



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-3

Time : 3 Hrs. 20 Min.

Answers

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

05/04/2024



CODE-A



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Answers & Solutions

BOTANY

SECTION-A

1. Answer (1)

Because of the rule of base pairing and complementarity, both the nucleic acids (DNA and RNA) have the ability to direct their duplication.

2. Answer (2)

Bacteriophage lambda has 48502 base pairs (bp) and 97,004 bases.

3. Answer (2)

The two chains have antiparallel polarity. It means, if one chain has the polarity of $5' \rightarrow 3'$, the other will have $3' \rightarrow 5'$ polarity.

4. Answer (1)

In a typical nucleus, some region of chromatin are loosely packed (and stains light) and are referred to as euchromatin. Euchromatin is said to be transcriptionally active chromatin.

5. Answer (3)

The given features are of C₄ plants, example- *Sorghum*. Tomato and bell pepper are C₃ plants. Cactus is a CAM plant.

6. Answer (3)

Carboxylation is the most crucial step of the Calvin cycle where CO₂ is utilized for the carboxylation of RuBP.

7. Answer (3)

An individual inflicted with Down's syndrome shows short statured with small round head, furrowed tongue and partially open mouth. Down's syndrome is caused due to presence of additional copy of the chromosome number 21.

8. Answer (2)

ZZ-ZW type of sex determination is found in birds. Grasshopper shows XO type of sex determination. Human and *Drosophila* shows XY type of sex determination.

9. Answer (2)

Mendel selected 14-true breeding pea plant varieties, as pairs which were similar except for one character with contrasting traits.

10. Answer (1)

For complete oxidation of one molecule of glucose in aerobic respiration six times substrate level phosphorylation will occur. Four times in glycolysis and two times in TCA cycle.

11. Answer (3)

Pollination is a broadly utilitarian service of an ecosystem.

12. Answer (4)

India now has 14 biosphere reserves, 90 national parks and 448 wildlife sanctuaries.

13. Answer (2)

1.3% of recombinant individuals were obtained when female *Drosophila* with yellow body and white eye was crossed with wild type male.

14. Answer (2)

The universal rules of nomenclature says:

- Biological names are generally in Latin and written in italics. They are Latinised or derived from Latin irrespective of their origin.
- Biological names are printed in italics to indicate their Latin origin.
- Genus first word starts with a capital letter while the specific epithet starts with a small letter.

15. Answer (2)

Commonly known forms of basidiomycetes are mushrooms, bracket fungi or puffballs.

The sex organs are absent, but plasmogamy is brought about by fusion of two vegetative or somatic cells of different strains or genotypes. The basidiospores are exogenously produced on the basidium.

16. Answer (3)

Tobacco Mosaic Virus (TMV) is a single stranded RNA virus.

17. Answer (2)

A leaf is said to be simple when its lamina is entire or when incised, the incisions do not touch the midrib.

18. Answer (4)

Leaves of certain insectivorous plants such as pitcher plant, Venus-flytrap are modified to trap insects.

19. Answer (4)

When stamens are attached to the perianth as in the flowers of lily the condition is termed as epiphyllous. If sepals are joint or fused together as in brinjal, the calyx is said to be gamosepalous.

In diadelphous condition the stamens are united into two bundles as in pea, lupin.

In apocarpous condition as in lotus and rose where multiple carpels are present in free state.

20. Answer (1)

Small openings which are formed due to rupturing in the epidermis occurs due to increase in number of complementary cells, creating pressure on epidermis which results in rupturing of epidermal cells are called lenticels.

21. Answer (3)

- Pith is not well developed in the roots of dicotyledons.
- In monocot root, **exarch** type of vascular bundle is seen.
- In dicot stem, vascular bundles are arranged in a **ring**.
- In monocot stem, endarch type of vascular bundle is seen.

22. Answer (2)

Lag phase is the initial phase of growth when rate of growth is very slow, representing the beginning of growth of micro-organisms.

23. Answer (2)

In some cereals such as rice and wheat within 30 minutes of their release, pollen grains lose viability but in some members of Rosaceae, Leguminosae and Solanaceae viability is maintained for months.

24. Answer (3)

Number of ovules in an ovary is one in wheat, paddy and mango.

25. Answer (1)

Prokaryotic cell is devoid of nuclear membrane and membrane bound cell organelle. Bacterial cell is a prokaryotic cell.

26. Answer (4)

The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. Aerobic respiration occurs in mitochondria

27. Answer (2)

Several ribosomes may attach to a single mRNA and form a chain called polyribosomes or polysome.

28. Answer (1)

In animals, mitotic division is only seen in the diploid somatic cells. However, there are few exceptions to this where haploid cells divide by mitosis, for example male honey bees. Against this, the plants can show mitotic division in both haploid and diploid cells.

29. Answer (4)
Centromere is a part of chromosome.
30. Answer (2)
Meiosis introduces the genetic variations in the population of organisms from one generation to the next.
31. Answer (4)
In green algae gametes can be motile or non motile.
32. Answer (3)
Brown algae have cell wall made up cellulose which is usually covered on the outside by gelatinous coating of algin.
Algin has good water holding capacity.
33. Answer (3)
Acetic acid is used in the preparation of vinegar and it is prepared by *Acetobacter aceti*.
34. Answer (4)
Introduction of goats resulted in exclusion of Abingdon tortoise from Galapagos island.
35. Answer (3)
A considerable amount of gross primary productivity is utilised by plants in respiration.
Net primary productivity = GPP – R
GPP = Gross primary productivity
R = Respiratory loss

SECTION-B

36. Answer (4)
Matthew Meselson and Franklin Stahl performed their experiment on *E. coli* to prove that DNA replication is semi-conservative in nature.
37. Answer (1)
UAA, UGA and UAG are stop codons, thus they do not have their associated tRNA. UUU codes for phenylalanine.
38. Answer (3)
Couple with genotype $I^A I^O \times I^B I^O$
- | | | |
|-----------------------------|-----------|-----------|
| $\frac{\text{♂}}{\text{♀}}$ | I^A | I^O |
| I^B | $I^A I^B$ | $I^B I^O$ |
| I^O | $I^A I^O$ | $I^O I^O$ |
- ∴ Offsprings will have probability of AB, A, B and O blood group type.
Maximum different type of blood group among all given genotype.

