

25/04/2024

CODE-A



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

(Advanced INTENSIVE Mastery for 720)

MM : 720

CST-14

Time : 3 Hrs. 20 Min.

Answers

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

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Answers & Solutions**CHEMISTRY****SECTION-A**

1. Answer (2)

Magnetic moment = $\sqrt{n(n+2)}$, n = unpaired electrons

$$\text{a. } [\text{Cu}(\text{NH}_3)_4]^{2+} = \text{Cu}^{2+} = [\text{Ar}]3d^94s^0 \\ = \sqrt{1(1+2)} = \sqrt{3} = 1.73 \text{ BM}$$

$$\text{b. } [\text{Cr}(\text{C}_2\text{O}_4)_2(\text{NH}_3)_2]^- = \text{Cr}^{3+} = \sqrt{3(3+2)} = \sqrt{15} \\ = 3.87 \text{ BM}$$

$$\text{c. } [\text{Fe}(\text{H}_2\text{O})_6]^{3+} = \text{Fe}^{3+} = \sqrt{5(5+2)} = \sqrt{35} \\ = 5.92 \text{ BM}$$

$$\text{d. } [\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_4 = \text{Ti}^{4+} = 0 \text{ unpaired electron} = 0$$

2. Answer (2)

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G < 0 \text{ (spontaneous reaction)}$$

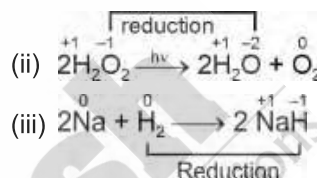
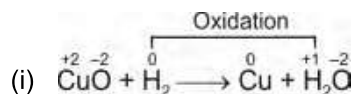
$$\frac{\Delta H}{T} < \Delta S$$

$$\frac{50 \times 10^3 \text{ J mol}^{-1}}{450} < \Delta S$$

$$111.11 \text{ JK}^{-1} \text{ mol}^{-1} < \Delta S$$

Only option (2) $120 \text{ JK}^{-1} \text{ mol}^{-1}$ is greater than $111.11 \text{ JK}^{-1} \text{ mol}^{-1}$

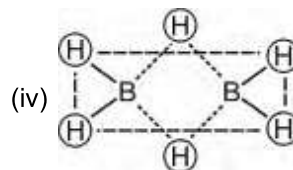
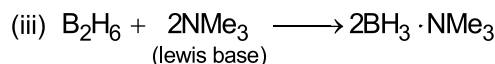
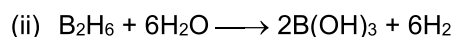
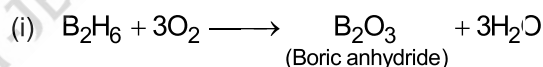
3. Answer (4)



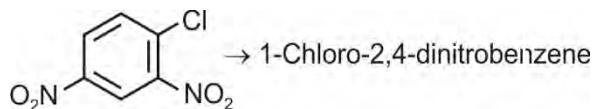
4. Answer (2)

$$\text{A}_2(\text{BC}_4)_3 \Rightarrow (+3) \times 2 + [(+6) + (-2) \times 4] \times 3 \\ = +6 + [6 - 8] \times 3 = +6 - 6 = 0$$

5. Answer (1)

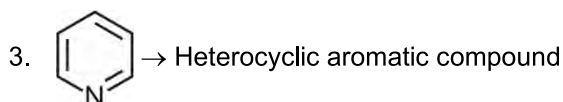
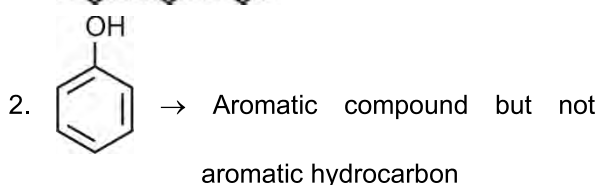
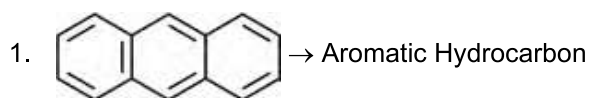
Both the boron atoms are sp^3 hybridised

6. Answer (2)

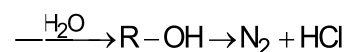
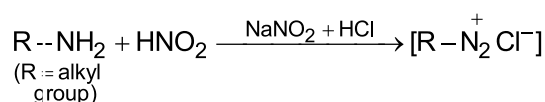


7. Answer (1)

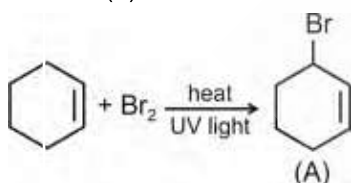
Compounds of only carbon and hydrogen showing aromaticity are known as aromatic hydrocarbon.



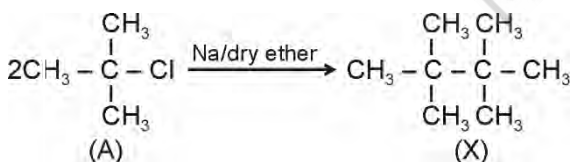
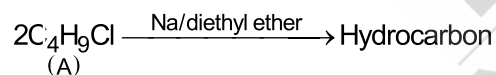
8. Answer (3)



9. Answer (2)



10. Answer (4)



Hydrocarbon (X) on monochlorination gives only one chloroderivative

11. Answer (3)



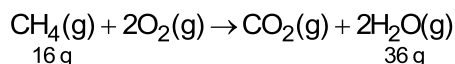
Let oxidation state of Pt = x

$$x - 1 - 1 - 1 = -1$$

$$x = +2$$

IUPAC name : Amminebromidochloridonitrito-N-platinate(II)ion

12. Answer (3)



16 g CH₄ on combustion gives 36 g of H₂O

8 g CH₄ on combustion gives 18 g of H₂O

13. Answer (3)

Prefix Multiples

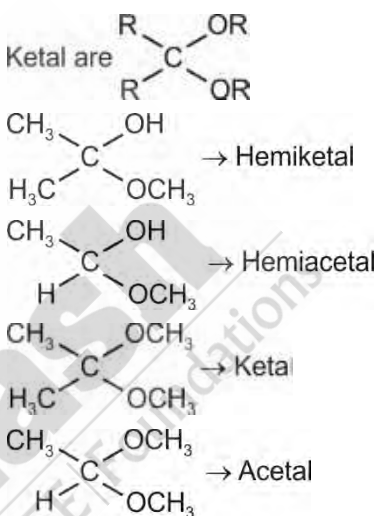
micro 10⁻⁶

mega 10⁶

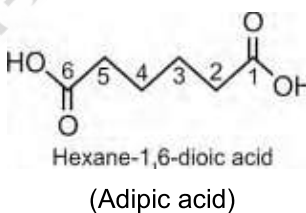
giga 10⁹

femto 10⁻¹⁵

14. Answer (2)



15. Answer (1)



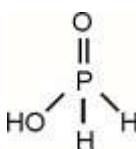
16. Answer (4)

