrate to secondary lymphoid organs like spleen, tonsils, Peyer's patches of small intestine, lymph nodes and appendix.

67. Answer (2)

Recognition sites for *BamH I*, *Sal I* and *Pvu II* are present in pBR322.

Hind II is the first discovered restriction enzyme.

68. Answer (3)

Skeletal muscle fibres are present in biceps while cardiac muscle fibres are present in heart.

Cardiac muscle fibres are uninucleated.

They both are striated muscles.

69. Answer (3)

Erythroblastosis foetalis has been observed between the Rh-ve blood of a pregnant mother with Rh +ve blood of the foetus.

Blood group A⁺ represents presence of Rh antigen whereas blood group A⁻ represents absence of Rh antigen.

70. Answer (2)

Areolar tissue is a loose connective tissue. It is present beneath the skin. It often serves as a support framework for epithelium.

71. Answer (4)

Frogs respire on land and in the water by two different methods. In water, skin acts as aquatic respiratory organ (cutaneous respiration). Dissolved oxygen in the water is exchanged through the skin by diffusion.

72. Answer (3)

The maximum volume of air a person can breathe out after a forced inspiration is called vital capacity. It includes ERV, TV and IRV.

73. Answer (3)

Zinc is a co-factor for the proteolytic enzyme, carboxypeptidase.

The essential chemical components of many coenzymes are vitamins, e.g., co-enzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.

74. Answer (4)

The smooth muscle fibres taper at both ends (fusiform) and do not show striations. The wall of internal organs such as the blood vessels, stomach and intestine contains this type of muscle. Cell junctions hold them together and they are bundled together in a connective tissue sheath.

75. Answer (2)

Class Osteichthyes include both marine and fresh water fishes with bony endoskeleton. Their body is streamlined. They have four pairs of gills which are covered by an operculum on each side.

Mouth is ventral in cartilaginous fishes.

76. Answer (3)

A special coronary system of blood vessels is present in our body exclusively for the circulation of blood to and from the cardiac musculature.

77. Answer (1)

Introduction of sex education in schools should be encouraged to provide right information to young children so as to discourage them from believing in myths and having misconceptions about sex-related aspects.

78. Answer (2)

The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution.

DNA spooling is a method of obtaining DNA in a form of spool over a glass rod.

79. Answer (4)

Prawn is an aquatic arthropod.

Hydra is a fresh water cnidarian.

Nereis is an aquatic annelid.

80. Answer (3)

The autonomic nervous system (part of PNS) is divided into sympathetic and parasympathetic neural system.

Sympathetic nervous system predominates during emergency conditions.

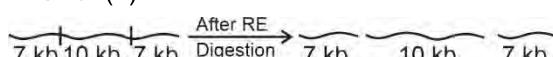
81. Answer (1)

Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers such as α -interferons which activate their immune system and help in destroying the tumor.

82. Answer (3)

Epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder. Rete testis and vasa efferentia are present inside testis.

83. Answer (2)



After gel electrophoresis, two bands will be seen, as two same fragments of 7 kb will form only one band.

84. Answer (1)

After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product.

The processes include separation and purification.

The product has to be formulated with suitable preservatives.

85. Answer (2)

Liver is the largest gland of human body which secretes bile-containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs.

SECTION-B

86. Answer (1)

Earthworm and leeches are monoecious.

Bombyx and *Periplaneta* (Arthropod), *Ancylostoma* (Aschelminth) are dioecious.

87. Answer (2)

Morphine is extracted from the latex of poppy plant, *Papaver somniferum*. Its receptors are opioid receptors which are present in our central nervous system and gastrointestinal tract. Acetylation of morphine produces smack/heroin. Morphine is an effective painkiller and sedative.

88. Answer (3)

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled. There is a negative intrapleural pressure pulling at the lung walls.

89. Answer (2)

Oxytocin – Milk ejection from mammary gland

Melatonin – Influences metabolism, pigmentation and our defense capability

Thyroxine – Controls metabolism of carbohydrates, proteins and fats

Cortisol – Maintains the cardio-vascular system as well as kidney functions

90. Answer (3)

Nitrogenous base when found attached to a sugar, then they are called nucleosides. If a phosphate group is also found esterified to the sugar, it is called nucleotide. Adenylic acid, thymidylic acid, guanylic acid are examples of nucleotides.

91. Answer (3)

- Golden rice is vitamin-A enriched, with gene from daffodil.

