

All India Aakash Test Series for NEET - 2026

TEST - 7 (Code-A)[Click here for Code-B Sol.](#)

Test Date : 25/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (1)

Hint & Sol.: For the expansion of an ideal gas between two same states, among the given options maximum work done will be in isobaric process as for isobaric $W = P(2V - V) = PV$.

2. Answer (1)

Hint: Efficiency of Carnot engine $\eta_{\text{Carnot}} = 1 - \frac{T_2}{T_1}$

$$\text{Sol.: } \eta_{\text{Carnot}} = 1 - \frac{400}{800} = 1 - \frac{1}{2} = \frac{1}{2}$$

\Rightarrow 50% efficiency

3. Answer (1)

Hint: $V_{P, \text{max}} = A\omega$

Sol.: $V_{P, \text{max}} = A\omega$, $A = 5 \times 10^{-2}$ m, $\omega = 400\pi$

$$V_{P, \text{max}} = 5 \times 10^{-2} \times 4 \times 10^2 \times \pi = 20\pi \text{ m/s}$$

4. Answer (1)

Hint: In this case the transverse wave travels with a constant acceleration of $g/2$.

Sol.: The wave travels with constant acceleration of $g/2$.

$$2.45 = \frac{1}{2} \times \frac{g}{2} \times t^2 \Rightarrow t^2 = \frac{2 \times 2 \times 2.45}{9.8} \Rightarrow t = 1 \text{ s}$$

5. Answer (3)

Hint: Speed of transverse wave in a string,

$$v = \sqrt{\frac{T}{\mu}}$$

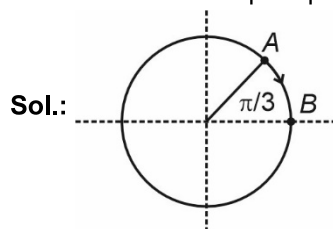
$$\text{Sol.: } v = \sqrt{\frac{T}{\frac{1}{l} \times \rho \times A \times l}} = \sqrt{\frac{T}{\rho A}}$$

$$\Rightarrow \frac{\Delta v}{v} = \frac{1}{2} \frac{\Delta T}{T} - \frac{1}{2} \frac{\Delta \rho}{\rho} - \frac{1}{2} \frac{\Delta A}{A}$$

$$\Rightarrow \frac{\Delta v}{v} = \frac{-1}{2} \frac{\Delta \rho}{\rho} \Rightarrow 1\% \text{ decrease}$$

6. Answer (3)

Hint: Use the concept of phasors



To go from half the amplitude to its positive extreme, angle that needs to be covered = $\frac{\pi}{3}$.

$$\frac{\pi}{3} = \frac{2\pi}{T} \times t \Rightarrow t = \frac{T}{6}$$

7. Answer (2)

Hint: Use the equation, $v = \omega\sqrt{A^2 - x^2}$

$$\text{Sol.: } v = \omega\sqrt{A^2 - x^2} \Rightarrow b\omega\sqrt{3} = \omega\sqrt{A^2 - b^2}$$

$$\Rightarrow \sqrt{A^2 - b^2} = \sqrt{3 \times b}$$

$$\Rightarrow A^2 - b^2 = 3b^2 \Rightarrow A^2 = 4b^2 \Rightarrow A = 2b$$

It has initially covered distance b , so further distance covered will be equal to b .

8. Answer (4)

Hint: Superposition of SHM having same frequency is also an SHM

$$\text{Sol.: For } y = \sin(\omega t) + \cos(\omega t)$$

$$= \sqrt{2} \left[\frac{1}{\sqrt{2}} \sin(\omega t) + \frac{1}{\sqrt{2}} \cos(\omega t) \right]$$

$$= \sqrt{2} \sin\left(\omega t + \frac{\pi}{4}\right)$$

Hence, it is a SHM.

Similarly, $y = \sin(\omega t) - \cos(\omega t)$ is also a SHM. Therefore all of the given functions represent simple harmonic motion.

9. Answer (2)

$$\text{Hint: Time, } T = 2\pi \sqrt{\frac{m}{K_{\text{eq}}}}$$

For combination of springs

$$K_P = K_1 + K_2, K_S = \frac{K_1 K_2}{(K_1 + K_2)}$$

$$\text{Sol.: } \frac{1}{K_{\text{eq}}} = \frac{1}{2K} + \frac{1}{2K} \Rightarrow \frac{1}{K_{\text{eq}}} = \frac{2}{2K} \Rightarrow K_{\text{eq}} = K$$

$$T = 2\pi \sqrt{\frac{m}{K}}$$

10. Answer (2)

Hint & Sol.: As particles have minimal movement at these points, they become tightly packed together by approaching compressions and preceding rarefactions resulting in maximum

pressure. There exists a phase difference of $\frac{\pi}{2}$ between pressure and displacement in sound wave and $f_0 = \frac{v}{2l}$ and $f_c = \frac{v}{4l} \Rightarrow f_0 = 2f_c$

11. Answer (3)

Hint: $v = f\lambda$, Beat frequency = $|f_1 - f_2|$

Sol.: $\alpha = f_1 - f_2 \Rightarrow \alpha = \frac{v}{\lambda_1} - \frac{v}{\lambda_2}$

$$\Rightarrow \alpha = v \left[\frac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2} \right]$$

$$v = \frac{\alpha \lambda_1 \lambda_2}{\lambda_2 - \lambda_1}$$

12. Answer (1)

Hint: Maximum amplitude occurs when phase difference $\Delta\phi = 0$

Sol.: $A_{\max} = \sqrt{A_1^2 + A_2^2 + 2A_1A_2} = A_1 + A_2$

$$\Rightarrow A_{\max} = 4A$$

13. Answer (2)

Hint: At constant pressure, $\Delta Q = nC_p\Delta T$ and $\Delta U = nC_v\Delta T$

Sol.: $\frac{\Delta U}{\Delta Q} = \frac{nC_v\Delta T}{nC_p\Delta T} = \frac{3R}{5R} = \frac{3}{5}$

14. Answer (1)

Hint: Use, $\Delta U = nC_v\Delta T$,
 $W = nR\Delta T$ (isobaric) and
 $W = -\Delta U$ (adiabatic)

Sol.: $W_{\text{isobaric}} = P\Delta V = nR\Delta T$
 $= 2 \times R \times T = 2RT$

$$\Delta U = nC_v\Delta T = \frac{2 \times 3R}{2} \times T = 3RT$$

For adiabatic process, $\Delta U + \Delta W = 0$

$$\Rightarrow \Delta U = -\Delta W \Rightarrow \Delta U = -3RT$$

15. Answer (1)

Hint: Use, first law of thermodynamics

Sol.: $\Delta Q = \Delta U + \Delta W \Rightarrow 60 \text{ J} = \Delta U - 20 \text{ J}$

$$\Rightarrow \Delta U = 80 \text{ J}$$

16. Answer (3)

Hint: The average translational K.E per molecule for all kind of gases is $\frac{3}{2}KT$.

Sol.: Since, temperature is same for both O_2 and He molecules, their (K.E) average translational will be identical, regardless of their different masses.

17. Answer (2)

Hint: $C_{v, \text{mix}} = \frac{n_1C_{v1} + n_2C_{v2}}{n_1 + n_2}$ and $C_p - C_v = R$

Sol.: $C_{v, \text{mix}} = \frac{4 \times 3R}{2} + \frac{2 \times 5R}{2} = \frac{6R + 5R}{6} = \frac{11R}{6}$

Now, $C_{p, \text{mix}} = \frac{11R}{6} + R = \frac{17R}{6}$

18. Answer (3)

Hint & Sol.: Since $P_1V_1 = P_2V_2$, therefore we are certain that $T_1 = T_2$, but it is possible that temperature does not remain same throughout the process, hence it may or may not be an isothermal process.

19. Answer (4)

Hint: RMS speed of gas molecules $v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

Sol.: $v_{\text{rms}} = \sqrt{\frac{3RT}{M}} \Rightarrow v_{\text{rms}} \propto \sqrt{T} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{300}{1200}}$

$$\frac{v_1}{v_2} = \sqrt{\frac{3}{12}} \Rightarrow \frac{v_1}{v_2} = \frac{1}{2} \Rightarrow v_2 = 2v_1$$

20. Answer (2)

Hint: Work done, $W = \int PdV$

Sol.: $V = \frac{\alpha}{T}$ and $PV = nRT \Rightarrow PV = \frac{nR\alpha}{V}$

$$\Rightarrow P = \frac{nR\alpha}{V^2}, dW = PdV \Rightarrow dW = \frac{nR\alpha}{V^2} dV$$

$$\Rightarrow W = \int nR\alpha \times \frac{dV}{V^2} = -nR\alpha \left[\frac{1}{V_2} - \frac{1}{V_1} \right]$$

$$\Rightarrow W = nR\alpha \left[\frac{1}{V_1} - \frac{1}{V_2} \right] = nR[T_1 - T_2]$$

21. Answer (3)

Hint: Molar specific heat capacity is defined as amount of heat given to one mole such that temperature increases by 1°C or 1 K .

Sol.: Using First law of thermodynamics

$$\Rightarrow \Delta U = \frac{Q}{2} \text{ and } \Delta U = nC_v\Delta T$$

Also $Q = nC\Delta T$

$$\Rightarrow \frac{Q}{2} = n \times \frac{5R}{2} \times \Delta T \Rightarrow \frac{Q}{n\Delta T} = 5R$$

22. Answer (3)

Hint: Use conservation of energy

Sol.: Since cylinder is adiabatic and piston is diathermic and fixed.

$$\Rightarrow n_1 \times Cv_1 \times (T - T_1) = n_2 \times Cv_2 \times (T_2 - T)$$

$$\Rightarrow \frac{P_1 \times V}{2 \times R \times T_1} \times \frac{3R}{2} \times (T - T_1) = \frac{P_2 \times V}{2RT_2} \times \frac{3R}{2} \times (T_2 - T)$$

$$\Rightarrow P_1 \left(\frac{T}{T_1} - 1 \right) = P_2 \left(1 - \frac{T}{T_2} \right)$$

$$\frac{P_1 T}{T_1} + \frac{P_2 T}{T_2} = P_2 + P_1 \Rightarrow T \left[\frac{P_1 T_2 + P_2 T_1}{T_1 T_2} \right] = P_1 + P_2$$

$$\Rightarrow T = \frac{(P_1 + P_2)(T_1 T_2)}{P_1 T_2 + P_2 T_1}$$

23. Answer (2)

Hint: For isobaric $W = P\Delta V$, for isothermal

$$W = nRT \ln \left(\frac{V_2}{V_1} \right)$$

Sol.: $W_{\text{isothermal}} = C \ln \left[\frac{V_2}{V_1} \right]$

$$W_{\text{isobaric}} = P[2V - V] = PV$$

$$W_{\text{isothermal}} = C \ln \left[\frac{V_2}{V_1} \right] = C \ln(2), (C = PV)$$

$$W_2 = PV \ln(2) \Rightarrow W_2 = W_1 \ln(2)$$

24. Answer (1)

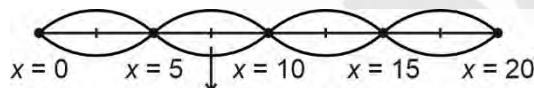
Hint: For standing wave formed on a string,

$$L = \frac{n\lambda}{2}$$

Sol.: At $x = 0, y = 0 \rightarrow$ Node

At $x = 20, y = 0 \rightarrow$ Node

$$\lambda = 10 \text{ cm} \Rightarrow L = \frac{4 \times 10}{2}$$



Second antinode = $5 + 2.5 = 7.5 \text{ cm}$

25. Answer (1)

Hint: $f = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$

Sol.: $f_1 \propto \sqrt{T_1}, f_2 \propto \sqrt{T_2}$ and $f'' \propto \sqrt{T_1 + T_2}$

$$f'' = k\sqrt{T_1 + T_2} \Rightarrow \frac{f''}{f_1} = \sqrt{\frac{T_1 + T_2}{T_1}}$$

$$f_1 = k\sqrt{T_1}$$

$$\Rightarrow \frac{f''}{80} = \sqrt{1 + \frac{225}{64}} \Rightarrow \frac{f''}{80} = \sqrt{\frac{289}{64}} \Rightarrow \frac{f''}{80} = \frac{17}{8}$$

$$f'' = 170 \text{ Hz}$$

26. Answer (4)

Hint: Use, $T = 2\pi \sqrt{\frac{l}{g}}$

Sol.: $T = 2\pi \sqrt{\frac{l}{g}} \Rightarrow \frac{\Delta T}{T} = \frac{1}{2} \frac{\Delta l}{l} + \frac{1}{2} \frac{\Delta g}{g}$

$$\Rightarrow \% \text{ change} = \frac{1}{2} \times 1\% = 0.5\%$$

27. Answer (2)

Hint: Use, $T = 2\pi \sqrt{\frac{M}{K}}$

Sol.: When spring stretches $\Rightarrow Mg = kx_0$

Time period, $T = 2\pi \sqrt{\frac{M}{2 \times k}}$

$$= 2\pi \sqrt{\frac{M \cdot x_0}{2 \times Mg}} = 2\pi \sqrt{\frac{x_0}{2g}}$$

28. Answer (1)

Hint: Displacement is minimum at mean position.

Sol.: At mean position, P.E is minimum and K.E is maximum.

29. Answer (1)

Hint & Sol.: The work done by string of a simple pendulum in one complete oscillation is equal to zero.

30. Answer (1)

Hint: Time period, $T = 2\pi \sqrt{\frac{m}{K}}$

Sol.: After collision velocity of block will be $0.5 u_0$

As motion starts from equilibrium position,

$$x = A \sin(\omega t)$$

$$v = A\omega \cos(\omega t)$$

$$\Rightarrow 0.5 u_0 = u_0 \cos(\omega t)$$

$$\Rightarrow \frac{2\pi}{T} \times t = \frac{\pi}{3} \Rightarrow t = \frac{T}{6}$$

$$\text{Total time} = \frac{T}{6} + \frac{T}{6} = \frac{T}{3} = \frac{2\pi}{3} \sqrt{\frac{m}{K}}$$

31. Answer (1)

Hint: Use the concept of refraction

Sol.: As air is denser medium so speed is slower in air than water for sound, hence it would bend towards normal ($v_{\text{water}} > v_{\text{air}}$).

32. Answer (4)

Hint & Sol.: Longitudinal wave is possible in solid, liquid and gases because they require a medium for particles to oscillate back and forth in same direction as the wave, transferring energy through the medium.

33. Answer (2)

Hint & Sol.: $(F_7)_C = (F_4)_0$

$$\Rightarrow 7 \cdot \left[\frac{v}{4l_c} \right] = 4 \left[\frac{v}{2l_0} \right]$$

$$\Rightarrow \frac{l_c}{l_0} = \frac{7}{8}$$

34. Answer (3)

Hint: According to Laplace's correction sound propagation in gaseous medium takes place under adiabatic condition.

Sol.: For any ideal gas

$$v_{\text{sound}} = \sqrt{\frac{\gamma RT}{M}}$$

35. Answer (1)

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

Sol.: $v_{\text{rms}} = \sqrt{\frac{3 \times 8.31 \times 300}{2 \times 10^{-3}}} = 1.93 \times 10^3 \text{ m/s}$

36. Answer (3)

Hint: For an ideal gas, the equipartition theorem states, each degree of freedom contributes $\frac{1}{2} K_B T$ to the mean energy per molecule.

