

All India Aakash Test Series for NEET - 2026

TEST - 3 (Code - I)**Click here for
Code-J Sol.**

Test Date : 19/01/2025

ANSWERS

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



13. Answer (1)

Hint: Work done (W) = $\vec{F} \cdot \vec{d} = Fd \cos \theta$

Sol.: Angle between force \vec{F} and displacement \vec{d} is 0° , therefore work done will be positive.

($\because \theta = 0^\circ \Rightarrow \cos \theta = 1$)

14. Answer (1)

Hint & Sol.: The total linear momentum of system and its kinetic energy remain conserved in an elastic collision.

15. Answer (3)

Hint: Write centripetal equation for body at B , C and D on circular track.

Sol.: As block moves upwards velocity decreases.

$$N_B = \frac{mV_B^2}{r} + mg \cos \theta$$

$$N_C = \frac{mV_C^2}{r}, N_D = \frac{mV_D^2}{r} - mg \cos \phi \Rightarrow N_B > N_C > N_D$$

16. Answer (3)

Hint: Kinetic energy of the woman, $K = \frac{1}{2} mv^2$

$$\text{Sol.} : K_f = (1.21) K_i \Rightarrow \frac{K_f}{K_i} = \frac{v_f^2}{v_i^2} = 1.21$$

$$\Rightarrow \frac{v_f}{v_i} = 1.1 \quad \therefore \frac{v_i}{v_f} = \frac{10}{11}$$

17. Answer (3)

Hint: Centre of mass of this uniform symmetric shape lies long its line of symmetry i.e., y -axis.

Sol.: As majority of mass is concentrated upwards, so C.O.M lies on OY .

18. Answer (1)

Hint & Sol.: The MOI of a rod about on axis passing through one end will be $\frac{ML^2}{3}$ while about

an axis passing through centre will be $\frac{ML^2}{12}$.

$$\Rightarrow \text{Ratio} = \frac{\frac{ML^2}{3}}{\frac{ML^2}{12}} = 4 : 1$$

19. Answer (1)

Hint: Rotational power, $P = \vec{\tau} \cdot \vec{\omega}$

Sol.:

$$P = (\hat{i} + 2\hat{j} + 3\hat{k}) \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 2 + 6 + 12 = 20 \text{ W}$$

20. Answer (4)

Hint: Distance of c.o.m of rod from that end,

$$x_{\text{cm}} = \frac{\int x \, dm}{\int dm} = \frac{\int \mu x \, dx}{\int \mu \, dx}$$

$$\text{Sol.} : x_{\text{cm}} = \frac{\int_0^L (3x) \, dx}{\int_0^L (3x) \, dx} = \frac{3 \int_0^L x^2 \, dx}{3 \int_0^L x \, dx} = \frac{2L}{3} = 2 \times \frac{3}{3} = 2 \text{ m}$$

21. Answer (3)

Hint: Time rate of change of kinetic energy of body has same unit as power of the body.

Sol.: (A – II) [kinetic energy] = $[ML^2T^{-2}]$

(B – I) [spring constant] = $[MT^{-2}]$

(D – III) and (C – III) [power] = $[ML^2T^{-3}]$

22. Answer (4)

Hint: Work done by all forces on bob, $W = W_{\text{tension}} + W_{\text{gravity}} = 0 + U_i - U_f$

Sol.: $W = U_A - U_B = -mgl = -4 \times 10 \times 1 = -40 \text{ J}$

23. Answer (3)

Hint & Sol.: The S.I unit of energy is joule.

24. Answer (4)

Hint: Angular momentum of rigid body rotating about fixed axis, $L = I\omega$

Sol.: $L = 0 \Rightarrow \omega = 0 \Rightarrow t^4 - 12t^3 = t^3(t - 12) = 0$

$\Rightarrow t = 12 \text{ s}$

25. Answer (4)

Hint: Use, $\vec{a}_{\text{COM}} = \frac{M_1 \vec{a}_1 + M_2 \vec{a}_2}{M_1 + M_2}$

Sol.: $\vec{a}_{\text{COM}} = \frac{M \times 0 + M \times 2\vec{a}}{2M} = \vec{a}$

26. Answer (3)

Hint: Velocity of centre of mass of system,

$$\vec{v}_{\text{cm}} = \frac{m_1 \vec{v}_1 + m_2 \vec{v}_2}{m_1 + m_2}$$

Sol.: $\vec{v}_{\text{cm}} = \frac{3(7\hat{j}) + 4(-7\hat{j})}{3 + 4} = -\frac{7\hat{j}}{7} = (-\hat{j}) \text{ m/s}$

Centre of mass will move down with speed of 1 m/s.

27. Answer (2)

Hint: Torque acting on rod about hinge point,
 $\tau_A = r_{\perp} F = I_A \alpha$

Sol.: Angular acceleration of rod,

$$\alpha = \frac{r_{\perp} F}{I_A} = \frac{\frac{1}{2} Mg}{\frac{ML^2}{3}}$$

$$\Rightarrow \alpha = \frac{3g}{2l} = \frac{3 \times 10}{2 \times 1.5}$$

$$= 10 \text{ rad/s}^2$$

28. Answer (2)

Hint & Sol.: In statement (A),
 $\tau = Fr_{\perp} = mgR \neq \text{zero}$

In statement (B), $W_{mg} = \vec{F} \cdot \vec{r} = mgR \cos 90^\circ = \text{zero}$

In statement (C), angular momentum

$$L = mv_{\perp} r = m(u \sin \theta) R \neq \text{zero}$$

29. Answer (1)

Hint: Commercial unit of energy = 1 kWh = $10^3 \times 3600 \text{ Ws} = 3.6 \times 10^6 \text{ J}$

Sol.: 1 erg = 10^{-7} J and 1 cal = 4.186 J

30. Answer (3)

Hint & Sol.: The cross product of two vector quantities always leads to a vector quantity and dot product always leads to a scalar quantity.

31. Answer (3)

Hint: Work done by torque (W) = change in rotational kinetic energy of body.

Sol.:

$$W = \frac{1}{2} I (\omega_f^2 - \omega_i^2) = \frac{1}{2} \times \frac{2}{5} MR^2 \omega_f^2 = \frac{1}{5} \times 5 \times 2^2 \times 2^2 = 16 \text{ J}$$

32. Answer (3)

Hint: Compare the formulae in both linear motion and rotational motion.

Sol.:

	Linear motion	Rotational analogue
(a - ii)	Force $F = Ma$	Torque $\tau = I\alpha$
(b - i)	Acceleration	Angular acceleration $\alpha = \frac{d\omega}{dt}$

(c - iv)	Velocity $v = \frac{dx}{dt}$	Angular velocity $\omega = \frac{d\theta}{dt}$
(d - iii)	Linear momentum, $p = Mv$	Angular momentum, $L = I\omega$

33. Answer (3)

Hint: Work done by retarding force = change in K.E.

$$\Rightarrow -Fx_{\text{max}} = K_f - K_i$$

$$\text{Sol.}:- 30 \times 2 = 0 - K_i \Rightarrow K_i = 60 \text{ J}$$

34. Answer (2)

Hint & Sol.: Friction does not associated with potential energy so it is a non-conservative force.

35. Answer (3)

$$\text{Hint: } W = \vec{F} \cdot \vec{d}$$

$$\text{Sol.}:- W = Fd \cos \theta$$

$$\theta = 180^\circ$$

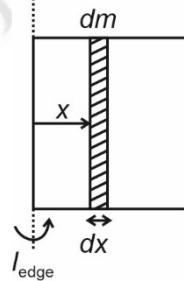
$$W = -ve$$

SECTION - B

36. Answer (1)

Hint: $I_{\text{edge}} = \int x^2 dm$ where $\frac{dm}{dx} = \frac{M}{l}$ for uniform plate

Sol.:



$$I_{\text{edge}} = \int_0^l x^2 \left(\frac{M}{l} \right) dx = \frac{M}{l} \left(\frac{x^3}{3} \right) \Big|_0^l = \frac{Ml^2}{3}$$

37. Answer (1)

Hint: If displaced slightly from original position, particle will tend to come back when in stable equilibrium and won't come back when in unstable equilibrium. In neutral equilibrium position, force remains zero when slightly displaced.

Sol.: At M, $\left\{ \begin{array}{l} x > x_M, \quad F = +ve \\ x = x_M, \quad F = 0 \\ x < x_M, \quad F = -ve \end{array} \right\} = \text{unstable}$

equilibrium

At N, $\left\{ \begin{array}{l} x > x_N, \quad F = -ve \\ x = x_N, \quad F = 0 \\ x < x_N, \quad F = +ve \end{array} \right\} = \text{stable equilibrium}$

38. Answer (2)

Hint: As external torque is zero, we apply conservation of angular momentum (L) for system in the context of rotation about a fixed axis.

Sol.: $L_{\text{initial}} = L_{\text{final}} \Rightarrow I_2\omega_2 - I_1\omega_1 = (I_2 + I_1)\omega_f$

New angular speed,

$$\omega_f = \frac{I_2\omega_2 - I_1\omega_1}{I_2 + I_1} = \frac{(4m)r^2(1) - mr^2(2)}{(4m)r^2 + mr^2} = \frac{2}{5} \text{ rad/s}$$

$\vec{\omega}_f$ is in same direction as $\vec{\omega}_2$. ($\because I_2\omega_2 > I_1\omega_1$)

39. Answer (2)

Hint: Coefficient of restitution,

$$e = \frac{\text{relative velocity of separation}}{\text{relative velocity of approach}}$$

Sol.: $e = \frac{6.5 - 3.5}{1 + 5} = \frac{3}{6} = 0.5$

40. Answer (3)

Hint: Use conservation of angular momentum

Sol.: Since the net external torque acting on the system is zero hence the angular momentum of system remains conserved.

41. Answer (2)

Hint: Using work-energy theorem, work done by non-conservative force = change in total mechanical energy of body

Sol.: $W_{\text{friction}} = E_{\text{final}} - E_{\text{initial}} = 0 - (K_{\text{initial}} + U_{\text{initial}})$
 $= -\left[\frac{1}{2}m(4)^2 + mg(1.2)\right] = -(80 + 120) = -200 \text{ J}$

42. Answer (3)

Hint: Area under $P - t$ graph = work done on particle (W)

Sol.: $W = \frac{1}{2} \times 2 \times 8 = (\text{K.E.})_f - (\text{K.E.})_i$

$\therefore (\text{K.E.})_f = 8 \text{ J}$

43. Answer (3)

Hint: For a particle performing circular motion,

$$F_c = \frac{mv^2}{R} \text{ and } F_t = m \frac{dv}{dt}$$

Sol.: $K = \frac{1}{2}mv^2 \propto t \Rightarrow v \propto \sqrt{t}$

$$F_t \propto \frac{d(\sqrt{t})}{dt} = \frac{1}{2}t^{-\frac{1}{2}}$$

$$F_c \propto (\sqrt{t})^2 = t$$

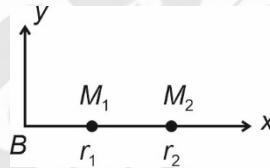
44. Answer (2)

Hint & Sol.: Since the particle is moving with constant speed and no external torque acts hence the angular momentum would remain conserved.

45. Answer (3)

Hint: The centre of mass of the fragments of the projectile continues along the same parabolic path to reach point B , which it would have followed if there were no explosion.

Sol.: Taking B as origin,



$$\bar{x}_{\text{CM}} = \frac{M_1\vec{r}_1 + M_2\vec{r}_2}{M_1 + M_2}$$

$$\Rightarrow \text{zero} = M_1\vec{r}_1 + M_2\vec{r}_2$$

$$\Rightarrow M_2\vec{r}_2 = -M_1\vec{r}_1$$

\therefore Both land on opposite sides of B , with $r_2 > r_1$ as $M_2 < M_1$.

46. Answer (2)

Hint & Sol.: A couple can produce only pure rotational motion.

47. Answer (4)

Hint: Perpendicular axis theorem is applicable only to planar bodies.

Sol.: Disc, ring are planar.

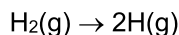
48. Answer (4)

Hint: F_{ext} on system is zero.

Sol.: Total linear momentum of system is conserved in every collision.

Corporate

Sol.: Entropy increases during boiling of egg because of denaturation of protein.



Entropy increases because number of gaseous moles increases.

60. Answer (3)

Hint: $Q = n C_m \Delta T$

Sol.: Moles of Al = $\frac{54}{27} = 2$

$$C_m = 24 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$\Delta T = 100 \text{ K}$$

$$Q = n C_m \Delta T$$

$$= 2 \times 24 \times 100$$

$$= 4800 \text{ J}$$

61. Answer (4)

Hint: For isothermal process; $\Delta T = 0$

For adiabatic process; $q = 0$

Sol.: $T_S = T_Q$ (for isothermal process)

$T_Q > T_R$ because for isothermal process temperature remains constant while for adiabatic expansion, cooling of gas takes place.