- Single strand of nucleic acid tagged with radioactive molecule is known as probe.
- Adenosine deaminase enzyme deficiency will lead to a disease called SCID.

92. Answer (1)

In gout, there is inflammation of joints due to accumulation of uric acid crystals.

93. Answer (3)

Man has bred selected plants and animals for agriculture, horticulture, sport and security. Man has domesticated many wild animals and crops. This intensive breeding programme has created breeds that differ from other breeds (e.g., dogs) but still are of the same group.

94. Answer (2)

Inner cell mass contains stem cells for formation and development of embryo. Delivery of child is called parturition. Relaxin is secreted from ovary in the later phase of pregnancy. Cleavage is a special type of mitotic cell division.

95. Answer (1)

Neutrophils are granulocytes, nucleated and constitutes 60-65% of the total WBCs. These are phagocytes.

Basophils secrete histamine, serotonin and heparin.

96. Answer (4)

Ovaries are considered as primary sex organs and vagina is considered as secondary sex organ in human female. External genitalia in human females include mons pubis, labia majora, labia minora, clitoris and hymen.

97. Answer (1)

According to Darwin, the organic evolution is due to natural selection of small and directional variations.

98. Answer (2)

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

99. Answer (4)

Troponin and tropomyosin are regulatory proteins in the muscle contraction while actin and myosin are contractile proteins.

100. Answer (1)

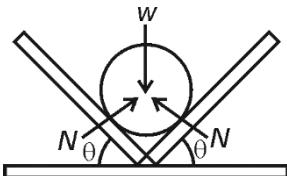
Selection of recombinants due to inactivation of antibiotic resistance gene is a cumbersome process because it requires simultaneous plating of two different antibiotics.

PHYSICS

SECTION-A

101. Answer (2)

The correct representation of FBD will be as shown.



102. Answer (2)

$$H_{max} = \frac{u^2 \sin^2 \theta}{2g} \quad \text{and} \quad R = \frac{u^2 \sin 2\theta}{g}$$

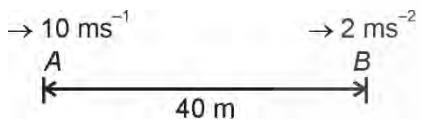
According to question,

$$\frac{u^2 \sin^2 \theta}{2g} = \frac{u^2 \sin 2\theta}{g}$$

$$\Rightarrow \frac{\sin \theta \times \sin \theta}{2} = 2 \times \sin \theta \times \cos \theta$$

$$\Rightarrow \tan \theta = 4 \quad \Rightarrow \theta = \tan^{-1}(4)$$

103. Answer (1)



$$a_{rel} = -2 \text{ m s}^{-2} \quad v_{rel} = 10 \text{ ms}^{-1}$$

$$S_{rel} = 10t - \frac{1}{2} \times 2 \times t^2 + 40$$

$$\Rightarrow S_{rel} = 10t - t^2 + 40$$

$$\text{For minimum } \frac{d(S_{rel})}{dt} = 0$$

$$\Rightarrow 10 - 2t = 0 \quad \Rightarrow t = 5 \text{ s}$$

104. Answer (3)

Let the initial velocity be u .

$$t_1 = \frac{u}{g+a} \quad \dots(i)$$

$$h = \frac{u^2}{2(g+a)} \quad \dots(ii)$$

from (i) and (ii)

$$t_1^2 = \frac{2h}{(g+a)}$$

during the downward motion,

$$h = \frac{1}{2}(g-a)t_2^2$$

$$t_2^2 = \frac{2h}{g-a}$$

$$t_2 > t_1$$

105. Answer (3)

$$PV = nRT, n \rightarrow \text{same}, R \rightarrow \text{Constant}, V \rightarrow \text{same}$$

$$\Rightarrow P \propto T$$

$$\Rightarrow \text{New pressure} = 2P$$

106. Answer (1)

(from 4 kg)

