

27/04/2024

CODE-A



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

*(Advanced INTENSIVE Mastery for 720)*

MM : 720

CST-15

Time : 3 Hrs. 20 Min.

Answers

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

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Answers & Solutions**BOTANY****SECTION-A**

1. Answer (3)
Algin is a hydrocolloid which has good water holding capacity.
Algin is obtained from brown algae.
2. Answer (1)
Gelidium is an example of red algae and it does not have vascular tissue.
3. Answer (4)
Ecological niche of an organism represents, the range of conditions that it can tolerate, the resources it utilises and its distinct functional role in ecological system.
Over a period of time, the organisms evolved adaptations to optimise its survival and reproduction in its habitat through natural selection.
4. Answer (3)
The first antibiotic Penicillin was discovered by Alexander Fleming while working on *Staphylococci* bacteria.
Full potential of Penicillin as an effective antibiotic was established by Ernest Chain and Howard Florey.
5. Answer (1)
Pyramid of energy is always upright in all ecosystems because the flow of energy is unidirectional from producer to consumer level.
6. Answer (2)
Intercalary meristem occurs between mature tissues. Occur in grasses and regenerate parts removed by grazing herbivores.
7. Answer (2)
In monocot stem, vascular bundles are conjoint and closed. It has sclerenchymatous hypodermis.
8. Answer (1)
Cytokinin is adenine derived phytohormone (N^6 -Furfurylamino purine, kinetin).
9. Answer (3)
Three cells are present at the chalazal end, known as antipodals.
10. Answer (1)
In pollen grain, exine has prominent apertures called germ pores where sporopollenin is absent.
11. Answer (1)
Chlorophyll pigments are present in the chloroplast.
12. Answer (3)
In prokaryotes, the genetic material is basically naked, not enveloped by a nuclear membrane.
13. Answer (2)
Ribosomes and nucleolus are non-membrane bound organelles.
14. Answer (3)
During anaphase the centromeres divide and the chromatids start moving towards the two opposite poles.
Anaphase II and anaphase I are stages of meiotic division.
15. Answer (4)
The growth of multicellular organisms is due to mitosis.

16. Answer (2)
Bivalent is pair of two homologous chromosomes. Hence, for 20 chromosomes, 10 bivalents will be there.
17. Answer (1)
Since, transcription and translation are energetically very expensive process these have to be tightly regulated.
18. Answer (3)
The hallmark of the double stranded helical structure of DNA is the hydrogen bonding between the bases from opposite strands.
19. Answer (3)
Less than 2% of human genome codes for proteins
Repeated sequences make up very large portion of the human genome. They do not have direct coding functions, but they shed light on chromosome structure, dynamics and evolution.
20. Answer (1)
The elucidation of the *lac* operon was also a result of a close association between a geneticist, Jacob and Monod. The repressor of the operon is constitutively synthesised from the *i* gene. Regulation of *lac* operon by repressor is referred to as negative regulation.
21. Answer (4)
C₄ plants shows Kranz anatomy. The primary CO₂ acceptor molecule in C₄ plants is a 3C molecule phosphoenol pyruvate (PEP).
22. Answer (3)
Fixation of CO₂ molecule occurs during dark reactions of photosynthesis.
23. Answer (3)
Types of gamete = 2^n (n = number of heterozygous loci)
Since $n = 3$
Types of gametes = $2^n = 2^3 = 8$
24. Answer (2)
Complex V or ATP synthase is involved in production of ATP from ADP and inorganic phosphate. The F₁ particle is a peripheral membrane protein and F₀ is an integral membrane protein complex.
25. Answer (4)
The gene that control starch synthesis in pea plants show pleiotropy.
26. Answer (2)
Shape of leaf of pea plant was not considered by Mendel in his experiment.
27. Answer (4)
India has only 2.4 % of the world's land area but, it shares global species diversity by 8.1%.
28. Answer (3)
The transition zone, the outermost part of the Biosphere reserve, is an area of active cooperation between reserve management and the local people.
29. Answer (2)
Colour blindness defect is due to mutation in certain genes present on the X chromosome. A normal couple (carrier) can have haemophilic son.
30. Answer (2)
Higher the taxa, less are the characteristics that the members within the taxon share.
In plants, classes with a few similar characters are assigned to a higher category called Division.
31. Answer (2)
Heterocyst are specialized cells that carry out atmospheric nitrogen fixation under anaerobic condition and also lack PSII activities.
32. Answer (4)
Cyanobacteria are Gram negative photosynthetic prokaryotes, being the most primitive organisms to have oxygenic photosynthesis.
33. Answer (2)
Aquatic plants such as *Pistia* and *Eichhornia* have a lateral branch which bear short internodes and each node bears a rosette of leaves and a tuft of roots.
34. Answer (2)
In some plants such as Australian acacia, the leaves are small and short-lived. The petioles in this plant expand, become green and synthesise food.
35. Answer (3)
Mustard and chilli have actinomorphic flowers which can be divided into two equal radial halves in any radial plane passing through the centre.

SECTION-B

36. Answer (2)
Phloem parenchyma is absent in monocot stem. In parenchyma, their walls are thin and made up of cellulose. In dicot leaf, vascular bundles do not possess cambium hence, they are conjoint and closed.
37. Answer (3)
Both Auxin and cytokinin promote cell division which shows their synergistic effect on cell division.