Work done is calculated as area under the curve in P - V diagram.

For expansion, work is done by the system so

$$W = -ve$$

$$\Delta U = q + w \text{ (For adiabatic)}$$

$$\Delta U = w$$

$$\Delta U = -ve$$

$$\text{so, } U_Q > U_R$$

62. Answer (1)

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

Sol.: $\Delta G = \Delta H - T\Delta S$

$$\text{As } \Delta n_g = 0$$

$$\Delta H = \Delta U = 5 \text{ kcal}$$

$$\Delta G = 5 - 300 \times 50 \times 10^{-3}$$

$$= 5 - 15$$

$$= -10 \text{ kcal}$$

63. Answer (2)

Hint & Sol.:

Adiabatic $\rightarrow q = 0$

Isochoric $\rightarrow \Delta V = 0$

Isothermal $\rightarrow \Delta T = 0$

Isobaric $\rightarrow \Delta P = 0$

64. Answer (4)

Hint: For spontaneous process, $\Delta G = -ve$.

Sol.: If $\Delta H = -ve$

$$\Delta S = +ve$$

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

then ΔG is $-ve$ at every temperature.

65. Answer (1)

Hint: $\Delta G = \Delta H - T\Delta S < 0$ (for spontaneous process).

Sol.: $T\Delta S_{\text{system}}$ is energy not available to do useful work.

ΔG is the net energy available to do useful work.

66. Answer (2)

Hint: $\Delta G^\circ = -2.303 RT \log K_c$

Sol.: $\Delta G^\circ = -2.303 \times R \times 300 \times \log 100$

$$= -2.303 \times 2 \times 300 \times R$$

$$= -1381.8 R \text{ kJ/mol}$$

67. Answer (3)

Hint & Sol.: $\Delta_{\text{sol}}H^\circ = \Delta_{\text{lattice}}H^\circ + \Delta_{\text{hyd}}H^\circ$

68. Answer (4)

Hint: During free expansion, $P_{\text{ext}} = 0$

$$\text{Sol.} \quad w = -P_{\text{ext}}\Delta V = -0 \times \Delta V = 0$$

69. Answer (4)

Hint: Extensive property is a property whose value depends upon quantity or size of matter present in the system.

Sol.: Internal energy, Heat capacity and Free energy are extensive properties.

70. Answer (4)

Hint & Sol.: $C_P - C_V = R$

71. Answer (3)

Hint: The greater the charge on the cation, the greater is the covalent character.

Sol.: For cations with electronic configuration $(n-1)d^n ns^0$ have more polarising power than that of alkali and alkaline earth metal cations.

Hence correct order of covalent character is

$$\text{KCl} < \text{CaCl}_2 < \text{ZnCl}_2$$

72. Answer (2)

Hint & Sol.: The point at which system acquires minimum energy is the point where net force of attraction balances the force of repulsion.

73. Answer (1)

Hint: In positive or in phase overlap orbitals forming bonds should have same phase and orientation in space.

Sol.: (1) in phase overlap

(2) is negative or out of phase overlap.

(3) & (4) are zero overlap.

74. Answer (2)

Hint: NO is an odd electron species

Sol.: CH₄ – complete octet

BCl₃ – Incomplete octet

H₂SO₄ – Expanded octet

75. Answer (2)

Hint: Formal charge = Valence electrons – total no. of non-bonding electrons – $\frac{1}{2}$ [total number of bonding electrons]

Sol.: Formal charge of N in NH₄⁺

$$= 5 - 0 - \frac{1}{2} \times 8$$

$$= +1$$

76. Answer (2)

Hint: The bond pair and lone pair repel each other to achieve positions having minimum repulsion. This determines shape and bond angle in a molecule.

Sol.:

Species	Bond angle
H ₂ O	104.5°
NH ₃	107°
NH ₄ ⁺	109.5°
SO ₂	119.5°
BF ₃	120°
CO ₂	180°

77. Answer (1)

Hint & Sol.: Mutual repulsion of the electrons in antibonding molecular orbital is more than the attraction between the electrons and the nuclei, this leads to net increase in energy. So electrons in antibonding molecular orbital destabilize the molecule.

78. Answer (3)

Hint: The magnitude of H-bonding depends on the physical state of the compound. It is maximum in solid state and minimum in gaseous state.

Sol.: When H-atom is present in between two highly electronegative atom within the same molecule, intramolecular hydrogen bond is formed. So o-nitrophenol forms intramolecular H-bond.

79. Answer (4)

Hint: There is no equilibrium between the canonical forms.

Sol.: Resonance stabilizes the molecule as the energy of resonance hybrid is less than energy of canonical structure.

80. Answer (3)

Hint & Sol.: According to VSEPR theory repulsive interaction decrease in the order lp – lp > lp – bp > bp – bp

81. Answer (4)

Hint: Triads had an atomic weights about half way between the atomic weights of other two.

Sol.: Zn, Cd and Hg do not form triad.

82. Answer (1)

Hint: Among isoelectronic species greater negative charge has higher radii and higher positive charge has lower radii.

Sol.: N³⁻ > O²⁻ > F⁻ > Na⁺ > Mg²⁺ > Al³⁺

83. Answer (3)

Hint: On moving across the period the ionisation enthalpy increases.

Sol.: Ionisation enthalpy of Be is greater than B due to more penetration of 2s electrons as compared to 2p electrons.

So correct order is

C > Be > B > Li.

84. Answer (4)

Hint: Noble gases have positive electron gain enthalpy.

Sol.: Ar being noble gas has positive electron gain enthalpy.

85. Answer (4)

Hint: s and p block elements are called representative element.

Sol.: Ga and Ge both belong to p block.

SECTION - B

86. Answer (3)

Hint: For an isolated system, entropy increases with time.

Sol.: ΔS can discriminate between reversible and irreversible process.

87. Answer (2)

Hint & Sol.: The crystalline solid state is the state of lowest entropy.

88. Answer (4)

Hint: $\Delta_{\text{vap}}U = \Delta_{\text{vap}}H - \Delta n_g RT$

Sol.: Number of moles = $\frac{18}{18} = 1 \text{ mol}$

$\Delta U = \Delta_{\text{vap}}H^\circ - \Delta n_g RT$

= $41 - 1 \times 8.314 \times 10^{-3} \times 373$

= $41 - 3.096 \text{ kJ mol}^{-1}$

= $37.904 \text{ kJ mol}^{-1}$

89. Answer (4)

Hint: At equilibrium, entropy of a system is maximum.

Sol.: At equilibrium, free energy of a system is minimum.

90. Answer (1)

Hint: $\Delta_f H$ of C_2H_4 is

$2C(s) + 2H_2(g) \rightarrow C_2H_4(g)$

Sol.:

$\Delta_f H_{C_2H_4} = [2\Delta_a H_{(C)} + 2BE_{(H-H)}] - [BE_{C=C} + 4BE_{C-H}]$

= $(2 \times 171 + 2 \times 104.3) - (140.9 + 4 \times 99.3)$

= $(342 + 208.6) - (140.9 + 397.2) = 12.5 \text{ kcal mol}^{-1}$

91. Answer (2)

Hint: The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation.

Sol.: The van der Waals radius represents the overall size of the atom which includes its valence shell in a non-bonded situation.

92. Answer (2)

Hint & Sol.: Electron in a molecular orbital is influenced by two or more nuclei depending upon the number of atoms in a molecule, thus molecular orbital is polycentric.

93. Answer (4)

Hint: Bond order = $\frac{1}{2}(N_b - N_a)$

Sol.:

Species	Bond order
O_2	2
O_2^-	1.5
O_2^+	2.5
O_2^{2+}	3

94. Answer (1)

Hint: Atomic orbitals of equal energy combine to form new set of equivalent orbitals known as hybrid orbitals.

Sol.:

Species	Hybridisation
H_2O	sp^3
CO_2	sp
PCl_5	sp^3d
BrF_5	sp^3d^2

95. Answer (2)

Hint: Dipole moment of a molecule is resultant dipole moment of individual bonds.

Sol.:

Molecule	Dipole moment (μD)
NH_3	1.47
NF_3	0.23
BF_3	0

96. Answer (2)

Hint: Fluorine is most electronegative element.

Sol.: Electron gain enthalpy of Cl is more negative than electron gain enthalpy F because of repulsion of electron from $2p$ subshell in F.

97. Answer (3)

Hint:

Unu \rightarrow Mendeleevium

Sol.: Unb \rightarrow Nobelium

Unt \rightarrow Lawrencium

Unq \rightarrow Rutherfordium

98. Answer (3)

Hint: Z = 32 is Ge.

Sol.: Configuration of Ge = $[Ar]3d^{10}4s^24p^2$

Group → 14

Period → 4

99. Answer (2)

Hint: Heat of vaporisation is amount of heat required to evaporate 1 mol water to constant temperature.

Sol.: Amount of heat required to evaporate 1 mol (18 g) water = 44.01 kJ

So heat required to evaporate 9 g

$$\text{Water} = \frac{44.01}{2}$$

$$= 22.005 \text{ kJ}$$

100. Answer (2)

Hint: Group 15 elements belongs to p-block

Sol.: The outer electronic configuration of group 15 elements is ns^2np^3 .

[BOTANY]

SECTION-A

101. Answer (3)

Hint: *Gloriosa* belongs to family Liliaceae.

Sol.: In *Gloriosa*, superior ovary is present in which gynoecium occupies the highest position and all other parts are situated below it.

102. Answer (1)

Hint: Casparian strips are found in innermost layer of cortex.

Sol.: Casparian strips are found in the cells of endodermis of the roots.

103. Answer (3)

Hint: These are absent in the monocotyledonous plants.

Sol.: Collenchyma is a living and elastic tissue which provides mechanical support to the growing parts of the plant such as young stem and petiole of the leaf.

104. Answer (4)

Hint: Rhizome is the modified underground stem.

Sol.: The axillary buds of stem of plants like *Bougainvillea* and *Citrus* grow and form hard, woody and pointed structures called thorns. Rhizome grows parallel or horizontal to the soil surface. It bears nodes and internodes.

105. Answer (2)

Hint: Xylem parenchyma helps in radial conduction of water.

Sol.: Xylem parenchyma is thin walled and living xylary element.

106. Answer (1)

Hint: *Solanum* and *Allium* belongs to Solanaceae and Liliaceae family, respectively.

Sol.: *Solanum tuberosum* (potato) and *Allium cepa* (onion) have modified underground stem.

Perianth is present in onion. Seeds are endospermous in both *Solanum* and *Allium*. Reticulate venation is present in the leaves of the *Solanum*.

107. Answer (1)

Hint: Stamens are united into two or more than two bundles in polyadelphous condition.

Sol.: Parietal placentation- *Argemone*
Stamens are free- Polyandrous
Free central placentation- *Dianthus*

108. Answer (4)

Hint: Tendrils provide support to the weak and tender stem of the grapevine.

Sol.: In grapevines, tendrils are modified axillary buds.

109. Answer (2)

Hint: Region of meristematic activity is few millimetres above the root cap.

Sol.: Cells in the region of meristematic activity divide repeatedly to produce new cells.

110. Answer (1)

Hint: Members of Fabaceae and Poaceae family shows zygomorphic symmetry.

Sol.: Flowers of sweet pea, *Cassia*, wheat, sugarcane and groundnut show zygomorphic symmetry.

Flowers of brinjal, chilli, tobacco and tulip shows actinomorphic symmetry.

111. Answer (4)

Hint: Vexillary or papilionaceous aestivation is found in the members of Fabaceae.

Sol.: Twisted aestivation- If one margin of the appendage overlaps that of the next one and so on.

Imbricate aestivation- If the margins of sepals or petals overlap one another but not in any particular direction.

Valvate aestivation- Sepals or petals in a whorl just touch one another at the margin, without overlapping.

112. Answer (1)

Hint: In pinnately compound leaves, leaflets are present on rachis.

Sol.: Silk cotton has palmately compound leaves whereas neem has pinnately compound leaves.

113. Answer (3)

Hint: Cotton belongs to Malvaceae family.

Sol.: In cotton, pentacarpellary gynoecium is present. Calyx has valvate aestivation and corolla has twisted aestivation. Its flower has numerous stamens with monothealous anther.

114. Answer (2)

Hint: Phylloclade is flattened in *Opuntia* or fleshy cylindrical structure in *Euphorbia*.

Sol.: Phylloclade is present in *Euphorbia* and it is a modified photosynthetic stem.

115. Answer (4)

Hint: The family is commonly known as mustard family.

Sol.: All the given features of a flower are found in the family Cruciferae.

116. Answer (3)

Hint: Adventitious roots are generally present in the monocotyledonous plants.

Sol.: Adventitious roots are developed from the plant parts other than the radicle.