We know,

$$x_{com} = \frac{6(10)}{4+6} = 6 \text{ m}$$

107. Answer (2)

We know,

$$I = I_{com} + MR^2$$

$$I = \frac{MR^2}{4} + MR^2$$

$$I = \frac{5MR^2}{4}$$

108. Answer (3)

$$\frac{4}{3}\pi R^3 = 8000 \times \frac{4}{3}\pi r^3$$

$$R^3 = 8000r^3$$

$$R = 20r$$

$$\text{Surface energy of small drop } E_1 = S \times 4\pi r^2$$

$$\text{Surface energy of larger drop } E_2 = S \times 4\pi(20r)^2$$

$$= S \times 4\pi \times 400r^2$$

$$\frac{E_1}{E_2} = \frac{1}{400}$$

109. Answer (1)

$$Y_A = \tan 30^\circ \quad \text{and} \quad Y_B = \tan 60^\circ$$

$$Y_A = \frac{1}{\sqrt{3}} \quad \text{and} \quad Y_B = \sqrt{3}$$

$$Y_A = \frac{\sqrt{3}}{3} = \frac{Y_B}{3}$$

$$Y_B = 3Y_A$$

110. Answer (3)

Speed in a medium is given by

$$v = \frac{c}{\sqrt{K\mu}}$$

111. Answer (1)

$$I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2 = (\sqrt{4I} + \sqrt{9I})^2 = 25I \text{ and}$$

$$I_{\min} = (\sqrt{I_2} - \sqrt{I_1})^2 = (\sqrt{9I} - \sqrt{4I})^2 = I$$

112. Answer (1)

Current through load resistance

$$I_L = \frac{V_L}{R_L} = \frac{30}{8 \times 10^3} = 3.75 \text{ mA}$$

$$I = I_Z + I_L$$

$$I = 25 + 3.75$$

$$I = 28.75 \text{ mA}$$

Voltage drop across $R = IR$

$$= 28.75 \times 10^{-3} \times 400 = 11.5 \text{ V}$$

Input voltage needed = $V_R + V_L$

$$= 11.5 + 30 = 41.5 \text{ V}$$

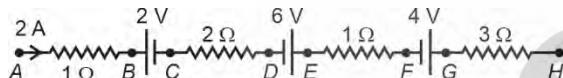
113. Answer (3)

Magnifying power when image is formed at infinity

$$\text{is } \frac{D}{f}.$$

114. Answer (3)

It can be observed in the given circuit that potential difference between points A and G is zero, hence they are at same potential.



$$V_A - (2 \times 1) - 2 - (2 \times 2) + 6 - (2 \times 1) + 4 = V_G$$

$$V_A - 10 + 10 = V_G \Rightarrow V_A = V_G$$

115. Answer (3)

$$R_1 = \frac{\rho_1 l}{A}, \quad R_2 = \frac{\rho_2 l}{A}$$

When resistors are connected in series, then

$$R_{\text{eq}} = R_1 + R_2$$

$$\rho_{\text{eq}} \times \frac{2l}{A} = \rho_1 \frac{l}{A} + \rho_2 \frac{l}{A}$$

$$\rho_{\text{eq}} = \frac{\rho_1 + \rho_2}{2}$$

116. Answer (4)

Formula of magnetic force on a charged particle is given by

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$|\vec{F}| = qvB \sin\theta$$

If θ is 0° or 180° , then the magnetic force on a charged particle is zero.

117. Answer (4)

Maximum magnetic field due to a cylindrical wire is on its surface.

$$B_{\max} = \frac{\mu_0 i}{2\pi R}$$

$$10^{-5} = \frac{4\pi \times 10^{-7} \times i}{\pi \times 2 \times 10^{-3}}$$

$$i = \frac{1}{20} \text{ A}$$

118. Answer (1)

Domains are present in ferromagnetic material.

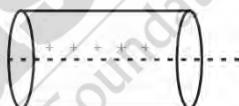
119. Answer (3)

$$\phi = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\phi_1 = \frac{2q_{\text{enc}}}{\epsilon_0}$$

$$= 2\phi$$

120. Answer (1)



Equipotential surface for line charge is cylindrical.

121. Answer (1)

$$v = \pm \omega \sqrt{A^2 - x^2}$$

$$a = \pm \omega^2 x$$

at $x = 0$, $v = v_{\text{max}}$ and $a = 0$

122. Answer (4)

 $y = A \sin(\omega t - kx)$ represents simple harmonic progressive wave.

