All India Aakash Test Series for NEET - 2027

TEST - 3 (Code-C)

Click here for Code-D Sol.

Test Date : 28/12/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: $\int_0^P d\vec{p} = \int_0^t \vec{F} \cdot dt$

Sol.: $\vec{F} = \left(3t\hat{i} + 6t^2\hat{j}\right)$ N

$$\int d\vec{p} = 3\left[\frac{t^2}{2}\right]_0^2 \hat{i} + 6\left[\frac{t^3}{3}\right]_0^2 \hat{j}$$

$$= \frac{3}{2}[4-0]\hat{i} + \frac{6}{3}[8-0]\hat{j}$$

$$\Delta\vec{p} = 6\vec{i} + 16\hat{j}$$

$$|\Delta\vec{p}| = \sqrt{36+256}$$

≈ 17 kg m/s

2. Answer (4)

Hint & Sol.: If $\vec{F}$ is parallel or antiparallel to motion then it changes magnitude of $\vec{v}$ only but not direction.

If $\vec{F}$ is $\perp$ to motion, it changes direction of $\vec{v}$ and not magnitude of $\vec{v}$

If $\vec{F}$ acts at an angle to motion, it changes both magnitude and direction of $\vec{v}$

3. Answer (3)

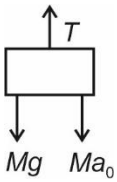
Hint & Sol.: If $\vec{F}_x = 0$, $\frac{dP_x}{dt} = 0$ then P_x = constant

$$\vec{I} = \Delta\vec{P} = \int \vec{F} dt$$

4. Answer (4)

Hint: $\vec{F}_{pseudo}$ = – (mass of body) × (acceleration of frame)

Sol.:



$T - Mg - Ma_0 = 0$

$T = Mg + Ma_0 = 4(10 + 1)$

$= 44$ N

5. Answer (1)

Hint & Sol.:

Ball bearing are used in machines to reduce power dissipation in form of heat by minimizing friction.

Static friction opposes impending relative motion

6. Answer (4)

Hint & Sol.: Scalar product is commutative i.e.,

$\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A} = AB\cos\theta$

$\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$

$\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$

7. Answer (4)

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

Sol.: For road $\vec{S}$ = zero

$\therefore$ W = zero

8. Answer (3)

Hint: P.E is defined for conservative forces only.

Sol.: As gravitational force is conservative, so work done against it is stored in form of potential energy.

Work done by conservative forces is independent of path.

9. Answer (2)

Hint: Work done = $\int \vec{F} \cdot \overrightarrow{dx}$ =Area under F-x curve

Sol.: $W = \frac{1}{2} \times (80+40) \times 10$

= 120 × 5 = 600 J

10. Answer (3)

Hint: $T.E = P.E + K.E$

Sol.: $E_1 = P.E + K.E$

$$= P.E + \frac{1}{2}P.E$$

$$= \frac{3}{2}mgh$$

$E_2 = P.E + K.E$

$= 3P.E$

$= 3mgh'$

$$3mgh' = \frac{3}{2}mgh$$

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

11. Answer (2)

Hint: Use equation $P = \frac{dW}{dt}$

Sol.: $dW = Pdt \Rightarrow \int dW = \int Pdt$

Work = Area under *P*-*t* curve

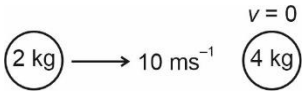
$= \frac{1}{2} \times 2 \times 40 + (6-2) \times 40$

= 200 J

12. Answer (1)

Hint: Apply momentum conservation and use equation of restitution, $e = \frac{\text{velocity of separation}}{\text{velocity of approach}}$.

Sol.: Before collision:



After collision:

$e = \frac{1}{2} = \frac{v_2 - v_1}{10} \Rightarrow v_2 - v_1 = 5$ ...(1)

Apply momentum conservation,

$2 \times 10 = 2v_1 + 4v_2$

$\Rightarrow v_1 + 2v_2 = 10$ ...(2)

On solving equations (1) and (2)

$v_1 = 0$ and $v_2 = 5$ m s^{-1}

13. Answer (3)

Hint: Motion of the particle in vertical direction remains unaffected.

Sol.: $T = \frac{2u\sin\theta}{g} = 6$ s

Horizontal velocity before collision = 40 m/s

Horizontal velocity after collision = 20 m/s

Time to reach at wall = 2 s

Remaining time = 4 s

Horizontal distance travelled by the particle after collision = 20 × 4 = 80 m.

14. Answer (2)

Hint: If $\vec{F} \perp \vec{S}$ then $\vec{F} \cdot \vec{S} = 0$

Sol.: $\vec{S} = \alpha\hat{i} + \alpha\hat{j} + \hat{k}$

$\vec{F} \cdot \vec{S} = \alpha^2 + 2\alpha - 15 = 0$

$\alpha = \frac{-2 \pm \sqrt{4 - 4(-15)}}{2} = -5$ and 3

15. Answer (4)

Hint: Work done = Zero

If $\vec{F}_{net} = 0$ or $\vec{S} = 0$ or $\theta = 90°$

Sol.: When body is moving with uniform velocity net force is zero so W.D = 0 and displacement of wall is zero so W.D is zero.

16. Answer (2)

Hint: Work done by normal reaction, $W = \vec{N} \cdot \vec{S} = NS\cos(\theta)$

Sol.: Block is moving in horizontal direction.

Work done = $NS\cos(90 - \alpha)$

$= mg\cos\alpha \cdot vt\cos(90 - \alpha) = \frac{mgvt\sin 2\alpha}{2}$

$= 150\sin 2\alpha$

17. Answer (3)

Hint: Total mechanical energy remains conserved.

Sol.: When block descends 20 mm, spring further stretches by 40 mm.

$\therefore$ Decrease in P.E of block

= Increase in K.E of block + Increase in elastic P.E of spring

$\Rightarrow 10 \times 10 \times 0.02 = \frac{1}{2} \times 10 \times v^2 + \frac{1}{2} \times 500 \times \left[(0.04 + 0.04)^2 - (0.04)^2\right]$

$2 = 5v^2 + 1.2$

$v^2 = \frac{16}{100}$

$v = \frac{4}{10} = \frac{2}{5}$ m/s

18. Answer (3)

Hint: Use equations: $P = \vec{F} \cdot \vec{v}$, $a = \frac{vdv}{dx}$

Sol.: $F = \frac{P}{v}$

$F = ma$

$m\frac{vdv}{dx} = \frac{P}{v}$

$\int_0^v v^2 dv = \frac{P}{m}\int_0^x dx$

$\frac{v^3}{3} = \frac{P}{m}x$

$v^3 = \frac{3P}{m}x \Rightarrow v = \left(\frac{3P}{m}\right)^{1/4} x^{1/3}$

$v = \frac{dx}{dt}$

$\int \frac{dx}{x^{1/3}} = \int \left(\frac{3P}{m}\right)^{1/3} dt$

$x \propto t^{3/2}$

19. Answer (1)

Hint & Sol.:

- In one dimensional elastic collision between equal masses, velocities get interchanged.
- Exchange of velocities directly results from conservation laws inelastic collision when masses are equal.