117. Answer (2)

Hint: In Australian acacia, the petiole expands and become, green coloured leaf like structure which perform the function of photosynthesis, and it is known as phyllode.

Sol.: In Australian acacia, the leaves are small, short lived and petiole is photosynthetic.

118. Answer (3)

Hint: In bean flower, the innermost petal is keel, which is also known as carina.

Sol.: In bean flowers, among the five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).

119. Answer (2)

Hint: In racemose inflorescence, the flowers are borne in an acropetal succession.

Sol.: In racemose inflorescence, younger flowers are present towards the apex and the older flowers are present at the base.

Flower consists of four whorls, which are successively arranged on the thalamus or receptacle.

120. Answer (4)

Hint: Tap root directly elongated from the radicle.

Sol.: In sweet potato, adventitious roots get swollen and store food.

121. Answer (4)

Hint: In both sunflower and marigold, placenta develops at the base of the ovary.

Sol.: Placentation in the sunflower and marigold is basal.

122. Answer (3)

Hint: Embryo is the result of syngamy and endosperm is the result of double fertilization.

Sol.: Testa is the outer protective layer of the seed. Embryo is the most important part of the seed. Endosperm is formed as a result of the double fertilization. Gram and pea are non-endospermous seeds. The outer covering of the endosperm in some monocot seeds separates the embryo by a proteinaceous layer called aleurone layer.

123. Answer (2)

Hint: Lodicules are found in the members of Poaceae.

Sol.: Perianth is represented as membranous scales called lodicules in *Zea mays*.

124. Answer (3)

Hint: Bicarpellary ovary with obliquely placed septum is found in potato.

Sol.: In members of Solanaceae, the ovary is bicarpellary and have obliquely placed septum.

125. Answer (2)

Hint: Both parenchyma and collenchyma are living simple permanent tissues.

Sol.: Parenchyma are thin walled and may have chloroplasts and intercellular spaces.

Collenchyma may have chloroplasts but intercellular spaces are always absent. It provides mechanical support to the plant parts.

126. Answer (2)

Hint: In this plant part, vascular bundles are arranged in a ring.

Sol.: The cells of the endodermis are rich in starch grains in dicotyledonous stem.

127. Answer (3)

Hint: In dicot stem, conjoint, collateral and open vascular bundle are present.

Sol.: Monocot root lacks hypodermis, cambium and medullary rays. Dicot stem has hypodermis, medullary rays and is eustelic. Both have well developed pith.

128. Answer (1)

Hint: All the tissues inner to the endodermis constitute the stele.

Sol.: Stele constitute pericycle, vascular bundle and pith.

129. Answer (2)

Hint: In dicot root, pith is small and inconspicuous and in dicot stem hypodermis is collenchymatous.

Sol.: In dicot stem, vascular bundles are conjoint and open and are arranged in a ring.

In monocot stem, vascular bundles are conjoint and closed.

130. Answer (3)

Hint: They are present on the axil of the leaves and are capable of forming branches and leaves.

Sol.: During the formation of leaves and elongation of stem, some cells 'left behind' from shoot apical meristem, constitute the axillary bud.

131. Answer (3)

Hint: Vessel is composed of row of cells placed one above the other in which the intervening walls get dissolved.

Sol.: Vessels differ from tracheids in being cell fusions because tracheids is a single long cell while vessel is a long tube like structure made up of many cells which are fused together to form it.

132. Answer (1)

Hint: In monocot stem, pericycle is absent.

Sol.: Pericycle consist of parenchymatous cells in roots.

The parenchymatous cells of pericycle become meristematic, and give rise to part of the vascular cambium and lateral roots in dicots.

133. Answer (3)

Hint: Trichomes prevent water loss whereas root hairs increase water absorption.

Sol.: Root hairs are unicellular and unbranched. Trichomes are unicellular or multicellular and branched or unbranched.

134. Answer (4)

Hint: Pith occupies the central part of the stem.

Sol.: The correct sequence of the tissue from outer to inner side of the stem is as follows:

Hypodermis → Endodermis → Pericycle → Pith

135. Answer (3)

Hint: Bundle sheath cells are absent in roots.

Sol.: Bundle sheath is absent in chilli roots.

SECTION-B

136. Answer (2)

Hint: Pitchers in *Nepenthes* is a modification of leaves.

Sol.: The pitcher in the insectivorous plant *Nepenthes* is a modified lamina.

137. Answer (1)

Hint: When stamens are attached to other floral appendages then it is called adhesion of stamens.

Sol.: In pea, diadelphous stamens are present, which shows cohesion of stamens.

In potato, lily and brinjal, adhesion of stamens are observed.

138. Answer (2)

Hint: In china rose, alternate phyllotaxy, superior ovary and valvate aestivation is present in calyx.

Sol.: In china rose, monoadelphous androecium and axile placentation is present.

139. Answer (3)

Hint: Aggregate fruits are developed from the polycarpellary and apocarpous ovary.

Sol.: If a fruit is formed without fertilisation it is called a parthenocarpic fruit.

140. Answer (2)

Hint: Leaf blade is also known as lamina.

Sol.: In some leguminous plants, the leaf base may become swollen, which is called the pulvinus. The petiole help hold the blade to light. Long thin flexible petioles allow leaf blades to flutter in wind. The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets.

141. Answer (2)

Hint: Ray florets of sunflower are epigynous flowers.

Sol.: Ray florets of sunflower have inferior ovary.

142. Answer (3)

Hint: Pneumatophores are present in the plants growing in the swampy region.

Sol.: Pneumatophores are found in some plants such as *Rhizophora*, in which many roots come out of the ground vertically upwards to get oxygen for respiration. They are negatively geotropic roots.

143. Answer (3)

Hint: The edible part of the turmeric is modified underground stem known as rhizome.

Sol.: Rhizome is a modified underground stem, which stores food and also acts as organ of perennation. It bears nodes and internodes, buds, scaly leaves, as in turmeric.

144. Answer (4)

Hint: Companion cells are the specialized parenchymatous cells, which are closely associated with sieve tube elements.

Sol.: Phloem fibres are sclerenchymatous fibres and they do not have branches.

Sieve tube elements are absent in the pteridophytes and gymnosperms.

Phloem parenchyma cells store various organic materials like resins, tannins, mucilage and latex etc.

145. Answer (4)

Hint: All of the given features are found in the monocot stem.

Sol.: All the given anatomical features can be observed in the stem of the maize, *i.e.*, stem of monocots.

146. Answer (2)

Hint: Isobilateral leaves have equal number of stomata on both the surfaces.

Sol.: Isobilateral leaves are found in monocots. They lack palisade parenchyma and have closed vascular bundles.

147. Answer (4)

Hint: Bulliform cells are found in monocot leaf especially in grasses.

Sol.: Bulliform cells become flaccid during water stress conditions and curl the leaf inward.

148. Answer (2)

Hint: All tissues except epidermis and vascular bundles constitute the ground tissue.

Sol.: The outermost layer of the root is called epiblema.

149. Answer (1)

Hint: Sclereids can be found in the roots, stems, leaves, flowers, etc.

Sol.: Sclereids are commonly found in the hard parts of the plant, however they occur in soft parts, *i.e.*, pulp of the fruits. Parenchyma helps in the secretion.

150. Answer (2)

Hint: In exarch type of arrangement of primary xylem, the protoxylem lies towards the periphery and metaxylem lies towards the centre.

Sol.: The first formed primary xylem is protoxylem. The protoxylem has vessels with narrow diameter and metaxylem has vessels with broad diameter.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: *Amphioxus* belongs to this sub-phylum

Sol.: Protonephridia or flame cells are the excretory structures in platyhelminths, rotifers, some annelids and the cephalochordates. Protonephridia are primarily concerned with osmoregulation. Prawns possess green glands for excretion, while cockroaches have Malpighian tubules. Earthworms excrete metabolic wastes through tubular structure, called nephridia.

152. Answer (2)

Hint: Humans are ureotelic

Sol.: Mammals, many terrestrial amphibians and marine fishes are ureotelic in nature. Many bony fishes are ammonotelic while reptiles, birds, land snails and insects are uricotelic animals.

153. Answer (4)

Hint: Involved in ultrafiltration of blood

Sol.: Glomerulus is a tuft of capillaries formed by the afferent arteriole – a fine branch of renal artery. Blood from glomerulus is carried away by an efferent arteriole. The renal tubule begins with a

double walled cup-like structure called Bowman's capsule. The tubule continues further to form PCT, loop of Henle and DCT.

154. Answer (3)

Hint: Approximately 200 mL of CO₂ is removed per minute

Sol.: Our lungs remove approximately 200 mL of CO₂ in one minute.

1 hour = 60 minutes

Hence, in 60 minutes our lungs will remove 200 mL × 60 minutes = 12000 mL/hour.

155. Answer (2)

Hint: Tubular part is involved in selective secretion

Sol.: Urine formation involves three main processes namely, glomerular filtration/ultrafiltration, reabsorption and secretion that takes place in different parts of the nephron. Ultrafiltration is carried out by the glomerulus, while tubular parts of nephron participate in secretion and reabsorption.

156. Answer (2)

Hint: Podocytes are present here

Sol.: The glomerular capillary blood pressure causes filtration of blood through 3 layers, *i.e.*, the endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a non-cellular basement membrane present between these two cellular layers.

157. Answer (3)

Hint: Include last thoracic vertebra

Sol.: Human kidneys are reddish brown, bean shaped structures situated between the levels of last thoracic *i.e.*, 12th thoracic vertebra and third lumbar vertebra, close to the dorsal inner wall of the abdominal cavity.

158. Answer (2)

Hint: Nitrogenous wastes are absorbed passively.

Sol.: Substances like glucose, amino acids, Na⁺, *etc.* in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport.

159. Answer (2)

Hint: Eliminated by liver

Sol.: Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum. This secretion provides a protective oily covering for the skin. Sweat produced by sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid, *etc.*

160. Answer (4)

Hint: Storage of Ca²⁺

Sol.: Red muscle fibres can be differentiated from white muscle fibres on the basis of :

- Amount of O₂ stored
- Amount of myoglobin
- Amount of sarcoplasmic reticulum but not on the basis of presence
- Amount of mitochondria

161. Answer (3)

Hint: 'H' zone disappears

Sol.: In a maximally contracted skeletal muscle fibre, the length of 'I' band *i.e.* isotropic band get reduced while 'A' band/anisotropic band retains its length with complete disappearance of 'H' zone.

162. Answer (2)

Hint: Meromyosin is a monomeric protein

Sol.: Sliding filament theory states that sliding of the thin filaments over the thick filaments leads to contraction of a muscle fibre. Actin is thin filament while myosin is thick filament. Each actin is made of two 'F' actins which are polymers of 'G' actins. Meromyosins polymerise to constitute one thick filament *i.e.*, myosin.

163. Answer (2)

Hint: Tetany is caused due to low Ca⁺⁺ in body fluid

Sol.:

- | | | |
|--------------------|---|---|
| Arthritis | – | Inflammation of joints |
| Tetany | – | Wild contractions in muscle due to low Ca ⁺⁺ in body fluid |
| Muscular dystrophy | – | Progressive degeneration of skeletal muscle mostly due to genetic disorder |
| Myasthenia gravis | – | Auto-immune disorder affecting neuro-muscular junction leading to fatigue, weakening and paralysis of skeletal muscle |

164. Answer (3)

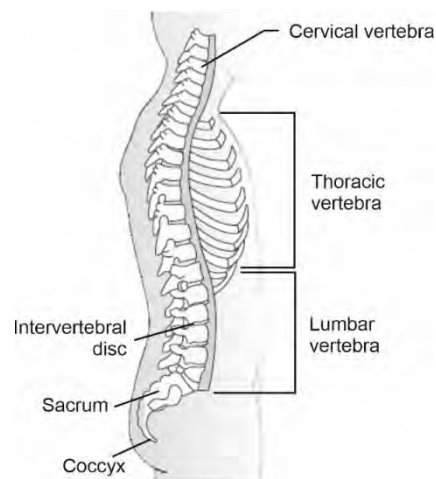
Hint: Number of curvatures in clavicle is equal to the total number of patella in humans

Sol.: Scapula and clavicle are bones of pectoral girdle. Each clavicle is a long slender bone with two curvatures. It articulates with the acromion process of the scapula.

165. Answer (3)

Hint: Its number is 5 in foetal stage

Sol.:



166. Answer (4)

Hint: No change in location

Sol.: Locomotory movements result in a change of place or location. Walking, running, flying, climbing, swimming are all some forms of locomotory movements. Chewing does not result in change of place or location.

167. Answer (2)

Hint: It is followed by thoracic vertebrae

Sol.: In humans, vertebral column is formed by 26 serially arranged vertebrae. It is differentiated into cervical (7), thoracic (12), lumbar (5), sacral (1-fused) and coccygeal (1-fused) regions starting from the skull.

