

**CODE-A****Corporate Office:** Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456**MM : 720****Mock Test-02****Time : 3 Hrs. 20 Min.****Answers**

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

MM : 720

Time : 3 Hrs. 20 Min.

Hints and Solutions

PHYSICS

SECTION-A

1. Answer (3)

- Rate of nuclear reaction is controlled by control rods made of cadmium or boron.
- Heavy water, graphite and beryllium oxide are used as moderator to slow down the fast neutrons.

2. Answer (1)

In α -particle scattering experiment, only about 0.14% of incident α -particles scatter by more than 1° and about 1 in 8000 particles deflect by more than 90° . Few of the particles may be reflected back.

3. Answer (2)

$$eV = \frac{1}{2}mv_0^2$$

$$v_0 = \sqrt{\frac{2eV}{m}}$$

$$R = \frac{mv_0}{qB}$$

$$R = \frac{m}{eB} \sqrt{\frac{2eV}{m}}$$

$$= \sqrt{\frac{2Vm}{eB^2}}$$

4. Answer (3)

Beat frequency

$$f = f_1 - f_2$$

$$= 384 - 380$$

$$= 4$$

$$\text{Time taken two successive maximum} = \frac{1}{f}$$

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

Time taken in two successive maxima and minima

$$= \frac{1}{2f}$$

$$= \frac{1}{8} \text{ s}$$

5. Answer (4)

$$900 + 900 = 5 \times V_s + 330 \times 5$$

$$5V_s = 1800 - 1650$$

$$V_s = 30 \text{ m/s}$$

6. Answer (2)

In forward bias diffusion dominant and drift is dominant in reverse bias.

7. Answer (3)

$$\frac{90}{100} I_E = I_C$$

$$I_E = \frac{10}{0.9} \text{ mA} = 11.11 \text{ mA}$$

$$I_B = I_E - I_C = 11.11 - 10 = 1.11 \text{ mA}$$

8. Answer (3)

$$\frac{\Delta T}{T} \times 100 = \frac{1}{5 \times 25} \times 100$$

$$= 0.8\%$$

9. Answer (1)

Ampere is the fundamental unit.

10. Answer (4)

Speed of the block

$$v = \frac{2\pi \times (25 \times 10^{-2})}{2} = 0.785 \text{ m/s}$$

$$a = \frac{v^2}{r} = 2.4 \text{ m/s}^2$$

$$\text{Normal reaction } N = \frac{mv^2}{r} = 0.48 \text{ N}$$

11. Answer (4)

$$\Delta L = \frac{FL}{AY}$$

$$\Rightarrow F = \frac{AY\Delta L}{L}$$

$$\Rightarrow F = \frac{10^{-5} \times 2 \times 10^{11} \times 1}{10}$$

$$= 2 \times 10^5 \text{ N}$$

12. Answer (3)

$$C = C_v + \frac{R}{1-x}$$

$$= \frac{5}{2}R + \frac{R}{1-x} = \frac{5}{2}R - \frac{R}{x-1}$$

C is negative, if

$$x-1 < \frac{2}{5}$$

$$x < 1.4$$

\therefore If x lies between 1 and 1.4, the C is negative.

13. Answer (3)

$$PV = nRT$$

$$n = \frac{(\rho gh)V}{RT}$$

$$n = \frac{13.6 \times 10^3 \times 9.8 \times 10^{-5} \times 300 \times 10^{-6}}{8.31 \times 300}$$

$$n = 16 \times 10^{-8}$$

$$\text{Number of molecules} = nN_A$$

$$= 16 \times 10^{-8} \times 6.023 \times 10^{23}$$

$$= 9.6 \times 10^{16}$$

14. Answer (2)

Paramagnetic and ferromagnetic materials have non zero permanent magnetic moment of their own. Only atoms of diamagnetic materials have zero permanent magnetic moment.

15. Answer (3)

$$z = \sqrt{R^2 + (\omega L)^2}$$

$$= \sqrt{R^2 + 4\pi^2 f^2 L^2}$$

$$= 26 \Omega$$

$$\text{Now, power} = V_{\text{rms}} I_{\text{rms}} \cos \phi = 6.5 \times \frac{6.5}{z} \times \frac{R}{z}$$

$$= \frac{6.5 \times 6.5 \times 10}{26}$$

$$= \frac{5}{8} \text{ W}$$

16. Answer (1)

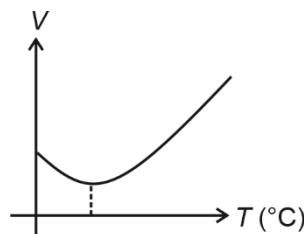
$$\frac{dT}{dt} = \frac{eA\sigma}{mC} (T^4 - T_0^4)$$

$$\Rightarrow \frac{dT}{dt} \propto \frac{1}{m}$$

\Rightarrow Mass of hollow sphere is less hence it will cool at a faster rate.