123. Answer (2)

$$\Delta P = \int F(t) dt = P_f - P_i$$

$$P_f = \left(\frac{1}{2} \times 4 \times 2 - \frac{1}{2} \times 1 \times 1 \right) \text{ Ns}$$

$$= 3 \text{ N s}$$

$$\text{KE} = \frac{P^2}{2m} = \frac{3 \times 3}{2 \times 1} = 4.5 \text{ J}$$

124. Answer (3)

$$\frac{1}{2} \times mv^2 = F.S$$

$$\frac{1}{2} \times 1 \times 64 = F \times (2\pi R) \times 2$$

$$32 = F \times 4\pi \times 2$$

$$F = \frac{32}{8\pi} = \frac{4}{\pi} \text{ N}$$

$$a_t = \frac{4}{\pi} \text{ ms}^{-2}$$

$$a_r = \frac{v^2}{r} = \frac{64}{2} = 32 \text{ ms}^{-2}$$

$$a = \sqrt{\left(\frac{4}{\pi}\right)^2 + (32)^2}$$

$$= 4\sqrt{\frac{1}{\pi^2} + 64}$$

$$= 4\sqrt{\frac{1+64\pi^2}{\pi^2}}$$

$$= \frac{4}{\pi} \sqrt{1+64\pi^2} \text{ ms}^{-2}$$

125. Answer (4)

There will be induced emf but no induced current to oppose the magnetic field of bar magnet. So the acceleration of bar magnet remains constant.

126. Answer (1)

The current should be equal to rms current.

127. Answer (1)

When $i = 0$, $V = E = 8$ volt

Also, $V = E - ir = 0$ for $i = 2$ A

$$\therefore 0 = 8 - 2 \times r \Rightarrow r = 4 \Omega$$

Current through battery will be maximum when

$$\text{load resistance is zero, and } i_{\max} = \frac{E}{r} = \frac{8}{4} = 2 \text{ A}$$

128. Answer (3)

$$KE_{\max} = hf - \phi,$$

hence KE_{\max} varies linearly with frequency. Also, intensity of radiation doesn't affect the KE of photoelectrons.

129. Answer (4)

$$L = mvr$$

$$v = \sqrt{\frac{GM}{r}}$$

$$v^2 = \frac{GM}{r} \Rightarrow r = \frac{GM}{v^2}$$

$$L = mv \cdot \frac{GM}{v^2} = \frac{GMm}{v}$$

130. Answer (1)

$$y = (\overline{A+B}) \bullet C$$

When $A = 0$, $B = 0$ and $C = 0$

$$y = (\overline{0+0}) \bullet 0 = 0$$

When $A = 1$, $B = 1$ and $C = 1$

$$y = (\overline{1+1}) \bullet 1 = 0$$

131. Answer (4)

For forward biased diode, P -junction should be at high potential as compared to N junction.

132. Answer (1)

$$\text{Slope of PV graph for adiabatic} = \frac{-\gamma P}{V}$$

$$\text{Slope of PV curve for isothermal} = \frac{-P}{V}$$

$$\text{Ratio} = \frac{1}{\gamma}$$

133. Answer (2)

As $\alpha_B > \alpha_A$ so strip B will bend outer side.

134. Answer (2)

Force acting on the base

$$F = P \times A = \rho g h A$$

$$= 10^3 \times 10 \times 1.6 \times 2 \times 10^{-3} = 32 \text{ N}$$

135. Answer (2)

For isobaric process $P = \text{constant}$

SECTION-B

136. Answer (3)

For escape, K.E + PE = 0

\therefore Mechanical energy = 0

137. Answer (2)

$$\beta = 2\alpha$$

$$\text{and } \gamma = 3\alpha$$

138. Answer (1)

$$F_{\text{avg}} \times \frac{T}{4} = |\vec{\Delta p}| \Rightarrow \frac{F_{\text{avg}}}{4} \times \frac{2\pi r}{v} = |mv\hat{j} - mv\hat{i}|$$

$$\Rightarrow \frac{F_{\text{avg}}}{4} \times \frac{2\pi r}{v} = \sqrt{2}mv \Rightarrow F_{\text{avg}} = \frac{\sqrt{2}mv^2 \times 2}{\pi r}$$