Sol.: Mean energy per molecule = $\frac{\alpha}{2} KT$

37. Answer (1)

Hint: Mean free path, $\lambda = \frac{1}{\sqrt{2}n\pi d^2}$, d is diameter of molecule

Sol.: $d^2 = \frac{1}{\sqrt{2}n\pi\lambda}$

$$d^2 = \frac{1}{\sqrt{2} \times 3 \times 10^8 \times \pi \times \frac{\pi}{3\sqrt{2}} \times 10^{-2}}$$

$$d^2 = \frac{1}{\pi^2 \times 10^6}$$

$$d = \frac{1}{\pi \times 10^3}$$

$$= \frac{10^{-3}}{\pi} \text{ cm} = \frac{10^{-5}}{\pi} \text{ m}$$

38. Answer (2)

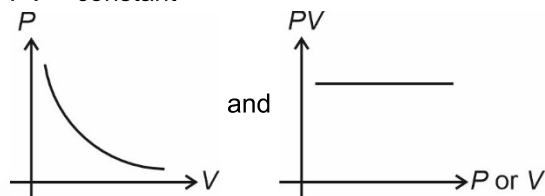
Hint: Molar specific heat capacity, $C = C_v + \frac{R}{1-x}$

Sol.: $C = \frac{3R}{2} + \frac{R}{1-x}$ and $PV^{-1} = C \rightarrow x = -1$

$$C = \frac{3R}{2} + \frac{R}{2} = 2R$$

39. Answer (4)

Hint & Sol.: According to Boyle's law, $PV = \text{constant}$



40. Answer (2)

Hint: For cyclic process, $\Delta Q = \Delta W$

Sol.: $\Delta Q = \text{area under curve}$

$$= 2.5 \times 10^{-6} \times 2 \times 10^5$$

$$\Delta Q = 5 \times 10^{-1} = 0.5 \text{ J}$$

41. Answer (4)

Hint & Sol.: Assertion is false as equipartition distributes energy among all degrees of freedom not strictly translational vs rotational and reason is true as reason lays down the condition when the real gas behaves as an ideal gas.

42. Answer (3)

Hint: $\eta = 1 - \frac{T_2}{T_1} = \frac{W_{\text{net}}}{Q_{\text{supplied}}}$

Sol.: $\eta = 1 - \frac{300}{500} = \frac{2}{5} = \frac{W}{200}$

$$\Rightarrow W = \frac{2}{5} \times 200 = 80 \text{ calories}$$

43. Answer (3)

Hint & Sol.: $AB \rightarrow$ Isothermal expansion
 $BC \rightarrow$ Adiabatic expansion
 $CD \rightarrow$ Isothermal compression
 $DA \rightarrow$ Adiabatic compression

44. Answer (1)

Hint: Use ideal gas equation, $PV = nRT$

Sol.: $P^2V = C$ and $PV = nRT$

$$\Rightarrow \frac{n^2 R^2 T^2}{V^2} V = C \Rightarrow \frac{T^2}{V} = C$$

$$\Rightarrow \frac{T_0^2}{V_0} = \frac{(T')^2}{2V_0} \Rightarrow (T')^2 = 2T_0^2$$

$$\Rightarrow T' = \sqrt{2}T_0$$

45. Answer (2)

Hint & Sol.: The equation of SHM is $a = -k(x + c)$ or $a = -kx$.

[CHEMISTRY]

46. Answer (2)

Hint: Percentage of bromine =

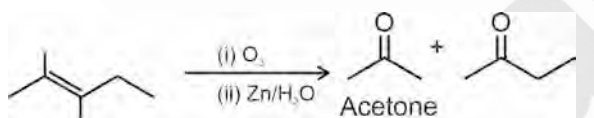
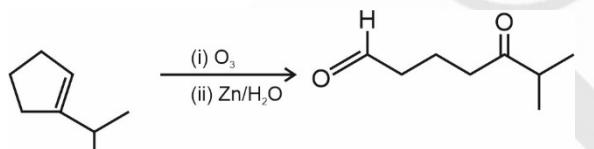
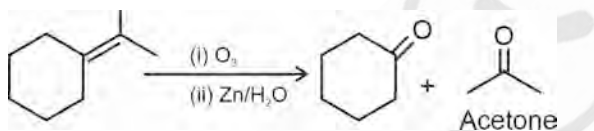
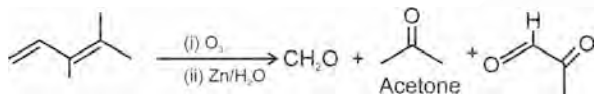
$$\frac{\text{Atomic mass of bromine} \times \text{Mass of AgBr} \times 100}{\text{Molecular mass of AgBr} \times \text{Mass of organic compound}}$$

Sol.: 188 g of AgBr contains 80 g of Br

$$1.41 \text{ g of AgBr contains } = \frac{80 \times 1.41}{188} \text{ g of Br}$$

$$\text{Percentage of Br} = \frac{80 \times 1.41 \times 100}{188 \times 1.6} = 37.5\%$$

47. Answer (4)

Hint: Alkenes on reductive ozonolysis give aldehydes or ketones as major products.**Sol.:**

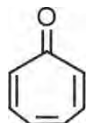
48. Answer (2)

Hint: The organic compounds having multiple bond (a double or triple bond) show electromeric effect in presence of attacking reagents.**Sol.:** Electromeric effect is temporary effect.

49. Answer (3)

Hint & Sol.: Hyperconjugation involves delocalisation of σ electrons of C – H bond of an alkyl group directly attached to an atom of unsaturated system or to an atom with an unshared p orbital.

50. Answer (2)

Hint: Structures of tropone is**Sol.:**

Structure	Name	Nature
	Tropone	Non-benzenoid aromatic
	Anthracene	Benzenoid aromatic
	Cyclooctatetraene	Nonaromatic
	1,3-Cyclobutadiene	Antiaromatic

51. Answer (1)

Hint: Higher is the molar mass of the compound, higher is the boiling point**Sol.:** For isomeric alkanes, higher is the branching, lower is the surface area, lower will be van der Waals force of attraction and lower will be the boiling point.

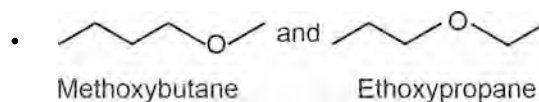
52. Answer (2)

Hint: Milliequivalents of H₂SO₄ reacted = milliequivalents of NH₃ produced**Sol.:** Milliequivalent of H₂SO₄ = 20 × 2 × 0.5 = 20

Percentage of nitrogen =

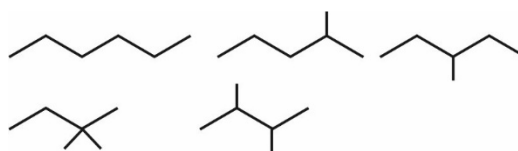
$$\frac{20 \times 14 \times 10^{-3} \times 100}{0.8} = 35\%$$

53. Answer (3)

Hint: Metamerism arises due to different alkyl chains on either side of a functional group in the molecule**Sol.:**

These are metamers

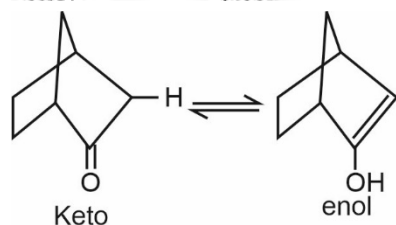
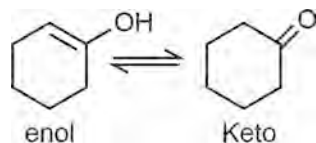
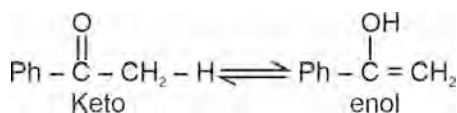
• Cyclohexene exists only in cis form because of its geometry

• Isomers of C₆H₁₄

54. Answer (3)

Hint: In keto-enol tautomerism, hydrogen from one centre to another moves with the assistance of π bond.

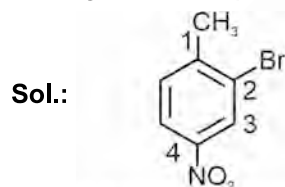
Sol.:



Compound (iv) will not show keto-enol tautomerism because it has no enolisable hydrogen atom.

55. Answer (2)

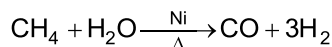
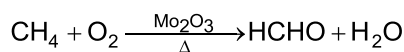
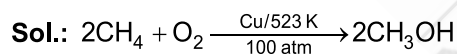
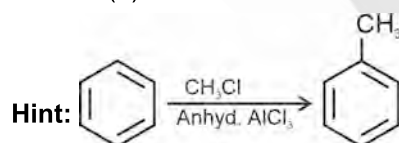
Hint: Lowest locant rule should be applied in naming of this compound.



Sol.:

2-Bromo-1-methyl-4-nitrobenzene

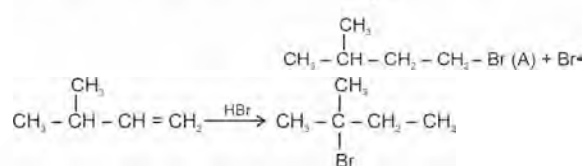
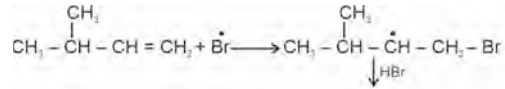
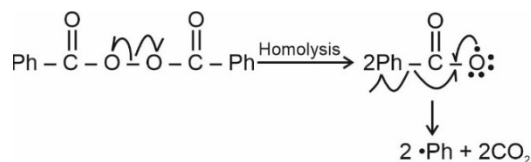
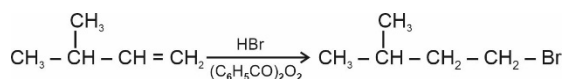
56. Answer (1)



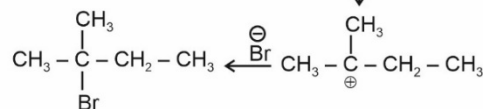
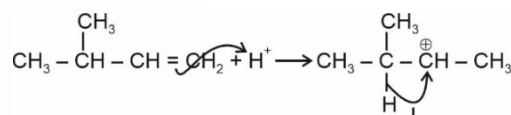
57. Answer (3)

Hint: HBr addition to unsymmetrical alkene may lead to carbocation rearrangement.

Sol.:



Mechanism:



58. Answer (2)

Hint & Sol.: Steam distillation technique is applied to separate substances which are steam volatile and are immiscible with water.

59. Answer (2)

Hint: 233 g of BaSO_4 contains 32 g of sulphur

Sol.: 233 g of BaSO_4 contains 32 g of sulphur

$$1.165 \text{ g of } \text{BaSO}_4 \text{ contains } \frac{32 \times 1.165}{233}$$

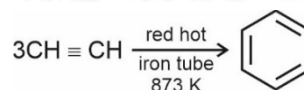
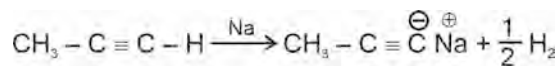
$$\text{Percentage of sulphur} = \frac{32 \times 1.165 \times 100}{233 \times 1.25}$$

$$= 12.8\%$$

60. Answer (1)

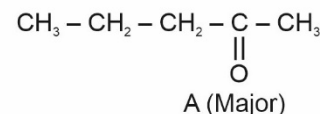
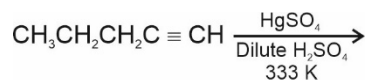
Hint: Terminal alkynes contain acidic hydrogen

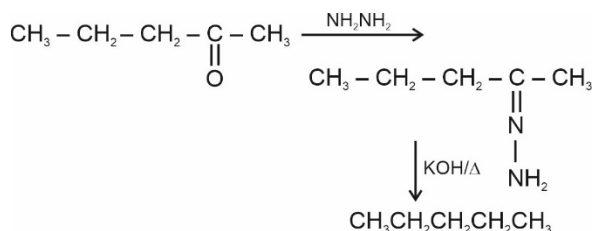
Sol.:



61. Answer (1)

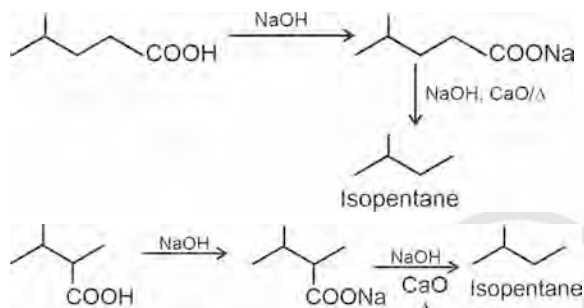
Hint:



Sol.:

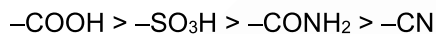
62. Answer (3)

Hint: Sodium salts of carboxylic acids on heating with soda lime gives alkanes containing one carbon less than carboxylic acid.

Sol.:

63. Answer (2)

Hint & Sol.: Correct order of priority of functional groups in IUPAC nomenclature:



64. Answer (2)

Hint & Sol.: Thin layer chromatography is a type of adsorption chromatography.

65. Answer (4)

Hint: $[\text{Fe}(\text{SCN})]^{2+}$ is blood red in colour.

Sol.:

Species	Colour
PbS	→ Black
$(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$	→ Yellow
$[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$	→ Violet
$[\text{Fe}(\text{SCN})]^{2+}$	→ Blood red

66. Answer (1)

Hint: +I effect causing group decreases acidic strength of carboxylic acid while -I effect causing group increases acidic strength.

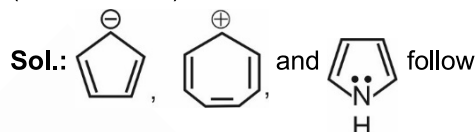
Sol.:

- CH₃, -C₂H₅ induces +I effect. +I effect of -C₂H₅ is greater than -CH₃.

- Cl has -I effect, if -Cl is closer to -COOH group then more will be -I effect and greater will be the acidic strength of carboxylic acid.
- Correct order of acidic strength is $\text{ClCH}_2\text{COOH} > \text{ClCH}_2\text{CH}_2\text{COOH} > \text{CH}_3\text{COOH} > \text{CH}_3\text{CH}_2\text{COOH}$

67. Answer (4)

Hint: Cyclic planar species having $(4n + 2)\pi$ electrons in conjugation are aromatic in nature ($n = 0, 1, 2, \dots$)



Huckel's $(4n + 2)\pi$ electron rule. These are aromatic in nature.

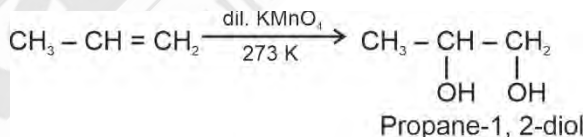
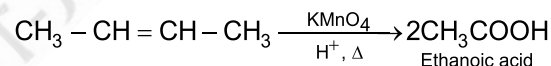
68. Answer (3)

Hint: The groups which direct the incoming electrophile to ortho and para positions are called ortho and para directing groups.

Sol.:

- NHCOCH₃, -C₂H₅, -OCH₃ and -NHR are ortho and para directing groups.
- CN, COR, -COOR are meta directing groups.

69. Answer (3)

Hint:**Sol.:**

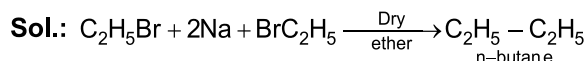
70. Answer (2)

Hint: Electron donating groups attached with benzene increases reactivity towards electrophilic substitution reaction.

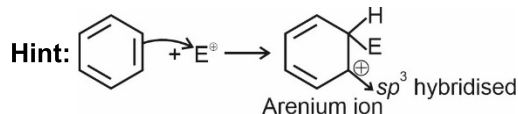
Sol.: Electron withdrawing groups attached with benzene decreases reactivity towards electrophilic substitution reaction.

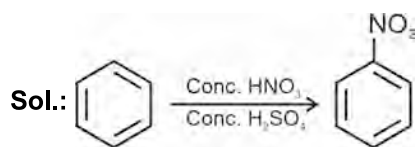
71. Answer (2)

Hint: Alkyl halides (except fluorides) on reduction with zinc and dilute hydrochloric acid give alkanes.

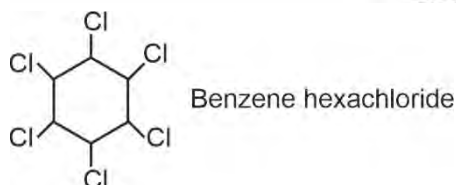
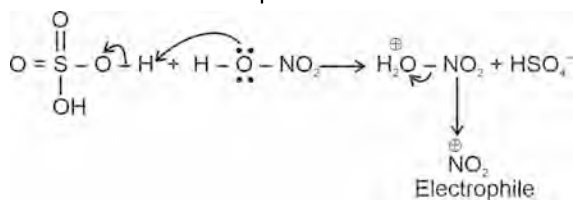


72. Answer (1)





Generation of electrophile



73. Answer (3)

Hint: Percentage of carbon =

$$\frac{\text{Atomic mass of carbon} \times \text{Mass of CO}_2 \times 100}{\text{Molecular mass of CO}_2 \times \text{Mass of organic compound}}$$

Sol.: 44 g of CO₂ contains 12 g carbon

1.32 g of CO₂ contains $\frac{12 \times 1.32}{44}$ g of carbon

Percentage of carbon = $\frac{12 \times 1.32 \times 100}{44 \times 0.39} = 92.3\%$

18 g of H₂O contains 2 g of hydrogen

0.27 g of H₂O contains $\frac{2 \times 0.27}{18}$ g of hydrogen

Percentage of hydrogen = $\frac{2 \times 0.27 \times 100}{18 \times 0.39} = 7.7\%$

74. Answer (3)

Hint: Kjeldahl method is not applicable to compounds in which nitrogen does not change to ammonium sulphate on treatment with concentrated sulphuric acid.