168. Answer (3)

Hint: Glycogen breaks into pyruvic acid

Sol.: Repeated activation of the muscles can lead to the accumulation of lactic acid due to anaerobic breakdown of glycogen, causing fatigue.

169. Answer (4)

Hint: Both actin binding site and ATP binding site are present on the same structure

Sol.: The globular head of meromyosin is an active ATPase enzyme and has binding site for ATP and active sites for actin.

Two filaments of tropomyosin run close to 'F' actin throughout its length. A complex protein troponin is distributed at regular intervals on the tropomyosin.

Each meromyosin has two components, a globular head with a short arm *i.e.*, HMM and a tail *i.e.*, LMM.

170. Answer (3)

Hint: One patella in each hind limb

Sol.: In a healthy human (male/female), there are 14 tarsals, 10 metatarsals, 2 femurs, 2 fibula and 2 patella.

171. Answer (3)

Hint: Exclude the bones of pectoral girdle

Sol.: Each coxal bone of pelvic girdle is formed by the fusion of three bones—ilium, ischium and pubis. At the point of fusion of these bones is a cavity called acetabulum to which thigh bone *i.e.*, femur articulates. Hence, bones involved in formation of acetabulum are ilium, ischium and pubis. Scapula is a bone of pectoral girdle.

172. Answer (4)

Hint: Also called false ribs

Sol.: In a healthy adult human, there are 12 pairs of ribs *i.e.*, 24 ribs. Each rib is a thin flat bone connected dorsally to the thoracic vertebrae of vertebral column. It has two articulation surfaces on its dorsal end and is hence called bicephalic.

8th, 9th and 10th pairs of ribs do not articulate directly with the sternum but join the 7th rib with the help of hyaline cartilage. These are called vertebrochondral or false ribs.

173. Answer (2)

Hint: Formed by the streaming of protoplasm

Sol.: Macrophages exhibit amoeboid movement. It is effected by pseudopodia formed by the streaming of protoplasm.

Cilia help in locomotion of *Paramecium* and flagella help in the locomotion of *Euglena*.

174. Answer (3)

Hint: Exclude facial bones

Sol.: Hyoid is a U-shaped bone present at the base of the buccal cavity and is included in the human skull. Maxilla and lacrimal are facial bones while ethmoid is a cranial bone.

175. Answer (1)

Hint: Blood pumping organ

Sol.: Cardiac muscle fibres are striated. Visceral muscles are located in the wall of hollow visceral organs of the body like the digestive tract, reproductive tract, *etc.* They do not exhibit any striation and are smooth in appearance.

176. Answer (3)

Hint: Joint that permits limited movements

Sol.: In cartilaginous joint, the bones involved are joined together with the help of cartilage. This type of joint is present between the adjacent vertebrae in the vertebral column. Fibrous joints do not allow any movement and are present between the flat skull bones.

Hinge joint and gliding joint are examples of synovial joint which allow considerable movement.

177. Answer (2)

Hint: Number of ear ossicles in an ear

Sol.: Renal pyramids, renal calyces and loop of Henle are found in the medulla region of kidney, while PCT, DCT and Bowman's capsule are found in cortex region of the kidney.

178. Answer (3)

Hint: Feature common in both cortical and juxta medullary nephrons

Sol.: The efferent arteriole emerging from the glomerulus forms a fine capillary network around the renal tubule called the peritubular capillaries. This network is present in both cortical as well as in juxtamedullary nephrons.

179. Answer (2)

Hint: 70-80% of electrolytes and water are reabsorbed here.

Sol.: PCT is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption. Bowman's capsule is lined by simple squamous epithelium.

180. Answer (4)

Hint: Electrolytes can be reabsorbed actively or passively

Sol.: The ascending limb of loop of Henle is impermeable to water but allows transport of electrolytes actively or passively. Therefore, as the concentrated filtrate passes upward it gets diluted due to the passage of electrolytes to the medullary fluid.

181. Answer (4)

Hint: Heparin is an anticoagulant.

Sol.: During the process of hemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit called artificial kidney. Before the blood is pumped into dialysing unit (artificial kidney), anticoagulant like heparin is added in the blood. The dialysing unit contains a coiled cellophane tube surrounded by a fluid (dialysing fluid) having the same composition as that of plasma except the nitrogenous wastes. This method is a boon for thousands of uremic patients all over the world.

182. Answer (3)

Hint: ANF is released by heart.

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

183. Answer (2)

Hint: Equal to the number of ear ossicles in a ear

Sol.: Appendicular skeleton includes bones of limbs and girdles. Bones of skull and vertebral column are included in axial skeleton. Zygomatic is a facial bone while stapes is a tiny bone present in middle ear. Sacrum is a component of vertebral column. Hence, sacrum, stapes and zygomatic can not be included in appendicular skeleton.

184. Answer (1)

Hint: Peristalsis

Sol.: Joints are essential for all the types of movements involving the bony parts of the body. Amoeboid, ciliary, flagellar and many muscular movements do not need joints.

185. Answer (3)

Hint: Identify cartilaginous joint

Sol.: Shoulder joint, joint between carpals and joint between first and second cervical vertebrae are synovial joints. Joint present between sixth and seventh thoracic vertebrae is a cartilaginous joint.

SECTION-B

186. Answer (2)

Hint: Diuretics are responsible for excess loss of water through urine.

Sol.: Caffeine and alcohol are diuretic substances which are responsible for excess loss of water through urine.

Vasopressin facilitates water reabsorption from latter parts of tubule thereby preventing diuresis. ANF is antagonistic to RAAS. It inhibits the reabsorption of Na^+ and reduces the release of aldosterone from adrenal cortex. It also increases excretion of Na^+ and water in urine.

187. Answer (2)

Hint: Presence of interstitial fluid gradient helps in easy passage of water from collecting duct.

Sol.: Mammals have the ability to produce a concentrated urine. The vasa recta and loop of Henle play a significant role in this. The proximity between loop of Henle and vasa recta as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium. This gradient is mainly caused by NaCl and urea. The transport of these substances facilitated by the special arrangement of loop of Henle and vasa recta is called counter current mechanism. The counter current mechanism helps to maintain concentration gradient in the medullary interstitium. Presence of such interstitial gradient helps in an easy passage of water from the collecting duct, thereby concentrating the filtrate (urine).

188. Answer (2)

Hint: Relaxation of urethral sphincter causes release of urine.

Sol.: The process of release of urine is called micturition and the neural mechanism causing it is called the micturition reflex. When urinary bladder gets filled with urine, the stretch receptors on the walls of the urinary bladder send signals to CNS. The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

189. Answer (1)

Hint: Plasma membrane of muscle fibre is called sarcolemma.

Sol.: A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibrils.

190. Answer (2)

Hint: 'Z' line is an elastic fibre

Sol.: The thick filaments in the 'A' band, *i.e.* anisotropic band are held together in the middle of this band by a thin fibrous membrane called 'M' line. 'Z' line bisects 'I' band. 'H' zone is a part of 'A' band in which myosin filaments are not overlapped by actin filaments.

191. Answer (4)

Hint: 'H' zone is a non-overlapped portion

Sol.: In resting state, the edges of thin filaments partially overlap the free ends of the thick filaments leaving the central part of thick filaments. This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.

192. Answer (3)

Hint: ANF acts antagonistic to renin angiotensin system

Sol.: **Renal calculi** – Stone or insoluble mass of crystallised salts (oxalates, *etc*) formed within the kidney.

ANF – Vasodilator secreted from the atria of heart

Gout – Inflammation of joints due to accumulation of uric acid crystals.

Renin – Released by JG cells which converts angiotensinogen into angiotensin-I

193. Answer (4)

Hint: Function of adrenal cortex

Sol.: Angiotensin II being a powerful vasoconstrictor increases the glomerular blood pressure and thereby GFR. Angiotensin II also activates adrenal cortex to release aldosterone which causes reabsorption of Na^+ and water from the distal parts of the tubule.

194. Answer (3)

Hint: JG cells

Sol.: JGA *i.e.* juxta glomerular apparatus is a special sensitive region formed by cellular modification in the DCT and the afferent arteriole at the location of their contact. A fall in GFR can activate JG cells to release renin which can

stimulate the glomerular blood flow and thereby brings GFR back to normal.

195. Answer (3)

Hint: Helps to produce concentrated urine

Sol.: Large amounts of water could be reabsorbed from collecting duct to produce concentrated urine. It allows passage of small amounts of urea into medullary interstitium to keep up the osmolarity.

196. Answer (2)

Hint: Common in menopausal women.

Sol.: Accumulation of urea in blood is called uremia. Accumulation of lactic acid due to anaerobic breakdown of glycogen causes fatigue.

197. Answer (2)

Hint: Flat skull bones exhibit fibrous joint.

Sol.: The two halves of the pelvic girdle meet ventrally to form the pubic symphysis containing fibrous cartilage. Fibrous joint is shown by flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.

198. Answer (2)

Hint: Few cartilages are also included in skeleton.

Sol.: In humans, skeletal system consists of a framework of bones and a few cartilages. Axial skeleton comprises 80 bones while appendicular skeleton comprises 126 bones. Bone has a very hard matrix due to presence of calcium salts and collagen fibres.

199. Answer (2)

Hint: Brain is protected by cranium.

Sol.: In humans, vertebral column is formed by 26 serially arranged units called vertebrae and is dorsally placed. It protects spinal cord whereas brain is protected by bony covering called cranium.

200. Answer (3)

Hint: Storehouse of Ca^{+2}

Sol.: The junction between a motor neuron and the sarcolemma of the muscle fibre is called neuromuscular junction or motor-end plate.



All India Aakash Test Series for NEET - 2026

TEST - 3 (Code - J)[Click here for Code-I Sol.](#)

Test Date : 19/01/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION-A

1. Answer (4)

Hint & Sol.: During pure translation, all particles of rigid body will move together *i.e.*, they have the same linear velocity at any instant of time.

2. Answer (2)

Hint: Torque about point is given by $\vec{\tau} = \vec{r} \times \vec{F}$

Sol.: $\vec{\tau} \cdot \vec{F} = 0 \Rightarrow 3 \times 8 - 4 \times 6 + 5\alpha = 0$

$\Rightarrow 5\alpha = 0 \Rightarrow \alpha = \text{zero}$

3. Answer (1)

Hint: Centre of mass (c.o.m) lies on the point of concurrence of medians *i.e.*, centroid G of $\triangle ABC$.

Sol.: Coordinates of

$$G\left(\frac{-2+1+6}{3}, \frac{0+8+0}{3}\right) = \left(\frac{5}{3}, \frac{8}{3}\right)$$

\therefore 1st quadrant.

4. Answer (2)

Hint & Sol.: The moment of inertia of ring about an axis passing through centre and perpendicular to plane of ring will be MR^2 .

5. Answer (4)

Hint & Sol.: Moment of inertia of a body does not depend on its angular velocity.

6. Answer (1)

Hint: Work done by conservative force, $W_c = U_i - U_f$, where U is potential energy.

Sol.: $W_c < 0 \Rightarrow U_i < U_f$

7. Answer (4)

Hint: Work done by constant force, $W = \vec{F} \cdot \vec{r}$

Sol.: $W = (-4\hat{i} + 5\hat{j} + 6\hat{k}) \cdot (3\hat{i} + 3\hat{j})$

$= -12 + 15 = 3 \text{ J}$

8. Answer (2)

Hint: Instantaneous power, $P = \vec{F} \cdot \vec{v}$

Sol.: Velocity $v \propto t^3$

Acceleration $a = \frac{dv}{dt} \propto t^2$

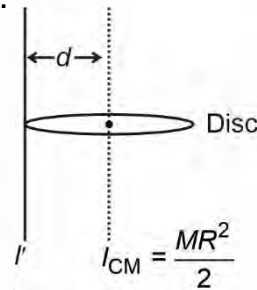
Force $F = ma \propto t^2$

Power $P \propto F \cdot v \Rightarrow P \propto t^2 \cdot t^3 \Rightarrow P \propto t^5$

9. Answer (3)

Hint: Using parallel axis theorem, $I' = I_{CM} + Md^2$

Sol.:



$\therefore I' = \frac{MR^2}{2} + MR^2 = \frac{3}{2}MR^2$

10. Answer (2)

Hint: Work done (W) is equal to the area under force-displacement curve.

Sol.: $W = \text{area of semi-circle} = \frac{\pi r_1 r_2}{2}$

$= \frac{\pi}{2} \times 5 \times 20 = 50\pi \text{ J}$

11. Answer (2)

Hint: Magnitude of momentum of body remains same if either $\vec{F} = \text{zero}$ or work done (W) by $\vec{F} = \text{zero}$

Sol.: $W = \vec{F} \cdot \vec{r} = \text{zero}$

$\Rightarrow -4 + 3\alpha + 1 = 0 \Rightarrow \alpha = 1$

12. Answer (2)

Hint: Energy stored in spring $= \frac{1}{2}kx^2$, whether elongation or compression.