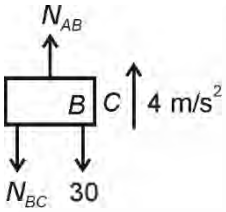
20. Answer (2)

Hint & Sol.:

a. Net force on block B

$F_{net} = ma = 12$ N

b.



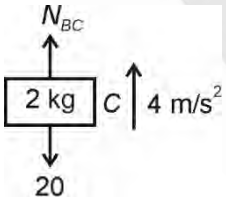
$\Rightarrow N_{AB} - N_{BC} - 30 = m_B \times 4$

$N_{BC} = 28$ N (derived in part c)

$\Rightarrow N_{AB} - 28 - 30 = 12$

$\Rightarrow N_{AB} = 70$ N

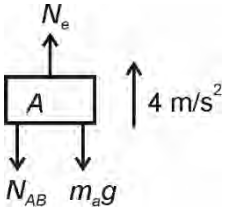
c.



$N_{BC} - 20 = 2 \times 4$

$N_{BC} = 28$ N

d.



$N_e - 70 - 50 = 5 \times 4$

$N_e = 140$ N

21. Answer (2)

Hint: For equilibrium point $\frac{dU}{dx} = 0$, and for stable equilibrium potential energy is minimum.

Sol.: At $x = 0$, the particle is in unstable equilibrium because, at $x = 0$, $\frac{dU}{dx} = 0$ and $\frac{d^2U}{dx^2} < 0$ while at $x = \pm a$ particle is in stable equilibrium.

22. Answer (3)

Hint: Apply conservation of mechanical energy

Sol.: $\frac{1}{2}mv^2 = \frac{1}{2}kx_{max}^2$

$x_{max} = \sqrt{\frac{m}{k}}v$

23. Answer (2)

Hint: Power required $P = \frac{W + KE}{\Delta t}$

Sol.: $P_r = \frac{mgh}{\Delta t} + \frac{\Delta KE}{\Delta t}$

$P_r = 3 \times 10 \times 10 + \frac{1}{2}\frac{mv^2}{t}$

$P_r = 300 + \frac{1}{2} \times 3 \times 100$

$P_r = 300 + 150$

$P_r = 450$ W

$\Rightarrow \therefore$ Power of motor $P_m = \frac{P_r}{\eta} = \frac{450}{0.6} = 750$ W

24. Answer (2)

Hint: $F = -\frac{dU}{dx}$

Sol.: For O to a part, F is constant and has a –ve value while for rest part it is zero as U becomes constant.

25. Answer (3)

Hint: $s = ut + \frac{1}{2}at^2$, $W_g = mg \times s$.

Sol.: $s_1 = 5$ m

$s_2 = 15$ m

$s_3 = 25$ m

W.D by gravity = $mg \times s$

$W_1 : W_2 : W_3 : \ldots\ldots = 1 : 3 : 5 : \ldots.$

26. Answer (3)

Hint: At equilibrium position, net force on the block is zero.

Sol.: $\therefore Kx = mg$

$$\frac{4mgx}{x_0} = mg$$

$$\Rightarrow x = \frac{x_0}{4}$$

$\therefore$ $(W.D)_{gravity} = mgx$

$$= \frac{mgx_0}{4}$$

27. Answer (1)

Hint: Power of the engine is getting utilised to increase the potential energy of the truck.

Sol.: Force against which work is done $F = mg\sin\theta$

$$= 10000 \times 10 \times \frac{1}{1000} = 100 \text{ N}$$

Speed $v = 36 \times \frac{5}{18} = 10$ m/s

$P = 100 \times 10 = 1000$ W

$= 1$ kW

28. Answer (4)

Hint: Use equation $F = \frac{mv^2}{r}$

Sol.: Let speeds at lowest and highest points be u and v respectively

$$T_L = mg + \frac{mu^2}{l} \quad \text{...(i)}$$

$$T_H = \frac{mv^2}{l} - mg \quad \text{...(ii)}$$

By conservation of mechanical energy,

$$\frac{mu^2}{2} - \frac{mv^2}{2} = mg(2l) \quad \text{...(iii)}$$

Solving equations (i), (ii) and (iii), we get

$T_L - T_H = 6mg$

29. Answer (3)

Hint: Block 2 kg moves with constant acceleration.

Sol.:

$$5g - T = 5a$$
$$T - 2g = 2a$$
$$3g = 7a$$

$$a = \frac{3g}{7}$$

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

$$25 = \frac{1}{2} \times \frac{3 \times 10}{7} \times t^2$$

$$\frac{25 \times 7}{15} = t^2$$

$$t = \sqrt{\frac{35}{3}} \text{ s}$$

30. Answer (3)

Hint: Use work-energy theorem

Sol.: $w_f + w_g = \Delta$K.E.

$$\Rightarrow -f_A x + mgx = \frac{1}{2}(m_T)v^2$$

$$\Rightarrow -\frac{1}{2} \times 2 \times 10 \times \frac{4}{100} + 4 \times 10 \times \frac{4}{100} = \frac{1}{2} \times 6 \times v^2$$

$$\Rightarrow \frac{-4}{10} + \frac{16}{10} = 3v^2$$

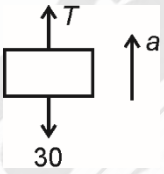
$$\Rightarrow \frac{12}{10} = 3v^2$$

$$\Rightarrow v^2 = \frac{4}{10} = \frac{2}{5} \Rightarrow v = \sqrt{\frac{2}{5}} \text{ m s}^{-1}$$

31. Answer (2)

Hint: Use, $F_{net} = ma$

Sol.:



$$\Rightarrow a = \frac{60 - 30}{3} = \frac{30}{3} = 10 \text{ m s}^{-2}, \text{ upwards}$$

32. Answer (1)

Hint: Apply conservation of mechanical energy.

Sol.: $2mgl = \frac{1}{2}mv^2$

$v = 2\sqrt{gl}$

33. Answer (2)

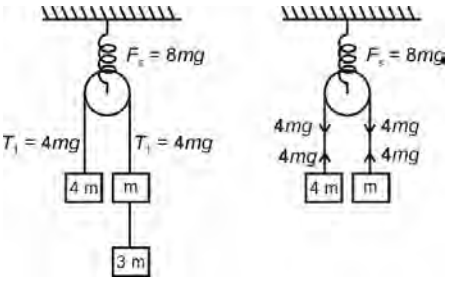
Hint: Just after string is cut:

(1) spring force remains same

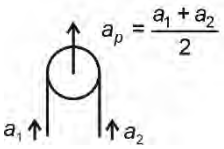
(2) string force can change instantaneously

Sol.:

Before After



After cutting string (1):



$F_s = 8mg$

Acceleration of mass $4m$:

$a_{4m} = 0$

Acceleration of mass m:

$$a_m = \frac{4mg - mg}{m} = 3g$$

Acceleration of pulley:

$$a_P = \frac{0 + 3g}{2}$$

$$a_P = \frac{3g}{2}$$

34. Answer (2)

Hint: Frictional force will provide necessary centripetal acceleration.