Sol.: Kjeldahl method is not applicable to compounds containing nitrogen in nitro, azo groups and nitrogen present in the ring.

75. Answer (2)

Hint: Lesser is the stability of alkene, more will be the energy released on catalytic hydrogenation of alkene.

Sol.: Greater is the number of α -hydrogen atoms, more is the stability of alkene and lesser is the amount of energy released on hydrogenation reaction.

76. Answer (3)

Hint: Benzyl carbocation $\left(\text{C}_6\text{H}_5\text{CH}_2^{\oplus}\right)$ is stabilised by resonance.

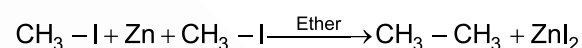
Sol.: Tert-butyl carbocation is more stable than benzyl carbocation.

Phenyl carbocation is unstable as the positive charge is present on carbon containing double bond.

77. Answer (1)

Hint: In Frankland's reaction, C-C bond formation takes place.

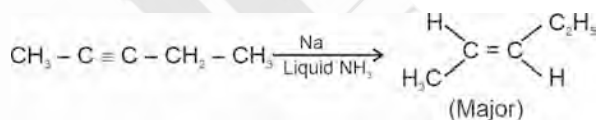
Sol.:



78. Answer (3)

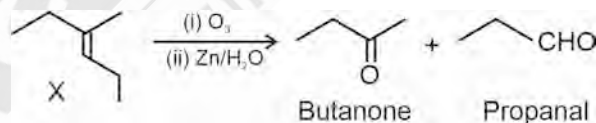
Hint: Lindlar's catalyst converts alkynes to cis-alkenes.

Sol.:

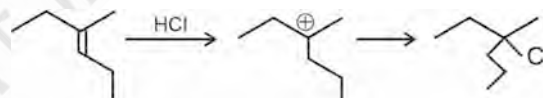


79. Answer (2)

Hint:

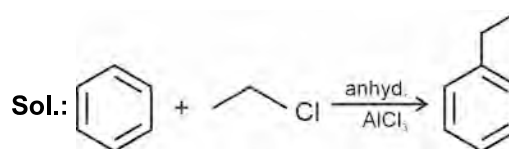


Sol.:



80. Answer (3)

Hint: Halogen atom attached to sp^3 carbon atom will be used as halide component in Friedel-Crafts reaction.

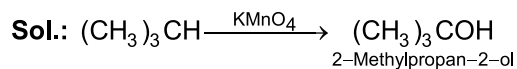
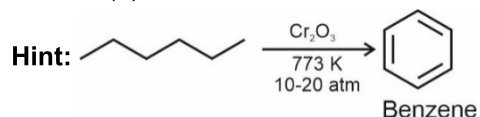


81. Answer (2)

Hint: More is the torsional strain, lesser is the stability of the molecule in the given conformation.

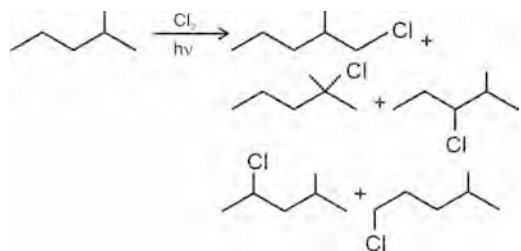
Sol.: If two $-\text{CH}_3$ groups of n-butane are closest to each other, then the torsional strain will be maximum and the conformation will be least stable (eclipsed conformation).

82. Answer (1)

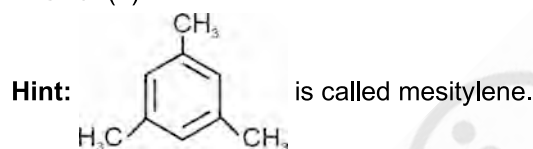


83. Answer (2)


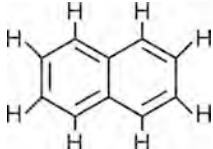
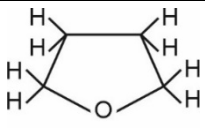
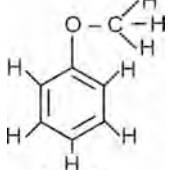
Hint & Sol.:



84. Answer (4)



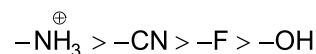
Sol.:

Compound	Number of σ bonds
 Mesitylene	21
 Naphthalene	19
 Tetrahydrofuran	13
 Anisole	16

85. Answer (2)

Hint: Positive charge on electronegative atom increases its -I effect

Sol.: Correct order of -I effect



86. Answer (4)

Hint: More symmetric is the structure, better is the crystal packing and higher is the melting point.

Sol.: trans-but-2-ene has more symmetrical structure than cis-but-2-ene, leading to a better crystal packing hence trans-but-2-ene has higher melting point than that of cis-but-2-ene.

87. Answer (2)

Hint: Actual pressure of N_2 gas = $725 - 15 = 710$ mm of Hg.Sol.: $PV = nRT$

$$n = \frac{PV}{RT} = \frac{710 \times 100}{760 \times 1000 \times 0.0821 \times 300}$$

$$n = 3.79 \times 10^{-3}$$

$$\text{Percentage of nitrogen} = \frac{3.79 \times 10^{-3} \times 28 \times 100}{0.5}$$

$$= 21.2\%$$

88. Answer (2)

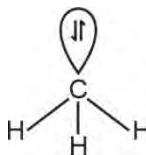
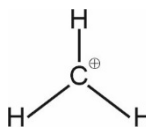
Hint: Iron (III) hexacyanidoferrate (II) is also known as ferriferrocyanide

Sol.: AgCl is soluble in NH_4OH solution.

89. Answer (2)

Hint & Sol.: $-\text{NO}_2$ present at para position stabilises the carbanion by -R effect.

90. Answer (2)

Hint: CH_3^- is pyramidal in shape while CH_3^+ is trigonal planar in shapeSol.: CH_3^- is sp^3 hybridised CH_3^+ is sp^2 hybridised

[BOTANY]

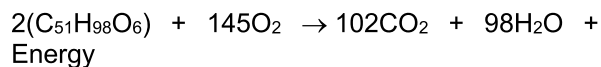
91. Answer (2)
Hint: Photosynthesis is a physico-chemical process that occurs in green plants.
Sol.: Reduction of NAD^+ into $\text{NADH} + \text{H}^+$ occurs during glycolysis, oxidative decarboxylation and Krebs' cycle. These events are associated with respiration.
92. Answer (3)
Hint: All the living cells in green plants perform respiration but not photosynthesis.
Sol.: All the cells that perform photosynthesis in plants are living and thus, all these cells will perform respiration too.
93. Answer (4)
Hint: Sugarcane stores carbohydrate as sugar in their stems.
Sol.: Spraying sugarcane crop with gibberellins increases the length of the stem, thus increasing the yield.
94. Answer (1)
Hint: KOH solution absorbs CO_2 present in the air.
Sol.: When the air lacks CO_2 , its fixation by RuBisCO, and thus the conversion of RuBP into 3-PGA through Calvin cycle, will not occur.
95. Answer (4)
Hint: Acetyl CoA enters the tricarboxylic acid pathway, also called Krebs' cycle, operating in the matrix of the mitochondria. $\text{NADH} + \text{H}^+$ and FADH_2 are generated in the Krebs' cycle which produce ATP through ETS.
Sol.: Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source.
 The first action spectrum of photosynthesis was described through the experiment conducted by T.W. Engelmann.
 Cornelius van Niel demonstrated that in green plants, hydrogen from an oxidisable compound reduces CO_2 to carbohydrates.
96. Answer (3)
Hint: All the food that is respired for life processes in organisms, directly or indirectly comes from photosynthesis.
Sol.: In plants, proteins, fats and organic acids can also be used as respiratory substances.
97. Answer (2)
Hint: One of the two processes of plant development is differentiation.
Sol.: Development in plants is the sum of two processes that are growth and differentiation.
98. Answer (4)
Hint: The chief pigment associated with photosynthesis is chlorophyll *a*.
Sol.: Each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system, also called antennae. A single chlorophyll *a* molecule forms the reaction centre.
99. Answer (2)
Hint: For each ATP produced, 4H^+ pass through F_0 from the intermembrane space to the matrix, down the electrochemical proton gradient.
Sol.: The component F_0 of complex V in the inner mitochondrial membrane is the integral protein complex that forms the channel through which protons cross the inner membrane.
100. Answer (1)
Hint: Relative growth rate = (Growth per unit time)/(Initial size) $\times 100$
Sol.: Relative growth rates of leaves P, Q, R and S are 100%, 75%, 26.6% and 37.5% respectively.
101. Answer (3)
Hint: A tissue can have structurally similar or dissimilar cells that perform a common function.
Sol.: Meristematic tissue present in the meristematic zone of a plant is made up of homogenous cells, *i.e.*, they are similar in structure and function.
102. Answer (3)
Hint: Chlorophyll *b* shows maximum absorption in blue and red regions of light and least absorption in green region.
Sol.: There is a complete one-to-one overlap between the absorption spectrum of chlorophyll *a* and the action spectrum of photosynthesis.
 Accessory pigments, like carotenoids, not only enable a wider range of wavelength of incoming light to be utilized for photosynthesis, but also protect chlorophyll *a* from photo-oxidation.
 Some photosynthesis does take place at the wavelengths other than blue and red regions of the visible spectrum.
103. Answer (2)
Hint: The respiratory pathway is an amphibolic pathway.
Sol.: Respiratory quotient is the ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration. Chemiosmosis requires a membrane,

a proton pump, a proton gradient and ATP synthase. In photorespiration, RuBP binds with O_2 to form one molecule of phosphoglycerate and phosphoglycolate.

104. Answer (2)

Hint: The lipid molecule taken as respiratory substrate is tripalmitin ($C_{51}H_{98}O_6$).

Sol.: Complete oxidation of tripalmitin is as follows:



Therefore, the ratio of O_2 consumed to CO_2 liberated = $145/102 = 1.42$ (approximately)

105. Answer (1)

Hint: Growth in organisms occurs when synthesis reactions are more than the breakdown reactions.

Sol.: During growth, the rate of anabolism is more than the rate of catabolism.

106. Answer (4)

Hint: Root elongating at a constant rate is an example of arithmetic growth.

Sol.: Mathematical representation of arithmetic growth is $L_t = L_0 + rt$. Expression of exponential growth is $W_t = W_0e^{rt}$. Lag phase of growth curve showing sigmoid curve shows slow initial growth.

107. Answer (3)

Hint: RuBP is the primary acceptor of CO_2 in C_3 plants.

Sol.: The primary acceptor of CO_2 in C_3 plants, such as wheat, is 5-carbon ketose sugar and the first stable product of this fixation is a 3-carbon compound, *i.e.*, 3-phosphoglycerate.

108. Answer (2)

Hint: Through the experiment conducted by T. W. Engelmann, the first action spectrum of photosynthesis was described.

Sol.: T. W. Engelmann used phototrophic eukaryotic organism *Cladophora* and heterotrophic prokaryotic organism, the bacteria.

109. Answer (1)

Hint: In prokaryotes, pyruvic acid undergoes oxidative decarboxylation in cytosol but this process is not a part of glycolysis.

Sol.: During glycolysis, two phosphate groups from 1, 3-bisphosphoglyceric acid are transferred to ADP to form ATP but in two different steps, *i.e.*, during conversion of 1,3-bisphosphoglyceric acid to 3-phosphoglyceric acid and phosphoenolpyruvate to pyruvic acid.

110. Answer (3)

Hint: In living organisms, respiratory substrates are often more than one.

Sol.: Pure proteins or fats are never used as respiratory substrates.

111. Answer (4)

Hint: The cells which are capable of self-perpetuation have the power to continue indefinitely through division.

Sol.: Meristems are the cells which are capable of self-perpetuation.

112. Answer (4)

Hint: An increase in surface area denotes the growth in a dorsiventral leaf.

Sol.: The growth of fruits and storage organs can be measured by finding out the increase in volume, fresh weight and dry weight.

113. Answer (4)

Hint: In the given diagram A, B, C, D and E are stroma lamella, grana lamella, stroma, ribosome and starch granule, respectively.

Sol.: For ATP synthesis, proton gradient is required, *i.e.*, proton concentration in lumen of thylakoid should be more than in stroma. The reducing equivalents for the synthesis of glucose are formed in thylakoids.

114. Answer (1)

Hint: The light reactions of photosynthesis occur in grana and stroma lamellae.

Sol.: C_4 plants show photosynthetic saturation at about $360 \mu L^{-1}$, while C_3 plants respond to increased CO_2 concentration and saturation is seen only beyond $450 \mu L^{-1}$.

115. Answer (4)

Hint: In C_4 plants, primary CO_2 fixation occurs in the mesophyll cells and secondary CO_2 fixation occurs in the bundle sheath cells.

Sol.: In C_4 plants, the bundle sheath cells may form several layers around the vascular bundles. They are characterized by having a large number of chloroplasts, thick walls impervious to gaseous exchange and no intercellular spaces.

116. Answer (2)

Hint: All the enzymes of Krebs' cycle are soluble in mitochondrial matrix, but succinate dehydrogenase is found attached to the inner mitochondrial membrane.

Sol.: Succinate dehydrogenase is the complex II. It is found attached to the inner membrane of mitochondria.

117. Answer (2)

Hint: One of the roles of terpene derivative phytohormone is to stimulate the synthesis of various types of hydrolytic enzymes for germination of seeds.

Sol.: Gibberellins are terpene derivative phytohormones. Auxins are indole compounds. Abscisic acid is a derivative of carotenoids.

118. Answer (2)

Hint: Auxin was isolated by F.W. Went from the tips of coleoptiles of oat seedlings.

Sol.: Plants respond to unilateral illumination by growing towards the light source (phototropism). Auxin is synthesized in the apical buds or the tip of coleoptile. From here, the auxin is transported towards the shaded side of the shoot tip, resulting in elongation of cells of that side. This causes the bending of shoot tip towards the light.

119. Answer (4)

Hint: Light reactions of photosynthesis are temperature sensitive but these are affected to a much lesser extent as compared to dark reactions.

Sol.: C₄ plants have a mechanism to increase CO₂ concentration at the enzyme site. They respond to higher temperatures and show higher rate of photosynthesis.

120. Answer (4)

Hint: Fats need to be broken down into glycerol and fatty acids first, to enter the respiratory pathway.

Sol.: If fatty acids are to be respired, they would first be degraded to acetyl CoA and enter the pathway. Glycerol would enter the pathway after being converted to glyceraldehyde-3-phosphate (PGAL).

121. Answer (3)

Hint: Some crops are raised for their fruits and seeds, whereas others are raised for their leaves.

Sol.: Since the plant hormone 'X' is responsible to inhibit flowering, this effect is used advantageously to prevent flowering in lettuce, where only leaves are edible.

122. Answer (2)

Hint: Ethylene breaks the dormancy of seeds, buds and initiates their germination.

Sol.: ABA induces dormancy of buds and seeds whereas, ethylene breaks the dormancy of seeds and buds. Therefore, they function antagonistically w.r.t. dormancy.

123. Answer (3)

Hint: In mitochondria, cytochrome *c* acts as electron carrier for transfer of electrons between complex III and IV.

Sol.: In ETS of mitochondria, cytochrome *c* acts as electron carrier for transfer of electrons from cytochrome *bc*₁ complex to cytochrome *c* oxidase complex.

124. Answer (4)

Hint: N⁶-furfurylamino purine is kinetin. It is a synthetic product and does not occur naturally in plants.

Sol.: Naphthalene acetic acid and 2, 4-dichlorophenoxyacetic acid are synthetic auxins but indole-3-acetic acid is a natural auxin.

125. Answer (3)

Hint: Flowering and fruit set up are synchronized by ethylene in pineapples.

Sol.: The auxins, such as NAA and 2, 4-D induce flowering in pineapples. Both auxin and ethylene are associated with flowering in pineapples.