$$\frac{r_2}{r_1} = \mu^{\Delta T/10}$$

$$= 3^{20/10}$$

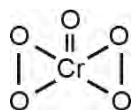
$$= 9$$

17. Answer (1)

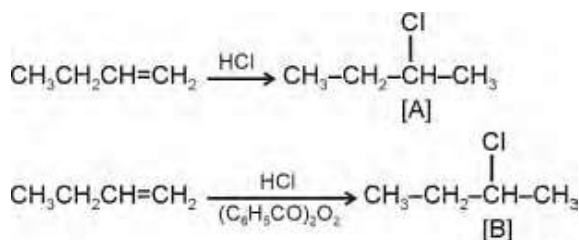


H₃PO₂ has one ionisable hydrogen, hence n-factor is 1.

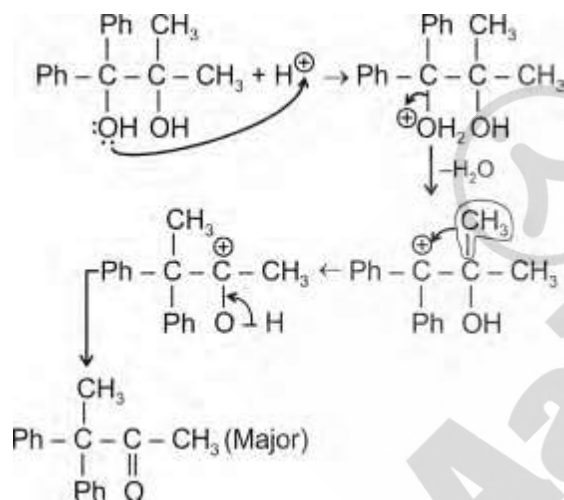
18. Answer (1)

In CrO_5 , there are two peroxo linkages.

19. Answer (2)

In presence of HCl , Anti-Markovnikov addition does not take place.

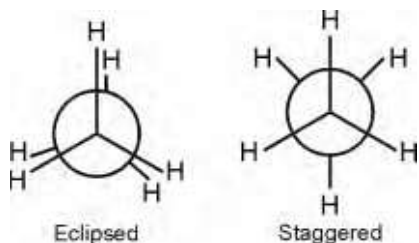
20. Answer (2)



21. Answer (2)

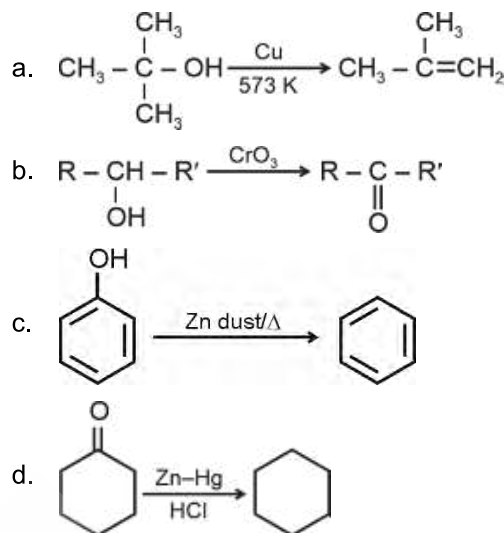
Vitamin	Deficiency Disease
Vitamin B ₁₂	Pernicious anaemia
Vitamin E	Increased fragility of RBCs and muscular weakness

22. Answer (4)



Newman's projections of ethane

23. Answer (4)



24. Answer (3)

Higher the value of K_H , lower is the solubility.

The correct order of solubility of gases is :

 $\text{C} > \text{B} > \text{A}$.

25. Answer (1)

$$\text{Na}_2\text{SO}_4 \rightleftharpoons 2\text{Na}^+ + \text{SO}_4^{2-}$$

1	0	0
$1-\alpha$	2α	α

$$i = \frac{1-\alpha + 2\alpha + \alpha}{1} = 1 + 2\alpha$$

26. Answer (2)

 $\text{BCl}_3 \longrightarrow sp^2$ hybridisation $\text{NCl}_3 \longrightarrow sp^3$ hybridisation

27. Answer (3)

 XeF_4 has sp^3d^2 hybridisation and planar structure.

28. Answer (2)

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

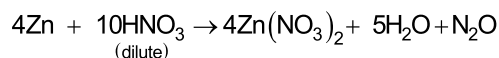
$$= R_H \left(\frac{1}{2^2} - \frac{1}{3^2} \right)$$

$$= R_H \left(\frac{1}{4} - \frac{1}{9} \right)$$

$$\frac{1}{\lambda} = \frac{5}{36} R_H$$

$$\lambda = \frac{36}{5 R_H}$$

29. Answer (2)



30. Answer (1)

Gas name	Formula
Phosgene	COCl_2
Tear gas	CCl_3NO_2
Mustard gas	$\text{ClCH}_2\text{CH}_2\text{SCH}_2\text{CH}_2\text{Cl}$

31. Answer (4)

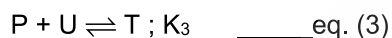
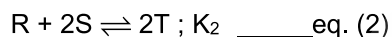
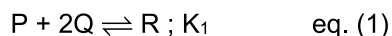
$Z = 48$ (Cd) $\rightarrow [\text{Kr}] 4d^{10}5s^2$ is d -block element.