Sol.: For maximum speed,

$$F_{max} = \frac{mv^2}{r} \Rightarrow \mu \times N = \frac{mv^2}{r} \text{ and } N = mg$$

$$\Rightarrow v_{max} = \sqrt{\mu rg} = \sqrt{\frac{1}{2} \times 20 \times 10} = 10 \text{ m/s}$$

35. Answer (4)

Hint & Sol.: Taking components of string force in horizontal direction: $T_1 \cos 30° = T_2 \cos 30°$

$\Rightarrow T_1 = T_2$

36. Answer (3)

Hint: Velocity of points A and B along rod is equal

Sol.: $v_B \cos 60° = v_A \cos 30°$

$$v_B \times \frac{1}{2} = 5 \times \frac{\sqrt{3}}{2}$$

$$v_B = 5\sqrt{3} \text{ m/s}$$

37. Answer (1)

Hint & Sol.: In some cases, μ_s and μ_k can exceed unity as some materials like silicon rubber can exhibit coefficients of friction greater than 1.

Mechanical advantage is equal to load over effort.

38. Answer (3)

Hint: $F_{thrust} = \frac{vdm}{dt}$

Sol.: $\frac{vdm}{dt} = ma$

$200 \times 5 = 2500 \times a$

$$a = \frac{2}{5} \text{ m/s}^2$$

39. Answer (1)

Hint & Sol.: In horizontal direction, $(F_{net})_{ext} = ma$

$$a = \frac{80 - 30}{20} = 2.5 \text{ m/s}^2$$

For block of mass 10 kg

$N - 30 = 10a$

$N = 55$ N

40. Answer (1)

Hint: Use principle of conservation of energy.

Sol.: Let the string slack at height, h then

$v^2 = u^2 - 2gh$

Also, $T - mg\cos\theta = \frac{mv^2}{r}$, as string slacks, $T = 0$

$$\Rightarrow \cos\theta = -\frac{v^2}{Rg} \text{ and } h = R(1 - \cos\theta)$$

$$\Rightarrow h = R + \frac{R \times v^2}{Rg} \Rightarrow h = R + \frac{1}{g}(4gR - 2gh)$$

$$\Rightarrow h = R + 4R - 2h \Rightarrow 3h = 5R \Rightarrow h = \frac{5R}{3}$$

41. Answer (3)

Hint & Sol.: If a body is acted upon by a single external force, it cannot remain in equilibrium.

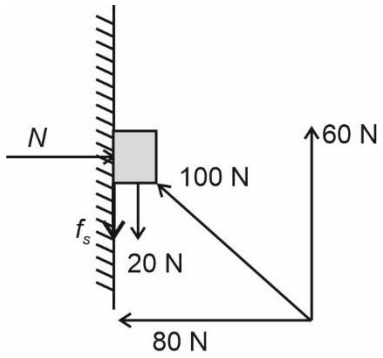
If a body is in equilibrium under the action of only two external forces, the forces must be equal and opposite.

42. Answer (1)

Hint: Friction force always tries to oppose the relative motion.

Sol.: $N = F\cos 37° = 80$ N

$(F_{net})_{up} = F\sin 37° - mg = 40$ N



$f_{lim} = \mu N = 40$ N

Friction = 40 N, downward

43. Answer (3)

Hint & Sol.: Retarding force $F = ma = mg\sin\theta + \mu mg\cos\theta$

$a = g(\sin 37° + \mu\cos 37°)$

$= 10\left(\frac{3}{5} + \frac{2}{5}\right)$

= 10 m/s^2

$s = \frac{u^2}{2a} = \frac{40\times 40}{2\times 10}$

= 80 m

44. Answer (2)

Hint: Here, energy lost during collision is given by,

$E = \frac{1}{2}\frac{m_1m_2}{m_1+m_2}(u_1-u_2)^2$

Sol.: $E = \frac{1}{2}\times\frac{m\times m}{m+m}(u_0)^2$

$E = \frac{1}{4}mu_0^2$

$E = \frac{1}{2}\times\frac{1}{2}mu_0^2$

$E = \frac{K_0}{2}$

45. Answer (4)

Hint: For crossing bridge in minimum time, it has to travel with maximum acceleration

Sol.: a = maximum acceleration produced in car

$ma = \mu N$

$ma = \mu mg$

$a = \mu g$ = 10 m/s^2

For crossing bridge in minimum time, it has to travel with maximum acceleration

u = 0, s = 500 m, a = 10 m/s^2

$500 = \frac{1}{2}\times 10\times t^2$

t = 10 s

[CHEMISTRY]

46. Answer (3)

Hint: $\Delta H = \Delta U + (P_2V_2 - P_1V_1)$

Sol.: $\Delta H = \Delta U + (P_2V_2 - P_1V_1)$

= 20 + 4 × 6 – 2 × 1

= 20 + 24 – 2

= 42 L atm

47. Answer (1)

Hint: $q_{sys} = \Delta U - w (w = -P_{ext}\cdot\Delta V)$

Sol.: $q_{sys} = \Delta U - (-P_{ext}\cdot\Delta V)$

$q_{sys} = P_{ext}\Delta V$

= 0 + 2(3 – 1)

= 4 L atm

$\Delta S_{surr} = \frac{(q_{rev})_{surr}}{T} = \frac{-q_{sys}}{T}$

$= \frac{-4\times 101.3}{300}$ J $= -1.35$ JK^{-1}

48. Answer (3)

Hint: for vacuum, $w = -P_{ex}\times\Delta U = 0$

for adiabatic process, $q = 0$

so $\Delta U = q + w = 0$

Sol.: The magnitude of work done by an ideal gas in the adiabatic expansion is more in a reversible process than that in irreversible process. Therefore the final temperature of an ideal gas in adiabatic expansion is less in reversible expansion than irreversible expansion.

49. Answer (4)

Hint: Work done is equal to area enclosed by ABCA.

Sol.: Area $= \frac{1}{2}\times AB\times AC$

$= \frac{1}{2}\times 2P_1\times 4V_1$

= 4P$_1$V$_1$

50. Answer (2)

Hint: Properties which do not depend upon the amount of substance is called intensive properties

Sol.: Molar heat capacity and density are intensive properties.

51. Answer (3)

Hint: $\Delta G° = -2.303\ RT\log K$

Sol.: $\Delta G° = -2.303 \times 8.314 \times 300 \times \log 10^3$

= –17.2 kJ mol^{-1}

52. Answer (4)

Hint: If ΔG is +ve, reaction is always non-spontaneous

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

If ΔH is +ve and ΔS is –ve then

ΔG is always +ve at all temperatures.