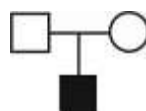
38. Answer (4)
Maturation of ovule(s) in seed(s), and development of zygote into an embryo are post-fertilisation events.
39. Answer (3)
Chloroplast is involved in the process of photosynthesis and stores starch.
40. Answer (4)
In anaphase I, the homologous chromosomes separate from each other and start moving towards the poles. While sister chromatids remain associated at their centromeres. Congression event occur at metaphase.
41. Answer (3)
There is single DNA-dependent RNA polymerase that catalyses transcription of all types of RNA.
42. Answer (4)
Polycistronic gene can be usually found in prokaryotes.
43. Answer (3)
All enzyme involve in the Krebs cycle are soluble in mitochondrial matrix but succinate dehydrogenase is found attached to inner mitochondrial membrane.
44. Answer (2)



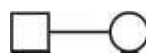
– Sex unspecified



– Mating between relatives



– Parents with affected male child



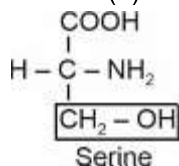
– Mating between male and female

45. Answer (2)
Prions are abnormally folded proteins which cause certain diseases like kuru disease in humans which is also called as laughing death disease.
46. Answer (1)
Radish belongs to Brassicaceae family. Marigold belongs to Asteraceae family. Ground nut belongs to Fabaceae and *Zea mays* belongs to Gramineae family.
47. Answer (4)
The stems are unbranched in *Cycas* and branched in *Pinus*.
48. Answer (1)
Cheese is partially degraded concentrate of milk fat and casein (milk protein). Roquefort cheese is ripened by fungi *Penicillium roqueforti*.
49. Answer (1)
Orchids and bees are the example of mutualism. In this interaction both species are benefited from each other.
50. Answer (3)
Primary succession starts at barren area, never having vegetation of any type or where no living organism ever existed. In burned or cut forests secondary succession occurs.

ZOOLOGY

SECTION-A

51. Answer (4)
Pars intermedia secretes only one hormone called melanocyte stimulating hormone (MSH).
52. Answer (3)
Inorganic catalysts work efficiently at high temperatures and high pressures, while enzymes get damaged at high temperatures.
53. Answer (4)
Enzymes are divided into six classes each with 4–13 subclasses named accordingly by a four-digit number.
54. Answer (3)



55. Answer (2)
Normal cells show a property called contact inhibition by the virtue of which, contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property. Treatment of AIDS with anti-retroviral drugs is only partially effective.
56. Answer (4)
- In a frog's heart, the ventricle opens into a sac-like conus arteriosus on the ventral side of the heart.
 - In female frogs, the ureters and oviducts open separately in the cloaca.
57. Answer (4)
Cannabinoids are a group of chemicals which interact with cannabinoid receptors present principally in the brain. Generally taken by inhalation and oral ingestion, these are known for their effects on the cardiovascular system of the body.

58. Answer (3)

In humans, the female gametes (ova) are haploid cells produced by meiotic cell division before ovulation and before fertilisation. Ovulation is release of ovum from ruptured Graafian follicle. This ovum remains arrested in meiosis-II till a sperm enters within the ovum.

59. Answer (4)

A reduction in the number of platelets can lead to clotting disorders which will lead to excessive loss of blood from the body.

60. Answer (2)

Vaccine safety testing	–	Transgenic mice
Ethical issues	–	GEAC
Biological products	–	Treatment of emphysema
Retroviral vector	–	Gene therapy

61. Answer (4)

Cellulose does not contain complex helices and hence cannot hold I₂.

62. Answer (1)

Sweat gland is an exocrine gland that bears ducts whereas pituitary, thymus and adrenal glands are ductless glands.

63. Answer (4)

Cardiac muscles	–	Intercalated discs
Smooth muscle fibres	–	Fusiform and unstriated
Striated muscle fibres	–	Nuclei are present at periphery
Myofibrils	–	Present within muscle fibres

64. Answer (4)

When a stimulus is applied at a site on a polarised axonal membrane, this site becomes freely permeable to Na⁺ which leads to depolarisation. Depolarised membrane remains in refractory period, so does not respond to stimuli of any strength.

65. Answer (2)

Forebrain consists of cerebrum, thalamus and hypothalamus. Cerebral aqueduct is a canal present in the midbrain. Hindbrain consists of pons, cerebellum and medulla oblongata.

66. Answer (3)

Enlarged end of penis called glans penis is covered by a loose fold of skin called foreskin.

67. Answer (4)

Ovaries are considered as the primary sex organs in human females. They are about 2–4 cm in length and are connected to the pelvic wall by ligament. During the fertile age, they produce ova and hormones.

68. Answer (2)

Neutrophils are the most abundant cells (60–65%) of the total WBCs and basophils are the least (0.5–1%) among them. Monocytes are 6–8%, eosinophils are 2–3% and lymphocytes are 20–25% of the total WBCs.

69. Answer (2)

The characteristic features of Aves are the presence of feathers and most of them can fly except the flightless birds. They are oviparous and development is direct. Their hind limbs have scales.

70. Answer (2)

During swallowing, glottis is covered by a thin elastic cartilaginous flap called epiglottis to prevent entry of food into the larynx. Nostrils, lungs and bronchi are paired structures. Epiglottis is an unpaired structure.

71. Answer (1)

The functioning of kidneys is efficiently monitored and regulated by hormonal feedback mechanism involving the hypothalamus, JGA and to a certain extent, the heart.

72. Answer (2)

At the level of tissues, where low pO₂, high pCO₂, high H⁺ concentration and higher temperature exist, these conditions are favourable for dissociation of oxygen from the oxyhaemoglobin.

73. Answer (3)

The two core techniques that enabled the birth of modern biotechnology are genetic engineering and bioprocess engineering.

74. Answer (3)

The normal *E. coli* does not carry resistance against any antibiotics.

75. Answer (1)

Open circulatory system is present in arthropods and hemichordates.

Fertilisation is external in hemichordates. Notochord is characteristic of chordates.

76. Answer (1)

During urine formation, the tubular cells secrete substances like H^+ , K^+ and ammonia into the filtrate.

77. Answer (2)

pBR322 can be made tetracycline sensitive by ligating the restriction site of either *Bam*H I or *Sal* I with a foreign DNA. They produce sticky ends.

78. Answer (2)

For transformation of host cell with rDNA, the heat shock is usually given at 42°C .