139. Answer (3)

We know,

$$\tau = l\alpha$$

$$600 = 120 \alpha$$

$$\alpha = 5 \text{ rad/s}^2$$

$$\text{Now, } \omega = \omega_0 + \alpha t$$

$$200 = 5t$$

$$t = \frac{200}{5} = 40 \text{ seconds}$$

140. Answer (3)

$$\text{Power} = \frac{\text{Energy}}{\text{Time}} = \frac{205 \times 10^6 \times 1.6 \times 10^{-19}}{1} \times 10^{17}$$

$$= 3.28 \times 10^6 \text{ W}$$

141. Answer (3)

For H-like element

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

for 1st line of Lyman series

$$\frac{1}{\lambda_1} = RZ^2 \left(\frac{1}{(1)^2} - \frac{1}{(2)^2} \right) \quad \dots(1)$$

for 2nd line of Lyman series

$$\frac{1}{\lambda_2} = RZ^2 \left(\frac{1}{(1)^2} - \frac{1}{(3)^2} \right) \quad \dots(2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{\lambda_2}{\lambda_1} = \frac{1 - \frac{1}{4}}{1 - \frac{1}{9}} = \frac{\frac{3}{4}}{\frac{8}{9}} = \frac{3}{4} \times \frac{9}{8}$$

$$\lambda_2 = \frac{27}{32} \lambda_1$$

$$= \frac{27}{32} \times 0.62$$

$$\lambda_2 = 0.52 \text{ Å}$$

142. Answer (3)

$$\delta = (\mu - 1) A \text{ and}$$

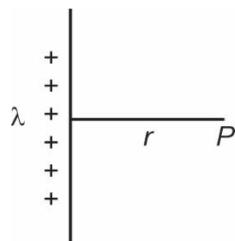
$$\mu = A + \frac{B}{\lambda^2} \dots\dots$$

$$\lambda \downarrow \Rightarrow \mu \uparrow \Rightarrow \delta - \text{maximum}$$

143. Answer (3)

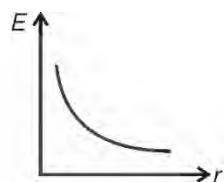
Fundamental quantities can't be derived from each other.

144. Answer (2)



$$E_p = \frac{\lambda}{2\pi\epsilon_0 r}$$

$$E_p \propto \frac{1}{r}$$



145. Answer (4)



$$C_{AB} = 2C$$

$$= \frac{2A\epsilon_0}{d}$$

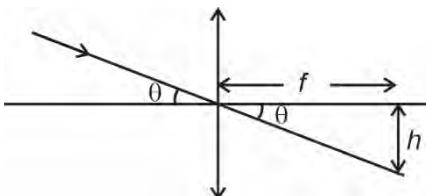
146. Answer (2)

By the principle of homogeneity

$$[B] = [A] = [Bt] = [C] = [L]$$

Hence unit of AC = m²

147. Answer (2)



$$\tan \theta = \frac{h}{f} \Rightarrow h = f \theta$$

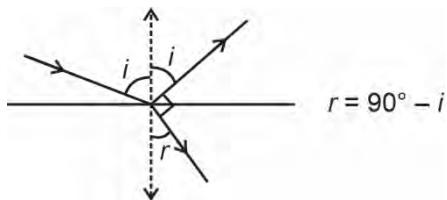
$$h = 50 \times 10^{-2} \times 2 \times 10^{-3}$$

$$h = 100 \times 10^{-5} \text{ m}$$

$$h = 1 \text{ mm}$$

148. Answer (3)

When light is incident at polarizing angle, then angle between reflected and refracted light is 90°.



149. Answer (3)

$$R = \frac{10}{2} = 5 \Omega$$

$$Z = \frac{10}{1} \Omega = 10 \Omega$$

$$R^2 + X_L^2 = Z^2$$

$$r = 90^\circ - i$$

$$X_L^2 = Z^2 - R^2$$

$$X_L^2 = 10^2 - 5^2 = 75 \Omega$$

$$X_L = 5\sqrt{3} \Omega$$

$$2\pi \times 50L = 5\sqrt{3}$$

$$L = \frac{5\sqrt{3}}{100\pi} = \frac{\sqrt{3}}{20\pi} \text{ H}$$

150. Answer (3)

In steady state:

$$\frac{Ldi}{dt} = \varepsilon = 0$$

CHEMISTRY

SECTION-A

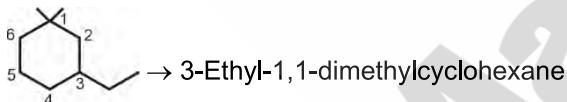
151. Answer (3)

Orthoboric acid (H_3BO_3) has a basicity of one. It does not lose H^+ ions while it accepts one lone pair of electrons from H_2O .