39. Answer (4)
Conversion of glucose to glucose 6-phosphate, the first irreversible reaction of glycolysis is catalysed by hexokinase.
40. Answer (4)
Reproduction is of both type asexual and sexual in saprophytic protists i.e. slime moulds.
41. Answer (3)
The filaments of stamens within a flower may vary in length as in *Salvia* and Mustard.
In monocotyledonous seed such as maize, the seed coat is membranous and generally fused with the fruit wall.
42. Answer (1)
 - Abaxial epidermis generally bears more stomata than adaxial epidermis. Adaxial (upper surface) may even lack stomata.
 - Mesophyll cells are differentiated into two types of cells—palisade parenchyma and spongy parenchyma.
 - In dicot leaf, reticulate venation is found, in which veins vary in thickness.
43. Answer (1)
 - Auxins such as IAA and IBA in the diluted form can be used to produce parthenocarpy.
 - Auxin inhibits abscission of younger leaves but it promotes abscission of older mature leaves, fruits and flowers.
44. Answer (1)
 - When hybrids made into apomicts, there is no segregation of characters in the hybrid progeny.
 - In *Citrus*, nucellar polyembryony is found.
45. Answer (2)
Each centrosome radiates out microtubules called asters during prophase.
46. Answer (2)
RER is frequently observed in the cells actively involved in protein synthesis and secretion.

47. Answer (4)
In Rhodophyceae gametes are non-motile.
48. Answer (3)
Lipase is an enzyme which is obtained from *Candida lipolytica* and is used in removing oily stains.
Streptokinase is obtained from *Streptococcus* and is used as clot buster.
49. Answer (4)

Amensalism	Species A	Species B
(-)		(O)
<i>Penicillium</i> secretes penicillin, that inhibits the growth of large number of bacteria is an example of amensalism.		

50. Answer (1)
Detritus food chain begins with detritus or dead organic matter. It is made up of decomposers.
Detritus → Earthworm → Sparrow → Falcon

ZOOLOGY

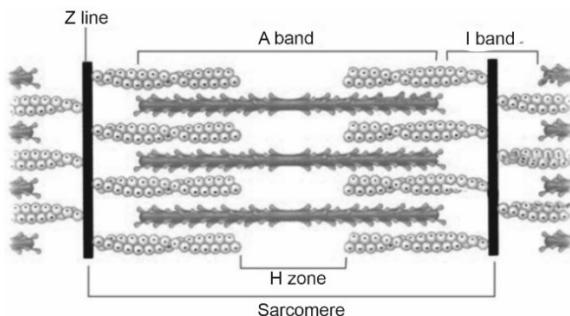
SECTION-A

51. Answer (2)
Spirometer is used to measure respiratory volumes and capacities.
MRI is used to detect cancers.
PCR stands for Polymerase Chain Reaction.
52. Answer (1)
Serum is plasma without the clotting factors. Calcium ions and other clotting factors present in the plasma play an important role in the clotting of blood.
53. Answer (1)
The bone cells (osteocytes) are present in the spaces called lacunae.
In bones, matrix is arranged in the form of concentric layers called lamellae.
54. Answer (4)
Amphibians, reptiles, birds and mammals respire through lungs (pulmonary respiration). Special vascularised structures called gills (branchial respiration) are used by most of the aquatic arthropods and molluscs. Fishes also use gills for respiration.
55. Answer (3)
Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.
Sweat produced by sweat gland contains NaCl, urea, lactic acid, etc.
56. Answer (4)
Asterias and *Antedon* are echinoderms whose most distinctive feature is the presence of water vascular system.

Presence of flagellated collar cells water canal system and are the characteristic features of sponges.

57. Answer (2)
In a standard ECG, the T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of ventricular systole or contraction.
58. Answer (1)
The CNS includes the brain and spinal cord. The PNS is divided into two divisions called somatic neural system and autonomic neural system. Autonomic neural system is further classified into sympathetic neural system and parasympathetic neural system.
59. Answer (3)
Collagen – Intercellular ground substance
GLUT-4 – Enables glucose transport into cells
Insulin – Peptide hormone
Receptor – Sensory reception
60. Answer (2)
All living members of the class Cyclostomata are ectoparasites on some fishes. They have a sucking and circular mouth without jaws. Their body is devoid of scales and paired fins. Cranium and vertebral column are cartilaginous.
61. Answer (2)
The neuroglial cells which make up more than one half the volume of the neural tissue in our body protect and support neurons.

62. Answer (1)



63. Answer (4)

In coitus interruptus, male partner withdraws his penis from the vagina just before ejaculation. Lactational amenorrhea is effective only up to a maximum period of six months following parturition. Condoms are barriers made of thin rubber/latex sheath and they are available for both males and females.

64. Answer (2)

Embryological support for evolution was proposed by Ernst Heckel based upon the observation of certain features during embryonic stage common to all vertebrates that are absent in adults. This proposal was disapproved on careful study performed by Karl Ernst von Baer. He noted that embryos never pass through the adult stages of other animals.

65. Answer (2)

Since DNA is enclosed within the membranes, researchers have to break the cell open to release DNA along with other macromolecules such as RNA, proteins, polysaccharides and also lipids.

The RNA can be removed by treatment with ribonucleases whereas proteins can be removed by treatment with proteases.

66. Answer (3)

Genetic engineering includes techniques to alter the chemistry of genetic material to introduce these into host organisms and thus change the phenotype of the host organism.

67. Answer (4)

The cells of alveoli secrete milk, which is stored in the cavities of alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct through which milk is sucked out by the baby.