79. Answer (1)

Troponin and tropomyosin are regulatory proteins whereas actin and myosin are contractile proteins.

80. Answer (3)

Smooth muscles do not exhibit any striations and are smooth in appearance.

Both smooth as well as cardiac muscles possess gap junctions.

81. Answer (2)

Rocks form sediments and a cross-section of Earth's crust indicates the arrangements of sediments one over the other.

Strata 'P' will contain fossils of most recently extinct organisms. And strata 'S' contains fossils of oldest extinct organisms.

82. Answer (1)

Evolution is not a directed process in the sense of determinism. It is a stochastic process based on chance events in nature and chance mutation in the organisms.

83. Answer (4)

AIDS, hepatitis-B and genital herpes are STIs that are not completely curable even if detected early and treated properly. PID, abortions, still births, etc., are complications that appear due to STIs.

84. Answer (2)

Though all individuals are vulnerable to STIs, but their incidences are reported to be very high among people in the age group of 15–24 years.

85. Answer (4)

If one is diagnosed with STIs, he/she must get the complete treatment.

Diaphragms, cervical caps and vaults do not protect the users from STIs.

SECTION-B

86. Answer (3)

There are 30 recombinant therapeutics world over that have been approved for human use. But, only 12 recombinant therapeutics presently are being marketed in India. So, 18 recombinant therapeutics of these are not being marketed.

87. Answer (2)

Gonadotropins (FSH + LH) reach at the peak plasma concentration during the time of ovulation (ovulatory phase). Estrogen also reaches at its peak during the ovulatory phase of the menstrual cycle. Progesterone plasma levels reach at its peak during the luteal phase of a regular menstrual cycle.

88. Answer (1)

Brain is the site for processing of vision, hearing, speech, memory, intelligence, emotions and thoughts. It is the central processing organ of the body. It controls both voluntary and involuntary actions of the body.

89. Answer (3)

TV – 500 mL
IRV – 2500–3000 mL
ERV – 1000–1100 mL
RV – 1100–1200 mL
IC – 3000–3500 mL
EC – 1500–1600 mL
FRC – 2100–2300 mL
VC – 4000–4600 mL
TLC – 5100–5800 mL

90. Answer (2)

The largest fragment among 'a', 'b', 'c' and 'd' is fragment 'c'. So, the 'c' fragment will be closest to the cathode.

91. Answer (3)

Temporal, parietal – Paired cranial bones
Nasal, maxilla – Paired facial bones
Sphenoid, ethmoid – Unpaired cranial bones
Mandible, hyoid – Unpaired skull bones

92. Answer (1)

According to Hardy-Weinberg equilibrium,
 $p + q = 1$

$$\therefore q = 0.4$$

$$\therefore p = 1 - 0.4 \\ = 0.6$$

$$\text{Frequency of individuals with } Bb \text{ genotype} \\ = 2pq = 2Bb = 2 \times 0.6 \times 0.4 = 0.48$$

93. Answer (4)
In ZIFT, the zygote or early embryos with upto 8 blastomeres are transferred into the fallopian tube. If semen collected from the husband or a healthy donor is artificially introduced into the uterus, it is called IUI i.e., Intra Uterine Insemination.
94. Answer (3)
AIDS is caused by the Human Immunodeficiency Virus (HIV), a member of a group of viruses called retroviruses, which have an envelope enclosing the RNA genome.
95. Answer (4)
Frogs have tympanum with internal ears. They do not have external ears.
Their brain is enclosed in a bony structure called the brain box (cranium). Their feet have webbed digits that help in swimming.
96. Answer (3)
Neural system provides a point-to-point rapid coordination among organs. The neural coordination is fast but short lived.

97. Answer (4)
In 1983, Eli Lilly, an American company, prepared Humulin (Human insulin).
98. Answer (2)
Adrenal medullary hormones can increase the cardiac output. The adrenal medulla secretes two hormones called adrenaline and noradrenaline. These are commonly called catecholamines.
99. Answer (3)
Cnidarians are characterized by the presence of cnidoblasts.
Sea hare is a mollusc.
Sea cucumber and Sea lily are echinoderms.
100. Answer (2)
Psilophyton gave rise to conifers while seed ferns gave rise to cycads, dicotyledons and monocotyledons.

PHYSICS

SECTION-A

101. Answer (3)
We know,
Escape speed $v_e = \sqrt{2gR}$
Escape K.E. = $\frac{1}{2}mv_e^2 = mgR$
K.E. = (500) (9.8) (6.4×10^6)
K.E. = 31360×10^6 J
K.E. = 3.1×10^{10} J
102. Answer (2)
We Know,
Linear acceleration $\vec{a} = \vec{\alpha} \times \vec{r}$
For particles on diameter $r = 0$
 $\therefore \vec{a} = 0$
All particles on surface have same angular speed and thus different linear speeds.
103. Answer (4)
We know,
 $\omega^2 = \omega_0^2 + 2\alpha\theta$
 $\frac{\omega_0^2}{4} = \omega_0^2 + 2\alpha(36)(2\pi)$
 $\alpha = -\frac{3\omega_0^2}{4} \left(\frac{1}{144\pi} \right)$
Now, $0 = \frac{\omega_0^2}{4} - 2\alpha\theta$

$$-\frac{\omega_0^2}{4} = 2 \left(\frac{-3\omega_0^2}{4} \right) \left(\frac{1}{144\pi} \right) \theta$$

$$\therefore \theta = 24\pi = 12 \text{ rotations}$$

104. Answer (3)

We know,

$$\text{Strain} = \frac{\text{Stress}}{\text{Young's Modulus}}$$

$$\text{Strain} = \frac{F_{av}}{AY}$$

$$\text{Strain} = \frac{F}{2AY} \text{ or } \frac{F}{2SY} \quad [\because F_{av} = \frac{F}{2}]$$