17. Answer (2)

The correct variation is shown by



18. Answer (1)

$$\frac{l_1}{l_2} = \frac{1}{25} \Rightarrow \frac{a_1}{a_2} = \frac{1}{5} \Rightarrow \frac{l_{\text{max}}}{l_{\text{min}}} = \frac{(a_1 + a_2)^2}{(a_1 - a_2)^2} = \frac{9}{4}$$

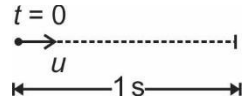
19. Answer (1)

According to Ampere – Maxwells' law

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 [ic + id]$$

20. Answer (3)

Let the first observation was taken when the body travelled 's' distance



$$u = \sqrt{2as}$$

$$\text{Distance travelled in } 1s = 20 = u + \frac{1}{2}a(1)^2$$

$$20 = u + \frac{a}{2} \quad \dots(i)$$

Distance travelled in 2s

$$= 20 + 40 = u(2) + \frac{1}{2}a(2)^2$$

$$60 = 2u + 2a$$

$$30 = u + a \quad \dots(ii)$$

Equation (ii) - (i)

$$10 = \frac{a}{2} \Rightarrow a = 20 \text{ m/s}^2$$

By equation (i)

$$20 = u + \frac{20}{2}$$

$$u = 10 = \sqrt{2as}$$

$$s = 2.5 \text{ m}$$

21. Answer (2)

Excess pressure inside the bubble which is greater than atmospheric pressure

$$= \frac{2T}{r} + \rho gh$$

$$= \frac{2 \times 0.075}{1 \times 10^{-3}} + 0.10 \times 10^3 \times 10$$

$$= 150 + 1000 = 1150 \text{ N/m}^2$$

22. Answer (2)

Dipole moment

$$p = ql = 1.6 \times 10^{-19} \times 1.28 \times 10^{-10}$$

$$= 2.048 \times 10^{-29} \text{ Cm}$$

Electric potential

$$V = \frac{1}{4\pi\epsilon_0} \frac{p}{r^2} = 9 \times 10^9 \times \frac{2.048 \times 10^{-29}}{144 \times 10^{-20}}$$

$$= 0.13 \text{ V}$$

23. Answer (4)

$$R = 2.3 \times 10^2 \Omega$$

$$= 23 \times 10^1 \Omega$$

↑

Brown colour

24. Answer (2)

As per Ohm's law

$$J = \sigma E$$

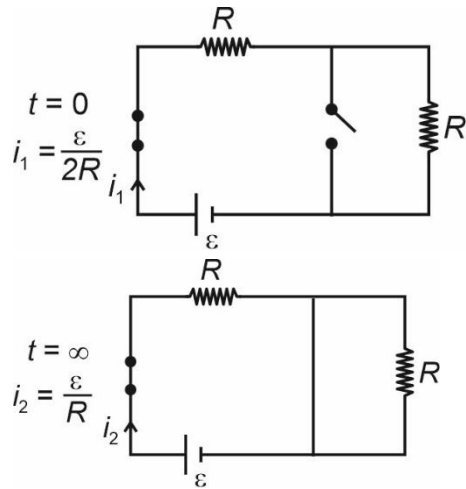
$$\frac{i}{A} = \frac{1}{\rho} E$$

$$E = \frac{\rho i}{A} = \frac{1.7 \times 10^{-8} \times 1}{2 \times 10^{-6}}$$

$$E = 0.85 \times 10^{-2}$$

$$E = 8.5 \times 10^{-3} \text{ V/m}$$

25. Answer (2)



26. Answer (1)

$$A = A_0 e^{\frac{-bt}{2m}}$$

$$\Rightarrow \frac{A_0}{2} = A_0 e^{\frac{-bT}{2m}} \quad \dots(i)$$

$$\text{And } \frac{A_0}{4} = A_0 e^{\frac{-bT'}{2m}} \quad \dots(ii)$$

$$\Rightarrow T' = 2T$$

27. Answer (4)

$$I_{\text{Solid sphere}} = \frac{2}{5} mR^2$$

$$I_{\text{Hollow sphere}} = \frac{2}{3} mR^2$$

$$I_{\text{Solid cylinder}} = \frac{1}{2} mR^2$$

$$I_{\text{Hollow cylinder}} = mR^2$$

28. Answer (3)

$$0 = \omega + \alpha_1 T$$

$$\Rightarrow \alpha_1 = -\frac{\omega}{T}$$

$$\text{Now } \theta_1 = \omega T + \frac{1}{2} \left(\frac{-\omega}{T} \right) T^2$$

$$\Rightarrow \theta_1 = \frac{1}{2} \omega T$$

$$\text{And, } \omega = 0 + \alpha_2 \left(\frac{T}{2} \right)$$

$$\Rightarrow \alpha_2 = \frac{2\omega}{T}$$

$$\text{Now, } \theta_2 = 0 + \frac{1}{2} \left(\frac{2\omega}{T} \right) \left(\frac{T}{2} \right)^2$$

$$= \frac{\omega T}{4}$$

$$\Rightarrow \theta = \omega T \left(\frac{1}{2} + \frac{1}{4} \right) = \frac{3\omega T}{4}$$

29. Answer (3)

As object moves from $2f$ to f , image will move from $2f$ to infinity on the other side away from lens.

30. Answer (2)

Deviation produced by a mirror

$$\delta = 180^\circ - 2i = 120^\circ$$

31. Answer (2)

After initial contact and then separation each sphere will be having $-2 \mu\text{C}$ charge

$$\text{So, } n = \frac{Q}{e} = \frac{-2 \times 10^{-6}}{-1.6 \times 10^{-19}} = 1.25 \times 10^{13}$$

Hence, sphere will have 1.25×10^{13} electron in excess.