32. Answer (1)

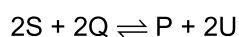
S have high negative electron gain enthalpy than oxygen atom.

Element	$\Delta_{\text{eg}}\text{H}(\text{kJ mol}^{-1})$
O	-141
S	-200

33. Answer (4)

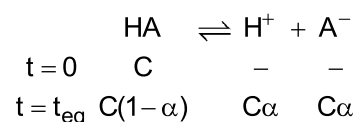


Multiply eq. (3) with 2, reverse it and add with eq. (1) and eq. (2) we get the target equation



$$K = \frac{K_1 K_2}{K_3^2}$$

34. Answer (3)



$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$

$$K_a = 10^{-7} = \text{C}\alpha^2 \quad [\text{As } 1-\alpha \approx 1]$$

$$10^{-7} = 4 \times 10^{-3} \times \alpha^2$$

$$\frac{1}{4} \times \frac{10^{-7}}{10^{-3}} = \alpha^2$$

$$\alpha^2 = \frac{1}{4} \times 10^{-4}$$

$$\alpha = \frac{1}{2} \times 10^{-2}$$

$$\alpha = 0.5 \times 10^{-2}$$

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

35. Answer (1)

$$\Lambda_m = k \times \frac{1000}{M}$$

$$\Lambda_m = \frac{2 \times 10^{-3} \times 10^3}{2 \times 10^{-2}}$$

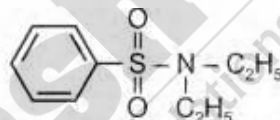
$$\Lambda_m = 100 \text{ Scm}^2 \text{ mol}^{-1}$$

SECTION-B

36. Answer (4)

Hydrogen atoms present on α -carbon take part in hyperconjugation. α -hydrogen atoms present on sp^2 hybridised carbon and bridged head carbon do not take part in hyperconjugation.

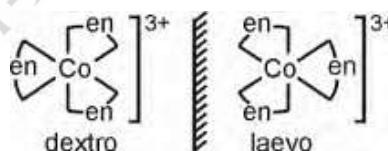
37. Answer (1)



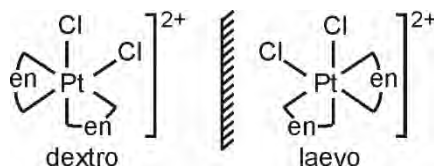
N,N-Diethylbenzenesulphonamide

N,N-Diethylbenzene sulphonamide does not contain any hydrogen atom attached to nitrogen atom, it is not acidic and hence insoluble in alkali.

38. Answer (2)



$[\text{Co}(\text{en})_3]^{3+}$ is an optically active isomer



39. Answer (4)

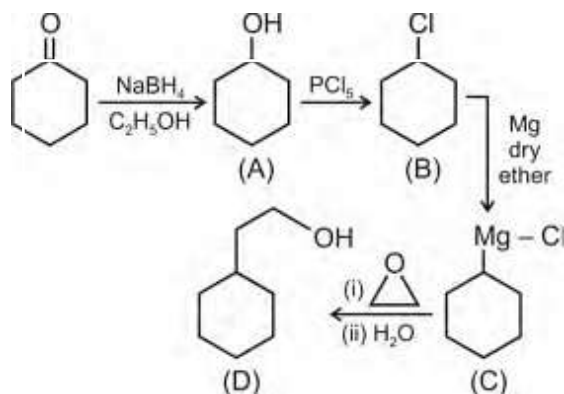
As stability of conjugate base increases, acidic strength of acid increases.

CCl_3COOH is more acidic than CH_3COOH due to CCl_3COO^- conjugate base is more stable than CH_3COO^- .

40. Answer (1)

For 1st order reaction $a_t = a_0 e^{-kt}$

41. Answer (1)



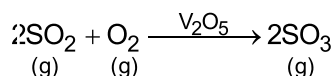
42. Answer (1)

Attack of electrophile results in the formation of σ -complex or arenium ion in which one of the carbon is sp^3 hybridised.

43. Answer (1)

Sucrose on hydrolysis gives equimolar mixture of D-(+)-Glucose and D-(-)-Fructose.

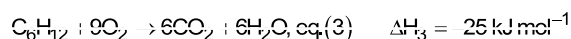
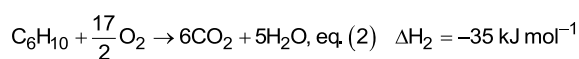
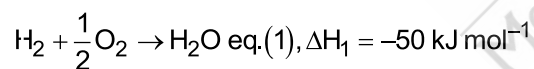
44. Answer (3)



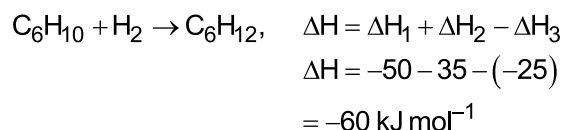
Catalytic oxidation of SO_2 with O_2 to give SO_3 in the presence of V_2O_5 (catalyst)

- Cu^+ undergoes disproportionation in aqueous phase.
- Cu exhibits variable oxidation states of +1 and +2
- PdCl_2 acts as a catalyst for oxidation of ethyne to ethanal.

45. Answer (2)



The required reaction is:



46. Answer (2)

O_2^+ has one unpaired electron so it is paramagnetic.

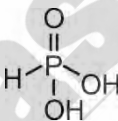
47. Answer (4)

Conductivity of electrolytic solution increases with increase in temperature and also depends on viscosity of solvent and concentration of the electrolyte.

48. Answer (3)

Catalyst lowers the activation energy for the forward and reverse reactions by exactly the same amount.

49. Answer (1)



2 hydrogen atoms attached to oxygen atom in P-OH are ionisable and causes basicity.

50. Answer (3)

$$\lambda = \frac{h}{mv}$$

$$\lambda = \frac{6.6 \times 10^{-34}}{3 \times 10^{-6} \times 1000}$$

$$\lambda = 2.2 \times 10^{-31} \text{ m}$$

BOTANY

SECTION-A

51. Answer (2)

Schwann proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.

52. Answer (4)

In the absence of ribosomes ER appears smooth and are called smooth endoplasmic reticulum (SER).

53. Answer (1)

The *cis* and *trans* faces of Golgi apparatus are entirely different, but interconnected.