105. Answer (4)

$$\lambda = \frac{h}{\sqrt{3mKT}}$$

$$\frac{\lambda_H}{\lambda_{He}} = \sqrt{\frac{m_{He}T_{He}}{m_HT_H}} = \sqrt{\frac{4(273+327)}{2(273+127)}}$$

$$= \sqrt{\frac{2(600)}{400}} = \sqrt{3}$$

106. Answer (2)

$$\begin{aligned} Q &= [m({}_1^2\text{H}) + m({}_1^3\text{H}) - m({}_2^4\text{He}) - m_n] \times 931.5 \text{ MeV} \\ &= [2.014102 + 3.016049 - 4.002603 - 1.008665] \times 931.5 \\ &= 0.018883 \times 931.5 \text{ MeV} \\ &= 17.59 \text{ MeV} \end{aligned}$$

107. Answer (3)

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

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

$$\Delta E = 1.6 \text{ eV}$$

108. Answer (3)

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

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

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

$$= (\overline{AB}) \cdot (\overline{AB})$$

$$Y = \overline{AB}$$

So output is 1 if $A = 1$, $B = 0$ and for any other cases output is 0.

109. Answer (4)

$$\frac{h_2}{h_1} = \frac{r_1}{r_2}$$

$$h_2 = 4h_1$$

$$= 4 \times 20$$

$$= 80 \text{ mm}$$

110. Answer (1)

We know, $\Delta Q = mc \Delta T$

Metals typically have lower specific heat capacity than wood and thus they have greater increase in temperature for same heat given.

111. Answer (2)

We know,

$$\left(\frac{dP}{dV} \right)_{\text{isothermal}} = -\frac{P}{V}$$

$$\therefore \text{Bulk modulus} = \left(\frac{-VdP}{dV} \right) = P$$

$$\text{and } \left(\frac{dP}{dV} \right)_{\text{Adiabatic}} = \frac{-\gamma P}{V}$$

$$\therefore \text{Its bulk modulus} = \gamma P$$

Also, Bulk modulus of isobaric ($dP = 0$) = 0

Bulk modulus of isochoric ($dV = 0$) = ∞

112. Answer (1)

Q and W will be different along these three paths.

But $Q - W$ or ΔU will be same along all three paths.

This is because Q and W are path functions but U is a state function.

Thus, $Q_1 - W_1 = Q_2 - W_2 = Q_3 - W_3 = \Delta U$.

113. Answer (3)

The emf will be induced

$$\varepsilon = -\frac{AdB}{dt}$$

So, the current will induced as loop is a closed circuit

114. Answer (4)

$$\text{Band width} = 2\Delta\omega = \frac{R}{L}$$

115. Answer (1)

$$v_1 = 0.4 \text{ m s}^{-1}$$

$$v_2 = 2v_1 = 0.8 \text{ m s}^{-1}$$

distance moved by 1 kg block = 1 m

Work done by tension = zero

distance moved by 2 kg block = 2 m

using work – energy theorem

$$\Delta KE = W_g + W_f$$

$$\frac{1}{2}(1)(0.4)^2 + \frac{1}{2}(2)(0.8)^2 = 10 - \mu mg \times 2$$

$$(0.08 + 0.64) = 10 - \mu \times 40$$

$$\mu \times 40 = 10 - 0.72$$

$$\mu = \frac{9.28}{40} = \frac{0.928}{4}$$

$$= 0.232$$

116. Answer (4)

$$P = F \cdot v$$

$$F = m(g + a) = 50 \times 12 \text{ N} = 600 \text{ N}$$

$$\text{Power} = 600 \times 2 \text{ W}$$

$$= 1200 \text{ W}$$

117. Answer (2)

$$q_0 = C_{\text{eff}} V$$

$$= 1 \times 10$$

$$= 10 \mu\text{C}$$

$$U = \frac{1}{2} \frac{Q^2}{C}$$

$$= \frac{1}{2} \times \frac{10 \times 10^{-6} \times 10 \times 10^{-6}}{2 \times 10^{-6}} \text{ J}$$

$$= 25 \mu\text{J}$$

118. Answer (3)

We know,

According to law of conservation of angular momentum

$$L_i = L_f$$

$$\left(\frac{1}{2} MR^2 \right) \omega = \left(\frac{1}{2} MR^2 + \frac{1}{2} \frac{M}{4} R^2 \right) \omega_f$$

$$M\omega = \left(\frac{5M}{4} \right) \omega_f$$

$$\omega_f = \frac{4}{5} \omega$$

119. Answer (2)

$$v = \sqrt{\frac{T}{\rho A}}$$

$$\frac{\Delta v}{v} \times 100 = \frac{1}{2} \frac{\Delta A}{A}$$

$$= \frac{1}{2} \times 4$$

$$= 2\%$$

120. Answer (1)

$$F_{\text{net}} = -kx$$

121. Answer (3)

$$\therefore [v] = [At] = [Bt^2]$$

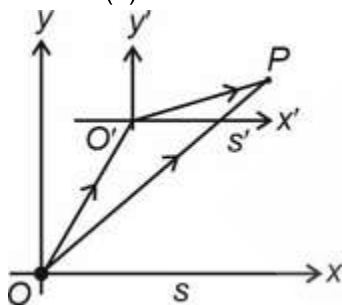
$$\therefore [A] = \frac{[v]}{[t]}, [B] = \frac{[v]}{[t^2]}$$

$$\frac{[A]}{[B]} = [T]$$

122. Answer (3)

As the velocity is given by slope of position time graph, the velocity becomes zero six times hence particle comes to rest six times.

123. Answer (3)



$$\vec{OP} = \vec{OO'} + \vec{O'P} \Rightarrow \vec{r}_{P,S} = \vec{r}_{S',S} + \vec{r}_{P,S'}$$

$$\text{Differentiating w.r.t. time} \Rightarrow \vec{V}_{P,S} = \vec{V}_{S',S} + \vec{V}_{P,S'}$$

$$\Rightarrow \vec{a}_{P,S} = \vec{a}_{P,S'} + \vec{O}$$

124. Answer (1)

The impulse on a body is equal to change in momentum.