32. Answer (1)

$$\tau = pE \sin \theta$$

$$\tau = q l E \sin \theta$$

$$\Rightarrow q = \frac{\tau}{E l \sin \theta} = \frac{8}{4 \times 10^5 \times 2 \times 10^{-2} \times \frac{3}{5}}$$

On solving $q = 1.67 \text{ mC}$

33. Answer (3)

$$v = u + at$$

$$30 = 0 + a \times 10 \Rightarrow a = 3 \text{ m s}^{-2}$$

Now, force exerted by the engine

$$F - 500 = ma$$

$$F = 500 + 1000 \times 3 = 3500 \text{ N}$$

Distance travelled during this,

$$s = ut + \frac{1}{2} at^2$$

$$= 0 + \frac{1}{2} \times 3 \times 100$$

$$= 150 \text{ m}$$

Hence, work done

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

$$= 3500 \times 150$$

$$= 5.25 \times 10^5 \text{ J}$$

34. Answer (2)

$$\text{Horizontal range } R = \frac{u^2 \sin 2\theta}{g}$$

In this case, $\sin 2\theta$ is the largest for $\theta = 42^\circ$ as compared that for $\theta = 27^\circ, 57^\circ$ and 68°

35. Answer (2)

Escape velocity

$$v_e = \sqrt{\frac{Gm}{R}}$$

$$v_e \propto \sqrt{m} \quad [G \text{ and } R \text{ are constant here}]$$

$$\Rightarrow \frac{v_{e1}}{v_{e2}} = \frac{\sqrt{m_1}}{\sqrt{m_2}} = \sqrt{\frac{m}{4m}}$$

$$\Rightarrow v_{e2} = 2v_{e1}$$

$$= 2 \times 60 = 120 \text{ km/s}$$

SECTION-B

36. Answer (3)

Net gravitational potential on the surface of the shell

$$V_{\text{net}} = V_{\text{due to particle}} + V_{\text{due to shell}}$$

$$= \frac{-Gm}{R} + \left[\frac{-G \times 3m}{R} \right]$$

$$= \frac{-4Gm}{R}$$

37. Answer (4)

On applying momentum conservation.

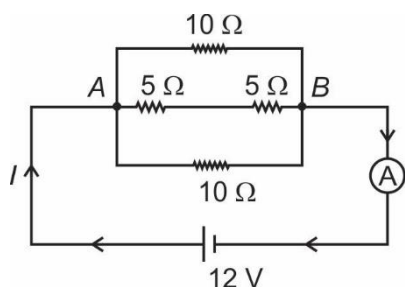
$$m_1 \vec{v}_1 + m_2 \vec{v}_2 = (m_1 + m_2) \vec{v}_0$$

$$\Rightarrow m(4\hat{i} + 3\hat{j}) + m(\hat{i} + 3\hat{j}) = (m + m) \vec{v}_0$$

$$\Rightarrow \vec{v}_0 = \frac{5\hat{i} + 6\hat{j}}{2} = \frac{5}{2}\hat{i} + 3\hat{j}$$

38. Answer (4)

Circuit can be redrawn as



$$R_{\text{eq}}|_{AB} = \frac{10}{3} \Omega$$

$$\text{Current } I = \frac{12}{R_{\text{eq}}|_{AB}} = \frac{12 \times 3}{10} = 3.6 \text{ A}$$

39. Answer (2)

$$\text{Energy stored in capacitor} = \frac{1}{2} CV^2 = ms\Delta T$$

$$V^2 = \frac{2ms\Delta T}{C}$$

$$V = \sqrt{\frac{2ms\Delta T}{C}}$$

40. Answer (4)

Photocurrent is inversely proportional to the square of distance

$$I \propto \frac{1}{r^2} \Rightarrow \frac{I_1}{I_2} = \left(\frac{r_2}{r_1} \right)^2$$

41. Answer (4)

- Surface tension of a liquid increases on adding soluble impurity to a liquid.
- Viscosity of a liquid decreases with increase in temperature of the liquid.
- If angle of contact of a liquid and a solid surface is greater than 90° , then the liquid will not wet the surface of the solid.

42. Answer (2)

$$D \sin \theta = n\lambda$$

$$\sin \theta \approx \theta = \frac{y}{d}$$

$$\Rightarrow \frac{Dy}{d} = n\lambda \Rightarrow y = \frac{n\lambda d}{D}$$

$$\Rightarrow \text{For first dark fringe, } y = \frac{\lambda d}{D}$$

$$\text{Hence, required distance } r = 2y = \frac{2\lambda d}{D}$$

43. Answer (3)

$$r = a + l \sin 30^\circ$$

$$= 1.4 \text{ m}$$

$$T \cos 30^\circ = mg \quad \dots (i)$$

$$T \sin 30^\circ = m r \omega^2 \quad \dots (ii)$$

On solving (i) and (ii)

$$\omega \approx 2 \text{ rad/s and } \omega = \frac{2\pi n}{60} \Rightarrow n \approx 19 \text{ rpm}$$