53. Answer (1)

Hint: For monoatomic gas $\gamma = 1.66$

Sol.: $\gamma = \frac{C_P}{C_V} = \frac{0.125}{0.075} = \frac{5}{3} = 1.67$

54. Answer (1)

Hint: $HCl + NaOH \rightarrow NaCl + H_2O$

Sol.: Millmoles of HCl = 200 × 0.2 $\Rightarrow$ 40 mmol

Millmoles of NaOH = 400 × 0.1 $\Rightarrow$ 40 mmol

Millmoles of H_2O formed = 40 mmol

Enthalpy of neutralization will be

$= \frac{40}{1000} \times -57.1\ kJ$

= –2.28 kJ

55. Answer (1)

Hint: $\Delta H_f = \sum BE_{(reactants)} - \sum BE_{(product)}$

Sol.: $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O$

$\Delta H = BE(H_2) + \frac{1}{2}BE(O_2) - 2BE(O-H)$

$= 433 + \frac{1}{2} \times 492 - 2 \times 464$

= –249 kJ/mol

56. Answer (2)

Hint & Sol.: $CuSO_4(s) \rightarrow CuSO_4(aq)$ ...(i)

$CuSO_4 \cdot 5H_2O(s) \rightarrow CuSO_4(aq) + 5H_2O$ ...(ii)

The hydration of $CuSO_4$ is given by

$CuSO_4(s) + 5H_2O \rightarrow CuSO_4 \cdot 5H_2O(s)$ ...(iii)

Applying (iii) = (i) – (ii)

= –66 – (+12)

= –78 kJ/mol

57. Answer (2)

Hint: State functions are those functions which depend upon only initial and final state.

Sol.: q and w are path functions

q + w = ΔU is a state function

H – TS = G is a state function

58. Answer (1)

Hint: $\Delta_{tran}S = \frac{\Delta_{tran}H}{T}$

Sol.: $\Delta_{tran}S = \frac{x \times 10^3}{300}$

= 3.3x $Jmol^{-1}K^{-1}$

59. Answer (3)

Hint: $q = nC_m\Delta T$

Sol.: $q = \frac{54}{27} \times 24 \times 10 = 480\ J$

60. Answer (2)

Hint & Sol.: The standard enthalpy of formation is zero for C(graphite).

61. Answer (4)

Hint: Work done by the system is –ve

Sol.: $\Delta U = q + w$

= 100 + (–50)

= 50 J

62. Answer (1)

Hint: $\Delta G° = \Delta H° - T\Delta S°$ and $\Delta H° = \Delta U° + \Delta n_g RT$

Sol.: $\Delta H° = \Delta U° + \Delta n_g RT = -10 - 1 \times 8.314 \times 10^{-3} \times 298 = -12.48$ kJ

$\Delta G° = \Delta H° - T\Delta S° = -12.48 - 298 \times (-50 \times 10^{-3})$

= –12.48 + 14.9

= 2.42 kJ

63. Answer (1)

Hint: Heat added to a system at lower temperature causes greater randomness than when the same quantity of heat is added to it at higher temperature.

$\Delta S = \frac{q_{rev}}{T}$

Sol.: $T\Delta S_{sys}$ is the energy which is not available to do useful work.

64. Answer (3)

Hint: In CH_4 energies required to break the individual C–H bonds in each successive step is different.

Sol.: The enthalpy of solution is the enthaly change associated with the addition of a specified amount of solute to the specified amount of solvent at a constant temperature and pressure.

65. Answer (1)

Hint: $\Delta H = \Delta U + \Delta n_g RT$

Sol.:

Reaction	**($\Delta H - \Delta U$)**
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	–2RT
$H_2(g) + I_2(g) \rightarrow 2HI(g)$	0
$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	RT
$PCl_3(g) + Cl_2(g) \rightarrow PCl_5(g)$	–RT

66. Answer (4)

Hint & Sol.: B.E. of C–H bond = $\frac{360}{4} = 90 \text{ kcal mol}^{-1}$

Bond dissociation energy (C_2H_6) = 6 × BE(C–H) + B.E.(C–C)

620 = 6 × 90 + B.E.(C–C)

$B.E_{(C-C)}$ = 620 – 540 = 80 kcal/mol

67. Answer (2)

Hint: $\Delta_rH = \sum\Delta_fH(\text{Products}) - \sum\Delta_fH(\text{reactants})$

Sol.: $\Delta_rH = \Delta_fH(CO_2) + 2 \times \Delta_fH(H_2O) - \Delta_fH(CH_4)$

= – 393.5 + 2 × (–286.2) – (–74.8) = –891.1 kJ/mol

68. Answer (3)

Hint: $w = -2.303nRT\log\frac{V_2}{V_1}$

Sol.: w = –2.303 × 2 × R × 300 × log10

= –600 × 2.303R

69. Answer (3)

Hint & Sol.: In reversible process, the surroundings are always in equilibrium with the system.

70. Answer (2)

Hint: At equilibrium; $\Delta G = 0$

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

$0 = \Delta H - T\Delta S$

$\Delta H = T\Delta S$

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

$= \frac{400 \times 10^3}{0.2 \times 10^3}$

= 2000 K

71. Answer (2)

Hint: During boiling of egg, entropy increases due to denaturation of protein.

Sol.:
- When temperature is increased, then entropy is increased.
- $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$

  Entropy increases due to release of gases.
- $2Cl(g) \rightarrow Cl_2(g)$

  Entropy decreased due to decreased number of moles of gas.

72. Answer (2)

Hint: With the help of Born-Haber cycle we can determine lattice enthalpy.

Sol.: From Born-Haber cycle,

Lattice enthalpy = $\Delta_fH^\ominus - \Delta_{sub}H^\ominus - \Delta_iH^\ominus - \frac{1}{2}\Delta_{bond}H^\ominus + \Delta_{eg}H^\ominus$

= –411 – 107 – 502 – 121 + 355

= –786 kJ/mol

73. Answer (4)

Hint: $2C(g) + 3H_2(g) + \frac{1}{2}O_2(g) \rightarrow C_2H_5OH(l)$ ...(i)

Sol.: $H_2 + \frac{1}{2}O_2 \rightarrow H_2O;\ \Delta_CH = -241.8 \text{ kJ mol}^{-1}$ ... (ii)

$C + O_2 \rightarrow CO_2;\ \Delta_CH = -393.5 \text{ kJ mol}^{-1}$ ...(iii)

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O;\ \Delta_CH = -1234.7 \text{ kJ mol}^{-1}$ ...(iv)

Using equation 3 × (ii) – (iv) + 2 × (iii) gives equation (i)

$\Delta_fH_{(C_2H_5OH)} = -277.7 \text{ kJ mol}^{-1}$

74. Answer (2)

Hint: O has least negative electron gain enthalpy (–141 kJ mol^{-1}) among group 16 elements.

Sol.: F has less negative electron gain enthalpy than Cl but more negative electron gain enthalpy than others group 17 elements.

75. Answer (1)

Hint & Sol.: The size of anion is larger than that of parent atom because addition of one or more electrons result in increased repulsion among the electrons and a decrease in effective nuclear charge.

76. Answer (4)

Hint: Due to more penetration of electron in 's' orbital, Mg has higher ionisation enthalpy than Al.