125. Answer (1)

$$y = 2x \left[1 - \frac{x}{4} \right] \text{ and } y = x \tan \theta \left[1 - \frac{x}{R} \right] \Rightarrow R = 4 \text{ m}$$

126. Answer (2)

$$V_{\text{rms}} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3 \times 8.31 \times 300}{32 \times 10^{-3}}} \approx 483 \text{ m s}^{-1}$$

127. Answer (2)

$$\text{Work done by battery} = \varepsilon It$$

$$540 = \varepsilon \times 2 \times 3 \times 60$$

$$\varepsilon = \frac{540}{6 \times 60} = \frac{540}{360} = \frac{3}{2} \text{ V}$$

128. Answer (3)

Apply KCL in the circuit:

$$i_{\text{entry}} = i_{\text{exit}}$$

$$2 + i = 1 + 2 + 3$$

$$i = 4 \text{ A}$$

129. Answer (4)

$$B_0 = \frac{\mu_0 i}{2R}$$

$$B' = \frac{n \times \mu_0 i}{2R'}; 2\pi R' \times n = 2\pi R \Rightarrow R' = \frac{R}{n}$$

$$B' = \frac{n \times \mu_0 i}{2 \frac{R}{n}} = \frac{n^2 \mu_0 i}{2R} = n^2 B_0$$

130. Answer (4)

Electron is at rest initially, therefore when the fields are switched on, electric field will move the electron in -ve x direction. Because the magnetic field is towards +ve x axis it will not apply any force on moving electron hence it will continue to move towards -ve x axis without any deflection.

131. Answer (1)

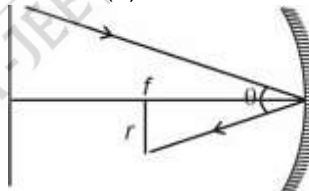
$$\text{Magnetic moment } (M) = m \times l$$

	Magnet 1	Magnet 2	Magnet 3
Pole strength	m_0	$2m_0$	$3m_0$
Length	l_0	$2l_0$	l_0

$$M_1 : M_2 : M_3 = m_0 l_0 : 2m_0 \times 2l_0 : 3m_0 \times l_0$$

$$M_1 : M_2 : M_3 = 1 : 4 : 3$$

132. Answer (1)



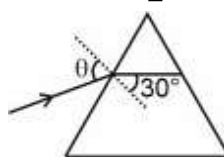
$$\Rightarrow \frac{\theta}{2} = \frac{r}{f} \Rightarrow r = \frac{f\theta}{2}$$

$$\text{Diameter } D = 2r = f\theta$$

133. Answer (4)

Given case is the case of minimum deviation

$$\Rightarrow r_1 = r_2 = \frac{A}{2} = 30^\circ$$



Using Snell's law

$$1 \cdot \sin \theta = \mu \sin 30^\circ$$

$$\sin \theta = \sqrt{2} \times \frac{1}{2}$$

$$\theta = 45^\circ$$

134. Answer (1)

$$\text{In medium, } \theta' = \frac{\theta}{\mu} = \theta' = \frac{0.08 \times 3}{4}$$

$$= 0.02 \times 3$$

$$\theta' = 0.06^\circ$$

135. Answer (1)

Change in electric field give rise to magnetic field.

SECTION-B

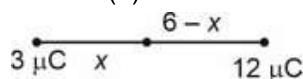
136. Answer (4)

$$F_{\text{net}} = 0$$

$$\tau_{\text{net}} = PE \sin \theta$$

Net torque may be zero or non-zero and net force will be always zero.

137. Answer (4)



$$\frac{3k}{x^2} = \frac{12k}{(6-x)^2}$$

$$6 - x = 2x$$

$$x = 2 \text{ cm}$$

138. Answer (3)

$$I = \frac{200}{10 \text{ k}\Omega} = 20 \text{ mA}$$

$$V_C = IX_C = 20 \text{ mA} \times \frac{1}{100 \times 10^{-6}} \Omega$$

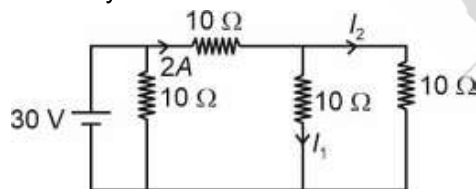
$$V_C = IX_C = 20 \text{ mA} \times 10^4 \Omega$$

$$= 200 \text{ V}$$

$$V_L = 200 \text{ V}$$

139. Answer (1)

In steady state inductor will behave as short circuit



$$I_2 = 1 \text{ A}$$

$$U = \frac{1}{2} \times 2 \times (1)^2$$

$$U = 1 \text{ J}$$

140. Answer (1)

We know,

$$T = \sqrt{\frac{3\pi}{\rho G}}$$

Thus, T is independent of R and it depends only on density of planet.

Hence, it will remain same

141. Answer (4)

$$E = \frac{dV}{dx}$$

$$= \frac{(6-0)}{(2-0)}$$

$$= 3 \text{ V/m}$$

142. Answer (3)

For spherical bubble excess pressure inside bubble

$$P = \frac{4T}{R}$$

If T i.e. surface tension increases then the surface tension tries to minimize surface area. Hence radius decreases.

143. Answer (1)

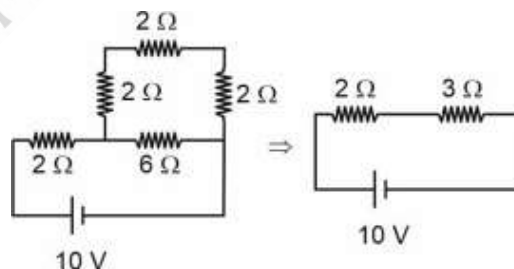
During convection, hotter and less dense fluid rises, while cooler and denser fluid sinks. In the pot of boiling water, the bottom part experiences heating from the stove. As the water near the bottom absorbs heat, it becomes less dense and rises allowing cooler water to take its place.