44. Answer (3)

$$TV^{n-1} = C$$

$$(pV)V^{n-1} = C$$

$$pV^n = C$$

$$\text{Bulk modulus } B = \frac{dPV}{\Delta V}$$

For $PV^n = \text{constant}$

$$\Rightarrow \frac{dP}{\Delta V} = -\frac{nP}{V}$$

$$\text{Hence, } B = nP$$

45. Answer (1)

45° phase angle means,

$$X_L = R$$

$$2\pi fL = R$$

$$L = 0.0159 \text{ H}$$

$$L = 16 \text{ mH}$$

46. Answer (1)

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

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

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

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

47. Answer (1)

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

$$h = \lambda p$$

$$n_1 u_1 = n_2 u_2$$

$$n_1 [M_1 L_1^2 T_1^{-1}] = n_2 [M_2 L_2^2 T_2^{-2}]$$

$$\frac{n_1}{n_2} = \left[\frac{10^{-3}}{1} \times 10^{-4} \times 1 \right]$$

$$\frac{n_1}{n_2} = 10^{-7}$$

$$\frac{u_1}{u_2} = \frac{n_2}{n_1}$$

$$= 10^7$$

48. Answer (3)

Magnetic field due to a long straight wire

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

$$\frac{B}{B'} = \frac{10}{5}$$

$$B' = \frac{B}{2}$$

49. Answer (2)

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

(For glass equiconvex lens)

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

(For water equiconvex lens)

$$\frac{1}{f_{\text{net}}} = \frac{1}{f} + \frac{1}{f'} + \frac{1}{f}$$

$$= \frac{1}{R} - \frac{2}{3R} + \frac{1}{R}$$

$$= \frac{4}{3R} = \frac{4}{3f}$$

$$\Rightarrow f' = \frac{3f}{4}$$

50. Answer (3)

Energy lost per unit time = power

$$\text{Power} = \tau \cdot \omega$$

$$= (5) (20)$$

$$= 100 \text{ W}$$

CHEMISTRY

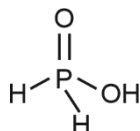
SECTION-A

51. Answer (2)

N_2O_3 is a blue solid at room temperature

52. Answer (1)

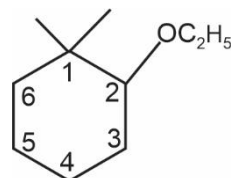
Hypophosphorous acid: H_3PO_2



53. Answer (1)

Alkyl iodides are often prepared by the reaction of alkyl chloride/bromides with NaI in dry acetone. This reaction is known as Finkelstein reaction.

54. Answer (3)



2-Ethoxy-1, 1-dimethylcyclohexane

55. Answer (4)

In Sandmeyer reaction, Cl^- , Br^- and CN^- nucleophiles can easily be introduced in the benzene ring.

56. Answer (2)

- Elastomers : Buna-S
- Fibres : Terylene
- Thermoplastic polymers : Polystyrene

- Thermosetting polymers : Bakelite

57. Answer (1)

Aspirin has analgesics and antipyretic properties.

58. Answer (2)

Sodium dichromate is more soluble in water than potassium dichromate.

59. Answer (4)

Feldspar, mica and asbestos exist as silicates minerals in nature whereas glass is an important man-made silicate.

60. Answer (1)

Li gives crimson red coloured flame in flame test whereas Mg does not give flame test.

61. Answer (3)

For $4d_{yz}$ orbital, $n = 4$ and $l = 2$

Radial nodes $= n - l - 1$

$$= 4 - 2 - 1 = 1$$

Angular nodes $= l = 2$

62. Answer (2)

Sodium is the most electropositive element among the given elements due to its maximum size.

63. Answer (2)

$$u_{av} = \sqrt{\frac{8RT}{\pi M}}$$

$$\frac{u_{He}}{u_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} = \sqrt{\frac{16}{4}} = \frac{2}{1}$$

64. Answer (3)

Maximum prescribed concentration of Mn in drinking water is 0.05 ppm.

65. Answer (2)

In fcc unit cell, the distance between face centre and body centre is $\frac{a}{2}$.

66. Answer (4)

For fcc unit cell, $Z = 4$

Number of atom lost due to Schottky defect

$$= 4 \times \frac{5}{100} = 0.2$$

\therefore Effective number of atoms per unit cell

$$= 4 - 0.2 = 3.8$$

67. Answer (2)

Since $E^\circ_{Ag^+/Ag} > E^\circ_{H^+/H_2}$ So Ag will not react with dil. HCl solution.

68. Answer (1)

At 500-800 K, lower temperature range in blast furnace CO(g) acts as reducing agent.

69. Answer (3)

Due to small size of Be^{2+} , BeH_2 is covalent in nature.

70. Answer (3)

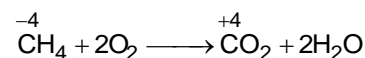
C_2H_5OH : Molar Mass $= 12 \times 2 + 6 \times 1 + 16 = 46$

$$\% \text{ of Carbon} = \frac{24}{46} \times 100 = 52.17$$

71. Answer (4)

Exothermic reaction may or may not be spontaneous in nature.