68. Answer (3)

Golden rice	– Vitamin-A enriched rice
C-peptide	– Proinsulin
Rosie	– Transgenic cow
Green revolution	– Agriculture

69. Answer (2)

Frogs can live both on land and in freshwater and belong to the class Amphibia. They do not have constant body temperature i.e., their body temperature varies with the temperature of the environment. Such animals are called cold blooded or poikilotherms.

They also have the ability to change the colour to hide them from their enemies (camouflage). This protective coloration is called 'mimicry'.

Calotes is a reptile.

70. Answer (3)

In human females, at puberty, only 60,000 to 80,000 primary follicles are left in each ovary. So, 1,20,000 to 1,60,000 primary follicles are left in both the ovaries.

71. Answer (3)

Expiration takes place when the intrapulmonary pressure is slightly above the atmospheric pressure. Relaxation of the diaphragm and the external intercostal muscles return the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume.

72. Answer (2)

Malaria is caused by a tiny protozoan, called *Plasmodium*. Different species of *Plasmodium* (*P. vivax*, *P. malaria* and *P. falciparum*) are responsible for different types of malaria. Of these, malignant malaria caused by *Plasmodium falciparum* is the most serious one and can even be fatal.

When the mosquito bites another human, sporozoites are injected with the bite. These sporozoites reach the liver through blood. In liver cells, they reproduce asexually, bursting the cells and releasing into the blood.

73. Answer (2)

Multipolar neuron	– Cell body with one axon and two or more dendrites
Bipolar neuron	– Cell body with one axon and one dendrite
Unipolar neuron	– Cell body with one axon only

74. Answer (2)

Branching descent and natural selection are the two key concepts of Darwinian theory of evolution.

75. Answer (3)

In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 gms per litre).

76. Answer (4)

Cocaine is commonly called coke or crack.

Tobacco contains a large number of chemical substances including nicotine.

Cannabinoids are also being abused by some sportspersons. Heroin is a depressant and slows down body functions.

77. Answer (3)

The total number of floating ribs in an adult human is 4 while the number of carpals in one limb is 8.

78. Answer (2)

According to the 2011 census report, the population growth rate of India was less than 2%, i.e., 20/1000/year, a rate at which our population could increase rapidly.

79. Answer (1)

Periodic abstinence is a natural method of contraception which works on the principle of avoiding chances of ovum and sperms meeting.

80. Answer (4)

Coitus interruptus is a natural method of contraception which does not involve any role of a hormone.

Lactational amenorrhea is also a natural method of contraception but this method involves the role of prolactin hormone. Cu 7 and multiload 375 are copper releasing IUDs.

81. Answer (3)

Normal activities of the heart are regulated intrinsically i.e., autoregulated by specialized muscles (nodal tissue), hence the heart is called myogenic.

A special neural centre in the medulla oblongata can moderate the cardiac function through Autonomic Nervous System (ANS).

82. Answer (4)

Hormones are also secreted by some tissues which are not endocrine glands. Endocrine cells present in different parts of the gastro-intestinal tract secrete four major peptide hormones, namely gastrin, secretin, cholecystokinin and gastric inhibitory peptide.

Gonadotropin releasing hormones are hypothalamic hormones.

83. Answer (2)

There are remarkable differences between the reproductive events in the male and female. For example, sperm formation continues even in old men, but formation of ovum ceases in women around the age of fifty years.

84. Answer (4)

Nucleotide – Nitrogenous base + Sugar + Phosphate

Nucleoside – Nitrogenous base + Sugar

Purines – Adenine and Guanine

Pyrimidines – Cytosine, Uracil, Thymine

85. Answer (2)

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

SECTION-B

86. Answer (3)

Analogous structures are a result of convergent evolution – different structures evolving for the same function and hence having similarity.

87. Answer (2)

Intestine	–	Smooth muscle fibres
Heart	–	Cardiac muscle fibres
Triceps	–	Skeletal muscle fibres

88. Answer (3)

Before industrialisation set in, it was observed that there were more white winged moths on trees than melanised moths. However, after industrialisation, i.e., in 1920, there were more dark-winged moths in the same area, i.e., the proportion was reversed.

89. Answer (4)

The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma. Sperms are not the constituent of seminal plasma.

90. Answer (4)

Direct method of gene transfer is defined as the method of introduction of DNA into host cells without the involvement of biological agents.

91. Answer (2)

Using *Agrobacterium* vector, nematode-specific genes were introduced into the host plant.

92. Answer (4)

An adult human excretes, on an average, 1 to 1.5 L urine per day. The urine formed is a light yellow coloured watery fluid which is slightly acidic (pH-6.0).

On an average, 25-30 gm of urea is excreted out per day.

93. Answer (2)

- Acquired immunity is pathogen specific.
- The T-cells themselves do not secrete antibodies, but help B-cells to produce them.
- The body is not able to differentiate between 'self' and 'nonself' cells, in auto-immune diseases.
- Since antibodies are found in the blood, the response given by them is called humoral immune response.

94. Answer (1)

A canal called cerebral aqueduct passes through the midbrain. Hindbrain comprises pons, cerebellum and medulla. Brain stem is formed by midbrain, pons and medulla oblongata which forms the connection between the brain and spinal cord.

95. Answer (2)

Adenohypophysis consists of two portions, pars distalis and pars intermedia. Neurohypophysis (pars nervosa) also known as posterior pituitary, stores and releases two hormones called oxytocin and vasopressin.

96. Answer (2)

Lyases → Enzymes that catalyse removal of group from substrates by mechanisms other than hydrolysis leaving double bonds.

Hydrolases → Enzymes catalysing hydrolysis of ester, ether, peptide, glycosidic, C-C, C-halide or P-N bonds.

97. Answer (1)

The blood vascular system of a frog involves heart, blood vessels and blood. Heart is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium. A triangular structure called sinus venosus joins the right atrium. It receives blood through the major veins called vena cava.