144. Answer (3)

Since the particle moves with constant speed hence the change in magnitude of velocity is zero.

145. Answer (4)

In steady state capacitor will act as an open circuit. Therefore, the simplified circuit will be



$$P = \frac{V^2}{R} = \frac{10 \times 10}{5} = 20 \text{ W}$$

146. Answer (2)

$$\left[\frac{dx}{dt} \right] = [LT^{-1}]$$

$$\left[\frac{d^2x}{dt^2} \right] = [LT^{-2}]$$

$$\left[\frac{dx}{dt} \right]^2 = [LT^{-1}]^2 = [L^2T^{-2}]$$

147. Answer (3)

Energy required to transfer an electron from E_1 level to E_4 level is

$$E = E_4 - E_1 = \frac{-13.6(3)^2}{(4)^2} - \left(\frac{-13.6(3)^2}{(1)^2} \right)$$

$$= -7.65 + 122.4$$

$$E = 114.75 \text{ eV}$$

$$\text{Wavelength of this radiation} \Rightarrow \lambda = \frac{12400}{114.75} \text{ \AA}$$

$$\lambda = 108.1 \text{ \AA}$$

148. Answer (4)

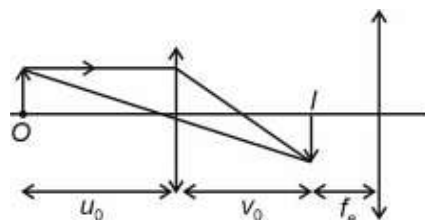
As per given data, n_e is negligible as compared to n_h , so

$$\sigma \approx en_h \mu_h$$

$$\sigma = (1.6 \times 10^{-19}) \times (6 \times 10^{20}) \times (0.052)$$

$$\sigma = 4.992 \Omega^{-1} \text{ m}^{-1}$$

149. Answer (2)



$$\Rightarrow \frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow v = \frac{uf}{u+f} = \frac{-3 \times 2}{-3+2} = 6 \text{ cm}$$

$$\text{So, } L = 6 + 3 = 9 \text{ cm}$$

150. Answer (2)

$$I_n = \frac{4I_0}{[(2n+1)\pi]^2}$$

On solving

$$I_0 : I_1 : I_2 \dots = 1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2}$$

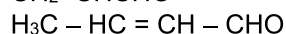
CHEMISTRY

SECTION-A

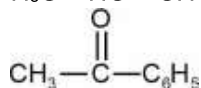
151. Answer (3)



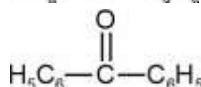
Acrolein



Crotonaldehyde

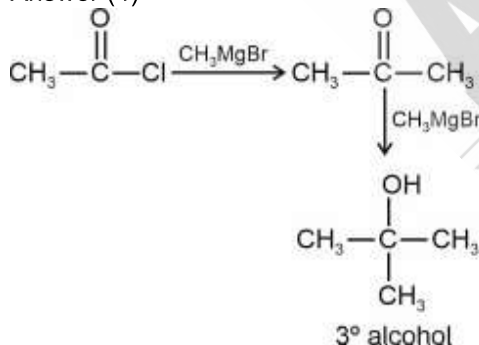


Acetophenone



Benzophenone

152. Answer (4)



153. Answer (2)

Addition of catalyst gives an alternative path to the reaction with lesser activation energy, that results into increase in rate of reaction.

154. Answer (4)

Balanced equation is as



155. Answer (4)

$$\Delta H = \Delta_{\text{neu}}H + 57.1$$

$$= -49.86 + 57.1$$

$$= 7.24 \text{ kJ mol}^{-1}$$

156. Answer (1)

Element	$\Delta_f H / \text{kJ mol}^{-1}$
N	1402
O	1314
Na	496
Mg	737

157. Answer (2)

Element	$\Delta_{\text{eg}} H / \text{kJ mol}^{-1}$
O	-141
S	-200
F	-333
Cl	-349

158. Answer (2)

More acidic solution will furnish more number of ions and hence increases the conductivity of the solution.

159. Answer (4)

$$\text{pH} = \frac{1}{2} [\text{pK}_w - \text{pK}_b - \log C]$$

$$5.13 = \frac{1}{2} [14 - \text{pK}_b - \log(10^{-1})]$$

$$5.13 \times 2 = 15 - \text{pK}_b$$

$$10.26 = 15 - \text{pK}_b$$

$$\text{pK}_b = 4.74$$

$$\text{K}_b = 10^{-4.74}$$

160. Answer (3)

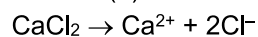
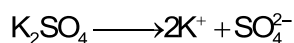
H_2O , NH_3 , CN^- are Lewis bases as can donate electron pair.

161. Answer (1)

Henry's law constant is inversely proportional to solubility.

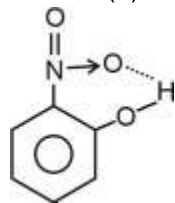
Solubility decreases with increase in temperature.

162. Answer (1)

Van't Hoff factor $i = 3$ 

$$i = 3$$

163. Answer (1)



o-nitrophenol exhibit intramolecular H-bonding

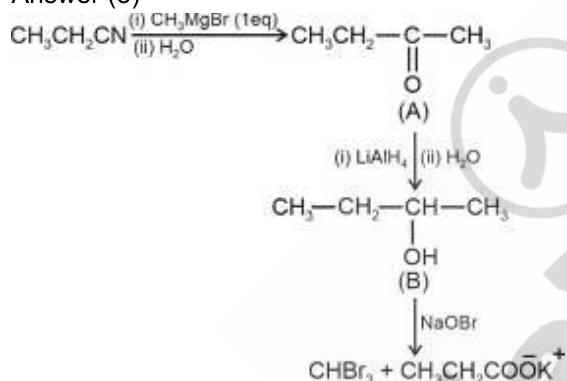
164. Answer (3)

Two unpaired electrons are present as $\pi^* 2p_x^1$ and $\pi^* 2p_y^1$.