126. Answer (1)

Hint: Water is the only source of hydrogen in plants.

Sol.: Since glucose, NADPH + H⁺, metabolic water and NADH + H⁺ have hydrogen and the only source of hydrogen is water, all these molecules will show radioactivity.

127. Answer (3)

Hint: After glycolysis, there can be alcoholic fermentation or lactic acid fermentation.

Sol.: In alcoholic fermentation, there is the production of CO₂ but in aerobic respiration, both CO₂ and H₂O are released.

128. Answer (1)

Hint: ABA stimulates the closure of stomata and increases the tolerance of plants to various kinds of stresses.

Sol.: Many of the extrinsic factors such as temperature and light, control plant growth and development via PGR.

129. Answer (4)

Hint: C₄ plants have a mechanism that increases the concentration of CO₂ at the enzyme RuBisCO site.

Sol.: There is requirement of 3 ATP and 2 NADPH molecules during Calvin cycle. In addition to this, 2 more molecules of ATP are used during Hatch and Slack pathway for per CO₂ fixed.

130. Answer (2)

Hint: In photosystem II associated with non-cyclic photophosphorylation, the reaction centre chlorophyll *a* absorbs 680 nm wavelength of light, causing electrons to become excited and these electrons are then picked up by an electron acceptor, which passes them to an electron transport system.

Sol.: In electron transport system, electrons move downhill, in terms of redox potential scale. From the electron transport system, the electrons move to the photosystem I and then again move downhill to reduce NADP⁺ into NADPH + H⁺.

131. Answer (4)

Hint: The light harvesting complex (LHC) is made up of hundreds of pigment molecules bound to proteins.

Sol.: LHC of each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system also called antennae. Other molecules of chlorophyll *a* are present in LHC.

132. Answer (1)

Hint: The energy released by oxidation in respiration is used to synthesise ATP.

Sol.: The ultimate source of energy on earth is sun. The light energy is converted into chemical energy by plants and this chemical energy is finally converted into energy currency of the cell, *i.e.*, ATP.

133. Answer (4)

Hint: Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity.

Sol.: One of the examples of plasticity is heterophylly in cotton, coriander and larkspur. In

such plants, the leaves of the juvenile plant are different in shape from those in mature plants.

134. Answer (1)

Hint: Ethylene could fit either of the groups, *i.e.*, as growth promoter and as growth inhibitor, but it is largely an inhibitor of growth activities.

Sol.: Ethylene promotes senescence and abscission of plant organs especially of leaves and flowers. Ethylene accelerates abscission in flowers and fruits (thinning of cotton, cherry, walnut). It promotes female flowers in cucumbers thereby, increasing the yield.

135. Answer (2)

Hint: C₃ pathway of photosynthesis is also known as Calvin cycle. This pathway is the main biosynthetic pathway for photosynthesis.

Sol.: C₃ pathway of photosynthesis occurs in both C₃ and C₄ plants. In C₄ plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO₂ at the enzyme site.

[ZOOLOGY]

136. Answer (4)

Hint: Frog is an amphibian.

Sol.: Kingdom – Animalia

Phylum – Chordata

Sub-phylum – Vertebrata

Division – Gnathostomata

Super class – Tetrapoda

Class – Amphibia

Genus – *Rana*

Species – *tigrina*

137. Answer (3)

Hint: A part of human hindbrain

Sol.: Pons is absent in the brain of a frog. Cerebrum and unpaired diencephalon are the parts of forebrain and cerebellum is the part of hindbrain.

138. Answer (3)

Hint: Less than 13

Sol.: The nervous system of frogs is organised into a central nervous system (brain and spinal cord), a peripheral nervous system (cranial and spinal nerves) and an autonomic nervous system (sympathetic and parasympathetic). There are ten pairs of cranial nerves arising from the brain.

139. Answer (3)

Hint: Includes organs of sight

Sol.: In cockroach, the head holds a bit of a nervous system while the rest is situated along the ventral (belly-side) part of its body. So, even if the head of a cockroach is cut off, it will still live for as long as one week. In the head region, the brain is represented by supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.

140. Answer (3)

Hint: Tracheoles are the site of exchange of gases.

Sol.: In cockroaches, the respiratory system consists of a network of trachea, that opens through 10 pairs of small holes called spiracles present on the lateral side of the body. Thin branching tubes (tracheal tubes sub-divided into tracheoles) carry oxygen from the outside to all the parts. The opening of the spiracles is regulated by the sphincters. Exchange of gases takes place at the tracheoles by diffusion.

141. Answer (3)

Hint: Invertebrates have ventrally located nervous system.

Sol.: The nervous system of cockroach consists of a series of fused, segmentally arranged ganglia joined by paired longitudinal connectives on the ventral side. Three ganglia lie in the thorax, and six in the abdomen. The nervous system of cockroach is spread throughout the body.

142. Answer (2)

Hint: Sexes are separate

Sol.: Both frog and cockroach are oviparous *i.e.*, both of them lay eggs.

Frogs exhibit external fertilisation while cockroach exhibits internal fertilisation.

143. Answer (4)

Hint: Leaping ability depends on limbs and brain

Sol.: The forelimbs and hind limbs help in swimming, walking, leaping and burrowing. The hind limbs end in five digits and they are larger and muscular than fore limbs that end in four digits. Feet have webbed digits that help in swimming.

While leaping, limbs are necessary to take off and land. Ears help to maintain balance/equilibrium.

144. Answer (4)

Hint: Exhibit camouflage

Sol.: The dorsal side of the body of *Rana tigrina* is generally olive green with dark irregular patches. The ventral side is uniformly pale yellow.

145. Answer (3)

Hint: Frogs respire through skin during summer and winter sleep.

Sol.: In case of water, skin acts as a respiratory organ (cutaneous respiration) in an adult frog. On land, the buccal cavity, skin and lungs act as the respiratory organs. During aestivation and hibernation, gaseous exchange takes place through skin (cutaneous respiration).

Branchial respiration occurs in tadpoles.

146. Answer (3)

Hint: Rohu is a freshwater fish.

Sol.: *Labeo* (Rohu) is a freshwater fish. *Betta* and *Pterophyllum* are aquarium fishes. Ctenophores (*Ctenoplana* and *Pleurobrachia*), hemichordates (*Saccoglossus* and *Balanoglossus*) and cephalochordates (*Branchiostoma*) are exclusively marine organisms.

147. Answer (3)

Hint: Includes jawless organisms

Sol.: Phylum Chordata is divided into three subphyla: Urochordata or Tunicata, Cephalochordata and Vertebrata. Cyclostomata is a class under the division Agnatha.

148. Answer (1)

Hint: Dolphin is a mammal.

Sol.: *Pavo* (bird) has dry skin without glands except the oil gland at the base of the tail.

Delphinus (mammal) is viviparous.

Exocoetus (flying fish) is a bony fish and possesses cycloid/ctenoid scales.

Testudo (tortoise) is a reptile and has dry and cornified skin covered with epidermal scutes.

149. Answer (4)

Hint: Exclude sting ray

Sol.: *Pristis* is a cartilaginous fish with saw shaped snout lined with rows of toothed denticles used for stunning and digging of prey.

Scoliodon - Dog fish

Torpedo - Has electric organs

Trygon - Sting ray

150. Answer (1)

Hint: Choose an echinoderm.

Sol.: Aschelminths are triploblastic, bilaterally symmetrical and pseudocoelomates (*e.g.*, *Wuchereria* and *Ancylostoma*).

Platyhelminths are acoelomates with bilateral symmetry (*e.g.*, *Fasciola*).

Molluscs are coelomates with bilateral symmetry (*e.g.*, *Aplysia*).

151. Answer (2)

Hint: Hemichordates possess gills.

Sol.: *Pila*, *Loligo*, *Balanoglossus*, *Clarias*, and *Hippocampus* possess gills for respiration. *Locusta* (locust) has tracheal tubes for respiration.

Balaenoptera has lungs.

Pila, *Loligo*, *Balanoglossus* and *Locusta* are invertebrates.

152. Answer (4)

Hint: A gregarious pest

Sol.: Lac is produced by *Laccifer* (lac insect). It is an economically beneficial insect. *Locusta* is a gregarious pest.

153. Answer (1)

Hint: Their monomeric unit is N-acetyl glucosamine.

Sol.: The male external genitalia are represented by male gonapophysis or phallomeres (chitinous asymmetrical structures, surrounding the male gonopore).

154. Answer (4)

Hint: Malpighian tubules are present at the junction of midgut and hindgut.

Sol.: Cockroach possesses three segments of thorax, each bearing a pair of walking legs. Hepatic caecae are present at the junction of foregut and midgut. A pair of salivary glands is present in alimentary canal. Uric acid formation occurs in Malpighian tubules which are lined by ciliated and glandular cells.

155. Answer (2)

Hint: Blood is pumped anteriorly to sinuses.

Sol.: Heart of cockroach consists of elongated muscular tube lying along mid-dorsal line of thorax and abdomen. It is differentiated into funnel-shaped chambers with ostia on either side. Blood from sinuses enter heart through ostia and is pumped anteriorly to sinuses again.

156. Answer (3)

Hint: An amphibian

Sol.: *Calotes* - Garden lizard

Hemidactylus - Wall lizard

Testudo - Tortoise

Bufo - Toad

157. Answer (3)

Hint: Fishes are poikilotherms.

Sol.: Fishes are cold-blooded animals (poikilothermous), *i.e.*, they lack the capacity to regulate their body temperature. So, fishes can die due to sudden change or fluctuations in the external temperature.

158. Answer (3)

Hint: Jointed filamentous structures arise from the 10th abdominal segment.

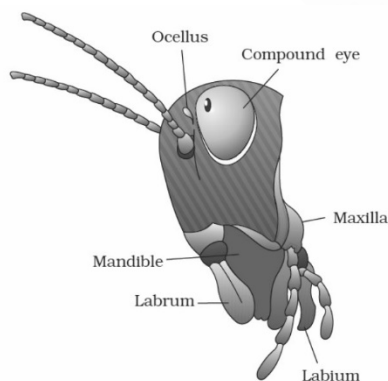
Sol.: Anal cerci – 10th abdominal segment of both male and female cockroaches

- Testes – 4th - 6th abdominal segments of males
- Ovaries – 2nd - 6th abdominal segments of females
- Mushroom-shaped gland – 6th - 7th abdominal segments of males

159. Answer (3)

Hint: Represents the lower jaw in humans

Sol.: Mandible has incising and grinding regions. Mandible and maxilla are paired mouth parts while labrum, labium and hypopharynx are unpaired structures.



160. Answer (4)

Hint: Platyhelminths are dorso-ventrally flattened animals.

Sol.: Adult echinoderms are radially symmetrical. Platyhelminths are triploblastic, bilaterally symmetrical with organ-level of body organisation. Many marine animals, for *e.g.*, members of the class Chondrichthyes, exhibit internal fertilisation.

161. Answer (2)

Hint: Commonly called tapeworm

Sol.: Hooks are absent in *Fasciola*. Alimentary canal is absent in *Taenia*. *Hirudinaria* is an ectoparasite. Flame cells are found in platyhelminths. *Ascaris* is an aschelminth.

162. Answer (2)

Hint: Vasa efferentia enter the kidneys on their side

Sol.: Frogs have well-organised male and female reproductive systems. Male reproductive organs consist of a pair of yellowish ovoid testes, which are found adhered to the upper part of kidneys by a double fold of peritoneum called mesorchium. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca. The cloaca is a small, median chamber that is used to pass faecal matter, urine and sperms to the exterior.

163. Answer (2)

Hint: Plays an important role during summer sleep

Sol.: In frogs, mucous glands are present in the skin which helps in respiration in water and on land.

164. Answer (3)

Hint: Equal to the number of digits in palm of man

Sol.: In cockroach, the sense organs are antennae, eyes, maxillary palps, labial palps and anal cerci. The head capsule bears a pair of compound eyes. A pair of thread-like antennae arise from membranous sockets lying in front of eyes. Antennae have sensory receptors that help in monitoring the environment. Anal style is a short, thread-like structure found only in male cockroaches.

165. Answer (1)

Hint: *Psittacula* is a chordate.

Sol.: In ctenophores, eight ciliated comb plates are present for locomotion.

Those animals in which the developing embryo has a third germinal layer, mesoderm, in between ectoderm and endoderm are called triploblastic animals.

Psittacula (parrot) is a triploblastic coelomate animal.

166. Answer (3)

Hint: Cnidocytes are present on the body and tentacles.

Sol.: In coelenterates, cnidoblasts or cnidocytes are present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

167. Answer (1)

Hint: Collateral gland is present only in females.

Sol.: In female cockroaches, anterior part of brood pouch or genital pouch contains female gonopore, spermathecal pore and collateral glands. In males, genital pouch or chamber lies at the hind end of abdomen. It contains dorsal anus, ventral male genital pore and gonapophyses.

168. Answer (2)

Hint: *Doliolum* is a urochordate.

Sol.: *Dentalium* is a non-cephalopod mollusc and *Doliolum* is a urochordate. Both of them have an open circulatory system.

Dentalium is a non-chordate and has a ventral, solid and double CNS. They also possess radula.

Doliolum is a chordate and has dorsal, hollow and single CNS.

169. Answer (2)

Hint: Similar to position of sternum in humans

Sol.: Male reproductive system in cockroaches consists of a pair of testes one lying on each lateral side in the 4th -6th abdominal segments. From each testis arises a thin vas deferens, which opens into ejaculatory duct through seminal vesicle. The ejaculatory duct opens into male gonopore situated ventral to the anus.

170. Answer (4)

Hint: Organs of sight and sound are well-organised structures.

Sol.: Frog has different types of sense organs, namely organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears). Out of these, eyes and internal ears are well-organised structures and the rest are cellular aggregations around nerve endings.

171. Answer (2)

Hint: Equal to the number of eyes you have

Sol.: Gills are present as the respiratory structures in prawns. Antennal glands are the excretory structures of prawns.

172. Answer (3)

Hint: Choose an echinoderm.

Sol.: *Pennatula* – Sea pen

Adamsia – Sea anemone

Antedon – Sea lily

Echinus – Sea urchin

173. Answer (3)

Hint: A mollusc

Sol.: Molluscs contain space between the hump and the mantle called the mantle cavity in which feather-like gills are present.

Hippocampus is a bony fish.

Ophiura is an echinoderm.

Petromyzon is a cyclostome.

Pinctada is a mollusc that produces pearls.

174. Answer (2)

Hint: Feature found in bony fishes

Sol.: *Scoliodon* is a cartilaginous fish while *Betta* is a bony fish. Operculum is present in bony fishes while it is absent in cartilaginous fishes. Both bony and cartilaginous fishes possess streamlined body and gill slits.

175. Answer (2)

Hint: Possess 3-chambered heart

Sol.: Heart of frog is 3-chambered and it pumps mixed blood. Its heart is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium.

176. Answer (4)

Hint: Reptiles lay eggs

Sol.: *Chameleon* – Mostly oviparous and direct development

Ichthyophis – Exhibits external fertilisation and it is a limbless amphibian

Pteropus – Viviparous mammal

177. Answer (3)

Hint: Characteristic feature of porifers

Sol.: • Water vascular system is present in echinoderms.

- Nematocysts are the stinging capsules in coelenterates.
- Water canal system is present in proifers.
- Parapodia is found in aquatic annelids.

178. Answer (2)

Hint: Birds and mammals are warm blooded.

Sol.: Amphibians and reptiles (*Crocodilus*, *Naja*, *Bangarus*, *Vipera*, *Chelone*, *Testudo*) are cold blooded animals.

Birds (*Columba*, *Aptenodytes*, *Pavo*, *Corvus*, *Psittacula*) are warm blooded animals.

179. Answer (1)

Hint: Diploblastic animals have mesoglea.

Sol.: Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm, are called diploblastic

animals, e.g., coelenterates. An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm. Sea lily is an echinoderm.

180. Answer (2)

Hint: Protochordates are marine.

Sol.: Subphyla Urochordata and Cephalochordata are often referred to as protochordates and are exclusively marine. In members of Urochordata, notochord is present only in larval tail, while in cephalochordates, it extends from head to tail region and is persistent throughout their life.

Members of both subphyla are exclusively marine.

Urochordates (tunicates) have an open circulatory system.