98. Answer (2)

Breathing or pulmonary ventilation is the process by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.

99. Answer (2)

Aplysia is a mollusc.

Ascaris belongs to the phylum Aschelminthes.

Euspongia belongs to the phylum Porifera.

100. Answer (2)

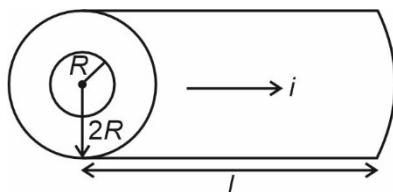
2^n copies of a DNA fragment are obtained after 'n' number of PCR cycles.

\therefore After 10 PCR cycles, $(2)^{10} = 1024$ copies will be obtained.

PHYSICS

SECTION-A

101. Answer (4)



$$R = \frac{\rho l}{A} = \frac{\rho \times l}{\pi((2R)^2 - R^2)}$$

$$= \frac{\rho l}{3\pi R^2}$$

102. Answer (4)

$$\text{When only switch } S_1 \text{ is closed} \Rightarrow V_1 = \frac{E}{2R} \times R = 0.5E$$

When only switch S_2 is closed \Rightarrow

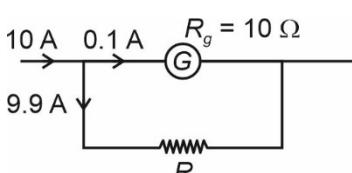
$$V_2 = \frac{E}{3R} \times 2R = 0.66E$$

When both S_1 and S_2 are closed \Rightarrow

$$V_3 = \frac{E}{5R} \times 2R = \frac{2E}{5}$$

$$\therefore V_2 > V_1 > V_3$$

103. Answer (3)



From the figure

$$0.1 \times 10 = 9.9 \times R$$

$$R = \frac{10}{99} \Omega$$

104. Answer (1)

The net magnetic field at point P will be zero as the magnitude of field due to both wires is same but opposite in direction.

105. Answer (3)

For diamagnetic substance $\chi < 0$ and $\mu_r > 0$

106. Answer (3)

It is true that matter waves have wavelength $\lambda = \frac{h}{mv}$ but photoelectric effect is a phenomenon that supports particle nature of light.

107. Answer (3)

$$\text{Energy produced } (E) = P \times t$$

$$= 800 \times 10^6 \times 1.5 \times 60 \times 60$$

$$= 8 \times 54 \times 10^{10}$$

$$E = 432 \times 10^{10} \text{ J}$$

$$\text{As } E = mc^2$$

$$m = \frac{E}{c^2} = \frac{432 \times 10^{10}}{(3 \times 10^8)^2}$$

$$= \frac{432}{9} \times 10^{-6}$$

$$m = 4.8 \times 10^{-5} \text{ kg}$$

108. Answer (4)

$$E_g = \frac{1240}{\lambda(\text{in nm})} \text{ eV}$$

$$E_g = \frac{1240}{775} = 1.6 \text{ eV}$$

109. Answer (1)

$$r_d = \frac{\Delta V}{\Delta I} = \frac{0.75 - 0.70}{10 \times 10^{-3}}$$

$$= \frac{0.05}{10^{-2}}$$

$$\Rightarrow r_d = 5 \Omega$$

110. Answer (2)

$$q = \sigma A$$

$$\sigma = \frac{12 \times 10^{-6}}{6 \times (10)^2 \times 10^{-4}}$$

$$\sigma = \frac{2 \times 10^{-6}}{10^{-2}}$$

$$= 200 \mu\text{C/m}^2$$

111. Answer (4)

$$W = q\Delta V$$

$$= 0 \times 20$$

$$= 0$$

112. Answer (3)

$$L = \frac{\lambda_{\max}}{2}$$

$$\lambda = 2 \times 20$$

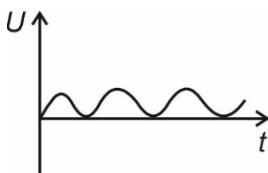
$$= 40 \text{ cm}$$

113. Answer (1)

$$X = A \sin \omega t$$

$$U = \frac{1}{2} K X^2$$

$$= \frac{1}{2} A^2 \sin^2 \omega t$$



114. Answer (2)

$$I = \frac{ml^2}{3} \sin^2 \theta$$

115. Answer (1)

We know, for a satellite revolving near earth's surface

$$v_0 = \sqrt{gR} = \sqrt{9.8 \times 6400 \times 10^6}$$

$$v_0 \approx 8000 \text{ m/s}$$

116. Answer (2)

$$\Delta I = \frac{wL}{A_0 Y}$$

$$\frac{\Delta I}{w} = \frac{L}{A_0 Y}$$

117. Answer (2)

According to law of conservation of angular momentum, folding hands decreases her moment of inertia and thus angular velocity increases.

118. Answer (2)

$$F = m(g + a)$$

$$= m(10 + 5) = 5 \times 15 \text{ N} = 75 \text{ N}$$

$$S = \frac{1}{2} \times 5 \times 2 \times 2 = 10 \text{ m}$$

$$W = 75 \times 10 \text{ J} = 750 \text{ J}$$

119. Answer (1)

$$\text{Power} = \vec{F} \cdot \vec{V}$$

$$F = m(g + g)$$

$$V = gt$$

$$P = 2mg(gt) = 2mg^2t$$

120. Answer (2)

$$v = \frac{d\phi}{dt}$$

$$[\phi] = [V] [t] = [\text{MLT}^2 \text{ A}^{-1}] = \text{volt-s}$$

121. Answer (3)

For graph II, peak value of current is smaller hence $R_{II} > R_I$

122. Answer (2)

An unitless quantity should always be dimensionless while the converse is not true.