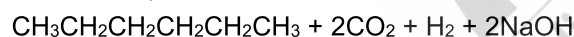
165. Answer (1)

Fructose is a reducing sugar and it reduces Tollens' reagent. It is a ketohexose.

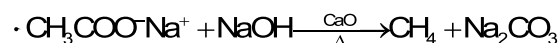
166. Answer (3)



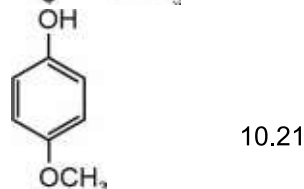
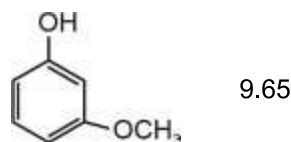
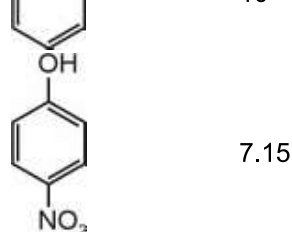
167. Answer (2)



168. Answer (1)

The rate of reaction of alkanes with halogens is:
 $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$ 

169. Answer (2)

Compounds pK_a 

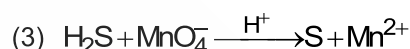
170. Answer (2)

The enthalpy change accompanying the complete neutralisation of one mole-equivalent of a strong acid with a strong base or vice versa in dilute solutions is -57.1 kJ .

171. Answer (3)

(1) Maximum percentage of lanthanoid metal (95%) is found in Mischmetal.

(2) The actinoids show in general +3 oxidation state

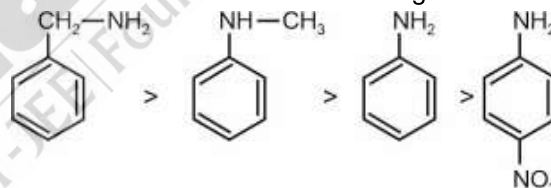


(4) CrO is basic

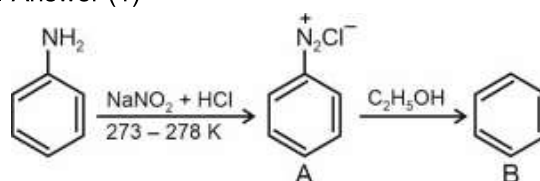
172. Answer (4)

Basic strength of amines depends on the availability of lone pair of electron on nitrogen atom.

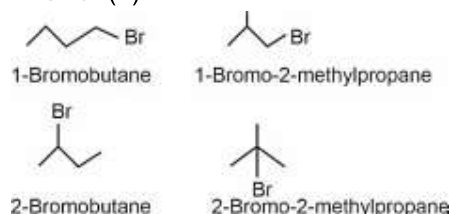
∴ The correct order of basic strength is



173. Answer (1)



174. Answer (1)



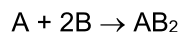
175. Answer (1)

The correct order of field strength is
 $\text{SCN}^- < \text{OH}^- < \text{NCS}^- < \text{CN}^-$

176. Answer (1)

$$\text{Mole fraction of solute} = \frac{0.2}{1.2} = \frac{1}{6}$$

177. Answer (3)



\therefore 1 mole of A reacts with 2 moles of B.

\therefore 3 moles of B reacts with 1.5 moles of A.

So, B is the limiting reagent.

Maximum number of moles of AB_2 formed is 1.5 moles

178. Answer (1)

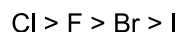
As we move away from the nucleus energy difference between consecutive shells decreases.

$E_5 \rightarrow E_4$ transition will emit least energetic photon.

179. Answer (1)

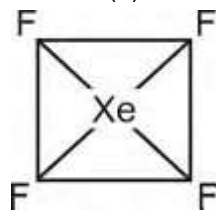
Halogens readily accept one electron to acquire noble gas electronic configuration.

Negative electron gain enthalpy of halogens follow the order.



Alkali metals attain stable electronic configuration by adding an electron.

180. Answer (3)



There are four 90° bond angles.

181. Answer (3)

The oxide in which the central atom can increase its oxidation state, (i.e. can get oxidised) can act as a reducing agent.

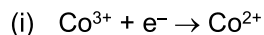
In SO_3 , S is in its highest oxidation state (+6) which cannot be exceeded further so, it cannot act as a reducing agent.

Oxide	Oxidation state of central atom	Highest Oxidation state of central atom
1. CO	+2	+4
2. N_2O	+1	+4
3. SO_3	+6	+6
4. ClO_2	+4	+7

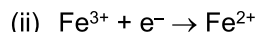
182. Answer (1)

The element with maximum tendency to get reduced to act as an oxidising agent gets the top position.

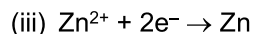
Due to the positive value of SRP, ($Ag^+ + e \rightarrow Ag$) will get the top position.

 Reaction E°/V


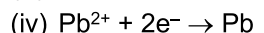
1.81



0.77



-0.76

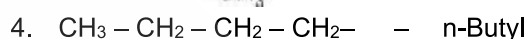
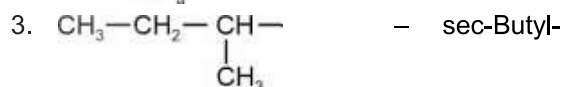
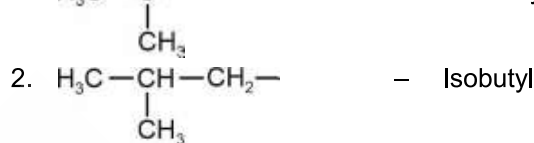


-0.13

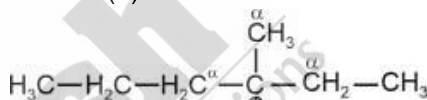
183. Answer (1)

In CCl_4 carbon does not have an empty orbital in outermost shell hence hydrolysis will not take place.