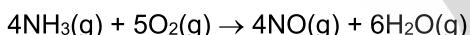
152. Answer (2)

- (i) Ammonium phosphomolybdate – Yellow
- (ii) Silver sulphide – Black
- (iii) Sodium thionitroprusside – Violet
- (iv) Ferriferrocyanide – Prussian blue

153. Answer (1)



154. Answer (4)



4 moles of NH_3 reacts with 5 moles of O_2 .

$$1 \text{ mole of } \text{NH}_3 \text{ reacts with moles of } \text{O}_2 = \frac{5}{4} = 1.25$$

\therefore 1.25 moles of O_2 are required.

So, O_2 is the limiting reagent and consumed completely.

Moles of $\text{NO}(\text{g})$ formed = 0.8

Moles of $\text{H}_2\text{O}(\text{g})$ formed = 1.2

155. Answer (3)

Molar mass of CO_2 = 44 g mol⁻¹

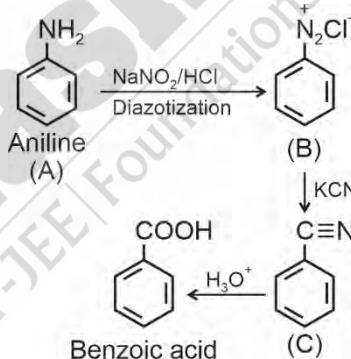
$$\text{Number of moles of } \text{CO}_2 = \frac{\text{Mass of } \text{CO}_2}{\text{Molar mass of } \text{CO}_2}$$

$$= \frac{2.2}{44} = 0.05 \text{ mole}$$

Number of molecules of CO_2 = $0.05 \times N_A$

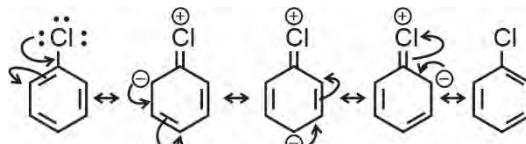
$$\begin{aligned} \text{Number of oxygen atoms is } \text{CO}_2 &= 2 \times 0.05 \times N_A \\ &= 0.1 \times 6.023 \times 10^{23} \\ &= 6.023 \times 10^{22} \end{aligned}$$

156. Answer (3)



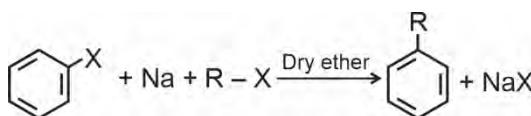
157. Answer (1)

Aryl halides are extremely less reactive towards nucleophilic substitution reaction due to resonance.



158. Answer (3)

Wurtz-Fittig reaction: A mixture of an alkyl halide and aryl halide gives an alkylarene when treated with sodium in dry ether and is called Wurtz-Fittig reaction.



159. Answer (2)

Outer electronic configuration of Eu ($Z = 63$) = $4f^7 6s^2$

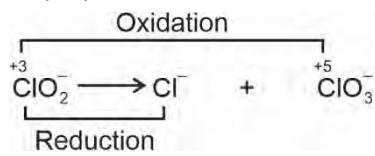
Outer electronic configuration of Cm ($Z = 96$) = $5f^7 6d^1 7s^2$

\therefore Europium and curium have half filled f-subshell.

160. Answer (1)

The species in intermediate oxidation state can undergo disproportionation (simultaneous oxidation and reduction both)

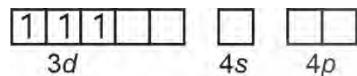
In ClO_2^- , Cl is in +3 oxidation state and can disproportionate as follows:



while S in SO_4^{2-} (+6), Cr in $\text{Cr}_2\text{O}_7^{2-}$ (+6) and Mn in MnO_4^- (+7) is in its highest oxidation state and can not undergo disproportionation.

161. Answer (3)

$[\text{Cr}(\text{NH}_3)_6]^{3+} = \text{Cr}^{3+} = 3d^3 4s^0$



Geometry = Octahedral

Hybridisation = d^2sp^3

$$\text{Magnetic moment} = \sqrt{n(n+2)}$$

$$= \sqrt{3(3+2)} = \sqrt{3(5)} = \sqrt{15}$$

$$= 3.87 \text{ BM}$$

162. Answer (3)

Molarity is an intensive property.

(Independent of amount of substance)

$$\text{Also Intensive property} = \frac{\text{Extensive Property}}{\text{Extensive Property}}$$

$$= \frac{\text{Moles}}{\text{Volume}}$$

163. Answer (3)

Zr is a d-block element.