123. Answer (3)

$$\text{Excess pressure inside a bubble or drop} = \frac{2T}{R}$$

124. Answer (3)

The change in temperature is same for both the scales.

$$\Delta^\circ C = \Delta K$$

125. Answer (1)

$$C_P - C_V = R \quad (\text{Mayer's relation})$$

126. Answer (4)

$$\Delta Q = \Delta U + W$$

$$210 = 50 + W$$

$$W = 160 \text{ J}$$

127. Answer (1)

The law of conservation of linear momentum is valid only when net external force acting on system is zero.

128. Answer (2)

$$a_c = \frac{a_t}{2}$$

$$\Rightarrow a_c = \frac{R\alpha}{2}$$

129. Answer (4)

$$v = \frac{dx}{dt} = \frac{d}{dt}(2t^2 + 3t + 4) = 4t + 3$$

$$v_{t=4 \text{ s}} = 19 \text{ m s}^{-1}$$

130. Answer (2)

$$\text{For (A)} : a = 2$$

$\therefore v = 2t + 4 \rightarrow$ Straight line (increasing)

$$\text{For (B)} : a = t$$

$\therefore v = \frac{t^2}{2} + 4 \rightarrow$ upwards parabola

$$\text{For (C)} : a = -t$$

$\therefore v = \frac{-t^2}{2} - 4 \rightarrow$ downward parabola

$$\text{For (D)} : a = -2$$

$a = -2t + 4 \rightarrow$ straight line (decreasing)

131. Answer (3)

$$\text{KE} = 5 \left(\frac{1}{2} RT \right) \Rightarrow \text{DoF} = 5 \Rightarrow C_V = \frac{5R}{2} = 2.5R$$

132. Answer (1)

Direction of propagation of electromagnetic wave is along $\vec{E} \times \vec{B}$

133. Answer (4)

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

If $\lambda \uparrow$ then $\mu \downarrow$

So, violet colour will have maximum angle of deviation.

134. Answer (2)

Upper and lower half of lens will behave as lens of different focal length, so, 2 images will form.

135. Answer (3)

Path difference between interfering wave for minimum intensity is $\frac{(2n-1)\lambda}{2}$.

SECTION-B

136. Answer (3)

Magnification of eye-piece lens

$$m_e = 1 + \frac{D}{f_e} = 1 + \frac{25}{5} = 6$$

And total magnification $m_T = 42$

$$m_T = m_e \times m_0$$

$$\Rightarrow 42 = 6 \times m_0$$

$$\Rightarrow m_0 = 7$$

137. Answer (1)

$$40\beta_1 = 60x\beta_2$$

$$40\lambda_1 = 60\lambda_2$$

$$\Rightarrow 40 \times 4000 = 60 \times \lambda_2$$

$$\Rightarrow \frac{16,000}{6} = \lambda_2$$

$$\Rightarrow \lambda_2 = 2667 \text{ Å}$$

138. Answer (4)

For the system to remain in equilibrium, $2T = \mu N$

$$\Rightarrow 2 \times T = \frac{6}{10} \times 6 \times 10 \Rightarrow T = 18 \text{ N}$$

$$\text{Also, } T = Mg \Rightarrow 18 = M \times 10 \Rightarrow M = 1.8 \text{ kg}$$

139. Answer (4)

We know, $C = \frac{\Delta Q}{m\Delta T}$, this suggests that substance

having low specific heat capacity can undergo an easy change in internal energy

Also, $C_P > C_V$ (for gases)

140. Answer (1)

$$F_v = 6\pi\eta r v T$$

$$F_v \propto r v T$$

$$\frac{(F_v)_1}{(F_v)_2} = \left(\frac{r_1}{r_2}\right) \left(\frac{v_{T_1}}{v_{T_2}}\right)$$

$$= \frac{2}{5} \times \frac{25}{4}$$

$$\frac{(F_v)_1}{(F_v)_2} = \frac{5}{2}$$

141. Answer (3)

$$\% \text{ error in } x = \frac{1}{2}[1\% + 2\% + 2 \times 2\%]$$

$$= \frac{7}{2}\%$$

142. Answer (2)

$$i(t) = 3\sin(100\pi t) + 4\cos(100\pi t)$$

$$I_{\text{rms}} = \frac{I_0}{\sqrt{2}}$$

$$I_0 = \sqrt{3^2 + 4^2} = 5$$

$$I_{\text{rms}} = \frac{5}{\sqrt{2}}$$

143. Answer (3)

$$i = 2 + t$$

$$E = Ri + L \frac{di}{dt}$$

$$E = 2(2+t) + 2 \frac{d}{dt}(2+t)$$

$$= 4 + 2t + 2$$

$$E = 6 + 2t = (6 + 2 \times 2)$$

$$= 10 \text{ V}$$

144. Answer (1)

Here, since forces involved are internal

$$\therefore \Delta x_{\text{com}} = 0$$

$$m_1(\Delta x_1) + m_2(\Delta x_2) + m_3(\Delta x_3) = (m_1 + m_2 + m_3) \Delta x_{\text{com}}$$

Let distance moved by plank is 'x' then

$$40(-x) + 50(7.5 - x) + 80(-2.5 - x) = 0$$

$$-40x + 375 - 50x - 200 - 80x = 0$$

$$175 = 170x$$

$$\therefore x = \frac{175}{170} = 1.03 \text{ m}$$

145. Answer (2)

We know,

$$g_{\text{Perth}} = g - R\omega^2 \cos^2\theta$$

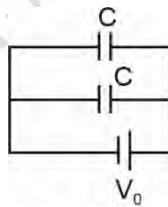
$$g_{\text{equator}} = g \quad [\because \cos\theta = 0]$$

$$\therefore g_{\text{equator}} - g_{\text{Perth}} = R\omega^2 \cos^2\theta$$

$$= R\omega^2 \left(\frac{4}{5}\right)^2$$

$$= \frac{16R\omega^2}{25}$$

146. Answer (2)



$$q_{\max} = 2 CV$$

$$C_{\text{eff}} = 2 C$$

$$2 CV = V_0 2C$$

$$V_0 = V$$

147. Answer (2)

$$mg = f$$

$$qE = mg + f$$

$$2mg = q \times E$$

$$2 \times 3.2 \times 10^{-17} = 1.6 \times 10^{-19} E$$

$$E = 400 \text{ V/m}$$

148. Answer (3)

Speed of electron in first excited state

$$v_1 = \frac{c}{137 \times 2} = \frac{c}{274}$$

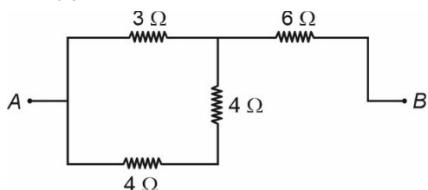
Speed of light in medium

$$v_2 = \frac{c}{\mu} = 2 \times 10^8 \text{ m/s}$$

$$\frac{v_1}{v_2} = \frac{3 \times 10^8}{274 \times 2 \times 10^8} = \frac{3}{548}$$