184. Answer (2)



185. Answer (3)



7 α -hydrogen atoms are involved in hyperconjugation

SECTION-B

186. Answer (4)

Oxidising power of metal ions increases with increase in standard reduction potential value.

187. Answer (1)

$$[OH^-] = \frac{0.2 \times 1000}{40 \times 100}$$

$$[OH^-] = 0.05 \text{ M}$$

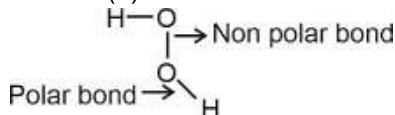
$$pOH = -\log(5 \times 10^{-2})$$

$$pOH = 2 - \log 5$$

$$pH = 14 - 2 + \log 5$$

$$= 12.7$$

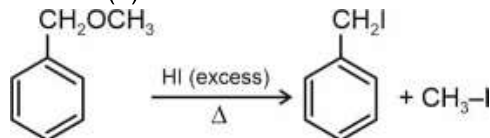
188. Answer (4)



189. Answer (3)

Cellulose occurs exclusively in plants and it is the most abundant organic substance in plant kingdom and composed of only β -D-glucose units

190. Answer (2)



191. Answer (3)

For isomeric alkane B.P. decreases as branching increases.

192. Answer (2)

$$W = -p(\Delta V) = -\left(\frac{nRT}{V}\right)(V_f - V_i)$$

\Rightarrow Work done by the system is already negative.

Hence, we can write

$$W = \left(\frac{\frac{1.6 \times 10^3}{32} \times 8.314 \times 273.15}{V} \right) (4V - V)$$

$$= \left(\frac{0.05 \times 10^3 \times 8.314 \times 273.15}{V} \right) (3V)$$

$$= 340.645 \times 10^3 \text{ J}$$

$$= 340645 \text{ J}$$

$$= 81105.9 \text{ cal}$$

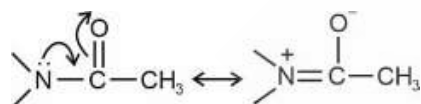
$$= 81.106 \text{ kcal}$$

193. Answer (1)

Order of melting point $W > Os > Ru > Cr$

194. Answer (2)

The lone pair of electrons on nitrogen of acetanilide interacts with oxygen atoms due to resonance as shown below:



Hence, the lone pair of electrons on nitrogen is less available for donation to benzene ring in resonance (+M_{effect})

195. Answer (3)

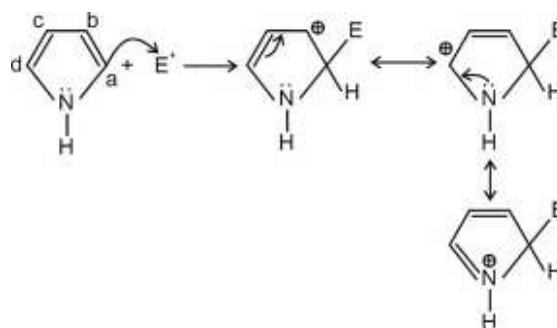
In $[\text{Co}(\text{NH}_3)_6]^{3+}$ is called an inner orbital or spin paired complex as Co^{3+} ion uses inner d -orbitals in hybridisation.

\therefore Hybridisation of Co in $[\text{Co}(\text{NH}_3)_6]^{3+}$ is d^2sp^3 .

196. Answer (4)

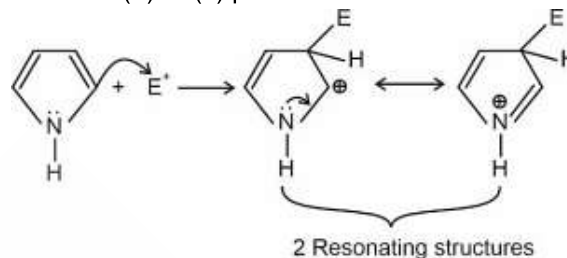
Positions (a) and (d) are equivalent. Similarly positions (b) and (c) are equivalent.

Attack of electrophile at position (a) or (d)



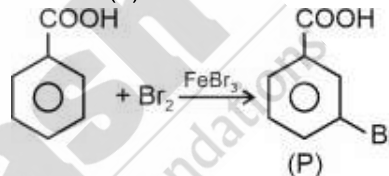
3 Resonating structures

Attack at (b) or (c) position :



Hence, possibility of attack of electrophile will be maximum at the positions (a) and (d).

197. Answer (3)



198. Answer (1)

$A \rightarrow B$

$[B] = kt$

$$= 10^{-4} \times 10 \times 60$$

$$= 0.06 \text{ mol}$$

$$= 0.06 \times 40 \text{ g}$$

$$= 2.4 \text{ g}$$

199. Answer (4)

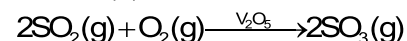
$$\Delta P = 18 \times 10^{-25} \text{ g cm s}^{-1}$$

$$m\Delta v = 18 \times 10^{-25} \text{ g cm s}^{-1}$$

$$\Delta v = \frac{18 \times 10^{-25} \text{ g cm s}^{-1}}{9 \times 10^{-28} \text{ g}}$$

$$= 2 \times 10^3 \text{ cm s}^{-1}$$

200. Answer (2)



$$\Delta H = -196.6 \text{ kJ mol}^{-1}$$

The reaction is exothermic and reversible.