72. Answer (2)



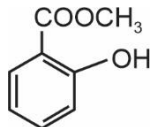
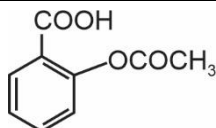
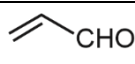
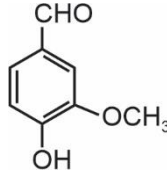
Change in oxidation state of carbon

$$= (+4) - (-4) = 8$$

73. Answer (4)

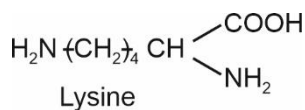
C-Cl bond in chlorobenzene has double bond character hence least reactive towards nucleophile substitution reaction.

74. Answer (2)

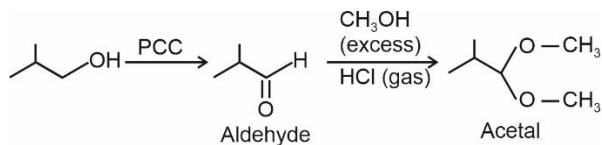
| | |
|--|--------------------|
|  | Oil of wintergreen |
|  | Aspirin |
|  | Acrolein |
|  | Vanillin |

75. Answer (1)

Amino acid which contains more number of amino group than carboxyl groups is called basic amino acid.



76. Answer (4)



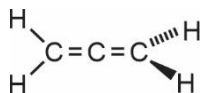
77. Answer (4)

| Complex ion | No. of unpaired electron(s) |
|-----------------------------------|-----------------------------|
| $[\text{CoF}_6]^{3-}$ | 4 |
| $[\text{Co}(\text{NH}_3)_6]^{3+}$ | 0 |
| $[\text{NiCl}_4]^{2-}$ | 2 |
| $[\text{Fe}(\text{CN})_6]^{3-}$ | 1 |

$$\text{Bohr magneton} = \sqrt{n(n+2)} \text{ BM} = \sqrt{1(1+2)}$$

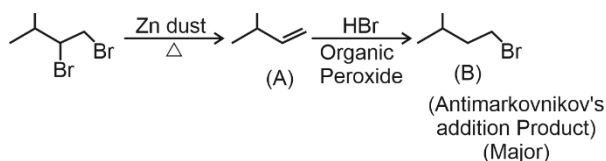
$$= 1.73 \text{ BM}$$

78. Answer (1)



Propadiene is non-planar molecule. It possesses plane of symmetry hence it is achiral molecule and optically inactive compound.

79. Answer (4)



80. Answer (3)

In paints, the dispersed phase is solid while dispersion medium is liquid.

81. Answer (1)

$$m = \frac{0.4 \times 1000}{40 \times 500} = \frac{1}{50}$$

$$\Delta T_f = i K_f m = 2 \times 1.86 \times \frac{1}{50} = 0.074 \text{ K}$$

82. Answer (3)

If concentration of CH_3COOH is greater than NaOH then the resulting solution will be acidic buffer.

83. Answer (4)

$$P_A = P_A^0 x_A = 100 x_A$$

$$= 2P_B = 2P_B^0 x_B = 2 \times 400 (1 - x_A)$$

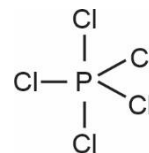
$$100 x_A = 800 - 800 x_A$$

$$x_A = \frac{8}{9}$$

84. Answer (1)

Rate law of a reaction can only be obtained experimentally.

85. Answer (4)



- Trigonal bipyramidal
- In PCl_5 , there are six 90° bond angles possible.

SECTION-B

86. Answer (3)

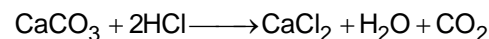
- The lower aliphatic amines are gases with fishy odour
- Primary amines with three or more carbon atoms are liquid.

87. Answer (3)

The unit of coefficient of viscosity (η) = Nsm^{-2}

88. Answer (4)

CaCO_3 reacts with dilute acid to liberate CO_2 gas



89. Answer (2)

$$\text{Co}^{2+} (Z = 27) : [\text{Ar}] 3d^7$$

$$\text{Cu} (Z = 29) : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$$

$$\text{Ca} (Z = 20) : 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$$

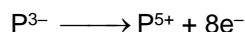
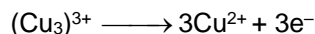
$$\text{Al} (Z = 13) : 1s^2 2s^2 2p^6 3s^2 3p^1$$

$$\text{Si} (Z = 14) : 1s^2 2s^2 2p^6 3s^2 3p^2$$

90. Answer (2)

As the concentration of weak electrolyte decreases its Δ_m increases non-linearly.

91. Answer (3)

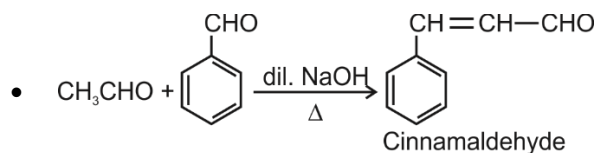


Total number of electrons lost by 1 mole Cu_3P
 $= 3 + 8 = 11$

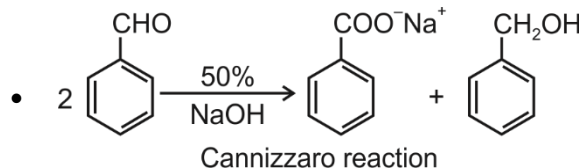
92. Answer (3)

The given complexes show ionisation isomerism. It arises when the counter ion in a complex salt is itself a potential ligand and can displace a ligand which can then become the counter ion.