Sol.: Due to half filled subshell p has higher first ionisation enthalpy than s

So, the correct order is

Na < Al < Mg < Si < S < P

77. Answer (1)

Hint: IUPAC official name of element with atomic number 101 is Mendelevium.

Sol.:

Atomic number	IUPAC official name
102	Nobelium
103	Lawrencium
104	Rutherfordium

78. Answer (2)

Hint: F is the most electronegative atom.

Sol.:

Element	Electronegativity values (on Pauling scale)
F	4
O	3.5
S	2.5
P	2.1

79. Answer (2)

Hint: *s* and *p*-block elements are representative elements.

Sol.: (A) $\rightarrow$ [Ar] $4s^1 \rightarrow$ K [*s*-block element]

(B) $\rightarrow$ [Ar] $3d^5 4s^1 \rightarrow$ Cr [*d*-block element]

(C) $\rightarrow$ [Kr] $4d^{10} 5s^2 5p^5 \rightarrow$ I [*p*-block element]

(D) $\rightarrow$ [Ar] $3d^{10} 4s^1 \rightarrow$ Cu [*d*-block element]

(E) $\rightarrow$ [Rn] $5f^0 6d^2 7s^2 \rightarrow$ Th [*f*-block element]

80. Answer (4)

Hint & Sol.: The first ionization energy of N is greater than that of O, because in nitrogen atom, three 2*p* electrons reside in different atomic orbital whereas in the oxygen atom, two of the four 2*p* electrons must occupy the same 2*p* orbital resulting in an increased electron-electron repulsion.

81. Answer (2)

Hint & Sol.:

Elements	$\Delta_{eg}H$ (kJ mol^{-1})
He	+48
Ne	+116
Ar	+96
Xe	+77

82. Answer (3)

Hint: p-Nitrophenol forms intermolecular H-bond.

Sol.: Dipole moment of H_2O is 1.85 D while that of NH_3 is 1.47 D.

83. Answer (4)

Hint: Orbital dipole moment due to lone pair also contributes to dipole moment.

Sol.: In case of NH_3 the orbital dipole due to lone pair is in the same direction as resultant dipole moment of N–H bonds, whereas in NF_3 the orbital dipole is in direction opposite to the resultant dipole moment of three N–F bonds. Hence, NH_3 is more polar than NF_3.

84. Answer (3)

Hint: O_3 molecule has two canonical forms.

Sol.: There is no such equilibrium between the canonical forms of a molecule.

85. Answer (1)

Hint: According to Fajans, the greater the charge on the cation, the greater the covalent character of an ionic bond.

Sol.: Zn^{2+} has more polarising power than Ca^{2+} because Zn^{2+} has pseudo inert gas electronic configuration.

86. Answer (3)

Hint: Bond order of O_2 is 2 and N_2 is 3

Sol.:

Species	Bond order
N_2^-	2.5
O_2^-	1.5
O_2^{2-}	1.0
O_2	2.0
N_2	3.0

87. Answer (3)

Hint: Species with *sp* hybridisation will have 180° bond angle.

Sol.:

Molecules	Bond angles
CO_2	180°
BF_3	120°
CH_4	109.5°
NH_3	107°
H_2O	104.5°

88. Answer (3)

Hint: $\overset{+}{N}H_4$ is sp^3 hybridised.

Sol.:

Species	Hybridization of central atom
SF_4	sp^3d
XeF_4	sp^3d^2
IF_7	sp^3d^3

89. Answer (2)

Hint: Highest occupied molecular orbital of C_2^{2-} is $\sigma 2p_z$.

Sol.: C_2 and B_2 have only π bond(s) according to molecular orbital theory.

90. Answer (1)

Hint: $N \equiv N \rightarrow O$

Sol.: BeH_2 and BCl_3 have less than eight electrons on central atoms. So, they have incomplete octet.

PF_5 and SF_6 have more than eight electrons on central atoms. So, they have expanded octet.

[BOTANY]

91. Answer (4)

Hint: Kingdom Protista includes unicellular eukaryotes.

Sol.: Kingdom Animalia includes heterotrophic, eukaryotic, multicellular organisms lacking cell wall.

92. Answer (1)

Hint: Phylogenetic relationship was not considered by Linnaeus.

Sol.: Presence or absence of cell wall was a common criteria that was used by both Linnaeus and Whittaker in their systems of classification.

93. Answer (2)

Hint: Bacteria may be autotrophic or heterotrophic.

Sol.: Members of the kingdom Monera show autotrophic (chemosynthetic and photosynthetic) or heterotrophic mode of nutrition and aerobic or anaerobic mode of respiration.

94. Answer (3)

Hint: Shoot or root tip of plants are not affected by viral infection.

Sol.: For a virus to replicate, its genome must be released into the cytoplasm of the host.

95. Answer (1)

Hint: In plants, root system develops from radicle.

Sol.: In majority of dicotyledonous plants, the direct elongation of the radicle leads to the formation of primary root which grows inside the soil.

96. Answer (2)

Hint: Fungi do not perform photosynthesis.

Sol.: Fungi show saprophytic or parastic mode of nutrition.

97. Answer (2)

Hint: Cyanobacteria lack flagellum throughout their life.

Sol.: Cyanobacteria have chlorophyll *a* pigment, similar to higher plants, to perform photosynthesis.

98. Answer (2)

Hint: Under unfavourable conditions, bacteria form endospore.

Sol.: Binary fission is the most common type of reproduction in bacteria.

99. Answer (3)

Hint: Some epidermal cells of root, present closest to the stem base, form root hairs.

Sol.: From maturation region, some of the epidermal cells form very fine and delicate, thread-like structures called root hairs.

100. Answer (2)

Hint: They do not utilise light as energy source.

Sol.: Chemosynthetic autotrophic bacteria play a great role in recycling nutrients like nitrogen, phosphorous, iron and sulphur.

101. Answer (1)

Hint: Tendril can be a modified stem or leaf.

Sol.: Tendrils develop from the axillary buds of stems. Some leaves can also modify into tendrils, as in Pea. In watermelon, stem tendrils are present.

102. Answer (4)

Hint: Archaebacteria that live in marshy areas are called methanogens.

Sol.: Methanogens are obligate anaerobes and grow on cellulose-rich food in the rumen of cattles.

103. Answer (3)

Hint: Marine forms of amoeboid protozoans have silica shells on their surface.

Sol.: Flagellated protozoans – The parasitic forms cause disease such as sleeping sickness.

Ciliated protozoans – They have a cavity (gullet) that opens to the outside of the cell surface.

Sporozoans – They include diverse organisms that have an infectious spore-like stage in their life cycle.

104. Answer (4)

Hint: Suckers are found in banana, pineapple, *Chrysanthemum*.

Sol.: In suckers, the lateral branches originate from the basal and underground portion of the main stem. They grow below the surface of the soil to some distance and then emerge out obliquely to form the aerial roots.

105. Answer (4)

Hint: All single-celled eukaryotes, according to the five kingdom classification, are placed under the Kingdom, Protista.

Sol.: Protists reproduce asexually, and sexually by a process involving cell fusion and zygote formation.