149. Answer (1)

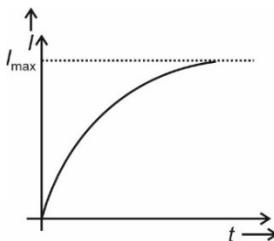
When positive of external battery is connected to A and negative of battery to B then effective circuit will be



$$R_{AB} = \frac{8 \times 3}{8 + 3} + 6 = 8.18 \Omega$$

150. Answer (3)

For an LR circuit, variation of current is exponential initially and later after a fairly long time the current becomes constant, hence we can say the inductive effect is lost after a long time



CHEMISTRY

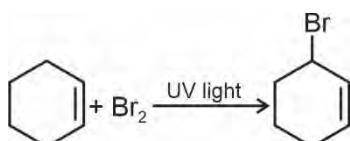
SECTION-A

151. Answer (3)

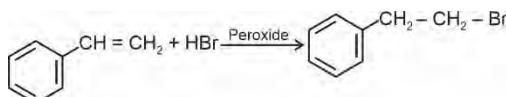
Element	$\Delta_i H (\text{kJ/mol})$
C	1086
Ge	761
Sn	708
Pb	715

152. Answer (2)

- Br₂ in presence of UV light gives free radical substitution reaction



- HBr in presence of organic peroxide, forms major product according to anti-Markovnikov's rule.



153. Answer (1)

In CH₂=CH-CH₂-Br, π -bond favours S_N2 reaction to a greater extent.

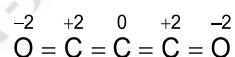
∴ CH₂=CH-CH₂-Br reacts fastest with S_N2 mechanism.

154. Answer (4)

Electron deficient species which can accept electrons are called electrophiles.

BF₃, SO₃ and AlCl₃ are electron deficient species, while NH₃ is a nucleophile due to the presence of lone pair of electron on nitrogen.

155. Answer (4)



156. Answer (1)



∴ 3 mol of Cl₂ ≡ 6 mol of NaOH

∴ 2 mol of Cl₂ ≡ $\frac{6}{3} \times 2 = 4$ mol of NaOH

157. Answer (3)

- | | | |
|--|---|---------------|
| (a) Na ₄ [Fe(CN) ₅ NOS] | - | Violet |
| (b) Fe ₄ [Fe(CN) ₆] ₃ .xH ₂ O | - | Prussian blue |
| (c) [Fe(SCN)] ²⁺ | - | Blood red |
| (d) (NH ₄) ₃ PO ₄ .12MoO ₃ | - | Yellow |

158. Answer (2)

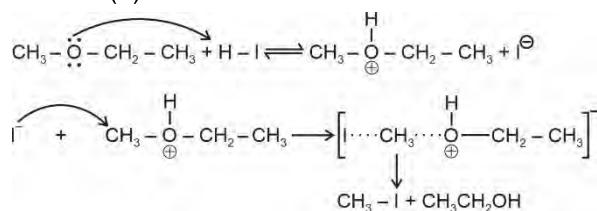
Halogen acid of chlorine → HOClO exist

HOFO ; HOBrO ; HOIO → do not exist.

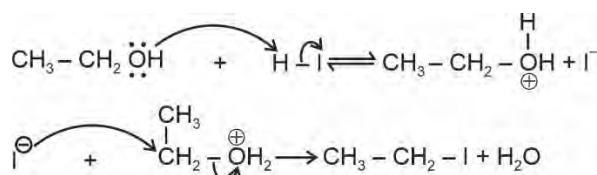
159. Answer (3)

α -Black phosphorus is obtained when red phosphorous is heated in a sealed tube at 803 K.

160. Answer (3)



When HI is in excess and the reaction is carried out at high temperature, ethanol reacts with another molecule of HI and is converted to ethyl iodide



161. Answer (3)

The weak polarity of ethers do not appreciably affect their boiling point.

The large difference in boiling points of alcohols and ethers is due to the presence of hydrogen bonding in alcohols.

Formula $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$ $\text{C}_2\text{H}_5-\text{O}-\text{C}_2\text{H}_5$ $\text{CH}_3(\text{CH}_2)_3-\text{OH}$
b.p / k 342 307.6 390

162. Answer (3)

Value of ℓ lies between 0 to $(n - 1)$, while spin

quantum number (s) has only two values $\pm \frac{1}{2}$.

$\therefore n = 4, \ell = 0, m = 0, s = +\frac{1}{2}$ is a possible set.

163. Answer (2)

Compound	Melting point (K)
HF	190
HCl	159
HBr	185
HI	222

164. Answer (3)

	Li	Be	B	C
Outer electronic configuration	$2s^1$	$2s^2$	$2p^1$	$2p^2$
	↓	↓	↓	↓

After removal of one e^- $1s^2$ $2s^1$ $2s^2$ $2p^1$

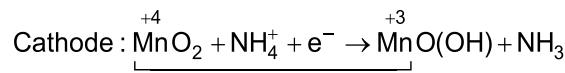
As we move left to right in a period, $Z_{\text{effective}}$ increases and hence IE increases but IE for $ns^2 > np^1$ due to stable configuration

1st I.E. \rightarrow C > Be > B > Li

165. Answer (1)

Due to the small size of oxygen, addition of electron is accompanied with less energy release.