54. Answer (3)

Spindle fibres attach to kinetochores of chromosomes in metaphase stage.

55. Answer (4)

During Anaphase-II of meiosis-II sister chromatids separation occur.

56. Answer (3)
Meiosis results the formation of daughter cells which are genetically dissimilar from each other. Recombination between homologous chromosomes occurs during pachytene stage of prophase I.
57. Answer (3)
In dsDNA, pentose sugar lacks 2'-OH group. Also Guanine forms three H-bond with cytosine.
58. Answer (3)
A failure in cell division after DNA replication results into polyploidy (a chromosomal anomaly).
59. Answer (1)
Cistron can be defined as a segment of DNA coding for a polypeptide.
60. Answer (1)
In capping, an unusual nucleotide (methylguanosine triphosphate) is added to 5' end of hnRNA.
61. Answer (2)
Photorespiration does not occur in C₄ plants.
62. Answer (1)
Water is an external factor affecting photosynthesis.
63. Answer (2)
Guard cells regulate the opening and closing of stomata.
64. Answer (3)
 - Intercellular spaces are absent in collenchyma.
 - Parenchyma forms the major component within organs and their walls are thin and made up of cellulose.
 - Sclerenchyma consists of long, narrow cells with thick and lignified walls.
65. Answer (2)
Foolish seedling disease or Bakanae disease of rice seedlings was caused by a fungal pathogen *Gibberella fujikuroi*.
66. Answer (1)
Black pepper and beet seeds have remnants of nucellus. This residual, persistent nucellus is called perisperm.
67. Answer (3)
 - Castor is a monoecious plant, both male and female flowers are present on the same plant.
 - In an ovary, many ovules are present in orchids.
 - Exine is made up of sporopollenin.
68. Answer (3)
In human ABO blood group, there are six different genotypes and four different phenotypes in the population because there are three different alleles of the gene.
69. Answer (4)
Recessive traits are expressed in the homozygous condition. In pea plant, round seeds and violet flowers are dominant traits.
Green seed colour, terminal flower position and yellow pod colour are recessive traits.
70. Answer (3)
Turner's syndrome is a disorder caused due to absence of one of the X chromosome, i.e., 45 with X⁰.
71. Answer (2)
In Mendelian dihybrid cross, 4 among the 16 individuals of F₂ offspring are homozygous, i.e., RRYY, RRyy, rrYY and rryy.
Number of individuals homozygous for both the characters is

$$\frac{4}{16} \times 256 = 64$$
72. Answer (3)
RQ of proteins = 0.9
RQ of fats = 0.7
RQ of glucose = 1
RQ of malic acid = 1.33
RQ of oxalic acid = 4
Therefore RQ of malic acid is greater than that of glucose.
73. Answer (2)
As we move from low to high latitude i.e., from the equator to the pole, the biodiversity decreases. Biodiversity is minimum in the arctic region, moderate in temperate area and maximum in tropical region.

74. Answer (4)

The species is confined to a particular region and not found anywhere else is known as endemic species.

75. Answer (4)

Families are characterised on the basis of both vegetative and reproductive features of plant species.

76. Answer (3)

In phycomycetes asexual reproduction takes place by zoospores (motile) or by aplanospores (non-motile). These spores are endogenously produced in sporangium.

Thermoacidophiles are archaeobacteria. Lichens do not grow in polluted areas. Mycorrhizal roots lack root cap and root hair.

77. Answer (4)

Flagellated protozoans are either free living or parasitic. The parasitic forms cause diseases such as sleeping sickness e.g., *Trypanosoma*.

78. Answer (3)

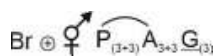
In a pinnately compound leaf number of leaflets are present on a common axis the rachis which represents the midrib of the leaf as in neem.

79. Answer (3)

The arrangement of veins and veinlets in the lamina of leaf is termed as venation. When veinlets form a network, the venation is termed as reticulate. *Hibiscus* sp., *Trifolium* and *Solanum tuberosum* show reticulate venation in their leaves.

80. Answer (2)

Onion is a source of food that belongs to family Liliaceae whose floral formula is



81. Answer (3)

Cytotaxonomy is based on cytological information like chromosome number, structure, behaviour.

82. Answer (3)

Spirogyra – Green alga

Cycas – Gymnosperm

Selaginella – Pteridophyte

Sphagnum – Moss

83. Answer (2)

Statins is produced by yeast *Monascus purpureus*.

84. Answer (4)

Cuckoo and crow is the example of brood parasitism. In mutualism both species are benefited and they are in obligatory relationship.

85. Answer (3)

Stratification is the vertical distribution of different species occupying different levels.

SECTION-B

86. Answer (1)

Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies. These are not bound by any membrane system and lie free in the cytoplasm.

87. Answer (3)

Anaphase is the best stage to study the shape of chromosomes.

88. Answer (1)

Sickle cell anaemia arises due to point mutation.

89. Answer (2)

When release factor binds to the stop codon, the process of translation terminates.

90. Answer (3)

All tissues exterior to the vascular cambium constitute the bark.

Autumn wood is darker in colour and has a higher density.

91. Answer (4)

Ethylene enhances the respiration rate during ripening of the fruits. This rise in rate of respiration is called respiratory climactic.

In most situations, ABA acts as antagonist to GAs.

92. Answer (1)

Pollination by wind is more common amongst abiotic pollinations.

93. Answer (2)

Law of Dominance is not universally applicable.

94. Answer (3)

Sucrose is converted into glucose and fructose by the enzyme invertase.

95. Answer (4)

TMV is a single stranded RNA virus.

96. Answer (1)
 Malvaceae – *Gossypium*
 Asteraceae – *Helianthus*
 Liliaceae – *Colchicum*
 Poaceae – *Cynodon*
97. Answer (4)
 In gymnosperm true roots, stem and leaves are present.
98. Answer (3)
 BOD (Biochemical oxygen demand) refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria.
99. Answer (1)
 Exponential growth is observed when resources are unlimited.
 It is represented by

$$\frac{dN}{dt} = rN$$
100. Answer (3)
 The natural reservoir of phosphorus is rock, which contains phosphorus in the form of phosphates.