93. Answer (4)



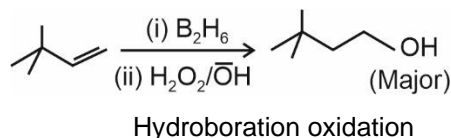
Cross-aldol condensation reaction



Cannizzaro reaction

• Aldehydes given positive Tollen's and Fehling's test.

94. Answer (2)



Hydroboration oxidation

95. Answer (3)

Free radicals containing α -hydrogen atom(s) show hyperconjugation.

96. Answer (1)

Since in adiabatic process $q = 0$ therefore molar heat capacity $= \frac{q}{\Delta t} = 0$.

97. Answer (3)

Less reactive metal sols can be prepared by Bredig's arc method.

98. Answer (4)

Since the given reaction $A \rightarrow B$ is exothermic (i.e. $\Delta H < 0$), the potential energy of product must be less than that of reactant.

99. Answer (2)

• $\text{N} \equiv \text{C} - \text{C} \equiv \text{N} \rightarrow 3\sigma$ and 4π bonds

• $\text{O} = \text{C} = \text{C} = \text{O} \rightarrow 4\sigma$ and 4π bonds

•  $\rightarrow 12\sigma$ and 3π bonds

• $\text{H} - \text{C} \equiv \text{C} - \text{H} \rightarrow 3\sigma$ and 2π bonds

100. Answer (3)



$$K_{sp} = [\text{Mg}^{2+}][\text{SO}_4^{2-}] = (s)(s) = s^2$$

$$s = \sqrt{K_{sp}} = \sqrt{10^{-10}} = 10^{-5} \text{ mol L}^{-1}$$

\therefore Maximum mass of MgSO_4 in 2 L

$$\text{Solution} = 2 \times 10^{-5} \times (120) = 2.4 \times 10^{-3} \text{ g.}$$

BOTANY

SECTION-A

101. Answer (2)

Xylem and phloem are complex permanent tissues in plant. They do not perform the function of photosynthesis.

102. Answer (3)

In monocot stem, xylem is endarch type as the protoxylem lies towards centre and metaxylem towards periphery.

103. Answer (4)

In coconut, mesocarp is fibrous and not edible.

104. Answer (2)

Leaves are modified into spines in *Aloe*.

Nerium has whorled phyllotaxy. Stem tendrils are found in cucumber.

In *Citrus*, axillary buds are modified into thorns.

105. Answer (4)

Nostoc is a cyanobacterium. It has rigid cell walls.

106. Answer (3)

| | |
|--|---|
| <p>The ribosomes associated with rough endoplasmic reticulum are of 80S type.</p> <p>These ribosomes have 60S and 40S subunits.</p> <p>107. Answer (1)</p> <p>Nucleolus is the site for active ribosomal RNA synthesis.</p> <p>108. Answer (2)</p> <p>Solanaceae is family of Potato.</p> <p>109. Answer (4)</p> <p>Manual is a book which contains complete listing and description of the plants growing in a particular area.</p> <p>110. Answer (1)</p> <p>Succinate dehydrogenase is found attached to inner membrane of mitochondria.</p> <p>111. Answer (3)</p> <p>Cyanobacteria like <i>Spirulina</i> is used as SCP.</p> <p>112. Answer (3)</p> <p>Natality is birth rate and immigration is entry of organisms in a particular habitat.</p> <p>113. Answer (2)</p> <p>Energy flow is unidirectional.</p> <p>114. Answer (3)</p> <p><i>Selaginella</i> is a heterosporous pteridophyte.</p> <p>115. Answer (2)</p> <p><i>Volvox</i> and <i>Fucus</i> have oogamous type of sexual reproduction.</p> <p>116. Answer (1)</p> <p>Root endodermis because of the layer of suberin has the ability of actively transporting ions in one direction only.</p> <p>117. Answer (2)</p> <p>Nitrogenase enzyme is Mo-Fe protein. It works under anaerobic conditions.</p> <p>118. Answer (1)</p> <p>Chromosomes start pairing together during zygotene stage.</p> <p>119. Answer (3)</p> | <p>During S phase DNA synthesis takes place and chromosome number remains the same.</p> <p>120. Answer (4)</p> <p>Constantly dividing cells present at both root and shoot apex represent the meristematic phase of growth.</p> <p>The cell wall of these cells are primary in nature, thin and cellulosic with abundant plasmodesmatal connections.</p> <p>121. Answer (3)</p> <p>Streptokinase is produced by the bacterium <i>Streptococcus</i> and modified by the genetic engineering is used as a clot buster for removing clots.</p> <p>122. Answer (2)</p> <p>Central cell initially contains two polar nuclei which fuses just before fertilization to form diploid definitive nucleus.</p> <p>Zygote is a diploid cell structure formed as a result of syngamy.</p> <p>123. Answer (4)</p> <p>Embryo formation is present in all plant groups except algae.</p> <p>124. Answer (1)</p> <p>Sequential stage(s) of translation are:</p> <p>(A) Binding of first charged tRNA at P site</p> <p>(B) Binding of next charged tRNA at A site</p> <p>(C) Peptide bond formation</p> <p>(D) Movement of ribosome on mRNA</p> <p>125. Answer (1)</p> <p>Aminoacyl synthetase binding loop in tRNA is first loop from 5' end. It is also called DHU loop.</p> <p>126. Answer (2)</p> <p>In double helical structure of DNA, the distance between two adjacent base pairs is approximately 0.34 nm.</p> <p>127. Answer (1)</p> <p>NADPH is called reducing power and is used in C₃ cycle.</p> <p>128. Answer (1)</p> <p>Aravali Hills of Rajasthan is sacred groves.</p> <p>129. Answer (1)</p> |
|--|---|

The increased accumulation of toxicants in food chain at higher trophic level is called biological magnification.