Sol.: During elongation, $x = 2 \text{ cm}$ and $U = +50 \text{ J}$.

During compression, $x = 2 \text{ cm}$ and $U = +50 \text{ J}$.

13. Answer (1)

Hint: Work done (W) = $\vec{F} \cdot \vec{d} = Fd \cos \theta$

Sol.: Angle between force \vec{F} and displacement \vec{d} is 0° , therefore work done will be positive.

($\because \theta = 0^\circ \Rightarrow \cos \theta = 1$)

14. Answer (1)

Hint & Sol.: The total linear momentum of system and its kinetic energy remain conserved in an elastic collision.

15. Answer (3)

Hint: Write centripetal equation for body at B, C and D on circular track.

Sol.: As block moves upwards velocity decreases.

$$N_B = \frac{mV_B^2}{r} + mg \cos \theta$$

$$N_C = \frac{mV_C^2}{r}, N_D = \frac{mV_D^2}{r} - mg \cos \phi \Rightarrow N_B > N_C > N_D$$

16. Answer (3)

Hint: Kinetic energy of the woman, $K = \frac{1}{2} mv^2$

$$\text{Sol.} : K_f = (1.21) K_i \Rightarrow \frac{K_f}{K_i} = \frac{v_f^2}{v_i^2} = 1.21$$

$$\Rightarrow \frac{v_f}{v_i} = 1.1 \quad \therefore \frac{v_i}{v_f} = \frac{10}{11}$$

17. Answer (3)

Hint: Centre of mass of this uniform symmetric shape lies long its line of symmetry i.e., y-axis.

Sol.: As majority of mass is concentrated upwards, so C.O.M lies on OY.

18. Answer (1)

Hint & Sol.: The MOI of a rod about on axis passing through one end will be $\frac{ML^2}{3}$ while about

an axis passing through centre will be $\frac{ML^2}{12}$.

$$\Rightarrow \text{Ratio} = \frac{\frac{ML^2}{3}}{\frac{ML^2}{12}} = 4 : 1$$

19. Answer (1)

Hint: Rotational power, $P = \vec{\tau} \cdot \vec{\omega}$

Sol.:

$$P = (\hat{i} + 2\hat{j} + 3\hat{k}) \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 2 + 6 + 12 = 20 \text{ W}$$

20. Answer (4)

Hint: Distance of c.o.m of rod from that end,

$$x_{\text{cm}} = \frac{\int x \, dm}{\int dm} = \frac{\int \mu x \, dx}{\int \mu \, dx}$$

$$\text{Sol.} : x_{\text{cm}} = \frac{\int_0^L (3x) \, dx}{\int_0^L (3x) \, dx} = \frac{3 \int_0^L x^2 \, dx}{3 \int_0^L x \, dx} = \frac{2L}{3} = 2 \times \frac{3}{3} = 2 \text{ m}$$

21. Answer (3)

Hint: $W = \vec{F} \cdot \vec{d}$

Sol.: $W = Fd \cos \theta$

$\theta = 180^\circ$

$W = -ve$

22. Answer (2)

Hint & Sol.: Friction does not associated with potential energy so it is a non-conservative force.

23. Answer (3)

Hint: Work done by retarding force = change in K.E.

$$\Rightarrow -Fx_{\text{max}} = K_f - K_i$$

$$\text{Sol.} : -30 \times 2 = 0 - K_i \Rightarrow K_i = 60 \text{ J}$$

24. Answer (3)

Hint: Compare the formulae in both linear motion and rotational motion.

Sol.:

	Linear motion	Rotational analogue
(a - ii)	Force $F = Ma$	Torque $\tau = I\alpha$
(b - i)	Acceleration	Angular acceleration $\alpha = \frac{d\omega}{dt}$
(c - iv)	Velocity $v = \frac{dx}{dt}$	Angular velocity $\omega = \frac{d\theta}{dt}$
(d - iii)	Linear momentum, $p = Mv$	Angular momentum, $L = I\omega$

25. Answer (3)

Hint: Work done by torque (W) = change in rotational kinetic energy of body.

Sol.:

$$W = \frac{1}{2} I (\omega_f^2 - \omega_i^2) = \frac{1}{2} \times \frac{2}{5} MR^2 \omega_f^2 = \frac{1}{5} \times 5 \times 2^2 \times 2^2 = 16 \text{ J}$$

26. Answer (3)

Hint & Sol.: The cross product of two vector quantities always leads to a vector quantity and dot product always leads to a scalar quantity.

27. Answer (1)

Hint: Commercial unit of energy = 1 kWh = $10^3 \times 3600$ Ws = 3.6×10^6 J

Sol.: 1 erg = 10^{-7} J and 1 cal = 4.186 J

28. Answer (2)

Hint & Sol.: In statement (A), $\tau = Fr_{\perp} = mgR \neq \text{zero}$

In statement (B), $W_{mg} = \vec{F} \cdot \vec{r} = mgR \cos 90^\circ = \text{zero}$

In statement (C), angular momentum

$$L = mv_{\perp}r = m(u \sin \theta)R \neq \text{zero}$$

29. Answer (2)

Hint: Torque acting on rod about hinge point, $\tau_A = r_{\perp} F = I_A \alpha$

Sol.: Angular acceleration of rod,

$$\alpha = \frac{r_{\perp} F}{I_A} = \frac{\frac{1}{2} Mg}{\frac{ML^2}{3}}$$

$$\Rightarrow \alpha = \frac{3g}{2l} = \frac{3 \times 10}{2 \times 1.5}$$

$$= 10 \text{ rad/s}^2$$

30. Answer (3)

Hint: Velocity of centre of mass of system,

$$\vec{v}_{\text{cm}} = \frac{m_1 \vec{v}_1 + m_2 \vec{v}_2}{m_1 + m_2}$$

$$\text{Sol.} \vec{v}_{\text{cm}} = \frac{3(7\hat{j}) + 4(-7\hat{j})}{3 + 4} = -\frac{7\hat{j}}{7} = (-\hat{j}) \text{ m/s}$$

Centre of mass will move down with speed of 1 m/s.

31. Answer (4)

Hint: Use, $\vec{a}_{\text{COM}} = \frac{M_1 \vec{a}_1 + M_2 \vec{a}_2}{M_1 + M_2}$

Sol.: $\vec{a}_{\text{COM}} = \frac{M \times 0 + M \times 2\vec{a}}{2M} = \vec{a}$

32. Answer (4)

Hint: Angular momentum of rigid body rotating about fixed axis, $L = I\omega$

Sol.: $L = 0 \Rightarrow \omega = 0 \Rightarrow t^4 - 12t^3 = t^3(t - 12) = 0$
 $\Rightarrow t = 12 \text{ s}$

33. Answer (3)

Hint & Sol.: The S.I unit of energy is joule.

34. Answer (4)

Hint: Work done by all forces on bob, $W = W_{\text{tension}} + W_{\text{gravity}} = 0 + U_i - U_f$

Sol.: $W = U_A - U_B = -mgl = -4 \times 10 \times 1 = -40 \text{ J}$

35. Answer (3)

Hint: Time rate of change of kinetic energy of body has same unit as power of the body.

Sol.: (A – II) [kinetic energy] = $[ML^2T^{-2}]$

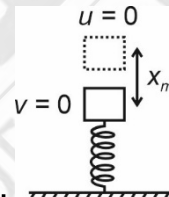
(B – I) [spring constant] = $[MT^{-2}]$

(D – III) and (C – III) [power] = $[ML^2T^{-3}]$

SECTION - B

36. Answer (3)

Hint: Total mechanical energy (E) is conserved as both spring force and gravitational force as conservative.



Sol.:

Initially, $E_i = U_{\text{body}} + K_i + U_{\text{spring}}$
 $= mg x_m + 0 + 0$

Finally, $E_f = U_{\text{body}} + K_f + U_{\text{spring}} = 0 + 0 + \frac{1}{2} kx_m^2$

$E_i = E_f \Rightarrow mgx_m = \frac{1}{2} kx_m^2 \Rightarrow x_m = \frac{2mg}{k}$

37. Answer (2)

Hint: Use equation of motion, $v^2 = u^2 + 2as = u^2 + 2(-\mu g)s$

Sol.: Final speed $v = \text{zero}$ and
 $u = 54 \times \frac{5}{18} = 15 \text{ m/s}$

\therefore Stopping distance,

$$s = \frac{u^2}{2\mu g} = \frac{15^2}{2(0.3)10} = \frac{75}{2} = 37.5 \text{ m}$$

38. Answer (4)

Hint: F_{ext} on system is zero.

Sol.: Total linear momentum of system is conserved in every collision.

39. Answer (4)

Hint: Perpendicular axis theorem is applicable only to planar bodies.

Sol.: Disc, ring are planar.

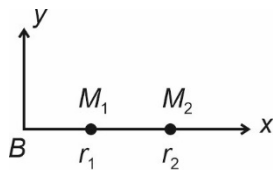
40. Answer (2)

Hint & Sol.: A couple can produce only pure rotational motion.

41. Answer (3)

Hint: The centre of mass of the fragments of the projectile continues along the same parabolic path to reach point B, which it would have followed if there were no explosion.

Sol.: Taking B as origin,



$$\bar{x}_{\text{CM}} = \frac{M_1 \vec{r}_1 + M_2 \vec{r}_2}{M_1 + M_2}$$

$$\Rightarrow \text{zero} = M_1 \vec{r}_1 + M_2 \vec{r}_2$$

$$\Rightarrow M_2 \vec{r}_2 = -M_1 \vec{r}_1$$

\therefore Both land on opposite sides of B, with $r_2 > r_1$ as $M_2 < M_1$.

42. Answer (2)

Hint & Sol.: Since the particle is moving with constant speed and no external torque acts hence the angular momentum would remain conserved.

43. Answer (3)

Hint: For a particle performing circular motion,

$$F_c = \frac{mv^2}{R} \text{ and } F_t = m \frac{dv}{dt}$$

Sol.: $K = \frac{1}{2} mv^2 \propto t \Rightarrow v \propto \sqrt{t}$

$$F_t \propto \frac{d(\sqrt{t})}{dt} = \frac{1}{2} t^{-\frac{1}{2}}$$

$$F_c \propto (\sqrt{t})^2 = t$$

44. Answer (3)

Hint: Area under $P - t$ graph = work done on particle (W)

Sol.: $W = \frac{1}{2} \times 2 \times 8 = (\text{K.E.})_f - (\text{K.E.})_i$

$\therefore (\text{K.E.})_f = 8 \text{ J}$

45. Answer (2)

Hint: Using work-energy theorem, work done by non-conservative force = change in total mechanical energy of body

Sol.: $W_{\text{friction}} = E_{\text{final}} - E_{\text{initial}} = 0 - (K_{\text{initial}} + U_{\text{initial}})$

$$= - \left[\frac{1}{2} m (4)^2 + mg(1.2) \right] = -(80 + 120) = -200 \text{ J}$$

46. Answer (3)

Hint: Use conservation of angular momentum

Sol.: Since the net external torque acting on the system is zero hence the angular momentum of system remains conserved.

47. Answer (2)

Hint: Coefficient of restitution,

$$e = \frac{\text{relative velocity of separation}}{\text{relative velocity of approach}}$$

Sol.: $e = \frac{6.5 - 3.5}{1 + 5} = \frac{3}{6} = 0.5$

48. Answer (2)

Hint: As external torque is zero, we apply conservation of angular momentum (L) for system in the context of rotation about a fixed axis.

Sol.: $L_{\text{initial}} = L_{\text{final}} \Rightarrow I_2 \omega_2 - I_1 \omega_1 = (I_2 + I_1) \omega_f$

New angular speed,

$$\omega_f = \frac{I_2 \omega_2 - I_1 \omega_1}{I_2 + I_1} = \frac{(4m)r^2(1) - mr^2(2)}{(4m)r^2 + mr^2} = \frac{2}{5} \text{ rad/s}$$

$\bar{\omega}_f$ is in same direction as $\bar{\omega}_2$. ($\because I_2 \omega_2 > I_1 \omega_1$)

49. Answer (1)

Hint: If displaced slightly from original position, particle will tend to come back when in stable equilibrium and won't come back when in unstable equilibrium. In neutral equilibrium position, force remains zero when slightly displaced.

$$\text{Sol.: At } M, \left\{ \begin{array}{l} x > x_M, \quad F = +ve \\ x = x_M, \quad F = 0 \\ x < x_M, \quad F = -ve \end{array} \right\} = \text{unstable}$$

equilibrium

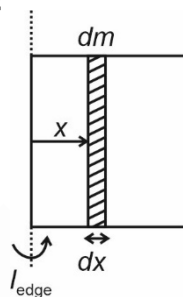
$$\text{At } N, \left\{ \begin{array}{l} x > x_N, \quad F = -ve \\ x = x_N, \quad F = 0 \\ x < x_N, \quad F = +ve \end{array} \right\} = \text{stable equilibrium}$$

50. Answer (1)

$$\text{Hint: } I_{\text{edge}} = \int x^2 dm \text{ where } \frac{dm}{dx} = \frac{M}{l} \text{ for uniform}$$

plate

Sol.:



$$I_{\text{edge}} = \int_0^l x^2 \left(\frac{M}{l} \right) dx = \frac{M}{l} \left(\frac{x^3}{3} \right)_0^l = \frac{Ml^2}{3}$$

[CHEMISTRY]

SECTION - A

51. Answer (4)

Hint: s and p block elements are called representative element.