ZOOLOGY

SECTION-A

101. Answer (3)
 Simple squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. It is found in the wall of blood vessels and air sacs of lungs and is involved in functions like forming a diffusion boundary.
102. Answer (4)
 The seminiferous tubules in humans open in vasa efferentia through rete testis. Vasa efferentia open into epididymis which opens into vas deferens.
103. Answer (3)
 In humans, neural system is divided into two parts:
 (1) Central Neural System (CNS)
 (2) Peripheral Neural System (PNS)
104. Answer (1)
 Earth was supposed to have been formed about 4.5 billion years back.
105. Answer (2)
 There are ten pairs of cranial nerves arising from the brain of a frog. Thus, total number of cranial nerves will be twenty.
106. Answer (3)
 Bt toxin exists as an inactive protoxin and once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilises the crystals.
107. Answer (3)
 Ovary is composed of ovarian follicles and stromal tissues. The estrogen is synthesized and secreted mainly by the growing ovarian follicles. After ovulation, the ruptured follicle is converted into corpus luteum which secretes progesterone.
108. Answer (2)

$$\begin{array}{c} \text{CH}_2 - \text{OH} \\ | \\ \text{CH} - \text{OH} \\ | \\ \text{CH}_2 - \text{OH} \end{array}$$

 Glycerol
109. Answer (2)
 The acid-soluble pool represents roughly the cytoplasmic composition. The macromolecules from cytoplasm and organelles become the acid-insoluble fraction.
110. Answer (3)
 Each antibody molecule has four peptide chains. Two small chains are called light chains and two longer chains are called heavy chains. Hence, an antibody molecule is represented as H_2L_2 . These antibodies are found in the blood and the response shown by them is called the humoral immune response.
111. Answer (2)
 The viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles. AIDS is not a congenital disease. HIV infection may be congenital.

112. Answer (3)

Both AIDS and hepatitis-B infections are chronic in nature and ultimately fatal. Both can be transmitted through sexual contact or infected blood. Diphtheria and plague are bacterial diseases.

113. Answer (1)

- Bidder's canal is present only in male frogs.
- Frogs have simple eyes (possessing only one unit).
- Blood vascular system of frogs is well developed closed type.

114. Answer (2)

There are two main categories of WBCs – granulocytes and agranulocytes. Neutrophils, eosinophils and basophils are different types of granulocytes, while lymphocytes and monocytes are agranulocytes.

115. Answer (2)

Erythroblastosis fetalis can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first Rh⁺ child.

116. Answer (4)

Clarias (Magur) is a fresh water bony fish.

117. Answer (2)

RNAi involves silencing of a specific mRNA due to complementary dsRNA molecule that binds to and prevents translation of the mRNA.

118. Answer (3)

Oxidoreductases/dehydrogenases-Enzymes catalysing oxidation-reduction between two substrates.

Ligases catalyse the linking together of two compounds.

Lyases catalyse the removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds.

119. Answer (2)

At electrical synapses, the membranes of pre and post-synaptic neurons are in very close proximity. Current can flow directly from one neuron into the other across these synapses.

120. Answer (2)

LH surge leads to ovulation. Progesterone is also known as pregnancy hormone.

121. Answer (3)

The immature male germ cells grow in size and are called primary spermatocytes. The primary spermatocytes periodically undergo meiosis.

122. Answer (3)

The bones of the forelimb are humerus, radius, ulna, carpals, metacarpals and phalanges.

Femur, tibia, fibula, metatarsals and phalanges are the bones of the hindlimb in humans.

123. Answer (4)

Intervertebral joint – Cartilaginous joint

Sutures – Fibrous joint

Joint between tarsals and between carpals – Synovial joints

124. Answer (4)

Chlorophyte ancestors gave rise to bryophytes while tracheophyte ancestors gave rise to zosterophyllum, arborescent lycopods and herbaceous lycopods.

125. Answer (2)

Darwin's finches are an example of adaptive radiation as well as founder effect.

They evolved from the original seed-eating finches enabling them to become insectivorous and vegetarian finches.

126. Answer (1)

Haemoglobin is a red coloured iron containing pigment present in the RBCs. Each haemoglobin can carry a maximum of four molecules of O₂.

127. Answer (1)

During expiration, relaxation of diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduces the thoracic volume and thereby the pulmonary volume. This leads to an increase in intra – pulmonary pressure to slightly above the atmospheric pressure causing the expulsion of air from the lungs.

128. Answer (4)

Euspongia belongs to the phylum Porifera.

Antedon (Echinoderm), *Loligo* (Mollusc) and *Limulus* (Arthropod) are dioecious.

129. Answer (1)

Bacteriophages because of their high number per cell, have very high copy number of their genome within the bacterial cells.

130. Answer (4)

Exonucleases remove nucleotides from the ends of the DNA whereas, endonucleases make cuts at specific positions within the DNA.

131. Answer (3)

Recombinant DNA Technology involves several steps in specific sequence such as, isolation of DNA, fragmentation of DNA by restriction endonucleases, isolation of a desired DNA fragment, ligation of the DNA fragment into a vector, transferring the rDNA into host, culturing of host cell in a medium and extraction of the desired product.

132. Answer (4)

The downstream processing and quality control testing vary from product to product.

133. Answer (4)

In vitro fertilization leading to a test tube baby, synthesising a gene and using it, developing a DNA vaccine or correcting a defective gene are all parts of biotechnology.

134. Answer (3)

Cockroaches show sexual dimorphism. Males bear a pair of short, thread-like anal styles which are absent in females.

135. Answer (3)

MTPs are considered relatively safe during the first trimester, i.e., up to 12 weeks of pregnancy.

SECTION-B

136. Answer (2)

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

137. Answer (2)

During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that blocks the entry of additional sperms.

138. Answer (1)

Erythropoietin hormone which stimulates RBCs formation is produced by juxtaglomerular cells of the kidneys.

139. Answer (4)

True fishes belong to the class Chondrichthyes and Osteichthyes.