130. Answer (3)

Ascospores and basidiospores are sexual spores produced by fungi.

131. Answer (1)

Viruses are obligate parasites.

132. Answer (4)

Plant viruses usually have ssRNA

133. Answer (1)

Genotype of a male who is suffering from colourblindness as well as haemophilia = $X^{ch}Y$.

Genotype of female with colourblind father = X^cX .

So probability of colourblind daughter = 50%.

134. Answer (2)

Birds show female heterogamety

135. Answer (2)

Sickle cell anaemia is caused due to mutation in gene related with beta globin chain of haemoglobin molecule.

SECTION-B

136. Answer (3)

Alburnum is sapwood. It is lighter in colour.

137. Answer (1)

Liliaceae is a family of monocot plants. In these plants, leaves have parallel venation.

138. Answer (2)

Ribosomes were first observed under the electron microscope as dense particles by George Palade.

139. Answer (3)

Sun is direct source of energy in GFC or grazing food chain.

140. Answer (2)

Conformers do not maintain constant body temperature.

141. Answer (3)

Canopy structure is a plant factor which affects photosynthesis.

142. Answer (4)

In haplontic life cycle sporophytic generation is represented only by one-celled zygote. Some algae like *Fucus* are diplontic. *Ectocarpus*, kelps, *Polysiphonia* are haplo-diplontic.

143. Answer (3)

Cork cambium is a dedifferentiated tissue.

144. Answer (2)

In fermentation of dough, cheese making and production of beverages, the main gas produced was carbon dioxide

145. Answer (3)

In double fertilization, syngamy involves the fusion of male gamete with the nucleus of egg cell.

146. Answer (3)

Release of hot waste water in aquatic body reduces DO.

147. Answer (1)

Genetic diversity helps in formation of ecotype and play a key role in speciation.

148. Answer (4)

Regulator gene (*i*) codes for repressor protein, it is constitutive gene which is functional always.

149. Answer (2)

Lichens cannot grow in SO₂ polluted areas.

150. Answer (2)

Genes for eye colour and body colour in *Drosophila* are present on same chromosome i.e. X

ZOOLOGY

SECTION-A

151. Answer (4)

A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron which may or may not be separated by a gap called synaptic cleft.

152. Answer (2)

Melatonin – Pineal gland

T₃ – Thyroid gland

PRL – Pars distalis

Norepinephrine – Adrenal medulla

153. Answer (1)

IUT involves transfer of embryos with more than 8 blastomeres into the uterus of a female.

154. Answer (4)

ELISA detects pathogen infection by detecting the presence of antigens or by detecting the antibodies synthesised against the pathogen.

155. Answer (4)

The stirrer in stirred-tank bioreactor facilitates even mixing and oxygen availability throughout the bioreactor.

156. Answer (2)

Downstream processing is done after completion of biosynthetic stage.

157. Answer (2)

DNase digests DNA, so we will not use DNase for isolation of DNA.

158. Answer (3)

Flippers of penguins and dolphins are an example of analogous organs.

159. Answer (2)

In 1953, S.L. Miller, an American scientist created similar conditions which existed on early earth in a laboratory scale. Vacuum was created to simulate reducing atmosphere as first no gases were present due to vacuum. Later mixture of gases was introduced that lacked oxygen.

160. Answer (2)

| | Examples | | Evidences of evolution |
|---|---|---|--|
| • | Hard parts of life forms found in rocks are called fossils. | – | Palaeontological evidences |
| • | Homologous and analogous organs | – | Morphological and anatomical evidences |
| • | A row of vestigial gill slits in embryos of vertebrates | – | Embryological evidences |

161. Answer (2)

Presence of high levels of $p\text{CO}_2$ and H^+ ions can activate the chemosensitive area present adjacent to rhythm centre.

162. Answer (3)

- Our lungs remove large amount of CO_2 and also significant quantities of water everyday. Different volatile materials are also readily eliminated through the lungs.

163. Answer (1)

- Fibrous joints do not allow any movement because the bones are firmly fixed together by strong collagen fibres.

164. Answer (3)

- Carpals (wrist bones – 8 in number in each forelimb)
- Tarsals (ankle bones – 7 in number in each hindlimb)

165. Answer (4)

- Bees are the pollinators of many of our crop species such as sunflower, *Brassica*, apple and pear.

166. Answer (3)

Alanine is an α -amino acid. It contains an amino group and a carboxyl acid group, both attached to the central carbon atom.

Adenylic acid is composed of adenosine with a phosphate molecule.

167. Answer (2)

The chitinous exoskeleton of arthropods is formed by the polymerisation of N-acetyl glucosamine.

Keratin sulphate is present in cornea, cartilage and bones.