166. Answer (1)



167. Answer (1)

$$\Delta G^\circ = -RT \ln K$$

$$\Delta G^\circ = -nFE_{\text{cell}}^\circ$$

$$-RT \ln K = -nFE_{\text{cell}}^\circ$$

$$\log K = \frac{nF}{RT} E_{\text{cell}}^\circ$$

$$\log K = \frac{nE^\circ}{0.0591} = \frac{2 \times 0.46}{0.0591} = 15.56$$

$$K = 3.7 \times 10^{15}$$

168. Answer (3)

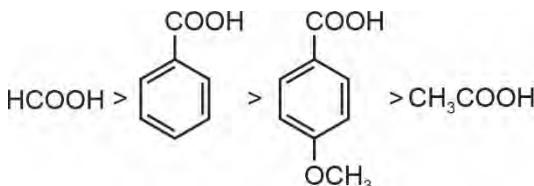
The ionic product of water (K_w) is temperature dependent

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

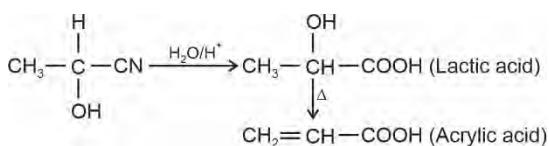
If the value of K_w change then concentration of H^+ and OH^- ions also changes which changes the pH of the solution.

169. Answer (4)

The correct order of acidic strength is:



170. Answer (2)



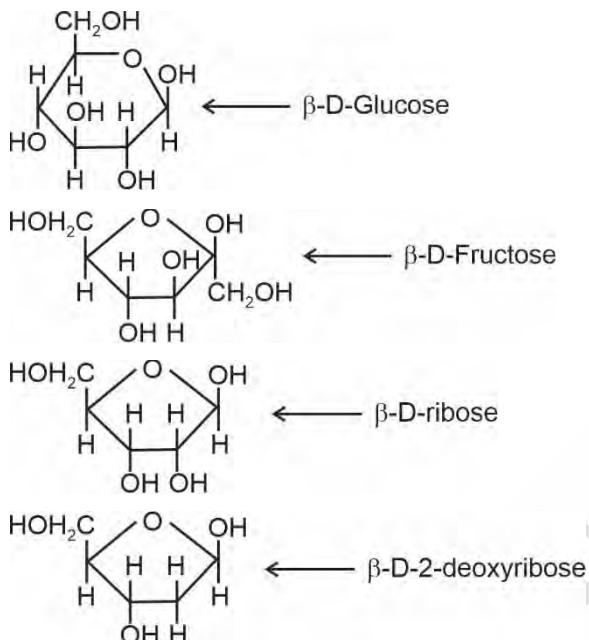
171. Answer (2)

- Both work (w) and heat (q) are path functions.
- During free expansion of an ideal gas, $w = 0$ for reversible as well as irreversible process.

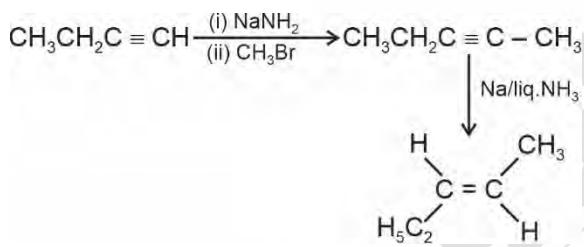
172. Answer (3)

 $\text{CoCl}_3 \cdot 4\text{NH}_3$ exists as $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$.Hence, only one mole of AgCl is produced on reaction with excess of AgNO_3 .

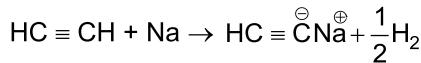
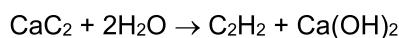
173. Answer (1)



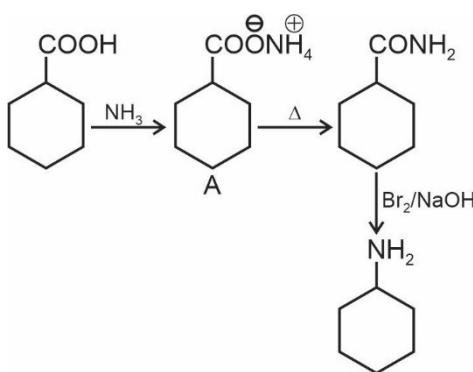
174. Answer (2)



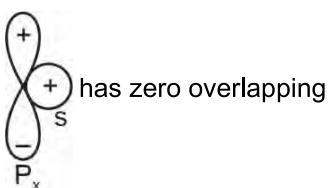
175. Answer (1)



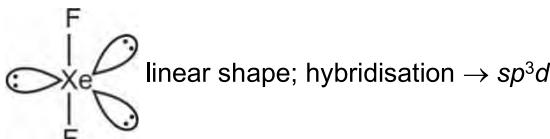
176. Answer (2)



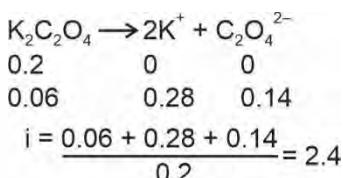
177. Answer (1)



178. Answer (4)



179. Answer (2)



180. Answer (1)

$$\text{Volume of the solution} = \frac{110}{1.1} = 100 \text{ mL}$$

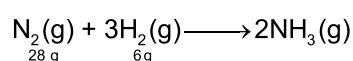
$$\text{Molarity} = \frac{18 / 180}{0.1} = 1 \text{ M}$$

181. Answer (2)

- Number of atoms in 64 g SO_2 = $\frac{64}{64} \times 3 \times N_A = 3N_A$
- Number of atoms in 8 g H_2 = $\frac{8}{2} \times 2 \times N_A = 8N_A$
- Number of atoms in 88 g CO_2 = $\frac{88}{44} \times 3 \times N_A = 6N_A$
- Number of atoms in 32 g O_3 = $\frac{32}{48} \times 3 \times N_A = 2N_A$

\therefore 8 g H_2 contains maximum number of atoms.