106. Answer (4)

Hint: Sac fungi are ascomycetes that consist of branched and septate hyphae.

Sol.: In ascomycetes, sexual spores are produced endogenously in sac like asci and are the sites of karyogamy and meiosis, whereas, in basidiomycetes, sexual spores are produced exogenously.

107. Answer (1)

Hint: Motile structures are absent in slime moulds.

Sol.: Fungi like features in the slime moulds is the formation of fruiting bodies.

108. Answer (2)

Hint: In cymose inflorescence, flowers are borne in the basipetal succession.

Sol.: In racemose inflorescence, the shoot axis continue to grow indefinitely.

109. Answer (1)

Hint: Two kingdom classification does not distinguish between unicellular and multicellular organisms.

Sol.: Linnaeus classified all living organism into two kingdoms – Plantae and Animalia, on the basis of cell wall, locomotion, mode of nutrition, response to external stimulus and contractile system.

110. Answer (3)

Hint: Wheat rust is caused by *Puccinia.*

Sol.: In basidiomycetes, mycelium is branched and septate. Asexual spores are generally not found.

111. Answer (2)

Hint: *Ustilago* is a smut fungus.

Sol.: *Rhizopus* – Fungus on moist bread, *i.e.,* bread mould.

Albugo – Causes White rust of crucifers.

Agaricus – Possesses umbrella like basidiocarp.

112. Answer (4)

Hint: In a pinnately compound leaf, a number of leaflets are present on a common axis, the rachis.

Sol.: Pinnately compound leaf is found in neem.

113. Answer (4)

Hint: Chrysophytes include diatoms, the chief producers in the oceans.

Sol.: Chrysophytes include diatoms and desmids. They are microscopic and float passively in water currents. Cell wall is present.

114. Answer (3)

Hint: The given organism is a dividing bacterium

Sol.: 'X' represents the non-cellulosic cell wall.

'Y' represents the cell membrane.

'Z' represents the circular DNA.

115. Answer (4)

Hint: Most fungi are saprophytes.

Sol.: Toadstools are poisonous mushrooms.

116. Answer (1)

Hint: Dikaryophase is the stage intervening between plasmogamy and karyogamy.

Sol.: The correct sequential order of events in the sexual cycle of *Penicillium:*

Plasmogamy $\rightarrow$ Dikaryophase $\rightarrow$ Karyogamy $\rightarrow$ Meiosis

117. Answer (3)

Hint: In *Alstonia*, more than two leaves arise at a node and form a whorl.

Sol.: In opposite phyllotaxy, a pair of leaves arise at each node and lie opposite to each other as in *Calotropis* and guava plants.

118. Answer (2)

Hint: Fruiting bodies are the result of sexual reproduction.

Sol.: Deuteromycetes is commonly known as imperfect fungi because only the asexual or vegetative phase of these fungi are known.

119. Answer (1)

Hint: *Alternaria* is considered as an imperfect fungus.

Sol.: *Neurospora* is used extensively in biochemical and genetic work.

120. Answer (4)

Hint: Ascocarps are found in the members of Ascomycetes.

Sol.: *Aspergillus* produces ascocarps.

121. Answer (4)

Hint: Oomycetes are also called algal fungi.

Sol.: Eubacteria are also called true bacteria.

122. Answer (2)

Hint: In monocots, the leaves show parallel venation.

Sol.: Reticulate venation is found in the leaves of dicot, *e.g.*, banyan

123. Answer (4)

Sol.: Viruses have protein coat called capsid, made of small subunits called capsomeres that protects the nucleic acid.

124. Answer (2)

Hint: Region of meristematic activity have soft delicate cells that can get damaged due to friction.

Sol.: Root cap protects the tender apex of the root as it makes its way through the soil. It is made up of parenchymatous cells.

125. Answer (1)

Hint: In sac fungi, ascus is the site of karyogamy.

Sol.: The site of karyogamy and meiosis in smut fungi is basidium.

126. Answer (3)

Hint: *Mycoplasma* lack cell wall and are insensitive to penicillin.

Sol.: *Mycoplasma* are facultative anaerobes.

127. Answer (1)

Hint: Bacteria are the sole members of the kingdom, Monera.

Sol.: Bacterial structure is very simple but they are very complex in behaviour.

128. Answer (3)

Hint: Thorns are the modification of axillary buds.

Sol.: Thorns are found in many plants such as, *Citrus*, *Bougainvillea*.Spines are found in cactus.

129. Answer (2)

Hint: Accumulation of deposits of the cell wall of diatoms over billions of years is referred to as 'diatomaceous earth'.

Sol.: Cell wall of diatoms form two thin overlapping shells which fit together as in a soap box.

130. Answer (3)

Hint: In cladode, stem is modified into a leaf like structure for photosynthesis while leaves are reduced to scales or spines.

Sol.: Plants present in arid regions, modify their stem into flattened (*Opuntia*) or fleshy cylindrical structure (*Euphorbia*) called phylloclade.

131. Answer (2)

Hint: The given features are true for Dinoflagellates.

Sol.: Dinoflagellates can be yellow, green, brown, blue or red, depending on the main pigments present in their cells.

132. Answer (4)

Hint: A bud is present in the axil of petiole in both simple and compound leaves, but not in the axil of leaflets of the compound leaves.

Sol.: A leaf is said to be simple, when its lamina is entire or when incised, the incision do not touch the midrib.

133. Answer (4)

Hint: Zoospores are asexual naked spores produced within a sporangium.

Sol.: Zygospore is a sexual spore that is formed by the fusion of two gametes.

134. Answer (3)

Hint: Coprophilous fungus grows on dung.

Sol.: Parasite – Live on living plants and animals.

Lichens – Symbiotic association of algae and fungi.

Mycorrhiza – Symbiotic association of fungi with plant roots.

135. Answer (2)

Hint: Creutzfeldt-Jacob disease is caused by prions.

Sol.: Creutzfeldt-Jacob disease is caused by abnormally folded proteins called prions.

[ZOOLOGY]

136. Answer (3)

Hint: Minimum water is required for its elimination among all the nitrogenous wastes

Sol.: Uric acid is the main nitrogenous excretory waste produced by birds and reptiles. It is least toxic and requires minimum amount of water for its elimination. Ammonia is the most toxic waste and requires large amount of water for its elimination.

137. Answer (3)

Hint: Participates in formation of juxta-glomerular apparatus

Sol.: JG cells of afferent arteriole are responsible for synthesis and release of renin which is responsible for increase in blood pressure and thus, GFR by acting through renin-angiotensin mechanism. Specialised cells of DCT along with JG cells form a complex structure called JGA that regulates blood pressure.

138. Answer (2)

Hint: Pivot joint is a freely movable joint.

Sol.: The 1st and 2nd vertebrae of vertebral column are called atlas and axis respectively which articulate with each other to form a pivot joint that is a type of synovial joint. So, synovial cavity with synovial fluid is present in joint space between atlas and axis. Adipose tissue is present beneath the skin, intercalated disc is present in cardiac muscle and interverterbal disc is present in between two adjacent vertebrae forming cartilaginous joint. An osteoligamentous ring is associated with formation of pivot joint.