Sol.: Ga and Ge both belong to p block.

52. Answer (4)

Hint: Noble gases have positive electron gain enthalpy.

Sol.: Ar being noble gas has positive electron gain enthalpy.

53. Answer (3)

Hint: On moving across the period the ionisation enthalpy increases.

Sol.: Ionisation enthalpy of Be is greater than B due to more penetration of 2s electrons as compared to 2p electrons.

So correct order is

C > Be > B > Li.

54. Answer (1)

Hint: Among isoelectronic species greater negative charge has higher radii and higher positive charge has lower radii.

Sol.: $N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$

55. Answer (4)

Hint: Triads had an atomic weights about half way between the atomic weights of other two.

Sol.: Zn, Cd and Hg do not form triad.

56. Answer (3)

Hint & Sol.: According to VSEPR theory repulsive interaction decrease in the order $lp - lp > lp - bp > bp - bp$

57. Answer (4)

Hint: There is no equilibrium between the canonical forms.

Sol.: Resonance stabilizes the molecule as the energy of resonance hybrid is less than energy of canonical structure.

58. Answer (3)

Hint: The magnitude of H-bonding depends on the physical state of the compound. It is maximum in solid state and minimum in gaseous state.

Sol.: When H-atom is present in between two highly electronegative atom within the same molecule, intramolecular hydrogen bond is formed. So o-nitrophenol forms intramolecular H-bond.

59. Answer (1)

Hint & Sol.: Mutual repulsion of the electrons in antibonding molecular orbital is more than the attraction between the electrons and the nuclei, this leads to net increase in energy. So electrons in antibonding molecular orbital destabilize the molecule.

60. Answer (2)

Hint: The bond pair and lone pair repel each other to achieve positions having minimum repulsion. This determines shape and bond angle in a molecule.

Sol.:

Species	Bond angle
H ₂ O	104.5°
NH ₃	107°
NH ₄ ⁺	109.5°
SO ₂	119.5°
BF ₃	120°
CO ₂	180°

61. Answer (2)

Hint: Formal charge = Valence electrons – total no. of non-bonding electrons – $\frac{1}{2}$ [total number of bonding electrons]

Sol.: Formal charge of N in NH₄⁺

$$= 5 - 0 - \frac{1}{2} \times 8$$

$$= +1$$

62. Answer (2)

Hint: NO is an odd electron species

Sol.: CH₄ – complete octet

BCl₃ – Incomplete octet

H₂SO₄ – Expanded octet

63. Answer (1)

Hint: In positive or in phase overlap orbitals forming bonds should have same phase and orientation in space.

Sol.: (1) in phase overlap

(2) is negative or out of phase overlap.

(3) & (4) are zero overlap.

64. Answer (2)

Hint & Sol.: The point at which system acquires minimum energy is the point where net force of attraction balances the force of repulsion.

65. Answer (3)

Hint: The greater the charge on the cation, the greater is the covalent character.

Sol.: For cations with electronic configuration (n – 1)dⁿ ns⁰ have more polarising power than that of alkali and alkaline earth metal cations.

Hence correct order of covalent character is

KCl < CaCl₂ < ZnCl₂

66. Answer (4)

Hint & Sol.: C_P – C_V = R

67. Answer (4)

Hint: Extensive property is a property whose value depends upon quantity or size of matter present in the system.

Sol.: Internal energy, Heat capacity and Free energy are extensive properties.

68. Answer (4)

Hint: During free expansion, P_{ext} = 0

Sol.: w = –P_{ext}ΔV = –0 × ΔV = 0

69. Answer (3)

Hint & Sol.: Δ_{sol}H° = Δ_{lattice}H° + Δ_{hyd}H°

70. Answer (2)

Hint: ΔG° = –2.303 RT log K_c

Sol.: ΔG° = –2.303 × R × 300 × log100

$$= -2.303 \times 2 \times 300 \times R$$

$$= -1381.8 R \text{ kJ/mol}$$

71. Answer (1)

Hint: ΔG = ΔH – TΔS < 0 (for spontaneous process).

Sol.: TΔS_{system} is energy not available to do useful work.

ΔG is the net energy available to do useful work.

72. Answer (4)

Hint: For spontaneous process, ΔG = –ve.

Sol.: If ΔH = –ve

ΔS = +ve

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

then ΔG is –ve at every temperature.

73. Answer (2)

Hint & Sol.:

Adiabatic → q = 0

Isochoric → ΔV = 0

Isothermal → ΔT = 0

Isobaric → ΔP = 0

74. Answer (1)

Hint: ΔG = ΔH – TΔS

Sol.: ΔG = ΔH – TΔS

As Δn_g = 0

ΔH = ΔU = 5 kcal

$$\Delta G = 5 - 300 \times 50 \times 10^{-3}$$

$$= 5 - 15$$

$$= -10 \text{ kcal}$$

75. Answer (4)

Hint: For isothermal process; $\Delta T = 0$ For adiabatic process; $q = 0$ **Sol.:** $T_S = T_Q$ (for isothermal process) $T_Q > T_R$ because for isothermal process temperature remains constant while for adiabatic expansion, cooling of gas takes place.

Work done is calculated as area under the curve in P - V diagram.

For expansion, work is done by the system so

 $W = -ve$ $\Delta U = q + w$ (For adiabatic) $\Delta U = w$ $\Delta U = -ve$ so, $U_Q > U_R$

76. Answer (3)

Hint: $Q = n C_m \Delta T$ **Sol.:** Moles of Al = $\frac{54}{27} = 2$ $C_m = 24 \text{ J mol}^{-1} \text{ K}^{-1}$ $\Delta T = 100 \text{ K}$ $Q = n C_m \Delta T$ $= 2 \times 24 \times 100$ $= 4800 \text{ J}$

77. Answer (2)

Hint: Increase in disorderness leads to increase in entropy.**Sol.:** Entropy increases during boiling of egg because of denaturation of protein. $\text{H}_2(\text{g}) \rightarrow 2\text{H}(\text{g})$

Entropy increases because number of gaseous moles increases.

78. Answer (2)

Hint: Heat of combustion = calorific value \times molar mass**Sol.:** $\Delta H_c(\text{C}_2\text{H}_6) = x \times 30$ $= 30x \text{ kJ mol}^{-1}$

79. Answer (1)

Hint: Phase transition is an isothermal process.**Sol.:** During melting of ice at melting point of H_2O , $\Delta T = 0$ Heat capacity = $\frac{q}{\Delta T} = \infty$

80. Answer (1)

Hint: Neutralisation reaction of strong acids with strong bases release maximum heat.**Sol.:** HF is strong acid and hydration of F^- is maximum hence it gives maximum heat of neutralisation.

81. Answer (1)

Hint: $\Delta H = \Delta U$ when $\Delta n_g = 0$ **Sol.:** $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g})$ $\Delta n_g = 0$ $\therefore \Delta H = \Delta U$

82. Answer (2)

Hint: Work done against external pressure is irreversible work done $w = -P_{\text{ext}} \Delta V$ **Sol.:** $w = -P_{\text{ext}} \Delta V$ $= -2 \times (11 - 1)$ $= -20 \text{ L atm}$

83. Answer (3)

Hint: State functions depend upon initial and final value and not on the path followed.**Sol.:** Entropy, Enthalpy and Gibb's energy are state functions.

84. Answer (1)

Hint: Hess's law of constant heat summation.**Sol.:** $\text{S} + \text{O}_2 \rightarrow \text{SO}_2(\text{g}) \dots(\text{i})$ $\text{S} + \frac{3}{2} \text{O}_2 \rightarrow \text{SO}_3(\text{g}) \dots(\text{ii})$

Applying,

(ii) - (i) we get

 $\text{SO}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{SO}_3(\text{g})$ $\Delta H = -395.72 - (-296.83)$ $= -98.89 \text{ kJ mol}^{-1}$

85. Answer (1)

Hint: $\Delta U = q + w$ **Sol.:** $q = 10 \text{ J}$ $w = -40 \text{ J}$ $\Delta U = q + w$ $= 10 - 40$ $= -30 \text{ J}$ **SECTION - B**

86. Answer (2)

Hint: Group 15 elements belongs to p-block**Sol.:** The outer electronic configuration of group 15 elements is $ns^2 np^3$.

87. Answer (2)

Hint: Heat of vaporisation is amount of heat required to evaporate 1 mol water to constant temperature.

Sol.: Amount of heat required to evaporate 1 mol (18 g) water = 44.01 kJ

So heat required to evaporate 9 g

$$\text{Water} = \frac{44.01}{2}$$

$$= 22.005 \text{ kJ}$$

88. Answer (3)

Hint: Z = 32 is Ge.

Sol.: Configuration of Ge = [Ar]3d¹⁰4s²4p²

Group → 14

Period → 4

89. Answer (3)

Hint:

Unu → Mendeleevium

Sol.: Unb → Nobelium

Unt → Lawrencium

Unq → Rutherfordium

90. Answer (2)

Hint: Fluorine is most electronegative element.

Sol.: Electron gain enthalpy of Cl is more negative than electron gain enthalpy F because of repulsion of electron from 2p subshell in F.

91. Answer (2)

Hint: Dipole moment of a molecule is resultant dipole moment of individual bonds.

Sol.:

Molecule	Dipole moment (μD)
NH ₃	1.47
NF ₃	0.23
BF ₃	0

92. Answer (1)

Hint: Atomic orbitals of equal energy combine to form new set of equivalent orbitals known as hybrid orbitals.

Sol.:

Species	Hybridisation
H ₂ O	sp ³
CO ₂	sp
PCl ₅	sp ³ d
BrF ₅	sp ³ d ²

93. Answer (4)

$$\text{Hint: Bond order} = \frac{1}{2}(N_b - N_a)$$

Sol.:

Species	Bond order
O ₂	2
O ₂ ⁻	1.5
O ₂ ⁺	2.5
O ₂ ²⁺	3

94. Answer (2)

Hint & Sol.: Electron in a molecular orbital is influenced by two or more nuclei depending upon the number of atoms in a molecule, thus molecular orbital is polycentric.

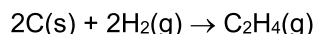
95. Answer (2)

Hint: The covalent radius is measured approximately as the radius of an atom's core which is in contact with the core of an adjacent atom in a bonded situation.

Sol.: The van der Waals radius represents the overall size of the atom which includes its valence shell in a non-bonded situation.

96. Answer (1)

Hint: Δ_fH of C₂H₄ is



Sol.:

$$\begin{aligned} \Delta_f H_{\text{C}_2\text{H}_4} &= [2\Delta_a H_{\text{C}} + 2BE_{\text{(H-H)}}] - [BE_{\text{C=C}} + 4BE_{\text{C-H}}] \\ &= (2 \times 171 + 2 \times 104.3) - (140.9 + 4 \times 99.3) \\ &= (342 + 208.6) - (140.9 + 397.2) = 12.5 \text{ kcal mol}^{-1} \end{aligned}$$

97. Answer (4)

Hint: At equilibrium, entropy of a system is maximum.

Sol.: At equilibrium, free energy of a system is minimum.

98. Answer (4)

Hint: $\Delta_{\text{vap}}U = \Delta_{\text{vap}}H - \Delta n_g RT$

Sol.: Number of moles = $\frac{18}{18} = 1 \text{ mol}$

$\Delta U = \Delta_{\text{vap}}H^\circ - \Delta n_g RT$

= $41 - 1 \times 8.314 \times 10^{-3} \times 373$

= $41 - 3.096 \text{ kJ mol}^{-1}$

= $37.904 \text{ kJ mol}^{-1}$

99. Answer (2)

Hint & Sol.: The crystalline solid state is the state of lowest entropy.

100. Answer (3)

Hint: For an isolated system, entropy increases with time.

Sol.: ΔS can discriminate between reversible and irreversible process.

[BOTANY]

SECTION-A

101. Answer (3)

Hint: Bundle sheath cells are absent in roots.

Sol.: Bundle sheath is absent in chilli roots.

102. Answer (4)

Hint: Pith occupies the central part of the stem.