164. Answer (2)

$$Z = 47 \rightarrow \text{Ag}$$

$$\text{Ag} \rightarrow [\text{Kr}]4d^{10}5s^1$$

$$\text{Group} \rightarrow 11 \text{ and Period} \rightarrow 5$$

165. Answer (2)

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0591}{2} \log\left(\frac{10^{-1}}{10^{-2}}\right)$$

$$E_{\text{cell}} = 0.51 - \frac{0.0591}{2} \log(10)$$

$$E_{\text{cell}} = 0.51 - 0.02955$$

$$E_{\text{cell}} = 0.48 \text{ V}$$

166. Answer (4)

Addition of CH_3COO^- shifts the equilibrium in backward direction, so $[\text{H}^+]$ will decrease and pH will increase.

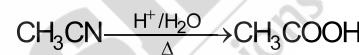
167. Answer (3)

- When K_c is very large the reaction proceeds to completion.
- When K_c is very small, reactants predominate over products and reaction proceeds rarely.

168. Answer (4)

Minimum two α -Hydrogens are required for aldol condensation.

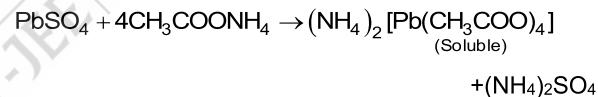
169. Answer (2)



170. Answer (2)

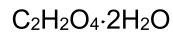
This is second order reaction for which unit of rate constant is $\text{mol}^{-1} \text{ L s}^{-1}$

171. Answer (2)



172. Answer (2)

Hydrated oxalic acid is

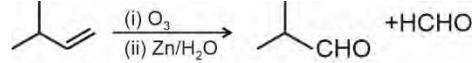


To prepare 0.1 molar 100 mL $\text{C}_2\text{H}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ (aq) = 10 mili mol

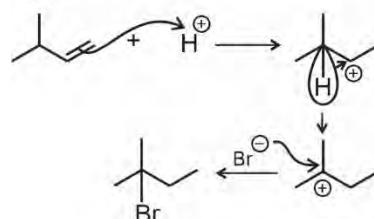
$$= 10 \times 126 \times 10^{-3} \text{ g}$$

$$= 1.26 \text{ g}$$

173. Answer (2)



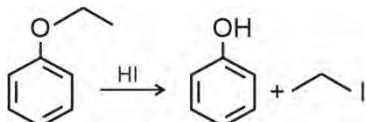
(A)



174. Answer (3)

Electron donating group ($-\text{CH}_3$) attached with benzene increases the reactivity of benzene nucleus towards electrophilic aromatic substitution reaction.

175. Answer (1)



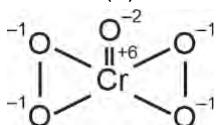
176. Answer (4)

Preparation of ether from alkoxide and alkyl halide is called Williamson synthesis.

177. Answer (1)

Lactose is a reducing sugar hence it reduces Tollens' reagents.

178. Answer (2)



179. Answer (1)

The volume of hypertonic solution increases till concentration of hypertonic and hypotonic solution becomes equal.

180. Answer (2)

$$\begin{aligned}\Delta T_f &= \frac{1000 \times k_f \times w_2}{M_2 \times w_1} \\ &= \frac{1000 \times 1.86 \times 23}{46 \times 1000} \\ &= 0.93\end{aligned}$$

$$\Delta T_f = T_f^\circ - T_{f(\text{sol})}$$

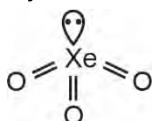
$$\begin{aligned}T_{f(\text{sol})} &= 0 - 0.93 \\ &= -0.93^\circ\text{C}\end{aligned}$$

181. Answer (2)

XeF_2 and CO_2 are non-polar.
 NH_3 , NF_3 and H_2O are polar.

182. Answer (1)

Hybridisation of XeO_3 is sp^3



183. Answer (2)

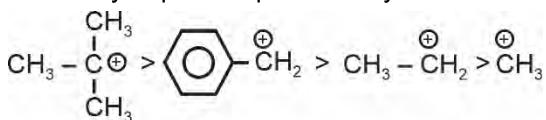
$$\begin{aligned}\text{Kinetic energy} &= h(v - v_0) \\ &= 6.6 \times 10^{-34} \text{ Js} (1 \times 10^{15} - 7 \times 10^{14}) \text{ s}^{-1} \\ &= 6.6 \times 10^{-34} (10^{14}) (10 - 7) \\ &= 6.6 \times 10^{-20} (3) = 19.8 \times 10^{-20} = 1.98 \times 10^{-19} \text{ J} \\ &\approx 2 \times 10^{-19} \text{ J}\end{aligned}$$

184. Answer (1)

Order of bond energy for halogens is
 $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$

185. Answer (3)

Reactivity depends upon stability of carbocation.