182. Answer (1)



N_2 is limiting reagent

28 g N_2 reacts with 6 g H_2 to form 34 g NH_3

\therefore 14 g N_2 on reaction with H_2 gives 17 g NH_3

183. Answer (1)

Catalyst can catalyse only spontaneous reaction.

184. Answer (3)

Heat released on neutralisation of 1 eq strong acid with 1 eq strong base in aqueous medium is 13.7 kcal.

185. Answer (3)

Pb^{2+} belongs to group I and group II

SECTION-B

186. Answer (2)

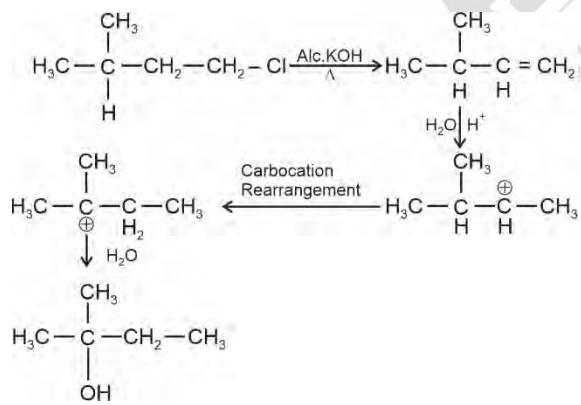
Paper chromatography is a type of partition chromatography.

Aniline-water mixture is separated using steam distillation.

187. Answer (2)

(a)	White P_4 + alkali	\rightarrow	H_3PO_2 Hypophosphorous acid
(b)	Red P_4 + alkali	\rightarrow	$\text{H}_4\text{P}_2\text{O}_6$ Hypophosphoric acid
(c)	P_4O_{10} + H_2O	\rightarrow	H_3PO_4 Orthophosphoric acid
(d)	P_2O_3 + H_2O	\rightarrow	H_3PO_3 Orthophosphorous acid

188. Answer (1)

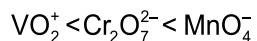


189. Answer (4)

- For $2s$ orbital probability density first decreases sharply to zero and again starts increasing.
- After reaching a small maxima it decreases and approaches zero.

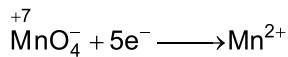
190. Answer (2)

The correct order of oxidising power is



This is due to the increasing stability of the lower species to which they are reduced.

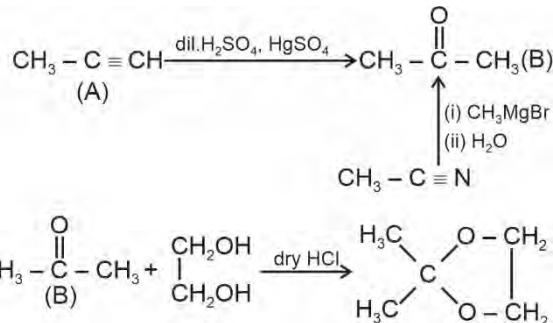
191. Answer (3)



1 mole of MnO_4^- requires 5 F charge

0.8 mole of MnO_4^- requires 5×0.8 F charge
= 4 F

192. Answer (3)



193. Answer (1)

- Exothermic reactions are favoured at low temperature.
- Addition of inert gas at constant volume has no effect on equilibrium state.
- When we decrease the pressure, reaction will shift towards that side which has higher number of gaseous moles.

194. Answer (2)

For a irreversible isothermal process,

$$w = -P_2(V_2 - V_1)$$

$$= -P_2 \left(\frac{nRT}{P_2} - \frac{nRT}{P_1} \right)$$

$$= -nRT \left(1 - \frac{P_2}{P_1} \right)$$

$$= -2 \times 8.314 \times 300 \left(1 - \frac{5}{1} \right)$$

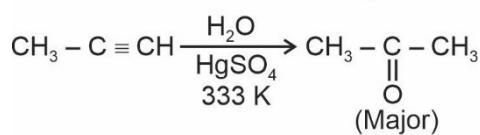
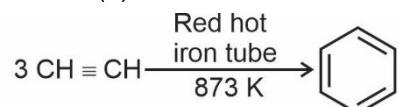
$$= 19.953 \text{ kJ}$$

195. Answer (2)

Increasing order of ligand field strength :



196. Answer (4)

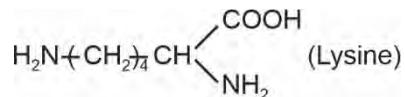


197. Answer (4)

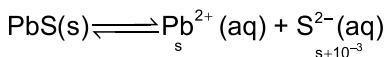
- sp^3 hybridised nitrogen is most basic in nature.
- In pyrrole the lone pair of electron is involved in aromatic sextet. Hence, it is least basic in nature.

198. Answer (3)

The amino acid which contains more number of amino than carboxyl group makes it basic amino acid



199. Answer (1)



$$K_{sp} = (s)(s + 10^{-3})$$

$$K_{sp} = (s) \times 10^{-3}$$

$$s = \frac{K_{sp}}{10^{-3}} = \frac{8 \times 10^{-28}}{10^{-3}} = 8 \times 10^{-25} \text{ mol L}^{-1}$$

200. Answer (3)

$$k = 2.303 \times 10^{-2} \text{ s}^{-1}$$

$$t = \frac{2.303}{k} \log \frac{[A]_0}{[A]_t}$$

$$[A]_0 = 1 \text{ g}, [A]_t = 0.1 \text{ g}$$

$$t = \frac{2.303}{2.303 \times 10^{-2}} \log \frac{1}{0.1} = 100 \text{ s}$$