Sol.: The correct sequence of the tissue from outer to inner side of the stem is as follows:

Hypodermis → Endodermis → Pericycle → Pith

103. Answer (3)

Hint: Trichomes prevent water loss whereas root hairs increase water absorption.

Sol.: Root hairs are unicellular and unbranched. Trichomes are unicellular or multicellular and branched or unbranched.

104. Answer (1)

Hint: In monocot stem, pericycle is absent.

Sol.: Pericycle consist of parenchymatous cells in roots.

The parenchymatous cells of pericycle become meristematic, and give rise to part of the vascular cambium and lateral roots in dicots.

105. Answer (3)

Hint: Vessel is composed of row of cells placed one above the other in which the intervening walls get dissolved.

Sol.: Vessels differ from tracheids in being cell fusions because tracheids is a single long cell while vessel is a long tube like structure made up of many cells which are fused together to form it.

106. Answer (3)

Hint: They are present on the axil of the leaves and are capable of forming branches and leaves.

Sol.: During the formation of leaves and elongation of stem, some cells 'left behind' from shoot apical meristem, constitute the axillary bud.

107. Answer (2)

Hint: In dicot root, pith is small and inconspicuous and in dicot stem hypodermis is collenchymatous.

Sol.: In dicot stem, vascular bundles are conjoint and open and are arranged in a ring.

In monocot stem, vascular bundles are conjoint and closed.

108. Answer (1)

Hint: All the tissues inner to the endodermis constitute the stele.

Sol.: Stele constitute pericycle, vascular bundle and pith.

109. Answer (3)

Hint: In dicot stem, conjoint, collateral and open vascular bundle are present.

Sol.: Monocot root lacks hypodermis, cambium and medullary rays. Dicot stem has hypodermis, medullary rays and is eustelic. Both have well developed pith.

110. Answer (2)

Hint: In this plant part, vascular bundles are arranged in a ring.

Sol.: The cells of the endodermis are rich in starch grains in dicotyledonous stem.

111. Answer (2)

Hint: Both parenchyma and collenchyma are living simple permanent tissues.

Sol.: Parenchyma are thin walled and may have chloroplasts and intercellular spaces.

Collenchyma may have chloroplasts but intercellular spaces are always absent. It provides mechanical support to the plant parts.

112. Answer (3)

Hint: Bicarpellary ovary with obliquely placed septum is found in potato.

Sol.: In members of Solanaceae, the ovary is bicarpellary and have obliquely placed septum.

113. Answer (2)
Hint: Lodicules are found in the members of Poaceae.
Sol.: Perianth is represented as membranous scales called lodicules in *Zea mays*.
114. Answer (3)
Hint: Embryo is the result of syngamy and endosperm is the result of double fertilization.
Sol.: Testa is the outer protective layer of the seed. Embryo is the most important part of the seed. Endosperm is formed as a result of the double fertilization. Gram and pea are non-endospermous seeds. The outer covering of the endosperm in some monocot seeds separates the embryo by a proteinaceous layer called aleurone layer.
115. Answer (4)
Hint: In both sunflower and marigold, placenta develops at the base of the ovary.
Sol.: Placentation in the sunflower and marigold is basal.
116. Answer (4)
Hint: Tap root directly elongated from the radicle.
Sol.: In sweet potato, adventitious roots get swollen and store food.
117. Answer (2)
Hint: In racemose inflorescence, the flowers are borne in an acropetal succession.
Sol.: In racemose inflorescence, younger flowers are present towards the apex and the older flowers are present at the base.
 Flower consists of four whorls, which are successively arranged on the thalamus or receptacle.
118. Answer (3)
Hint: In bean flower, the innermost petal is keel, which is also known as carina.
Sol.: In bean flowers, among the five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).
119. Answer (2)
Hint: In Australian acacia, the petiole expands and become, green coloured leaf like structure which perform the function of photosynthesis, and it is known as phyllode.
Sol.: In Australian acacia, the leaves are small, short lived and petiole is photosynthetic.
120. Answer (3)
Hint: Adventitious roots are generally present in the monocotyledonous plants.
Sol.: Adventitious roots are developed from the plant parts other than the radicle.
121. Answer (4)
Hint: The family is commonly known as mustard family.
Sol.: All the given features of a flower are found in the family Cruciferae.
122. Answer (2)
Hint: Phylloclade is flattened in *Opuntia* or fleshy cylindrical structure in *Euphorbia*.
Sol.: Phylloclade is present in *Euphorbia* and it is a modified photosynthetic stem.
123. Answer (3)
Hint: Cotton belongs to Malvaceae family.
Sol.: In cotton, pentacarpellary gynoecium is present. Calyx has valvate aestivation and corolla has twisted aestivation. Its flower has numerous stamens with monothealous anther.
124. Answer (1)
Hint: In pinnately compound leaves, leaflets are present on rachis.
Sol.: Silk cotton has palmately compound leaves whereas neem has pinnately compound leaves.
125. Answer (4)
Hint: Vexillary or papilionaceous aestivation is found in the members of Fabaceae.
Sol.: Twisted aestivation- If one margin of the appendage overlaps that of the next one and so on.
 Imbricate aestivation- If the margins of sepals or petals overlap one another but not in any particular direction.
 Valvate aestivation- Sepals or petals in a whorl just touch one another at the margin, without overlapping.
126. Answer (1)
Hint: Members of Fabaceae and Poaceae family shows zygomorphic symmetry.
Sol.: Flowers of sweet pea, *Cassia*, wheat, sugarcane and groundnut show zygomorphic symmetry.
 Flowers of brinjal, chilli, tobacco and tulip shows actinomorphic symmetry.
127. Answer (2)
Hint: Region of meristematic activity is few millimetres above the root cap.
Sol.: Cells in the region of meristematic activity divide repeatedly to produce new cells.
128. Answer (4)
Hint: Tendrils provide support to the weak and tender stem of the grapevine.
Sol.: In grapevines, tendrils are modified axillary buds.

129. Answer (1)

Hint: Stamens are united into two or more than two bundles in polyadelphous condition.

Sol.: Parietal placentation- *Argemone*
Stamens are free- Polyandrous
Free central placentation- *Dianthus*

130. Answer (1)

Hint: *Solanum* and *Allium* belongs to Solanaceae and Liliaceae family, respectively.

Sol.: *Solanum tuberosum* (potato) and *Allium cepa* (onion) have modified underground stem. Perianth is present in onion. Seeds are endospermous in both *Solanum* and *Allium*. Reticulate venation is present in the leaves of the *Solanum*.

131. Answer (2)

Hint: Xylem parenchyma helps in radial conduction of water.

Sol.: Xylem parenchyma is thin walled and living xylary element.

132. Answer (4)

Hint: Rhizome is the modified underground stem.

Sol.: The axillary buds of stem of plants like *Bougainvillea* and *Citrus* grow and form hard, woody and pointed structures called thorns. Rhizome grows parallel or horizontal to the soil surface. It bears nodes and internodes.

133. Answer (3)

Hint: These are absent in the monocotyledonous plants.

Sol.: Collenchyma is a living and elastic tissue which provides mechanical support to the growing parts of the plant such as young stem and petiole of the leaf.

134. Answer (1)

Hint: Casparian strips are found in innermost layer of cortex.

Sol.: Casparian strips are found in the cells of endodermis of the roots.

135. Answer (3)

Hint: *Gloriosa* belongs to family Liliaceae.

Sol.: In *Gloriosa*, superior ovary is present in which gynoeceum occupies the highest position and all other parts are situated below it.

SECTION-B

136. Answer (2)

Hint: In exarch type of arrangement of primary xylem, the protoxylem lies towards the periphery and metaxylem lies towards the centre.

Sol.: The first formed primary xylem is protoxylem. The protoxylem has vessels with narrow diameter and metaxylem has vessels with broad diameter.

137. Answer (1)

Hint: Sclereids can be found in the roots, stems, leaves, flowers, etc.

Sol.: Sclereids are commonly found in the hard parts of the plant, however they occur in soft parts, *i.e.*, pulp of the fruits. Parenchyma helps in the secretion.

138. Answer (2)

Hint: All tissues except epidermis and vascular bundles constitute the ground tissue.

Sol.: The outermost layer of the root is called epiblema.

139. Answer (4)

Hint: Bulliform cells are found in monocot leaf especially in grasses.

Sol.: Bulliform cells become flaccid during water stress conditions and curl the leaf inward.

140. Answer (2)

Hint: Isobilateral leaves have equal number of stomata on both the surfaces.

Sol.: Isobilateral leaves are found in monocots. They lack palisade parenchyma and have closed vascular bundles.

141. Answer (4)

Hint: All of the given features are found in the monocot stem.

Sol.: All the given anatomical features can be observed in the stem of the maize, *i.e.*, stem of monocots.

142. Answer (4)

Hint: Companion cells are the specialized parenchymatous cells, which are closely associated with sieve tube elements.

Sol.: Phloem fibres are sclerenchymatous fibres and they do not have branches.

Sieve tube elements are absent in the pteridophytes and gymnosperms.

Phloem parenchyma cells store various organic materials like resins, tannins, mucilage and latex etc.

143. Answer (3)

Hint: The edible part of the turmeric is modified underground stem known as rhizome.

Sol.: Rhizome is a modified underground stem, which stores food and also acts as organ of perennation. It bears nodes and internodes, buds, scaly leaves, as in turmeric.

144. Answer (3)

Hint: Pneumatophores are present in the plants growing in the swampy region.

Sol.: Pneumatophores are found in some plants such as *Rhizophora*, in which many roots come out of the ground vertically upwards to get oxygen for respiration. They are negatively geotropic roots.

145. Answer (2)

Hint: Ray florets of sunflower are epigynous flowers.

Sol.: Ray florets of sunflower have inferior ovary.

146. Answer (2)

Hint: Leaf blade is also known as lamina.

Sol.: In some leguminous plants, the leaf base may become swollen, which is called the pulvinus. The petiole help hold the blade to light. Long thin flexible petioles allow leaf blades to flutter in wind.

The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets.

147. Answer (3)

Hint: Aggregate fruits are developed from the polycarpellary and apocarpous ovary.

Sol.: If a fruit is formed without fertilisation it is called a parthenocarpic fruit.

148. Answer (2)

Hint: In china rose, alternate phyllotaxy, superior ovary and valvate aestivation is present in calyx.

Sol.: In china rose, monoadelphous androecium and axile placentation is present.

149. Answer (1)

Hint: When stamens are attached to other floral appendages then it is called adhesion of stamens.

Sol.: In pea, diadelphous stamens are present, which shows cohesion of stamens.

In potato, lily and brinjal, adhesion of stamens are observed.

150. Answer (2)

Hint: Pitchers in *Nepenthes* is a modification of leaves.

Sol.: The pitcher in the insectivorous plant *Nepenthes* is a modified lamina.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: Identify cartilaginous joint

Sol.: Shoulder joint, joint between carpals and joint between first and second cervical vertebrae are synovial joints. Joint present between sixth and seventh thoracic vertebrae is a cartilaginous joint.

152. Answer (1)

Hint: Peristalsis

Sol.: Joints are essential for all the types of movements involving the bony parts of the body. Amoeboid, ciliary, flagellar and many muscular movements do not need joints.

153. Answer (2)

Hint: Equal to the number of ear ossicles in a ear

Sol.: Appendicular skeleton includes bones of limbs and girdles. Bones of skull and vertebral column are included in axial skeleton. Zygomatic is a facial bone while stapes is a tiny bone present in middle ear. Sacrum is a component of vertebral column. Hence, sacrum, stapes and zygomatic can not be included in appendicular skeleton.

154. Answer (3)

Hint: ANF is released by heart.

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

155. Answer (4)

Hint: Heparin is an anticoagulant.

Sol.: During the process of hemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit called artificial kidney. Before the blood is pumped into dialysing unit (artificial kidney), anticoagulant like heparin is added in the blood. The dialysing unit contains a coiled cellophane tube surrounded by a fluid (dialysing fluid) having the same composition as that of plasma except the nitrogenous wastes. This method is a boon for thousands of uremic patients all over the world.

156. Answer (4)

Hint: Electrolytes can be reabsorbed actively or passively

Sol.: The ascending limb of loop of Henle is impermeable to water but allows transport of electrolytes actively or passively. Therefore, as the concentrated filtrate passes upward it gets diluted due to the passage of electrolytes to the medullary fluid.

157. Answer (2)

Hint: 70-80% of electrolytes and water are reabsorbed here.

Sol.: PCT is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption. Bowman's capsule is lined by simple squamous epithelium.

158. Answer (3)

Hint: Feature common in both cortical and juxta medullary nephrons

Sol.: The efferent arteriole emerging from the glomerulus forms a fine capillary network around the renal tubule called the peritubular capillaries. This network is present in both cortical as well as in juxtamedullary nephrons.