Class Chondrichthyes – Dog fish

Class Osteichthyes – Flying fish, Angel fish

Phylum Echinodermata – Star fish

140. Answer (1)

The cerebral cortex is referred to as grey matter due to its greyish appearance. The neuronal cell bodies are concentrated here giving the grey colour. The white matter of brain is due to the presence of myelinated nerve fibres.

141. Answer (1)

The principal nitrogenous waste in humans is urea and is synthesised in the liver by urea cycle but eliminated mostly through kidneys.

142. Answer (2)

At high altitude, pO_2 falls proportionately in the atmospheric air. This lowers the alveolar pO_2 and reduces the diffusion of oxygen from the alveolar air to the blood. To compensate this, the body produces more RBCs to adjust in that environment.

143. Answer (4)

When more than one adaptive radiations appeared to have occurred in an isolated geographical area (representing different habitats), one can call this convergent evolution. Flying phalanger as well as sugar glider are Australian marsupials and show divergent evolution.

144. Answer (3)

An acromion process is characteristically found in the pectoral girdle of mammals.

Glenoid cavity is a depression to which head of the humerus articulates to form shoulder joint.

145. Answer (3)

4 parathyroid glands are present on the back side of the thyroid gland. Parathyroid hormone along with TCT, play a significant role in Ca^{2+} balance in the body.

146. Answer (2)

Adenylic acid and uridylic acid are nucleotides. A nucleotide has three chemically distinct components. One is heterocyclic compound, the second is a monosaccharide and third is a phosphate group.

Lecithin is composed of phosphoric acid, choline, esters of glycerol and two fatty acids.

147. Answer (3)

Night blindness occurs due to the deficiency of vitamin-A. Genetically modified crop, Golden rice, has enhanced nutritional value (enriched in vitamin-A) and its consumption helps in solving the problem of night blindness.

148. Answer (1)

- Bone, cartilage and blood are specialized connective tissues.
- The bone marrow in some bones is the site of production of blood cells.

149. Answer (4)

STIs like syphilis, gonorrhoea, genital warts, chlamydiasis, etc., are completely curable if detected early and treated properly. Hepatitis-B, genital herpes and HIV infections are not completely curable even if detected early and treated properly.

150. Answer (2)

Protection from STIs – Condoms

Terminal method of contraception – Sterilisation

Removal of small part of fallopian tube – Tubectomy

Implants inhibit implantation.

PHYSICS

SECTION-A

151. Answer (1)

Statement A is correct. Astronomical unit, parsec and light year are indeed units for measuring astronomical distances.

Statement B is incorrect. The correct order of the units is $\text{Au} < \text{ly} < \text{parsec}$.

152. Answer (2)

$$U = q\Delta V \\ = qV$$

153. Answer (4)

$$\phi = \vec{E} \cdot \vec{A} \\ \phi = E\pi R^2 \cos 90^\circ \\ = 0$$

154. Answer (2)

Laplace's correction in the formula for the speed is given by Newton was needed because sound wave propagate adiabatically.

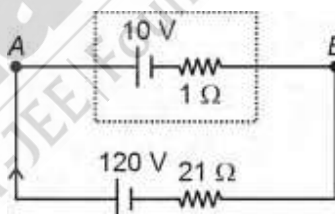
155. Answer (1)

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

156. Answer (1)

Usually electrons are the carriers of current but in some cases like electrolytic liquids positive and negative ions carry the electric current.

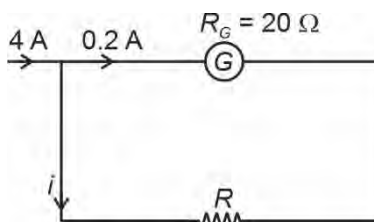
157. Answer (2)



$$i = \frac{120 - 10}{21 + 1} = \frac{110}{22} = 5 \text{ A}$$

$$V_A - V_B = \text{Terminal voltage} = \varepsilon + ir = (10 + 5 \times 1) \text{ V} \\ = 15 \text{ V}$$

158. Answer (3)



$$0.2 \times R_G = iR$$

$$0.2 \times 20 = (4 - 0.2)R$$

$$R = \frac{0.2 \times 20}{3.8} = \frac{20}{19} \Omega$$

159. Answer (4)

$$\frac{1}{2}mv^2 = Vq \Rightarrow v \propto \sqrt{V}$$

$$F = qvB \Rightarrow F \propto v$$

$$\therefore F \propto \sqrt{V}$$

$$\frac{F}{F'} = \sqrt{\frac{V}{8V}} \Rightarrow F' = 2\sqrt{2}F$$

160. Answer (2)

Magnetic field produced by circular coil carrying current is similar to a bar magnet.

161. Answer (3)

Intermediate image formed on compound microscope is real, inverted and magnified.

162. Answer (4)

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

$$\frac{1}{f} = \left(\frac{3 \times 3}{2 \times 4} - 1 \right) \left(\frac{1}{R} + \frac{1}{R} \right)$$

$$\frac{1}{f} = \frac{1}{8} \times \frac{2}{R}$$

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

$$f = 4R$$

163. Answer (4)

$$\lambda_{\text{micro}} = 1 \text{ mm to } 30 \text{ cm}$$

$$\lambda_{\text{infra}} = 780 \text{ nm to } 1 \text{ mm}$$

$$F_{\text{x ray}} > F_{\text{UV}}$$

164. Answer (3)

$$\text{At central fringe } \Delta\phi = 0$$

$$\text{And at 3rd dark fringe } \Delta\phi = \frac{2\pi}{\lambda} \Delta x$$

$$\Delta\phi = \frac{2\pi}{\lambda} \times \frac{5}{2} \lambda$$

$$= 5\pi$$

165. Answer (1)

$$W = \vec{F} \cdot \vec{S}$$

$$W = (2\hat{i} - 3\hat{j}) \cdot (4\hat{i} + 2\hat{j})$$

$$\therefore W = 8 - 6 = 2 \text{ J}$$

166. Answer (2)

$$mv_0 = M\sqrt{5g\ell} + \frac{mv_0}{4}$$

$$mv_0 - \frac{mv_0}{4} = M\sqrt{5g\ell}$$

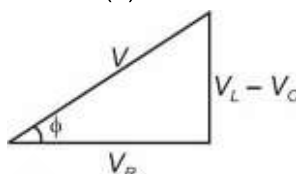
$$\frac{3}{4}mv_0 = M\sqrt{5g\ell}$$

$$\frac{3}{4} \times 50 \times 10^{-3} v_0 = \sqrt{5 \times 10 \times 2}$$

$$\frac{3}{4} \times 50 \times 10^{-3} v_0 = 10$$

$$v_0 = \frac{40}{150} \times 10^3 = \frac{4000}{15} = \frac{800}{3} \text{ ms}^{-1}$$