Aakash
Medical | IIT-JEE | Foundations

All India Aakash Test Series for NEET - 2026

TEST - 7 (Code-B)[Click here for Code-A Sol.](#)

Test Date : 25/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint & Sol.: The equation of SHM is $a = -k(x + c)$ or $a = -kx$.

2. Answer (1)

Hint: Use ideal gas equation, $PV = nRT$

Sol.: $P^2V = C$ and $PV = nRT$

$$\Rightarrow \frac{n^2 R^2 T^2}{V^2} V = C \Rightarrow \frac{T^2}{V} = C$$

$$\Rightarrow \frac{T_0^2}{V_0} = \frac{(T')^2}{2V_0} \Rightarrow (T')^2 = 2T_0^2$$

$$\Rightarrow T' = \sqrt{2}T_0$$

3. Answer (3)

Hint & Sol.: $AB \rightarrow$ Isothermal expansion

$BC \rightarrow$ Adiabatic expansion

$CD \rightarrow$ Isothermal compression

$DA \rightarrow$ Adiabatic compression

4. Answer (3)

Hint: $\eta = 1 - \frac{T_2}{T_1} = \frac{W_{\text{net}}}{Q_{\text{supplied}}}$

Sol.: $\eta = 1 - \frac{300}{500} = \frac{2}{5} = \frac{W}{200}$

$$\Rightarrow W = \frac{2}{5} \times 200 = 80 \text{ calories}$$

5. Answer (4)

Hint & Sol.: Assertion is false as equipartition distributes energy among all degrees of freedom not strictly translational vs rotational and reason is true as reason lays down the condition when the real gas behaves as an ideal gas.

6. Answer (2)

Hint: For cyclic process, $\Delta Q = \Delta W$

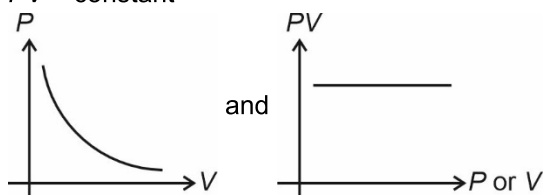
Sol.: $\Delta Q =$ area under curve

$$= 2.5 \times 10^{-6} \times 2 \times 10^5$$

$$\Delta Q = 5 \times 10^{-1} = 0.5 \text{ J}$$

7. Answer (4)

Hint & Sol.: According to Boyle's law, $PV = \text{constant}$



8. Answer (2)

Hint: Molar specific heat capacity, $C = C_v + \frac{R}{1-x}$

Sol.: $C = \frac{3R}{2} + \frac{R}{1-x}$ and $PV^{-1} = C \rightarrow x = -1$

$$C = \frac{3R}{2} + \frac{R}{2} = 2R$$

9. Answer (1)

Hint: Mean free path, $\lambda = \frac{1}{\sqrt{2}n\pi d^2}$, d is diameter of molecule

Sol.: $d^2 = \frac{1}{\sqrt{2}n\pi\lambda}$

$$d^2 = \frac{1}{\sqrt{2} \times 3 \times 10^8 \times \pi \times \frac{\pi}{3\sqrt{2}} \times 10^{-2}}$$

$$d^2 = \frac{1}{\pi^2 \times 10^6}$$

$$d = \frac{1}{\pi \times 10^3}$$

$$= \frac{10^{-3}}{\pi} \text{ cm} = \frac{10^{-5}}{\pi} \text{ m}$$

10. Answer (3)

Hint: For an ideal gas, the equipartition theorem states, each degree of freedom contributes $\frac{1}{2} K_B T$ to the mean energy per molecule.

Sol.: Mean energy per molecule = $\frac{\alpha}{2} KT$

11. Answer (1)

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

Sol.: $v_{\text{rms}} = \sqrt{\frac{3 \times 8.31 \times 300}{2 \times 10^{-3}}} = 1.93 \times 10^3 \text{ m/s}$

12. Answer (3)

Hint: According to Laplace's correction sound propagation in gaseous medium takes place under adiabatic condition.

Sol.: For any ideal gas

$$v_{\text{sound}} = \sqrt{\frac{\gamma RT}{M}}$$

13. Answer (2)

Hint & Sol.: $(F_7)_C = (F_4)_0$

$$\Rightarrow 7 \cdot \left[\frac{v}{4l_c} \right] = 4 \left[\frac{v}{2l_0} \right]$$

$$\Rightarrow \frac{l_c}{l_0} = \frac{7}{8}$$

14. Answer (4)

Hint & Sol.: Longitudinal wave is possible in solid, liquid and gases because they require a medium for particles to oscillate back and forth in same direction as the wave, transferring energy through the medium.

15. Answer (1)

Hint: Use the concept of refraction

Sol.: As air is denser medium so speed is slower in air than water for sound, hence it would bend towards normal ($v_{\text{water}} > v_{\text{air}}$).

16. Answer (1)

Hint: Time period, $T = 2\pi\sqrt{\frac{m}{K}}$

Sol.: After collision velocity of block will be $0.5 u_0$
As motion starts from equilibrium position,

$$x = A \sin(\omega t)$$

$$v = A\omega \cos(\omega t)$$

$$\Rightarrow 0.5 u_0 = u_0 \cos(\omega t)$$

$$\Rightarrow \frac{2\pi}{T} \times t = \frac{\pi}{3} \Rightarrow t = \frac{T}{6}$$

$$\text{Total time} = \frac{T}{6} + \frac{T}{6} = \frac{T}{3} = \frac{2\pi}{3} \sqrt{\frac{m}{K}}$$

17. Answer (1)

Hint & Sol.: The work done by string of a simple pendulum in one complete oscillation is equal to zero.

18. Answer (1)

Hint: Displacement is minimum at mean position.

Sol.: At mean position, P.E is minimum and K.E is maximum.

19. Answer (2)

Hint: Use, $T = 2\pi\sqrt{\frac{M}{K}}$

Sol.: When spring stretches $\Rightarrow Mg = kx_0$

$$\text{Time period, } T = 2\pi\sqrt{\frac{M}{2 \times k}}$$

$$= 2\pi\sqrt{\frac{M \cdot x_0}{2 \times Mg}} = 2\pi\sqrt{\frac{x_0}{2g}}$$

20. Answer (4)

Hint: Use, $T = 2\pi\sqrt{\frac{l}{g}}$

$$\text{Sol. } T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow \frac{\Delta T}{T} = \frac{1}{2} \frac{\Delta l}{l} + \frac{1}{2} \frac{\Delta g}{g}$$

$$\Rightarrow \% \text{ change} = \frac{1}{2} \times 1\% = 0.5\%$$

21. Answer (1)

Hint: $f = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$

Sol.: $f_1 \propto \sqrt{T_1}$, $f_2 \propto \sqrt{T_2}$ and $f'' \propto \sqrt{T_1 + T_2}$

$$f'' = k\sqrt{T_1 + T_2} \Rightarrow \frac{f''}{f_1} = \sqrt{\frac{T_1 + T_2}{T_1}}$$

$$f_1 = k\sqrt{T_1}$$

$$\Rightarrow \frac{f''}{80} = \sqrt{1 + \frac{225}{64}} \Rightarrow \frac{f''}{80} = \sqrt{\frac{289}{64}} \Rightarrow \frac{f''}{80} = \frac{17}{8}$$

$$f'' = 170 \text{ Hz}$$

22. Answer (1)

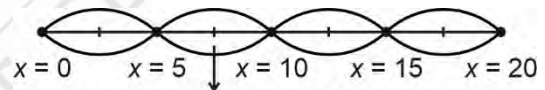
Hint: For standing wave formed on a string,

$$L = \frac{n\lambda}{2}$$

Sol.: At $x = 0$, $y = 0 \rightarrow$ Node

At $x = 20$, $y = 0 \rightarrow$ Node

$$\lambda = 10 \text{ cm} \Rightarrow L = \frac{4 \times 10}{2}$$



Second antinode = $5 + 2.5 = 7.5 \text{ cm}$

23. Answer (2)

Hint: For isobaric $W = P\Delta V$, for isothermal

$$W = nRT \ln\left(\frac{V_2}{V_1}\right)$$

$$\text{Sol. } W_{\text{isothermal}} = C \ln\left[\frac{V_2}{V_1}\right]$$

$$W_{\text{isobaric}} = P[2V - V] = PV$$

$$W_{\text{isothermal}} = C \ln\left[\frac{V_2}{V_1}\right] = C \ln(2), (C = PV)$$

$$W_2 = PV \ln(2) \Rightarrow W_2 = W_1 \ln(2)$$

24. Answer (3)

Hint: Use conservation of energy

Sol.: Since cylinder is adiabatic and piston is diathermic and fixed.

$$\Rightarrow n_1 \times C_{v1} \times (T - T_1) = n_2 \times C_{v2} \times (T_2 - T)$$

$$\Rightarrow \frac{P_1 \times V}{2 \times R \times T_1} \times \frac{3R}{2} \times (T - T_1) = \frac{P_2 \times V}{2RT_2} \times \frac{3R}{2} \times (T_2 - T)$$

$$\Rightarrow P_1 \left(\frac{T}{T_1} - 1 \right) = P_2 \left(1 - \frac{T}{T_2} \right)$$

$$\frac{P_1 T}{T_1} + \frac{P_2 T}{T_2} = P_2 + P_1 \Rightarrow T \left[\frac{P_1 T_2 + P_2 T_1}{T_1 T_2} \right] = P_1 + P_2$$

$$\Rightarrow T = \frac{(P_1 + P_2)(T_1 T_2)}{P_1 T_2 + P_2 T_1}$$

25. Answer (3)

Hint: Molar specific heat capacity is defined as amount of heat given to one mole such that temperature increases by 1°C or 1 K .

Sol.: Using First law of thermodynamics

$$\Rightarrow \Delta U = \frac{Q}{2} \text{ and } \Delta U = nC_v \Delta T$$

$$\text{Also } Q = nC \Delta T$$

$$\Rightarrow \frac{Q}{2} = n \times \frac{5R}{2} \times \Delta T \Rightarrow \frac{Q}{n \Delta T} = 5R$$

26. Answer (2)

Hint: Work done, $W = \int P dv$

$$\text{Sol.} : V = \frac{\alpha}{T} \text{ and } PV = nRT \Rightarrow PV = \frac{nR\alpha}{V}$$

$$\Rightarrow P = \frac{nR\alpha}{V^2}, dW = PdV \Rightarrow dW = \frac{nR\alpha}{V^2} dV$$

$$\Rightarrow W = \int nR\alpha \times \frac{dV}{V^2} = -nR\alpha \left[\frac{1}{V_2} - \frac{1}{V_1} \right]$$

$$\Rightarrow W = nR\alpha \left[\frac{1}{V_1} - \frac{1}{V_2} \right] = nR[T_1 - T_2]$$

27. Answer (4)

Hint: RMS speed of gas molecules $v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

$$\text{Sol.} : v_{\text{rms}} = \sqrt{\frac{3RT}{M}} \Rightarrow v_{\text{rms}} \propto \sqrt{T} \Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{300}{1200}}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{3}{12}} \Rightarrow \frac{v_1}{v_2} = \frac{1}{2} \Rightarrow v_2 = 2v_1$$

28. Answer (3)

Hint & Sol.: Since $P_1 V_1 = P_2 V_2$, therefore we are certain that $T_1 = T_2$, but it is possible that temperature does not remain same throughout the process, hence it may or may not be an isothermal process.

29. Answer (2)

Hint: $C_{v, \text{mix}} = \frac{n_1 C_{v1} + n_2 C_{v2}}{n_1 + n_2}$ and $C_p - C_v = R$

$$\text{Sol.} : C_{v, \text{mix}} = \frac{\frac{4 \times 3R}{2} + \frac{2 \times 5R}{2}}{6} = \frac{6R + 5R}{6} = \frac{11R}{6}$$

$$\text{Now, } C_{p, \text{mix}} = \frac{11R}{6} + R = \frac{17R}{6}$$

30. Answer (3)

Hint: The average translational K.E per molecule for all kind of gases is $\frac{3}{2}KT$.

Sol.: Since, temperature is same for both O_2 and He molecules, their (K.E) average translational will be identical, regardless of their different masses.

31. Answer (1)

Hint: Use, first law of thermodynamics

$$\text{Sol.} : \Delta Q = \Delta U + \Delta W \Rightarrow 60 \text{ J} = \Delta U - 20 \text{ J}$$

$$\Rightarrow \Delta U = 80 \text{ J}$$

32. Answer (1)

Hint: Use, $\Delta U = nC_v \Delta T$,

$W = nR \Delta T$ (isobaric) and

$W = -\Delta U$ (adiabatic)

$$\text{Sol.} : W_{\text{isobaric}} = P \Delta V = nR \Delta T = 2 \times R \times T = 2RT$$

$$\Delta U = nC_v \Delta T = \frac{2 \times 3R}{2} \times T = 3RT$$

For adiabatic process, $\Delta U + \Delta W = 0$

$$\Rightarrow \Delta U = -\Delta W \Rightarrow \Delta U = -3RT$$

33. Answer (2)

Hint: At constant pressure, $\Delta Q = nC_p \Delta T$ and $\Delta U = nC_v \Delta T$

$$\text{Sol.} : \frac{\Delta U}{\Delta Q} = \frac{nC_v \Delta T}{nC_p \Delta T} = \frac{\frac{3R}{2}}{\frac{5R}{2}} = \frac{3}{5}$$

34. Answer (1)

Hint: Maximum amplitude occurs when phase difference $\Delta \phi = 0$

$$\text{Sol.} : A_{\text{max}} = \sqrt{A_1^2 + A_2^2 + 2A_1 A_2} = A_1 + A_2$$

$$\Rightarrow A_{\text{max}} = 4A$$

35. Answer (3)

Hint: $v = f\lambda$, Beat frequency = $|f_1 - f_2|$

$$\text{Sol.} : \alpha = f_1 - f_2 \Rightarrow \alpha = \frac{v}{\lambda_1} - \frac{v}{\lambda_2}$$

$$\Rightarrow \alpha = v \left[\frac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2} \right]$$

$$v = \frac{\alpha \lambda_1 \lambda_2}{\lambda_2 - \lambda_1}$$

36. Answer (2)

Hint & Sol.: As particles have minimal movement at these points, they become tightly packed together by approaching compressions and preceding rarefactions resulting in maximum pressure. There exists a phase difference of $\frac{\pi}{2}$ between pressure and displacement in sound wave and $f_0 = \frac{v}{2l}$ and $f_c = \frac{v}{4l} \Rightarrow f_0 = 2f_c$

37. Answer (2)

Hint: Time, $T = 2\pi\sqrt{\frac{m}{K_{eq}}}$,

For combination of springs

$$K_P = K_1 + K_2, K_S = \frac{K_1 K_2}{(K_1 + K_2)}$$

Sol.: $\frac{1}{K_{eq}} = \frac{1}{2K} + \frac{1}{2K} \Rightarrow \frac{1}{K_{eq}} = \frac{2}{2K} \Rightarrow K_{eq} = K$

$$T = 2\pi\sqrt{\frac{m}{K}}$$

38. Answer (4)

Hint: Superposition of SHM having same frequency is also an SHM

Sol.: For $y = \sin(\omega t) + \cos(\omega t)$

$$= \sqrt{2} \left[\frac{1}{\sqrt{2}} \sin(\omega t) + \frac{1}{\sqrt{2}} \cos(\omega t) \right]$$

$$= \sqrt{2} \sin\left(\omega t + \frac{\pi}{4}\right)$$

Hence, it is a SHM.

Similarly, $y = \sin(\omega t) - \cos(\omega t)$ is also a SHM. Therefore all of the given functions represent simple harmonic motion.

39. Answer (2)

Hint: Use the equation, $v = \omega\sqrt{A^2 - x^2}$

Sol.: $v = \omega\sqrt{A^2 - x^2} \Rightarrow b\omega\sqrt{3} = \omega\sqrt{A^2 - b^2}$

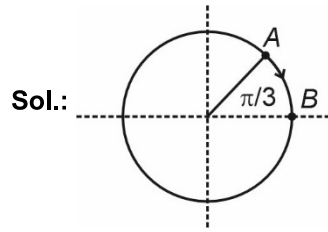
$$\Rightarrow \sqrt{A^2 - b^2} = \sqrt{3} \times b$$

$$\Rightarrow A^2 - b^2 = 3b^2 \Rightarrow A^2 = 4b^2 \Rightarrow A = 2b$$

It has initially covered distance b , so further distance covered will be equal to b .