**SECTION-B**

186. Answer (4)

Ion	$\lambda^\circ/\text{S cm}^2 \text{ mol}^{-1}$
H^+	349.6
OH^-	199.1
Na^+	50.1
K^+	73.5

187. Answer (3)



for pure water $[\text{H}^+] = [\text{OH}^-]$

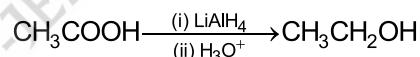
$$[\text{H}^+] [\text{OH}^-] = K_w$$

$$[\text{H}^+] = 10^{-5}$$

188. Answer (2)

$$\begin{aligned}\% \text{ of Nitrogen} &= \frac{14 \times 2 \times 15 \times 0.5}{1000 \times 0.5} \times 100 = 42\% \\ \% \text{ of Carbon} &= 100 - (42 + 10) \\ &= 48\%\end{aligned}$$

189. Answer (2)



190. Answer (2)

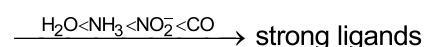
$$\begin{aligned}t_{1/2} &= \frac{a_0}{2k} \\ &= \frac{1}{10^{-2} \times 2} = \frac{100}{2} = 50 \text{ s}\end{aligned}$$

191. Answer (3)

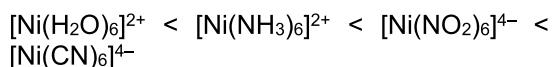
- Change in entropy is negative as $\Delta n_g < 0$, $\therefore \Delta S < 0$
- Since by polymerising molecules together, number of freely moving particles gets reduced $\therefore \Delta S < 0$
- When a gas expands at constant temperature, the constituent particles move freely of $\Delta S > 0$.
- When a liquid crystallizes into a solid, it obtains more ordered state. $\therefore \Delta S < 0$

192. Answer (4)

Spectrochemical series



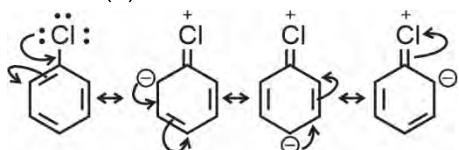
∴ Energy absorbed for excitation will be in the order



$$\text{As } E = \frac{hc}{\lambda}$$

∴ The order of wavelength absorbed will be opposite.

193. Answer (1)

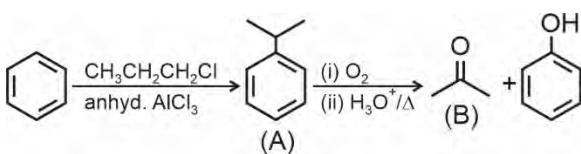


Due to partial double bond character in aryl halides, they do not undergo nucleophilic substitution with the anion formed by phthalimide in Gabriel phthalimide synthesis.

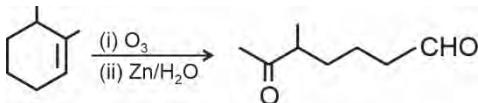
194. Answer (1)

Element	$\Delta_a H^\circ$ (kJ/mol ⁻¹)
V	515
Mn	281
Fe	416
Ni	430

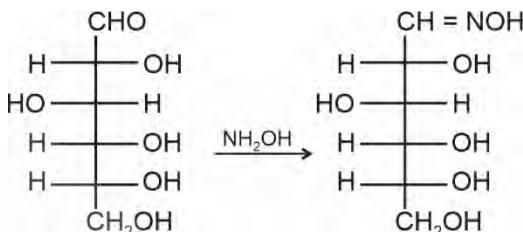
195. Answer (4)



196. Answer (2)



197. Answer (3)



198. Answer (1)

Polar bond is formed between two atoms of different electronegativity.

199. Answer (2)

Total number of nodes are given by $(n - 1)$, i.e., sum of 'l' angular nodes and $(n - l - 1)$ radial nodes.

200. Answer (2)

The catalyst used in Deacon's process is CuCl_2 .