159. Answer (2)

Hint: Number of ear ossicles in an ear

Sol.: Renal pyramids, renal calyces and loop of Henle are found in the medulla region of kidney, while PCT, DCT and Bowman's capsule are found in cortex region of the kidney.

160. Answer (3)

Hint: Joint that permits limited movements

Sol.: In cartilaginous joint, the bones involved are joined together with the help of cartilage. This type of joint is present between the adjacent vertebrae in the vertebral column. Fibrous joints do not allow any movement and are present between the flat skull bones.

Hinge joint and gliding joint are examples of synovial joint which allow considerable movement.

161. Answer (1)

Hint: Blood pumping organ

Sol.: Cardiac muscle fibres are striated. Visceral muscles are located in the wall of hollow visceral organs of the body like the digestive tract, reproductive tract, etc. They do not exhibit any striation and are smooth in appearance.

162. Answer (3)

Hint: Exclude facial bones

Sol.: Hyoid is a U-shaped bone present at the base of the buccal cavity and is included in the human skull. Maxilla and lacrimal are facial bones while ethmoid is a cranial bone.

163. Answer (2)

Hint: Formed by the streaming of protoplasm

Sol.: Macrophages exhibit amoeboid movement. It is effected by pseudopodia formed by the streaming of protoplasm.

Cilia help in locomotion of *Paramecium* and flagella help in the locomotion of *Euglena*.

164. Answer (4)

Hint: Also called false ribs

Sol.: In a healthy adult human, there are 12 pairs of ribs i.e., 24 ribs. Each rib is a thin flat bone connected dorsally to the thoracic vertebrae of vertebral column. It has two articulation surfaces on its dorsal end and is hence called bicephalic. 8th, 9th and 10th pairs of ribs do not articulate directly with the sternum but join the 7th rib with the help of hyaline cartilage. These are called vertebrochondral or false ribs.

165. Answer (3)

Hint: Exclude the bones of pectoral girdle

Sol.: Each coxal bone of pelvic girdle is formed by the fusion of three bones- ilium, ischium and pubis. At the point of fusion of these bones is a cavity called acetabulum to which thigh bone i.e., femur articulates. Hence, bones involved in formation of acetabulum are ilium, ischium and pubis. Scapula is a bone of pectoral girdle.

166. Answer (3)

Hint: One patella in each hind limb

Sol.: In a healthy human (male/female), there are 14 tarsals, 10 metatarsals, 2 femurs, 2 fibula and 2 patella.

167. Answer (4)

Hint: Both actin binding site and ATP binding site are present on the same structure

Sol.: The globular head of meromyosin is an active ATPase enzyme and has binding site for ATP and active sites for actin.

Two filaments of tropomyosin run close to 'F' actin throughout its length. A complex protein troponin is distributed at regular intervals on the tropomyosin.

Each meromyosin has two components, a globular head with a short arm i.e., HMM and a tail i.e., LMM.

168. Answer (3)

Hint: Glycogen breaks into pyruvic acid

Sol.: Repeated activation of the muscles can lead to the accumulation of lactic acid due to anaerobic breakdown of glycogen, causing fatigue.

169. Answer (2)

Hint: It is followed by thoracic vertebrae

Sol.: In humans, vertebral column is formed by 26 serially arranged vertebrae. It is differentiated into cervical (7), thoracic (12), lumbar (5), sacral (1-fused) and coccygeal (1-fused) regions starting from the skull.

170. Answer (4)

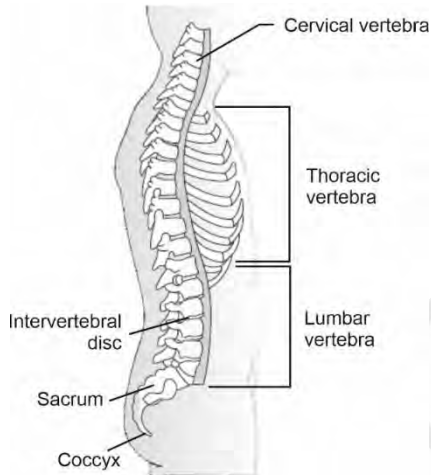
Hint: No change in location

Sol.: Locomotory movements result in a change of place or location. Walking, running, flying, climbing, swimming are all some forms of locomotory movements. Chewing does not result in change of place or location.

171. Answer (3)

Hint: Its number is 5 in foetal stage

Sol.:



172. Answer (3)

Hint: Number of curvatures in clavicle is equal to the total number of patella in humans

Sol.: Scapula and clavicle are bones of pectoral girdle. Each clavicle is a long slender bone with two curvatures. It articulates with the acromion process of the scapula.

173. Answer (2)

Hint: Tetany is caused due to low Ca^{++} in body fluid

Sol.:

Arthritis	–	Inflammation of joints
Tetany	–	Wild contractions in muscle due to low Ca^{++} in body fluid
Muscular dystrophy	–	Progressive degeneration of skeletal muscle mostly due to genetic disorder

Myasthenia gravis – Auto-immune disorder affecting neuro-muscular junction leading to fatigue, weakening and paralysis of skeletal muscle

174. Answer (2)

Hint: Meromyosin is a monomeric protein

Sol.: Sliding filament theory states that sliding of the thin filaments over the thick filaments leads to contraction of a muscle fibre. Actin is thin filament while myosin is thick filament. Each actin is made of two 'F' actins which are polymers of 'G' actins. Meromyosins polymerise to constitute one thick filament *i.e.*, myosin.

175. Answer (3)

Hint: 'H' zone disappears

Sol.: In a maximally contracted skeletal muscle fibre, the length of 'I' band *i.e.* isotropic band get reduced while 'A' band/anisotropic band retains its length with complete disappearance of 'H' zone.

176. Answer (4)

Hint: Storage of Ca^{2+}

Sol.: Red muscle fibres can be differentiated from white muscle fibres on the basis of:

- Amount of O_2 stored
- Amount of myoglobin
- Amount of sarcoplasmic reticulum but not on the basis of presence
- Amount of mitochondria

177. Answer (2)

Hint: Eliminated by liver

Sol.: Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum. This secretion provides a protective oily covering for the skin. Sweat produced by sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid, *etc.*

178. Answer (2)

Hint: Nitrogenous wastes are absorbed passively.

Sol.: Substances like glucose, amino acids, Na^+ , *etc.* in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport.

179. Answer (3)

Hint: Include last thoracic vertebra

Sol.: Human kidneys are reddish brown, bean shaped structures situated between the levels of last thoracic *i.e.*, 12th thoracic vertebra and third lumbar vertebra, close to the dorsal inner wall of the abdominal cavity.

180. Answer (2)

Hint: Podocytes are present here

Sol.: The glomerular capillary blood pressure causes filtration of blood through 3 layers, *i.e.*, the endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a non-cellular basement membrane present between these two cellular layers.

181. Answer (2)

Hint: Tubular part is involved in selective secretion

Sol.: Urine formation involves three main processes namely, glomerular filtration/ultrafiltration, reabsorption and secretion that takes place in different parts of the nephron. Ultrafiltration is carried out by the glomerulus, while tubular parts of nephron participate in secretion and reabsorption.

182. Answer (3)

Hint: Approximately 200 mL of CO₂ is removed per minute

Sol.: Our lungs remove approximately 200 mL of CO₂ in one minute.

1 hour = 60 minutes

Hence, in 60 minutes our lungs will remove 200 mL × 60 minutes = 12000 mL/hour.

183. Answer (4)

Hint: Involved in ultrafiltration of blood

Sol.: Glomerulus is a tuft of capillaries formed by the afferent arteriole – a fine branch of renal artery. Blood from glomerulus is carried away by an efferent arteriole. The renal tubule begins with a double walled cup-like structure called Bowman's capsule. The tubule continues further to form PCT, loop of Henle and DCT.

184. Answer (2)

Hint: Humans are ureotelic

Sol.: Mammals, many terrestrial amphibians and marine fishes are ureotelic in nature. Many bony fishes are ammonotelic while reptiles, birds, land snails and insects are uricotelic animals.

185. Answer (3)

Hint: *Amphioxus* belongs to this sub-phylum

Sol.: Protonephridia or flame cells are the excretory structures in platyhelminths, rotifers, some annelids and the cephalochordates. Protonephridia are primarily concerned with osmoregulation. Prawns possess green glands for excretion, while cockroaches have Malpighian tubules. Earthworms excrete metabolic wastes through tubular structure, called nephridia.

SECTION-B

186. Answer (3)

Hint: Storehouse of Ca⁺²

Sol.: The junction between a motor neuron and the sarcolemma of the muscle fibre is called neuromuscular junction or motor-end plate.

187. Answer (2)

Hint: Brain is protected by cranium.

Sol.: In humans, vertebral column is formed by 26 serially arranged units called vertebrae and is dorsally placed. It protects spinal cord whereas brain is protected by bony covering called cranium.

188. Answer (2)

Hint: Few cartilages are also included in skeleton.

Sol.: In humans, skeletal system consists of a framework of bones and a few cartilages. Axial skeleton comprises 80 bones while appendicular skeleton comprises 126 bones. Bone has a very hard matrix due to presence of calcium salts and collagen fibres.

189. Answer (2)

Hint: Flat skull bones exhibit fibrous joint.

Sol.: The two halves of the pelvic girdle meet ventrally to form the pubic symphysis containing fibrous cartilage. Fibrous joint is shown by flat skull bones which fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.

190. Answer (2)

Hint: Common in menopausal women.

Sol.: Accumulation of urea in blood is called uremia. Accumulation of lactic acid due to anaerobic breakdown of glycogen causes fatigue.

191. Answer (3)

Hint: Helps to produce concentrated urine

Sol.: Large amounts of water could be reabsorbed from collecting duct to produce concentrated urine. It allows passage of small amounts of urea into medullary interstitium to keep up the osmolarity.

192. Answer (3)

Hint: JG cells

Sol.: JGA *i.e.* juxta glomerular apparatus is a special sensitive region formed by cellular modification in the DCT and the afferent arteriole at the location of their contact. A fall in GFR can activate JG cells to release renin which can stimulate the glomerular blood flow and thereby brings GFR back to normal.

193. Answer (4)

Hint: Function of adrenal cortex

Sol.: Angiotensin II being a powerful vasoconstrictor increases the glomerular blood pressure and thereby GFR. Angiotensin II also activates adrenal cortex to release aldosterone which causes reabsorption of Na^+ and water from the distal parts of the tubule.

194. Answer (3)

Hint: ANF acts antagonistic to renin angiotensin system

Sol.: **Renal calculi** – Stone or insoluble mass of crystallised salts (oxalates, etc) formed within the kidney.

ANF – Vasodilator secreted from the atria of heart

Gout – Inflammation of joints due to accumulation of uric acid crystals.

Renin – Released by JG cells which converts angiotensinogen into angiotensin-I

195. Answer (4)

Hint: 'H' zone is a non-overlapped portion

Sol.: In resting state, the edges of thin filaments partially overlap the free ends of the thick filaments leaving the central part of thick filaments. This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.

196. Answer (2)

Hint: 'Z' line is an elastic fibre

Sol.: The thick filaments in the 'A' band, i.e. anisotropic band are held together in the middle of this band by a thin fibrous membrane called 'M' line. 'Z' line bisects 'I' band. 'H' zone is a part of 'A' band in which myosin filaments are not overlapped by actin filaments.

197. Answer (1)

Hint: Plasma membrane of muscle fibre is called sarcolemma.

Sol.: A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibrils.

198. Answer (2)

Hint: Relaxation of urethral sphincter causes release of urine.

Sol.: The process of release of urine is called micturition and the neural mechanism causing it is called the micturition reflex. When urinary bladder gets filled with urine, the stretch receptors on the walls of the urinary bladder send signals to CNS. The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

199. Answer (2)

Hint: Presence of interstitial fluid gradient helps in easy passage of water from collecting duct.

Sol.: Mammals have the ability to produce a concentrated urine. The vasa recta and loop of Henle play a significant role in this. The proximity between loop of Henle and vasa recta as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium. This gradient is mainly caused by NaCl and urea. The transport of these substances facilitated by the special arrangement of loop of Henle and vasa recta is called counter current mechanism. The counter current mechanism helps to maintain concentration gradient in the medullary interstitium. Presence of such interstitial gradient helps in an easy passage of water from the collecting duct, thereby concentrating the filtrate (urine).

200. Answer (2)

Hint: Diuretics are responsible for excess loss of water through urine.

Sol.: Caffeine and alcohol are diuretic substances which are responsible for excess loss of water through urine.

Vasopressin facilitates water reabsorption from latter parts of tubule thereby preventing diuresis. ANF is antagonistic to RAAS. It inhibits the reabsorption of Na^+ and reduces the release of aldosterone from adrenal cortex. It also increases excretion of Na^+ and water in urine.