167. Answer (2)



$$V \sin \phi = V_L - V_C$$

$$\sin \phi = \frac{80 - 40}{80} = \frac{1}{2}$$

$$\cos \phi = \sqrt{1 - \left(\frac{1}{2}\right)^2}$$

$$\cos \phi = \frac{\sqrt{3}}{2}$$

168. Answer (2)

As soon as the contact is broken current increases due to Lenz's law

169. Answer (3)

$$\frac{F - 32}{9} = \frac{K - 273}{5}$$

$$\Rightarrow F = -459.4^\circ\text{F}$$

$$\approx -460^\circ\text{F}$$

170. Answer (3)

$$F = \eta \frac{Adv}{dy}$$

$$= 3 \times 2 \times 10^{-2} \times \frac{9 \times 10^{-2}}{3 \times 10^{-3}}$$

$$F = 1.8 \text{ N}$$

171. Answer (2)

When the water is heated from 20°C to 50°C , there is only a slight change in its volume. So, we can treat this process as isochoric. In an isochoric process.

$$(W.D)_{\text{system}} = 0$$

$$\Delta U = Q = ms_v \Delta T$$

$$\text{Mass of water} = 100 \text{ g}$$

$$= 0.1 \text{ kg}$$

$$\Delta T = 30 \text{ K}$$

$$Q = 0.1 \times 4200 \times 30$$

$$Q = 12600 \text{ J}$$

$$Q = 12.6 \text{ kJ}$$

172. Answer (3)

When heat is supplied at constant pressure, a part of it goes in the expansion of gas and remaining part is used to increase temperature of gas which in turn increases internal energy.

173. Answer (1)

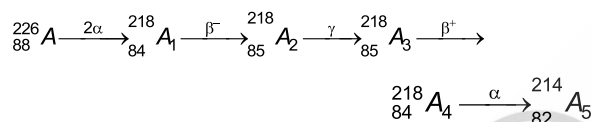
$$\Delta\lambda = \lambda_B - \lambda_A = \frac{hc}{\phi_B} - \frac{hc}{\phi_A}$$

$$= \frac{1242}{3} - \frac{1242}{6}$$


$$= 414 - 207$$

$$= 207 \text{ nm}$$

174. Answer (3)



175. Answer (4)

NOT \rightarrow NAND \rightarrow NOR \rightarrow 

176. Answer (1)

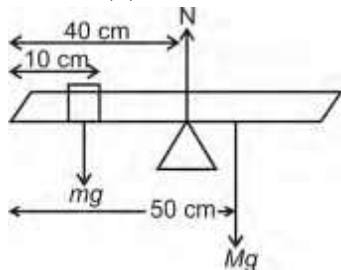
$$v_{mp} = \sqrt{\frac{2RT}{M}}$$

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

$$v_{avg} = \sqrt{\frac{8RT}{\pi M}}$$

$$\text{Mean free path } \lambda = \frac{1}{\sqrt{2} \pi n d^2}$$

177. Answer (3)



According to principle of moments

$$mg(30) = (0.3)g[10] \Rightarrow m = \frac{1}{10} \text{ kg}$$

$$m = 100 \text{ gram}$$

178. Answer (2)

We know, $\tau = I\alpha$

$$\therefore \frac{\alpha}{\tau} = \frac{1}{I} \xrightarrow{\text{SI unit}} \frac{1}{\text{kg m}^2} = \text{m}^{-2} \text{ kg}^{-1}$$

179. Answer (1)

We know, gravitation field intensity,

$$I_g = \frac{F}{m} = \frac{GMm}{r^2(m)}$$

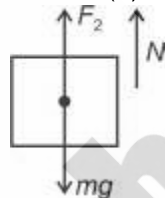
$$I_g = \frac{GM}{r^2} = g$$

180. Answer (2)

From the graph,

Plastic region of A is considerably large while in B the plastic region is small. Thus A is ductile while B is brittle.

181. Answer (3)

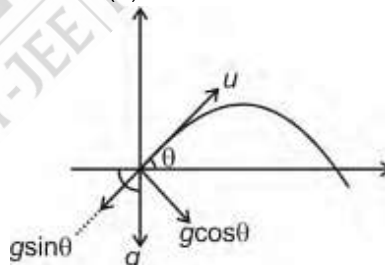


$$N + F_2 = mg$$

$$\Rightarrow N = mg - F_2$$

As the normal reaction decreases the maximum value of static friction decreases and it may start sliding.

182. Answer (3)



$$\Rightarrow R = \frac{u^2}{g \cos \theta}$$

183. Answer (3)

$$V = \frac{t^2}{35} \Rightarrow a = \frac{dv}{dt} = \frac{2t}{35}$$

i.e. body undergoes non-uniform acceleration.

184. Answer (3)

$$Y_{\text{Mono}} = \frac{5}{3}, Y_{\text{dia}} = \frac{7}{5}$$

$\Rightarrow Y_{\text{Mono}} > Y_{\text{dia}}$ but degree of freedom is more for diatomic gas as compared to monoatomic gas.

185. Answer (2)

Since the displacement of particle is zero hence the average velocity would be zero.