40. Answer (3)

Hint: Use the concept of phasors



Sol.:

To go from half the amplitude to its positive extreme, angle that needs to be covered = $\frac{\pi}{3}$.

$$\frac{\pi}{3} = \frac{2\pi}{T} \times t \Rightarrow t = \frac{T}{6}$$

41. Answer (3)

Hint: Speed of transverse wave in a string,

$$v = \sqrt{\frac{T}{\mu}}$$

Sol.: $v = \sqrt{\frac{T}{\frac{1}{l} \times \rho \times A \times l}} = \sqrt{\frac{T}{\rho A}}$

$$\Rightarrow \frac{\Delta v}{v} = \frac{1}{2} \frac{\Delta T}{T} - \frac{1}{2} \frac{\Delta \rho}{\rho} - \frac{1}{2} \frac{\Delta A}{A}$$

$$\Rightarrow \frac{\Delta v}{v} = \frac{-1}{2} \frac{\Delta \rho}{\rho} \Rightarrow 1\% \text{ decrease}$$

42. Answer (1)

Hint: In this case the transverse wave travels with a constant acceleration of $g/2$.

Sol.: The wave travels with constant acceleration of $g/2$.

$$2.45 = \frac{1}{2} \times \frac{g}{2} \times t^2 \Rightarrow t^2 = \frac{2 \times 2 \times 2.45}{9.8} \Rightarrow t = 1 \text{ s}$$

43. Answer (1)

Hint: $V_{P, \max} = A\omega$

Sol.: $V_{P, \max} = A\omega$, $A = 5 \times 10^{-2} \text{ m}$, $\omega = 400 \pi$

$$V_{P, \max} = 5 \times 10^{-2} \times 4 \times 10^2 \times \pi = 20 \pi \text{ m/s}$$

44. Answer (1)

Hint: Efficiency of Carnot engine $\eta_{\text{Carnot}} = 1 - \frac{T_2}{T_1}$

Sol.: $\eta_{\text{Carnot}} = 1 - \frac{400}{800} = 1 - \frac{1}{2} = \frac{1}{2}$

$\Rightarrow 50\% \text{ efficiency}$

45. Answer (1)

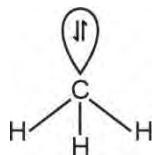
Hint & Sol.: For the expansion of an ideal gas between two same states, among the given options maximum work done will be in isobaric process as for isobaric $W = P(2V - V) = PV$.

[CHEMISTRY]

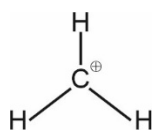
46. Answer (2)

Hint: $\ominus\text{CH}_3$ is pyramidal in shape while $\oplus\text{CH}_3$ is trigonal planar in shape

Sol.: $\ominus\text{CH}_3$ is sp^3 hybridised



$\oplus\text{CH}_3$ is sp^2 hybridised



47. Answer (2)

Hint & Sol.: $-\text{NO}_2$ present at para position stabilises the carbanion by $-R$ effect.

48. Answer (2)

Hint: Iron (III) hexacyanidoferrate (II) is also known as ferriferrocyanide

Sol.: AgCl is soluble in NH_4OH solution.

49. Answer (2)

Hint: Actual pressure of N_2 gas = $725 - 15 = 710$ mm of Hg.

Sol.: $PV = nRT$

$$n = \frac{PV}{RT} = \frac{710 \times 100}{760 \times 1000 \times 0.0821 \times 300}$$

$$n = 3.79 \times 10^{-3}$$

$$\text{Percentage of nitrogen} = \frac{3.79 \times 10^{-3} \times 28 \times 100}{0.5}$$

$$= 21.2\%$$

50. Answer (4)

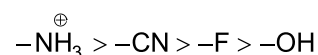
Hint: More symmetric is the structure, better is the crystal packing and higher is the melting point.

Sol.: trans-but-2-ene has more symmetrical structure than cis-but-2-ene, leading to a better crystal packing hence trans-but-2-ene has higher melting point than that of cis-but-2-ene.

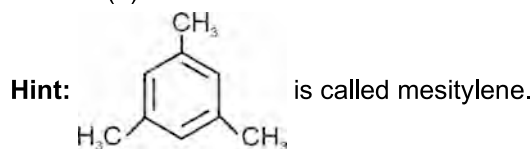
51. Answer (2)

Hint: Positive charge on electronegative atom increases its $-I$ effect

Sol.: Correct order of $-I$ effect

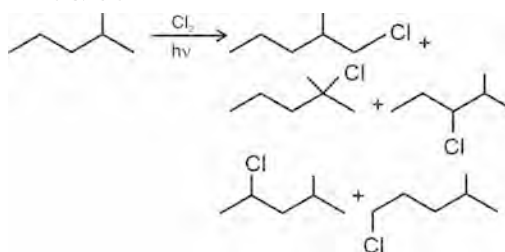


52. Answer (4)

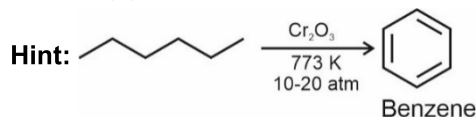
**Sol.:**

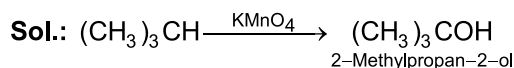
Compound	Number of σ bonds
 Mesitylene	21
 Naphthalene	19
 Tetrahydrofuran	13
 Anisole	16

53. Answer (2)

Hint & Sol.:

54. Answer (1)





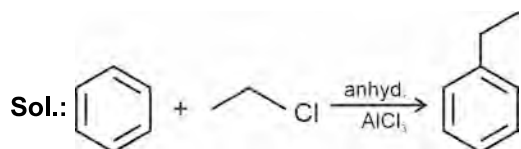
55. Answer (2)

Hint: More is the torsional strain, lesser is the stability of the molecule in the given conformation.

Sol.: If two $-\text{CH}_3$ groups of n-butane are closest to each other, then the torsional strain will be maximum and the conformation will be least stable (eclipsed conformation).

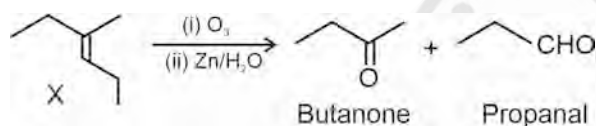
56. Answer (3)

Hint: Halogen atom attached to sp^3 carbon atom will be used as halide component in Friedel-Crafts reaction.

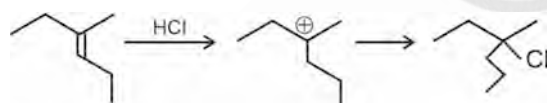


57. Answer (2)

Hint:



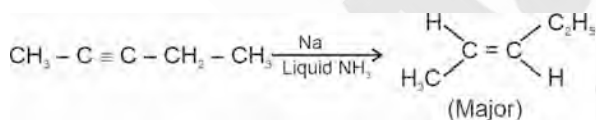
Sol.:



58. Answer (3)

Hint: Lindlar's catalyst converts alkynes to cis-alkenes.

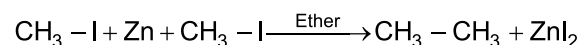
Sol.:



59. Answer (1)

Hint: In Frankland's reaction, C-C bond formation takes place.

Sol.:



60. Answer (3)

Hint: Benzyl carbocation $(\text{C}_6\text{H}_5\text{CH}_2^+)$ is stabilised by resonance.

Sol.: Tert-butyl carbocation is more stable than benzyl carbocation.

Phenyl carbocation is unstable as the positive charge is present on carbon containing double bond.

61. Answer (2)

Hint: Lesser is the stability of alkene, more will be the energy released on catalytic hydrogenation of alkene.

Sol.: Greater is the number of α -hydrogen atoms, more is the stability of alkene and lesser is the amount of energy released on hydrogenation reaction.

62. Answer (3)

Hint: Kjeldahl method is not applicable to compounds in which nitrogen does not change to ammonium sulphate on treatment with concentrated sulphuric acid.

Sol.: Kjeldahl method is not applicable to compounds containing nitrogen in nitro, azo groups and nitrogen present in the ring.

63. Answer (3)

Hint: Percentage of carbon =

$$\frac{\text{Atomic mass of carbon} \times \text{Mass of CO}_2 \times 100}{\text{Molecular mass of CO}_2 \times \text{Mass of organic compound}}$$

Sol.: 44 g of CO_2 contains 12 g carbon

1.32 g of CO_2 contains $\frac{12 \times 1.32}{44}$ g of carbon

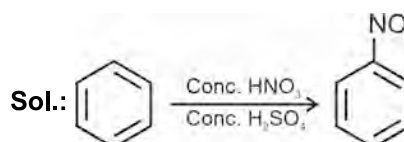
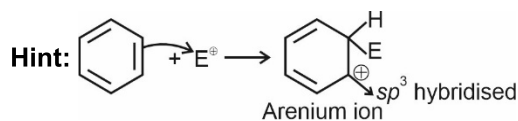
Percentage of carbon = $\frac{12 \times 1.32 \times 100}{44 \times 0.39} = 92.3\%$

18 g of H_2O contains 2 g of hydrogen

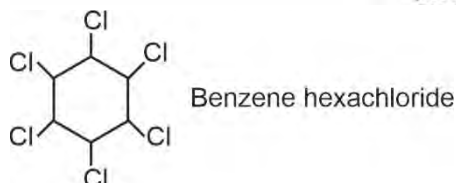
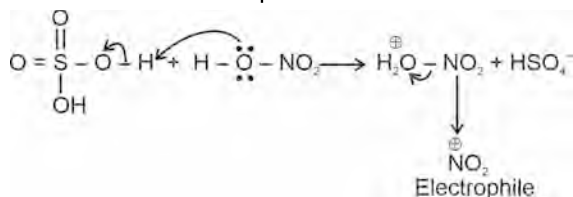
0.27 g of H_2O contains $\frac{2 \times 0.27}{18}$ g of hydrogen

Percentage of hydrogen = $\frac{2 \times 0.27 \times 100}{18 \times 0.39} = 7.7\%$

64. Answer (1)

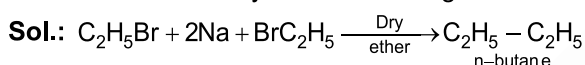


Generation of electrophile



65. Answer (2)

Hint: Alkyl halides (except fluorides) on reduction with zinc and dilute hydrochloric acid give alkanes.



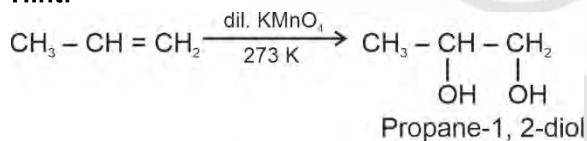
66. Answer (2)

Hint: Electron donating groups attached with benzene increases reactivity towards electrophilic substitution reaction.

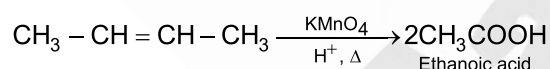
Sol.: Electron withdrawing groups attached with benzene decreases reactivity towards electrophilic substitution reaction.

67. Answer (3)

Hint:



Sol.:



68. Answer (3)

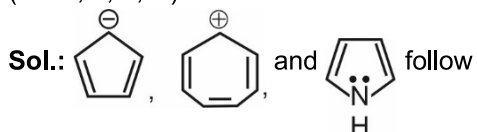
Hint: The groups which direct the incoming electrophile to ortho and para positions are called ortho and para directing groups.

Sol.:

- $-NHCOCH_3$, $-C_2H_5$, $-OCH_3$ and $-NHR$ are ortho and para directing groups.
- $-CN$, COR , $-COOR$ are meta directing groups.

69. Answer (4)

Hint: Cyclic planar species having $(4n + 2)\pi$ electrons in conjugation are aromatic in nature ($n = 0, 1, 2, \dots$)



Huckel's $(4n + 2)\pi$ electron rule. These are aromatic in nature.

70. Answer (1)

Hint: +I effect causing group decreases acidic strength of carboxylic acid while -I effect causing group increases acidic strength.

Sol.:

- $-CH_3$, $-C_2H_5$ induces +I effect. +I effect of $-C_2H_5$ is greater than $-CH_3$.
- Cl has -I effect, if $-Cl$ is closer to $-COOH$ group then more will be -I effect and greater will be the acidic strength of carboxylic acid.
- Correct order of acidic strength is $ClCH_2COOH > ClCH_2CH_2COOH > CH_3COOH > CH_3CH_2COOH$

71. Answer (4)

Hint: $[Fe(SCN)]^{2+}$ is blood red in colour.

Sol.:

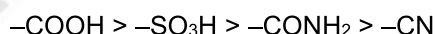
Species	Colour
PbS	→ Black
$(NH_4)_3PO_4 \cdot 12MoO_3$	→ Yellow
$[Fe(CN)_5NOS]^{4-}$	→ Violet
$[Fe(SCN)]^{2+}$	→ Blood red

72. Answer (2)

Hint & Sol.: Thin layer chromatography is a type of adsorption chromatography.

73. Answer (2)

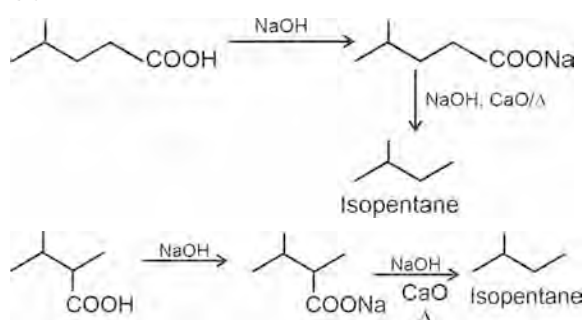
Hint & Sol.: Correct order of priority of functional groups in IUPAC nomenclature:



74. Answer (3)

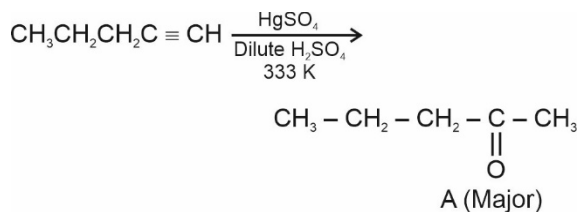
Hint: Sodium salts of carboxylic acids on heating with soda lime gives alkanes containing one carbon less than carboxylic acid.

Sol.:

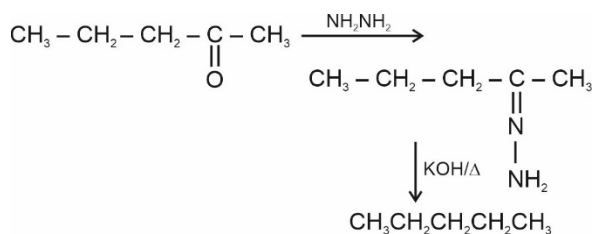


75. Answer (1)

Hint:



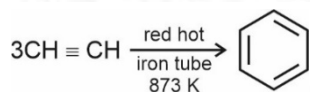
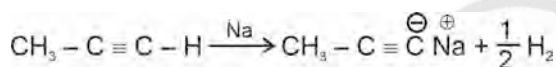
Sol.:



76. Answer (1)

Hint: Terminal alkynes contain acidic hydrogen

Sol.:



77. Answer (2)

Hint: 233 g of BaSO₄ contains 32 g of sulphur

Sol.: 233 g of BaSO₄ contains 32 g of sulphur

$$1.165 \text{ g of BaSO}_4 \text{ contains } \frac{32 \times 1.165}{233}$$

$$\text{Percentage of sulphur} = \frac{32 \times 1.165 \times 100}{233 \times 1.25}$$

$$= 12.8\%$$

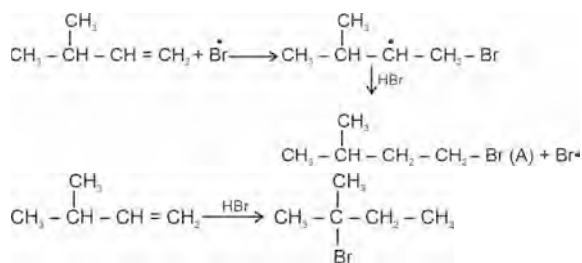
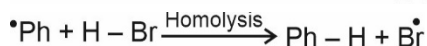
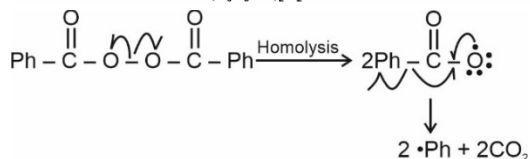
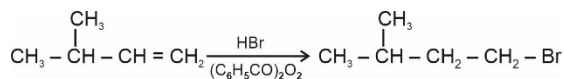
78. Answer (2)

Hint & Sol.: Steam distillation technique is applied to separate substances which are steam volatile and are immiscible with water.