139. Answer (4)

Hint: Formed by fusion of three bones

Sol.: Femur is commonly known as thigh bone which articulates with a cavity formed by fusion of three bones; ilium, ischium and pubis. Pubic symphysis is a type of cartilaginous joint between two pubic bones ventrally. Pubic symphysis does not participate in formation of acetabulum.

140. Answer (3)

Hint: Junction between neuron and sarcolemma of a muscle fibre.

Sol.: Stimulation of a muscle fibre by a motor neuron occurs at the neuromuscular junction. Junction between a motor neuron and sarcolemma of a muscle fibre is called neuro-muscular junction or motor-end plate.

141. Answer (2)

Hint: Collecting duct receives DCTs of many nephrons.

Sol.: Glomerular capillaries along with podocytes present in Bowman's capsule form filtration membrane which is responsible for filtration of blood. Glomerulus is a part of nephron but is not a part of renal tubule. Renal tubule is differentiated into Bowman's capsule, PCT, Loop of Henle and DCT. So, nephron consists of two parts renal corpuscle (glomerulus + Bowman's capsule) and renal tubule. So, collecting duct is not a part of nephron but helps in maintaining pH and ionic balance of the blood.

142. Answer (4)

Hint: Skeletal system also includes cartilages.

Sol.: Skeletal system consists of both bones and cartilages. It does not play any role in movements of body parts carried out by involuntary muscles. Our skull is dicondylic because two occipital condyles of occipital bone articulate with two facets present on superior surface of atlas.

143. Answer (1)

Hint: Actin filaments are present in 'I' band.

Sol.: Myofibrils have alternate dark and light bands on them because dark band contains thick myosin filaments and thin actin filaments while light band contains only thin actin filaments. So, skeletal muscle fibres are also called striated muscle fibres.

144. Answer (3)

Hint: Filtrate formed by both kidneys per day is about 180 L.

Sol.: In normal adult human about 180 L of glomerular filtrate is formed per day by both kidneys. So, only 90 L of glomerular filtrate is formed by each kidney per day.

145. Answer (3)

Hint: Ammonia is the most toxic nitrogenous waste.

Sol.: Ammonia is the most toxic form and requires large amount of water for its elimination whereas uric acid being the least toxic can be removed with a minimum loss of water.

146. Answer (1)

Hint: In bony fishes, main excretory organ has no significant role in excretion of ammonia.

Sol.: Many bony fishes, aquatic insects and aquatic amphibians, generally excrete ammonia by diffusion across body surfaces (amphibians) or through gill surfaces (in fish) as ammonium ions. Kidneys do not play any significant role in its removal.

147. Answer (2)

Hint: Aquatic animals are generally ammonotelic.

Sol.: Amphioxus – Ammonotelic

Land snail, wall lizard, ostrich – Uricotelic

Toad, Monkey – Ureotelic

148. Answer (2)

Hint: Flame cells are found in platyhelminths.

Sol.: Protonephridia or flame cells are excretory structures in platyhelminths, *e.g.* *Planaria*. Malpighian tubules are the main excretory structures in insects.

Nephridia are the main excretory structures in annelids and green glands are the excretory structures in aquatic arthropods *e.g.*, Crustaceans (Prawns).

149. Answer (3)

Hint: Fibrous cartilage is present in pubic symphysis

Sol.: Pubic symphysis is a type of cartilaginous joint because fibrous cartilage is present in between two pelvic bones. Saddle joint and gliding joint are synovial joints. Bones fuse end to end in fibrous joint by dense fibrous connective tissue.

150. Answer (4)

Hint: Ammonia is converted into urea in the liver of humans.

Sol.: In humans, urea is synthesized within liver by ornithine cycle from ammonia and CO_2. It is mostly eliminated from the body by kidneys but small amounts of urea is also excreted through sweat and saliva.

151. Answer (1)

Hint: Least amount of water is required for elimination of uric acid.

Sol.: Ammonia is the most toxic and highly diffusible. So, it is not stored in the body and diffuses out in water as it is formed. Urea and uric acid, being lesser toxic can be retained in the body for certain time. Less water is required in elimination of urea and uric acid. So, production of urea and uric acid is a terrestrial adaptation for conservation of water.

152. Answer (2)

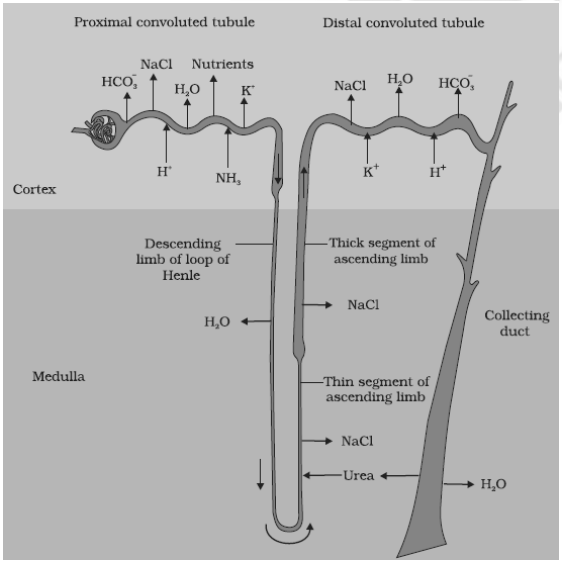
Hint: Cardiac muscles are striated and involuntary.

Sol.: All locomotions are movements but all movements are not locomotions. Cardiac muscles are striated but they are involuntary. Smooth muscles are involuntary but all involuntary muscles are not smooth, *e.g*. cardiac muscles.

153. Answer (2)

Hint: Selective secretion of H^+ is done to maintain pH and ionic balance.

Sol.:



154. Answer (2)

Hint: Cytoskeleton is helpful in locomotion.

Sol.: Amoeboid movement is exhibited by leucocytes, macrophages and *Amoeba*. It is affected by pseudopodia formed by streaming of protoplasm. Cytoskeletal elements like microfilaments are also involved in amoeboid movement. Actin and myosin filaments are found in sarcoplasm of muscles in a regular array.

155. Answer (3)

Hint: Tongue has voluntary muscles.

Sol.: Coordinated movements of cilia present in trachea are helpful in removing dust particles and some of the foreign substances inhaled along with atmospheric air. Passage of ova through the female reproductive tract is also facilitated by ciliary movements. In *Paramoecium*, cilia helps in the movement of food through cytopharynx and in locomotion as well. Tongue present in human's buccal cavity performs muscular movement due to presence of skeletal voluntary muscle in it.

156. Answer (1)

Hint: Muscle classified on basis of their appearance.

Sol.: Based on their location, three types of muscles are identified: (i) skeletal, (ii) visceral and (iii) cardiac.

On the basis of their appearance, muscles are classified into two categories: (i) striated/striped and (ii) unstriated/unstriped. Based on the nature of regulation of their activities, muscles are also classified into two categories: (i) voluntary and (ii) involuntary.