SECTION-B

186. Answer (2)

According to conservation of angular momentum

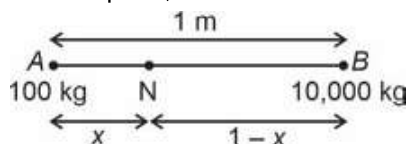
$$L_i = L_f$$

$$Mr^2\omega = [Mr^2 + 2mr^2]\omega'$$

$$\frac{M\omega}{M + 2m} = \omega'$$

187. Answer (3)

For null point,



$$(I_g)_A = (I_g)_B$$

$$\frac{G100}{x^2} = \frac{G(10,000)}{(1-x)^2}$$

$$(1-x)^2 = (10x)^2$$

$$1-x = 10x$$

$$1 = 11x$$

$$x = \frac{1}{11} \text{ m}$$

188. Answer (2)

$$\Delta\phi = \frac{2\pi}{\lambda} \Delta x = \frac{2\pi}{\lambda} \times \frac{\lambda}{4}$$

$$\Delta\phi = \frac{\pi}{2}$$

$$I_{\text{net}} = 4I \cos^2\left(\frac{\Delta\phi}{2}\right)$$

$$I_1 = 4I \cos^2\left(\frac{\pi}{4}\right) = 2I$$

$$I_{\text{max}} = I_0 = 4I$$

$$\frac{I_1}{I_0} = \frac{2I}{4I} = \frac{1}{2}$$

189. Answer (2)

Angle of prism is the angle between the inclined surface where refraction occurs so, $A = 25^\circ$

190. Answer (3)

Torque applied on a body

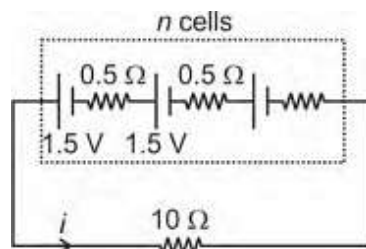
$\tau = \text{Force} \times \text{Perpendicular distance}$

$$[\tau] = [\text{MLT}^{-2}] \quad [L] = [\text{ML}^2\text{T}^{-2}]$$

$$\frac{\Delta\tau}{\tau} \times 100 = \left[\frac{\Delta m}{m} + \frac{2\Delta L}{L} + \frac{2\Delta T}{T} \right] \times 100$$

$$\% \text{ accuracy in torque} = 2\% + 2 \times 2\% + 2 \times 2\% = 10\%$$

191. Answer (3)



$$i = \frac{V_{\text{eq}}}{R_{\text{eq}}} = \frac{n \times 1.5}{10 + n \times 0.5} = 0.5$$

$$\Rightarrow 2.5n = 10$$

$$\Rightarrow n = 4$$

192. Answer (4)

$$I_{\text{rms}}^2 = \frac{1}{T} \int_0^T (2 + 2\sqrt{2} \sin 100\pi t)^2 dt$$

$$= \frac{1}{T} \int_0^T (4 + 8 \sin^2 100\pi t + 8\sqrt{2} \sin(100\pi t)) dt$$

$$= \frac{1}{T} \int_0^T 4 dt + \frac{8}{T} \int_0^T \sin^2 100\pi t dt + \frac{8\sqrt{2}}{T} \int_0^T \sin 100\pi t dt$$

$$= \frac{4T}{T} + \frac{8}{T} \times \frac{T}{2}$$

$$I_{\text{rms}}^2 = 8$$

$$I_{\text{rms}} = 2\sqrt{2} \text{ A}$$

193. Answer (2)

$$\text{Induced emf } |\varepsilon| = L \frac{di}{dt}$$

$$= 4 \times 10^{-3} \times 10 \times 10^{-3}$$

$$= 40 \mu\text{V}$$

194. Answer (1)

For an ideal gas in isobaric process

$$Q = nC_p\Delta T$$

$$W = P\Delta V$$

$$= nR\Delta T$$

$$\text{Required ratio} = \frac{W}{Q}$$

$$= \frac{nR\Delta T}{nC_p\Delta T}$$

$$\frac{R}{C_p} = \frac{R}{\frac{\gamma R}{\gamma - 1}} = \frac{2}{5}$$

$$[\text{Since } \gamma = \frac{5}{3}, \text{ for monatomic gas}]$$

195. Answer (1)



$$B = mg + F_v$$

$$F_v = B - mg$$

$$F_v = 5\sigma vg - \sigma vg$$

$$\frac{F_v}{\sigma vg} = 4 \Rightarrow \frac{F_v}{mg} = 4$$

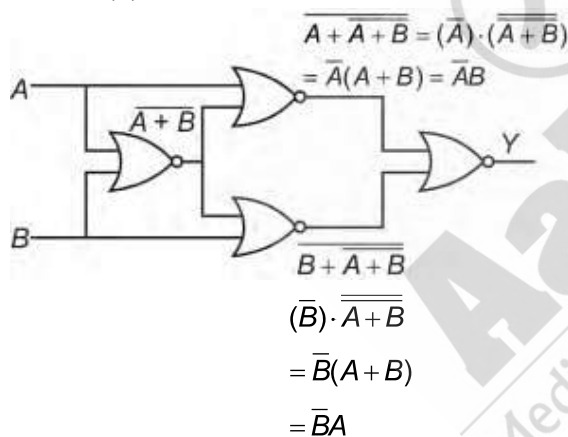
196. Answer (3)

The energy of the electron beam is 12.75 eV, which is enough to excite the electron to the $n = 4$ state.

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

$$= \frac{4 \times 3}{2} = 6$$

197. Answer (3)



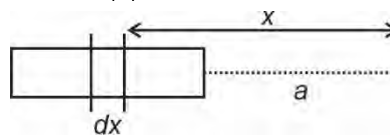
$$Y = \overline{AB} + \overline{BA} = (\overline{AB}) \cdot (\overline{BA})$$

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

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

$$= AB + \overline{A}\overline{B} \quad (\text{XNOR gate})$$

198. Answer (1)



$$dE = \frac{dq}{4\pi\epsilon_0 x^2}$$

$$\int dE = \int_a^{2a} \frac{\lambda dx}{4\pi\epsilon_0 x^2}$$

$$E = \frac{\lambda}{4\pi\epsilon_0} \left[-\frac{1}{x} \right]_a^{2a}$$

$$= \frac{\lambda}{8\pi\epsilon_0 a}$$

199. Answer (1)

$$V = \frac{kq}{R}$$

$$q = \left(\frac{VR}{k} \right)$$

$$E = \frac{kq}{r^2}$$

$$= \frac{VR}{r^2}$$

200. Answer (2)

Additional force required to move with same

$$\text{velocity} = \frac{vdm}{dt}$$

$$= 10 \times 3$$

$$= 30 \text{ N}$$