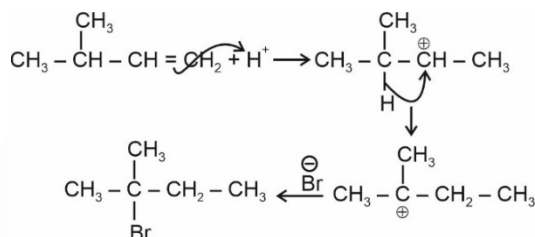
79. Answer (3)

Hint: HBr addition to unsymmetrical alkene may lead to carbocation rearrangement.

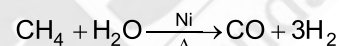
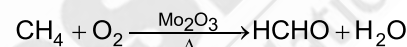
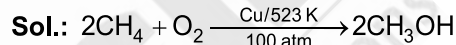
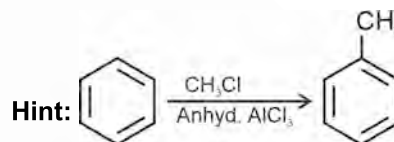
Sol.:



Mechanism:

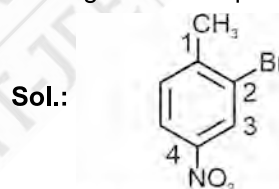


80. Answer (1)



81. Answer (2)

Hint: Lowest locant rule should be applied in naming of this compound.

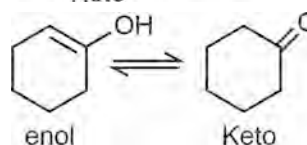
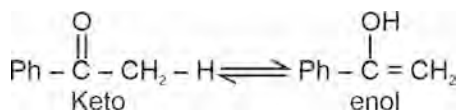


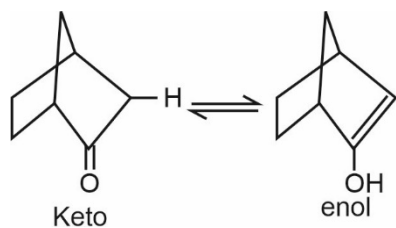
2-Bromo-1-methyl-4-nitrobenzene

82. Answer (3)

Hint: In keto-enol tautomerism, hydrogen from one centre to another moves with the assistance of π bond.

Sol.:



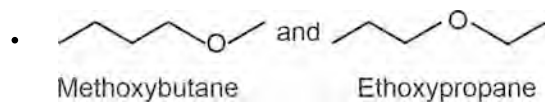


Compound (iv) will not show keto-enol tautomerism because it has no enolisable hydrogen atom.

83. Answer (3)

Hint: Metamerism arises due to different alkyl chains on either side of a functional group in the molecule

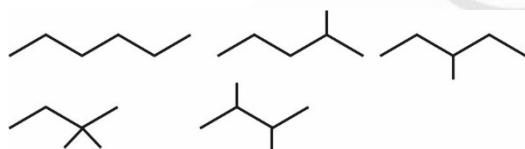
Sol.:



These are metamers

- Cyclohexene exists only in cis form because of its geometry

- Isomers of C₆H₁₄



84. Answer (2)

Hint: Milliequivalents of H₂SO₄ reacted = milliequivalents of NH₃ produced

Sol.: Milliequivalent of H₂SO₄ = 20 × 2 × 0.5 = 20

Percentage of nitrogen =

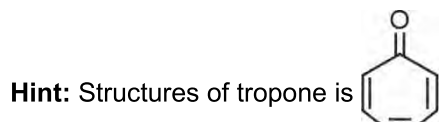
$$\frac{20 \times 14 \times 10^{-3} \times 100}{0.8} = 35\%$$

85. Answer (1)

Hint: Higher is the molar mass of the compound, higher is the boiling point

Sol.: For isomeric alkanes, higher is the branching, lower is the surface area, lower will be van der Waals force of attraction and lower will be the boiling point.

86. Answer (2)



Sol.:

Structure	Name	Nature
	Tropone	Non-benzenoid aromatic
	Anthracene	Benzenoid aromatic
	Cyclooctatetraene	Nonaromatic
	1,3-Cyclobutadiene	Antiaromatic

87. Answer (3)

Hint & Sol.: Hyperconjugation involves delocalisation of σ electrons of C – H bond of an alkyl group directly attached to an atom of unsaturated system or to an atom with an unshared p orbital.

88. Answer (2)

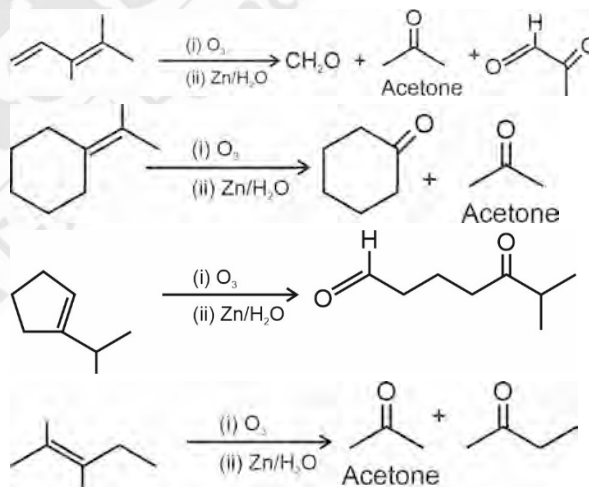
Hint: The organic compounds having multiple bond (a double or triple bond) show electromeric effect in presence of attacking reagents.

Sol.: Electromeric effect is temporary effect.

89. Answer (4)

Hint: Alkenes on reductive ozonolysis give aldehydes or ketones as major products.

Sol.:



90. Answer (2)

Hint: Percentage of bromine =

$$\frac{\text{Atomic mass of bromine} \times \text{Mass of AgBr} \times 100}{\text{Molecular mass of AgBr} \times \text{Mass of organic compound}}$$

Sol.: 188 g of AgBr contains 80 g of Br

$$1.41 \text{ g of AgBr contains } = \frac{80 \times 1.41}{188} \text{ g of Br}$$

$$\text{Percentage of Br} = \frac{80 \times 1.41 \times 100}{188 \times 1.6} = 37.5\%$$

[BOTANY]

91. Answer (2)

Hint: C₃ pathway of photosynthesis is also known as Calvin cycle. This pathway is the main biosynthetic pathway for photosynthesis.

Sol.: C₃ pathway of photosynthesis occurs in both C₃ and C₄ plants. In C₄ plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO₂ at the enzyme site.

92. Answer (1)

Hint: Ethylene could fit either of the groups, *i.e.*, as growth promoter and as growth inhibitor, but it is largely an inhibitor of growth activities.

Sol.: Ethylene promotes senescence and abscission of plant organs especially of leaves and flowers. Ethylene accelerates abscission in flowers and fruits (thinning of cotton, cherry, walnut). It promotes female flowers in cucumbers thereby, increasing the yield.

93. Answer (4)

Hint: Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity.

Sol.: One of the examples of plasticity is heterophylly in cotton, coriander and larkspur. In such plants, the leaves of the juvenile plant are different in shape from those in mature plants.

94. Answer (1)

Hint: The energy released by oxidation in respiration is used to synthesise ATP.

Sol.: The ultimate source of energy on earth is sun. The light energy is converted into chemical energy by plants and this chemical energy is finally converted into energy currency of the cell, *i.e.*, ATP.

95. Answer (4)

Hint: The light harvesting complex (LHC) is made up of hundreds of pigment molecules bound to proteins.

Sol.: LHC of each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system also called antennae. Other molecules of chlorophyll *a* are present in LHC.

96. Answer (2)

Hint: In photosystem II associated with non-cyclic photophosphorylation, the reaction centre chlorophyll *a* absorbs 680 nm wavelength of light, causing electrons to become excited and these

electrons are then picked up by an electron acceptor, which passes them to an electron transport system.

Sol.: In electron transport system, electrons move downhill, in terms of redox potential scale. From the electron transport system, the electrons move to the photosystem I and then again move downhill to reduce NADP⁺ into NADPH + H⁺.

97. Answer (4)

Hint: C₄ plants have a mechanism that increases the concentration of CO₂ at the enzyme RuBisCO site.

Sol.: There is requirement of 3 ATP and 2 NADPH molecules during Calvin cycle. In addition to this, 2 more molecules of ATP are used during Hatch and Slack pathway for per CO₂ fixed.

98. Answer (1)

Hint: ABA stimulates the closure of stomata and increases the tolerance of plants to various kinds of stresses.

Sol.: Many of the extrinsic factors such as temperature and light, control plant growth and development via PGR.

99. Answer (3)

Hint: After glycolysis, there can be alcoholic fermentation or lactic acid fermentation.

Sol.: In alcoholic fermentation, there is the production of CO₂ but in aerobic respiration, both CO₂ and H₂O are released.

100. Answer (1)

Hint: Water is the only source of hydrogen in plants.

Sol.: Since glucose, NADPH + H⁺, metabolic water and NADH + H⁺ have hydrogen and the only source of hydrogen is water, all these molecules will show radioactivity.

101. Answer (3)

Hint: Flowering and fruit set up are synchronized by ethylene in pineapples.

Sol.: The auxins, such as NAA and 2, 4-D induce flowering in pineapples. Both auxin and ethylene are associated with flowering in pineapples.

102. Answer (4)

Hint: N⁶-furfurylamino purine is kinetin. It is a synthetic product and does not occur naturally in plants.

Sol.: Naphthalene acetic acid and 2, 4-dichlorophenoxyacetic acid are synthetic auxins but indole-3-acetic acid is a natural auxin.

103. Answer (3)

Hint: In mitochondria, cytochrome *c* acts as electron carrier for transfer of electrons between complex III and IV.

Sol.: In ETS of mitochondria, cytochrome *c* acts as electron carrier for transfer of electrons from cytochrome *bc₁* complex to cytochrome *c* oxidase complex.

104. Answer (2)

Hint: Ethylene breaks the dormancy of seeds, buds and initiates their germination.

Sol.: ABA induces dormancy of buds and seeds whereas, ethylene breaks the dormancy of seeds and buds. Therefore, they function antagonistically w.r.t. dormancy.

105. Answer (3)

Hint: Some crops are raised for their fruits and seeds, whereas others are raised for their leaves.

Sol.: Since the plant hormone 'X' is responsible to inhibit flowering, this effect is used advantageously to prevent flowering in lettuce, where only leaves are edible.

106. Answer (4)

Hint: Fats need to be broken down into glycerol and fatty acids first, to enter the respiratory pathway.

Sol.: If fatty acids are to be respired, they would first be degraded to acetyl CoA and enter the pathway. Glycerol would enter the pathway after being converted to glyceraldehyde-3-phosphate (PGAL).

107. Answer (4)

Hint: Light reactions of photosynthesis are temperature sensitive but these are affected to a much lesser extent as compared to dark reactions.

Sol.: *C₄* plants have a mechanism to increase CO₂ concentration at the enzyme site. They respond to higher temperatures and show higher rate of photosynthesis.

108. Answer (2)

Hint: Auxin was isolated by F.W. Went from the tips of coleoptiles of oat seedlings.

Sol.: Plants respond to unilateral illumination by growing towards the light source (phototropism). Auxin is synthesized in the apical buds or the tip of coleoptile. From here, the auxin is transported towards the shaded side of the shoot tip, resulting in elongation of cells of that side. This causes the bending of shoot tip towards the light.

109. Answer (2)

Hint: One of the roles of terpene derivative phytohormone is to stimulate the synthesis of

various types of hydrolytic enzymes for germination of seeds.

Sol.: Gibberellins are terpene derivative phytohormones. Auxins are indole compounds. Abscisic acid is a derivative of carotenoids.

110. Answer (2)

Hint: All the enzymes of Krebs' cycle are soluble in mitochondrial matrix, but succinate dehydrogenase is found attached to the inner mitochondrial membrane.

Sol.: Succinate dehydrogenase is the complex II. It is found attached to the inner membrane of mitochondria.

111. Answer (4)

Hint: In *C₄* plants, primary CO₂ fixation occurs in the mesophyll cells and secondary CO₂ fixation occurs in the bundle sheath cells.

Sol.: In *C₄* plants, the bundle sheath cells may form several layers around the vascular bundles. They are characterized by having a large number of chloroplasts, thick walls impervious to gaseous exchange and no intercellular spaces.

112. Answer (1)

Hint: The light reactions of photosynthesis occur in grana and stroma lamellae.

Sol.: *C₄* plants show photosynthetic saturation at about 360 μL^{-1} , while *C₃* plants respond to increased CO₂ concentration and saturation is seen only beyond 450 μL^{-1} .

113. Answer (4)

Hint: In the given diagram A, B, C, D and E are stroma lamella, grana lamella, stroma, ribosome and starch granule, respectively.

Sol.: For ATP synthesis, proton gradient is required, *i.e.*, proton concentration in lumen of thylakoid should be more than in stroma. The reducing equivalents for the synthesis of glucose are formed in thylakoids.

114. Answer (4)

Hint: An increase in surface area denotes the growth in a dorsiventral leaf.

Sol.: The growth of fruits and storage organs can be measured by finding out the increase in volume, fresh weight and dry weight.

115. Answer (4)

Hint: The cells which are capable of self-perpetuation have the power to continue indefinitely through division.

Sol.: Meristems are the cells which are capable of self-perpetuation.

116. Answer (3)

Hint: In living organisms, respiratory substrates are often more than one.

Sol.: Pure proteins or fats are never used as respiratory substrates.

117. Answer (1)

Hint: In prokaryotes, pyruvic acid undergoes oxidative decarboxylation in cytosol but this process is not a part of glycolysis.

Sol.: During glycolysis, two phosphate groups from 1, 3-bisphosphoglyceric acid are transferred to ADP to form ATP but in two different steps, *i.e.*, during conversion of 1,3-bisphosphoglyceric acid to 3-phosphoglyceric acid and phosphoenolpyruvate to pyruvic acid.

118. Answer (2)

Hint: Through the experiment conducted by T. W. Engelmann, the first action spectrum of photosynthesis was described.

Sol.: T. W. Engelmann used phototrophic eukaryotic organism *Cladophora* and heterotrophic prokaryotic organism, the bacteria.

119. Answer (3)

Hint: RuBP is the primary acceptor of CO₂ in C₃ plants.

Sol.: The primary acceptor of CO₂ in C₃ plants, such as wheat, is 5-carbon ketose sugar and the first stable product of this fixation is a 3-carbon compound, *i.e.*, 3-phosphoglycerate.

120. Answer (4)

Hint: Root elongating at a constant rate is an example of arithmetic growth.

Sol.: Mathematical representation of arithmetic growth is $L_t = L_0 + rt$. Expression of exponential growth is $W_t = W_0 e^{rt}$. Lag phase of growth curve showing sigmoid curve shows slow initial growth.

121. Answer (1)

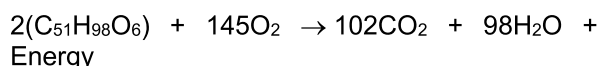
Hint: Growth in organisms occurs when synthesis reactions are more than the breakdown reactions.

Sol.: During growth, the rate of anabolism is more than the rate of catabolism.

122. Answer (2)

Hint: The lipid molecule taken as respiratory substrate is tripalmitin (C₅₁H₉₈O₆).

Sol.: Complete oxidation of tripalmitin is as follows:



Therefore, the ratio of O₂ consumed to CO₂ liberated = 145/102 = 1.42 (approximately)

123. Answer (2)

Hint: The respiratory pathway is an amphibolic pathway.

Sol.: Respiratory quotient is the ratio of the volume of CO₂ evolved to the volume of O₂ consumed in respiration. Chemiosmosis requires a membrane, a proton pump, a proton gradient and ATP synthase. In photorespiration, RuBP binds with O₂ to form one molecule of phosphoglycerate and phosphoglycolate.

124. Answer (3)

Hint: Chlorophyll *b* shows maximum absorption in blue and red regions of light and least absorption in green region.

Sol.: There is a complete one-to-one overlap between the absorption spectrum of chlorophyll *a* and the action spectrum of photosynthesis.