168. Answer (3)

Chondroitin sulphate is one of the building blocks of cartilage.

Inulin is a polymer of fructose.

169. Answer (2)

Psoriasis is an autoimmune disease but Alzheimer's disease is a progressive neurologic disorder that affects the memory. Cell mediated immune response is responsible for graft rejection.

170. Answer (1)

The BCG vaccine contains live bacteria that have been weakened (attenuated).

171. Answer (4)

Eptatretus is a genus of hagfish placed in class Cyclostomata of phylum Chordata.

172. Answer (4)

Water vascular system is a characteristic feature of echinoderms. Prototherians are egg laying mammals. Gnathostomata is divided into two superclasses i.e, Pisces and Tetrapoda. Scales are present in fishes, reptiles, birds and mammals.

173. Answer (2)

Petromyzon – Spawning in fresh water
Psittacula – Homoiothermous
Exocoetus – Marine bony fish
Hyla – Presence of cloaca

174. Answer (2)

After implantation, placenta is formed by interdigitation of chorionic villi with uterine tissue. Chorionic villi are surrounded by uterine tissue and maternal blood.

175. Answer (3)

Menstruation phase lasts for 3-5 days whereas menstrual cycle is of 28-29 days in normal human females.

176. Answer (3)

In unicellular organisms such as protists and monerans, cell division is itself a mode of reproduction. *Hydra* is a multicellular animal.

177. Answer (2)

Progesterone maintains the endometrium of uterus for pregnancy, so is called the pregnancy hormone.

178. Answer (4)

It is the diagram of adipose tissue, which is a type of loose connective tissue.

179. Answer (4)

Pharynx, ileum, oesophagus and rectum are present in the digestive system of both cockroaches and humans.

180. Answer (4)

Vitamins and minerals are required in small quantities. Majority of mammals have 2 sets of teeth during their life, a set of deciduous teeth replaced by a set of permanent teeth. This type of dentition is called diphyodont. Partially hydrolysed proteins in the chyme reaches the intestine.

181. Answer (3)

Fatty acids are first incorporated into small droplets called micelles which move into the intestinal mucosa. They are re-formed into very small protein coated fat globules called the chylomicrons which are transported into lacteals in the villi. These lymph vessels ultimately release the absorbed substances into the blood stream.

182. Answer (1)

| Blood Group | Antigens on RBCs | Antibodies in Plasma | Donor's Group |
|-------------|------------------|----------------------|---------------|
| A | A | anti-B | A, O |
| B | B | anti-A | B, O |
| AB | A, B | nil | AB, A, B, O |
| O | nil | anti-A, B | O |

183. Answer (3)

The end of the T-wave marks the end of systole.

184. Answer (3)

The valves in the heart allows the flow of blood only in one direction, that is, from the atria to the ventricles and from the ventricles to the pulmonary artery/aorta. These valves prevent any backward flow.

185. Answer (4)

The chemical carcinogens in tobacco smoke have been identified as a major cause of lung cancer.

SECTION-B

186. Answer (4)

| | |
|---|--|
| <p>The external ear receives sound waves and directs them to the ear drum.</p> <p>187. Answer (1)</p> <p>Exocrine glands have ducts whereas endocrine glands lack ducts.</p> <p>188. Answer (3)</p> <p>Injections and implants have similar mode of action as that of pills, but their effective period is longer.</p> <p>189. Answer (2)</p> <p>Trichomoniasis is caused by a protozoa <i>Trichomonas vaginalis</i>. Syphilis, cholera and typhoid are bacterial diseases.</p> <p>190. Answer (1)</p> <p>The protein crystals contain a toxic insecticidal protein.</p> <p>191. Answer (4)</p> <p>Recognition sequence of <i>EcoRI</i> is</p> <p>— 5'GAATTC3' — — 3'CTTAAG5' —</p> <p>192. Answer (2)</p> <p>DNA ligase belongs to class VI of enzymes <i>i.e.</i>, ligases.</p> <p>193. Answer (2)</p> <p>Genetic recombination occurs during meiosis due to crossing over. Natural selection is a process in which heritable variations enabling better survival</p> | <p>are enabled to reproduce and leave greater number of progeny.</p> <p>194. Answer (3)</p> <ul style="list-style-type: none"> • Bulk of CO₂ released from body tissues into the blood is present as bicarbonate in blood plasma and RBCs <i>i.e.</i> about 70%. <p>195. Answer (3)</p> <p>Asparagine is a non-essential amino acid in humans. It is used in the biosynthesis of proteins.</p> <p>196. Answer (2)</p> <p>Heroin is synthesized by acetylation of morphine. <i>Ascaris</i> infection usually occurs by drinking water containing eggs of <i>Ascaris</i>.</p> <p>197. Answer (3)</p> <p>Notochord is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in chordates.</p> <p>198. Answer (1)</p> <p><i>Ancylostoma</i> is a pseudocoelomate. <i>Antedon</i> has radial symmetry and <i>Taenia</i> is acoelomate.</p> <p>199. Answer (3)</p> <p>Spermatids undergo spermiogenesis to form spermatozoa. Primary spermatocytes periodically undergo meiosis. Primary oocyte is formed before delivery of female child.</p> <p>200. Answer (1)</p> <p>Spleen is the graveyard of RBCs.</p> |
|---|--|

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