Accessory pigments, like carotenoids, not only enable a wider range of wavelength of incoming light to be utilized for photosynthesis, but also protect chlorophyll *a* from photo-oxidation.

Some photosynthesis does take place at the wavelengths other than blue and red regions of the visible spectrum.

125. Answer (3)

Hint: A tissue can have structurally similar or dissimilar cells that perform a common function.

Sol.: Meristematic tissue present in the meristematic zone of a plant is made up of homogenous cells, *i.e.*, they are similar in structure and function.

126. Answer (1)

Hint: Relative growth rate = (Growth per unit time)/(Initial size) × 100

Sol.: Relative growth rates of leaves P, Q, R and S are 100%, 75%, 26.6% and 37.5% respectively.

127. Answer (2)

Hint: For each ATP produced, 4H⁺ pass through F₀ from the intermembrane space to the matrix, down the electrochemical proton gradient.

Sol.: The component F₀ of complex V in the inner mitochondrial membrane is the integral protein complex that forms the channel through which protons cross the inner membrane.

128. Answer (4)

Hint: The chief pigment associated with photosynthesis is chlorophyll *a*.

Sol.: Each photosystem has all the pigments (except one molecule of chlorophyll *a*) forming a light harvesting system, also called antennae. A single chlorophyll *a* molecule forms the reaction centre.

129. Answer (2)

Hint: One of the two processes of plant development is differentiation.

Sol.: Development in plants is the sum of two processes that are growth and differentiation.

130. Answer (3)

Hint: All the food that is respired for life processes in organisms, directly or indirectly comes from photosynthesis.

Sol.: In plants, proteins, fats and organic acids can also be used as respiratory substances.

131. Answer (4)

Hint: Acetyl CoA enters the tricarboxylic acid pathway, also called Krebs' cycle, operating in the matrix of the mitochondria. NADH + H⁺ and FADH₂ are generated in the Krebs' cycle which produce ATP through ETS.

Sol.: Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source.

The first action spectrum of photosynthesis was described through the experiment conducted by T.W. Engelmann.

Cornelius van Niel demonstrated that in green plants, hydrogen from an oxidisable compound reduces CO₂ to carbohydrates.

132. Answer (1)

Hint: KOH solution absorbs CO₂ present in the air.

Sol.: When the air lacks CO₂, its fixation by RuBisCO, and thus the conversion of RuBP into 3-PGA through Calvin cycle, will not occur.

133. Answer (4)

Hint: Sugarcane stores carbohydrate as sugar in their stems.

Sol.: Spraying sugarcane crop with gibberellins increases the length of the stem, thus increasing the yield.

134. Answer (3)

Hint: All the living cells in green plants perform respiration but not photosynthesis.

Sol.: All the cells that perform photosynthesis in plants are living and thus, all these cells will perform respiration too.

135. Answer (2)

Hint: Photosynthesis is a physico-chemical process that occurs in green plants.

Sol.: Reduction of NAD⁺ into NADH + H⁺ occurs during glycolysis, oxidative decarboxylation and Krebs' cycle. These events are associated with respiration.

[ZOOLOGY]

136. Answer (4)

Hint: Frog is an amphibian.

Sol.: Kingdom – Animalia

Phylum – Chordata

Sub-phylum – Vertebrata

Division – Gnathostomata

Super class – Tetrapoda

Class – Amphibia

Genus – *Rana*

Species – *tigrina*

137. Answer (3)

Hint: A part of human hindbrain

Sol.: Pons is absent in the brain of a frog. Cerebrum and unpaired diencephalon are the parts of forebrain and cerebellum is the part of hindbrain.

138. Answer (3)

Hint: Less than 13

Sol.: The nervous system of frogs is organised into a central nervous system (brain and spinal cord), a peripheral nervous system (cranial and spinal nerves) and an autonomic nervous system (sympathetic and parasympathetic). There are ten pairs of cranial nerves arising from the brain.

139. Answer (3)

Hint: Includes organs of sight

Sol.: In cockroach, the head holds a bit of a nervous system while the rest is situated along the ventral (belly-side) part of its body. So, even if the head of a cockroach is cut off, it will still live for as long as one week. In the head region, the brain is represented by supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.

140. Answer (3)

Hint: Tracheoles are the site of exchange of gases.

Sol.: In cockroaches, the respiratory system consists of a network of trachea, that opens through 10 pairs of small holes called spiracles present on the lateral side of the body. Thin branching tubes (tracheal tubes sub-divided into tracheoles) carry oxygen from the outside to all the parts. The opening of the spiracles is regulated by the sphincters. Exchange of gases takes place at the tracheoles by diffusion.

141. Answer (3)

Hint: Invertebrates have ventrally located nervous system.

Sol.: The nervous system of cockroach consists of a series of fused, segmentally arranged ganglia joined by paired longitudinal connectives on the ventral side. Three ganglia lie in the thorax, and six in the abdomen. The nervous system of cockroach is spread throughout the body.

142. Answer (2)

Hint: Sexes are separate

Sol.: Both frog and cockroach are oviparous *i.e.*, both of them lay eggs.

Frogs exhibit external fertilisation while cockroach exhibits internal fertilisation.

143. Answer (4)

Hint: Leaping ability depends on limbs and brain

Sol.: The forelimbs and hind limbs help in swimming, walking, leaping and burrowing. The hind limbs end in five digits and they are larger and muscular than fore limbs that end in four digits. Feet have webbed digits that help in swimming.

While leaping, limbs are necessary to take off and land. Ears help to maintain balance/equilibrium.

144. Answer (4)

Hint: Exhibit camouflage

Sol.: The dorsal side of the body of *Rana tigrina* is generally olive green with dark irregular patches. The ventral side is uniformly pale yellow.

145. Answer (3)

Hint: Frogs respire through skin during summer and winter sleep.

Sol.: In case of water, skin acts as a respiratory organ (cutaneous respiration) in an adult frog. On land, the buccal cavity, skin and lungs act as the respiratory organs. During aestivation and hibernation, gaseous exchange takes place through skin (cutaneous respiration).

Branchial respiration occurs in tadpoles.

146. Answer (3)

Hint: Rohu is a freshwater fish.

Sol.: *Labeo* (Rohu) is a freshwater fish.

Betta and *Pterophyllum* are aquarium fishes. Ctenophores (*Ctenoplana* and *Pleurobrachia*), hemichordates (*Saccoglossus* and *Balanoglossus*) and cephalochordates (*Branchiostoma*) are exclusively marine organisms.

147. Answer (3)

Hint: Includes jawless organisms

Sol.: Phylum Chordata is divided into three subphyla: Urochordata or Tunicata, Cephalochordata and Vertebrata. Cyclostomata is a class under the division Agnatha.

148. Answer (1)

Hint: Dolphin is a mammal.

Sol.: *Pavo*(bird) has dry skin without glands except the oil gland at the base of the tail.

Delphinus(mammal) is viviparous.

Exocoetus (flying fish) is a bony fish and possesses cycloid/ctenoid scales.

Testudo (tortoise) is a reptile and has dry and cornified skin covered with epidermal scutes.

149. Answer (4)

Hint: Exclude sting ray

Sol.: *Pristis* is a cartilaginous fish with saw shaped snout lined with rows of toothed denticles used for stunning and digging of prey.

Scoliodon - Dog fish

Torpedo - Has electric organs

Trygon - Sting ray

150. Answer (1)

Hint: Choose an echinoderm.

Sol.: Aschelminths are triploblastic, bilaterally symmetrical and pseudocoelomates (*e.g.*, *Wuchereria* and *Ancylostoma*).

Platyhelminths are acoelomates with bilateral symmetry (*e.g.*, *Fasciola*).

Molluscs are coelomates with bilateral symmetry (*e.g.*, *Aplysia*).

151. Answer (2)

Hint: Hemichordates possess gills.

Sol.: *Pila*, *Loligo*, *Balanoglossus*, *Clarias*, and *Hippocampus* possess gills for respiration. *Locusta* (locust) has tracheal tubes for respiration.

Balaenoptera has lungs.

Pila, *Loligo*, *Balanoglossus* and *Locusta* are invertebrates.

152. Answer (4)

Hint: A gregarious pest

Sol.: Lac is produced by *Laccifer* (lac insect). It is an economically beneficial insect. *Locusta* is a gregarious pest.

153. Answer (1)

Hint: Their monomeric unit is N-acetyl glucosamine.

Sol.: The male external genitalia are represented by male gonapophysis or phallomeres (chitinous asymmetrical structures, surrounding the male gonopore).

154. Answer (4)

Hint: Malpighian tubules are present at the junction of midgut and hindgut.

Sol.: Cockroach possesses three segments of thorax, each bearing a pair of walking legs. Hepatic caecae are present at the junction of foregut and midgut. A pair of salivary glands is present in alimentary canal. Uric acid formation occurs in Malpighian tubules which are lined by ciliated and glandular cells.

155. Answer (2)

Hint: Blood is pumped anteriorly to sinuses.

Sol.: Heart of cockroach consists of elongated muscular tube lying along mid-dorsal line of thorax and abdomen. It is differentiated into funnel-shaped chambers with ostia on either side. Blood from sinuses enter heart through ostia and is pumped anteriorly to sinuses again.

156. Answer (2)

Hint: Protochordates are marine.

Sol.: Subphyla Urochordata and Cephalochordata are often referred to as protochordates and are exclusively marine. In members of Urochordata, notochord is present only in larval tail, while in cephalochordates, it extends from head to tail region and is persistent throughout their life.

Members of both subphyla are exclusively marine. Urochordates (tunicates) have an open circulatory system.

157. Answer (1)

Hint: Diploblastic animals have mesoglea.

Sol.: Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm, are called diploblastic animals, e.g., coelenterates. An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm. Sea lily is an echinoderm.

158. Answer (2)

Hint: Birds and mammals are warm blooded.

Sol.: Amphibians and reptiles (*Crocodilus*, *Naja*, *Bangarus*, *Vipera*, *Chelone*, *Testudo*) are cold blooded animals.

Birds (*Columba*, *Aptenodytes*, *Pavo*, *Corvus*, *Psittacula*) are warm blooded animals.

159. Answer (3)

Hint: Characteristic feature of porifers

Sol.: • Water vascular system is present in echinoderms.

- Nematocysts are the stinging capsules in coelenterates.
- Water canal system is present in proifers.
- Parapodia is found in aquatic annelids.

160. Answer (4)

Hint: Reptiles lay eggs

Sol.: *Chameleon* – Mostly oviparous and direct development

Ichthyophis – Exhibits external fertilisation and it is a limbless amphibian

Pteropus – Viviparous mammal

161. Answer (2)

Hint: Possess 3-chambered heart

Sol.: Heart of frog is 3-chambered and it pumps mixed blood. Its heart is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium.

162. Answer (2)

Hint: Feature found in bony fishes

Sol.: *Scoliodon* is a cartilaginous fish while *Betta* is a bony fish. Operculum is present in bony fishes while it is absent in cartilaginous fishes. Both bony and cartilaginous fishes possess streamlined body and gill slits.

163. Answer (3)

Hint: A mollusc

Sol.: Molluscs contain space between the hump and the mantle called the mantle cavity in which feather-like gills are present.

Hippocampus is a bony fish.

Ophiura is an echinoderm.

Petromyzon is a cyclostome.

Pinctada is a mollusc that produces pearls.

164. Answer (3)

Hint: Choose an echinoderm.

Sol.: *Pennatula* – Sea pen

Adamsia – Sea anemone

Antedon – Sea lily

Echinus – Sea urchin

165. Answer (2)

Hint: Equal to the number of eyes you have

Sol.: Gills are present as the respiratory structures in prawns. Antennal glands are the excretory structures of prawns.

166. Answer (4)

Hint: Organs of sight and sound are well-organised structures.

Sol.: Frog has different types of sense organs, namely organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears). Out of these, eyes and internal ears are well-organised structures and the rest are cellular aggregations around nerve endings.

167. Answer (2)

Hint: Similar to position of sternum in humans

Sol.: Male reproductive system in cockroaches consists of a pair of testes one lying on each lateral side in the 4th -6th abdominal segments. From each testis arises a thin vas deferens, which opens into ejaculatory duct through seminal vesicle. The ejaculatory duct opens into male gonopore situated ventral to the anus.

168. Answer (2)

Hint: *Doliolum* is a urochordate.

Sol.: *Dentalium* is a non-cephalopod mollusc and *Doliolum* is a urochordate. Both of them have an open circulatory system.

Dentalium is a non-chordate and has a ventral, solid and double CNS. They also possess radula.

Doliolum is a chordate and has dorsal, hollow and single CNS.

169. Answer (1)

Hint: Collateral gland is present only in females.

Sol.: In female cockroaches, anterior part of brood pouch or genital pouch contains female gonopore, spermathecal pore and collateral glands. In males, genital pouch or chamber lies at the hind end of abdomen. It contains dorsal anus, ventral male genital pore and gonapophyses.

170. Answer (3)

Hint: Cnidocytes are present on the body and tentacles.

Sol.: In coelenterates, cnidoblasts or cnidocytes are present on the tentacles and the body. Cnidoblasts are used for anchorage, defense and for the capture of prey.

171. Answer (1)

Hint: *Psittacula* is a chordate.

Sol.: In ctenophores, eight ciliated comb plates are present for locomotion.

Those animals in which the developing embryo has a third germinal layer, mesoderm, in between ectoderm and endoderm are called triploblastic animals.

Psittacula (parrot) is a triploblastic coelomate animal.

172. Answer (3)

Hint: Equal to the number of digits in palm of man

Sol.: In cockroach, the sense organs are antennae, eyes, maxillary palps, labial palps and anal cerci. The head capsule bears a pair of compound eyes. A pair of thread-like antennae arise from membranous sockets lying in front of eyes. Antennae have sensory receptors that help in monitoring the environment. Anal style is a short, thread-like structure found only in male cockroaches.

173. Answer (2)

Hint: Plays an important role during summer sleep

Sol.: In frogs, mucous glands are present in the skin which helps in respiration in water and on land.

174. Answer (2)

Hint: Vasa efferentia enter the kidneys on their side

Sol.: Frogs have well-organised male and female reproductive systems. Male reproductive organs consist of a pair of yellowish ovoid testes, which are found adhered to the upper part of kidneys by a double fold of peritoneum called mesorchium. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca. The cloaca is a small, median chamber that is used to pass faecal matter, urine and sperms to the exterior.

175. Answer (2)

Hint: Commonly called tapeworm

Sol.: Hooks are absent in *Fasciola*. Alimentary canal is absent in *Taenia*. *Hirudinaria* is an ectoparasite. Flame cells are found in platyhelminths. *Ascaris* is an aschelminth.

176. Answer (4)

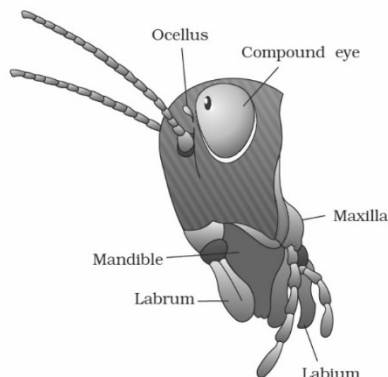
Hint: Platyhelminths are dorso-ventrally flattened animals.

Sol.: Adult echinoderms are radially symmetrical. Platyhelminths are triploblastic, bilaterally symmetrical with organ-level of body organisation. Many marine animals, for e.g., members of the class Chondrichthyes, exhibit internal fertilisation.

177. Answer (3)

Hint: Represents the lower jaw in humans

Sol.: Mandible has incising and grinding regions. Mandible and maxilla are paired mouth parts while labrum, labium and hypopharynx are unpaired structures.



178. Answer (3)

Hint: Jointed filamentous structures arise from the 10th abdominal segment.

Sol.: Anal cerci – 10th abdominal segment of both male and female cockroaches

- Testes – 4th - 6th abdominal segments of males
- Ovaries – 2nd - 6th abdominal segments of females
- Mushroom-shaped gland – 6th - 7th abdominal segments of males

179. Answer (3)

Hint: Fishes are poikilotherms.

Sol.: Fishes are cold-blooded animals (poikilothermous), i.e., they lack the capacity to regulate their body temperature. So, fishes can die due to sudden change or fluctuations in the external temperature.

180. Answer (3)

Hint: An amphibian

Sol.: *Calotes* - Garden lizard
Hemidactylus - Wall lizard
Testudo - Tortoise
Bufo - Toad