157. Answer (2)

Hint: Equal to the total number of bones in pectoral girdle.

Sol.: Muscle fibres have special properties like excitability, extensibility, contractility and elasticity. Excitability is a common feature of both muscles and nerve fibres.

158. Answer (3)

Hint: Smooth muscles are present in visceral organs.

Sol.: Smooth muscles are also known as non-striated involuntary muscles. These muscles are found in the wall of digestive tract and genital tract and are responsible for the transportation of food through digestive tract and gametes through the genital tract respectively.

159. Answer (2)

Hint: Bone forming suture with parietal bones.

Sol.: Sphenoid and ethmoid form the floor of cranial cavity. Occipital bone forms the posterior part of cranial cavity and frontal bone forms the anterior most part of the roof of cranial cavity as well as bony part of forehead.

160. Answer (3)

Hint: Suffix 'itis' represents inflammation.

Sol.: Muscular dystrophy is a genetic disorder in which progressive degeneration of skeletal muscle takes place.

Tetany is characterised by rapid spasms in muscle due to low Ca^{+2} in body fluids.

Arthritis is inflammation of joints due to any reason but when it is due to accumulation of uric acid crystals in the region of joints, it is called gout.

161. Answer (1)

Hint: Most toxic nitrogenous waste

Sol.: Maximum reabsorption of nutrients, electrolytes and water occurs in PCT but this part is also responsible for secretion of H^+ and NH_3.

162. Answer (2)

Hint: Sacrum is connected with coxal bones on each side

Sol.: Pelvic girdle consists of two coxal bones, one on each side of the body. Each coxal bone is formed by fusion of ilium, ischium and pubis during embryonic development. Sacrum is connected with coxal bones on each side dorsally but ventrally they are joined with each other forming pubic symphysis.

163. Answer (2)

Hint: Functional unit of a skeletal muscle fibre.

Sol.: Muscle fibre is the structural unit of a muscle. Sarcomere is considered as functional unit of muscle contraction. Any movement which leads to change in position of animal is called locomotion. Muscle fatigue is due to accumulation of lactic acid.

164. Answer (4)

Hint: Nitrogenous wastes are absent in dialysing fluid.

Sol.: Dialysing fluid contains all the constituents as in plasma except nitrogenous wastes. On an average, human kidneys can produce urine nearly four times concentrated than initial filtrate formed.

165. Answer (2)

Hint: Myosin pulls attached actin filaments towards the centre of 'A' band.

Sol.: According to sliding filament theory, only actin filaments slide over myosin filaments which leads to decrease in length of sarcomere. Length of actin filaments, myosin filaments and 'A' band remains unchanged but length of 'I' band and 'H' zone decreases whereas length of overlapping zone between actin and myosin filaments increases during muscle contraction.

166. Answer (4)

Hint: It is secreted from atrial wall.

Sol.: Renin, vasopressin and aldosterone are synergestic w.r.t. increase in blood volume and blood pressure. They all concentrate the urine by retaining water and electrolytes in the body. Atrial natriuretic factor is responsible for loss of water and electrolytes through urine by increasing vasodilation of afferent arteriole and thus, favour the formation of large quantities of dilute urine.

167. Answer (2)

Hint: Wrist bones

Sol.:

Name of bone(s)		Common name(s)
1. Clavicle	-	Collar bone
2. Carpals	-	Wrist bones
3. Metacarpals	-	Palm bones
4. Sternum	-	Breast bone
5. Femur	-	Thigh bone

168. Answer (2)

Hint: CNS passes on motor messages to initiate contraction of smooth muscle.

Sol.: When urine is accumulated in urinary bladder to a certain amount, the stretch receptors present on the wall of urinary bladder send signals to the CNS. Now CNS gives voluntary signals which passes through motor nerve fibres to urinary bladder and carries contraction of smooth muscles of urinary bladder and simultaneous relaxation of urethral sphincter causing the release of urine to outside through urethra.

169. Answer (4)

Hint: Osmotic gradient

Sol.: Passage of molecules through porous cellophane membrane is independent of solubility of molecules. It depends upon concentration gradient of molecules between blood plasma and dialysing fluid.

170. Answer (1)

Hint: Hemodialysis is performed for such type of physiological conditions.

Sol.: Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia. Our lungs remove large amounts of CO_2

approximately 200 mL/min or 12 L / hour. A small amount of urea is excreted through sweat glands and salivary glands. Sebum is excreted out through sebaceous glands.

171. Answer (2)

Hint: One per cent of GFR per day is 1.8 L

Sol.: GFR/day = 180 L

Urine passed out per day = 180 L $\times$1/100 = 1800 mL

$\because$ 30 g of urea is present in 1800 mL of urine

$\therefore$ 1 g of urea will be present in 1800 mL/30 g = 60 mL of urine

172. Answer (4)

Hint: It is equal to the total number of false ribs.

Sol.: Total number of ear ossicles = 6

Total number of girdle bones = 6

Total number of cervical vertebrae = 7

Total number of tarsals = 14

Total number of cranial bones = 8

173. Answer (1)

Hint: Consider the movements performed by involuntary muscles.

Sol.: Joints are essential for all types of movements involving the bony parts of the body. But joints are not involved in movements associated with cardiac and smooth muscles. Locomotory movements are no exception to joints. Joints are the points of contact between bones or between bones and cartilages. Joints act as fulcrum in the various locomotory movements.

174. Answer (2)

Hint: Clavicle is placed in our body in horizontal plane.

Sol.: In humans, the dorsal flat, triangular body of scapula has a slightly elevated ridge called the spine which projects as a flat expanded process called the acromion. Lateral end of clavicle (collar bone) articulates with acromion to form acromio-clavicular joint. Medial end of collar bone articulates with sternum to form sterno-clavicular joint.

175. Answer (4)

Hint: Osmotic change affects osmoreceptors.

Sol.: Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration.

176. Answer (3)

Hint: Lactic acid is present in sweat.

Sol.: Liver secretes bile-containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs. Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.

177. Answer (4)

Hint: Ascending limb is permeable to electrolytes.

Sol.: NaCl is transported by ascending limb of Henle's loop which is exchanged with descending limb of vasa recta. NaCl is returned to the interstitium through ascending portion of vasa recta. Henle's loop and vasa recta through counter current mechanism, play a significant role to produce a concentrated urine in mammals.

178. Answer (1)

Hint: Equal to the total number of bones in pectoral girdle.

Sol.: Actin filament is formed by two 'F' actins helical wound to each other and are considered as filamentous proteins. Two filaments of another protein, tropomyosin also run close to the 'F' actins throughout its length. A complex protein troponin is distributed at regular intervals on the tropomyosin which are globular proteins.

179. Answer (4)

Hint: Head of meromyosin acts as an active ATPase.

Sol.: HMM consists of globular head and a short arm. Both are collectively called cross arm. Two binding sites for ATP and two binding sites for actin are present on head of cross arm. So, short arm is devoid of any binding sites.

180. Answer (2)

Hint: There are two unpaired facial bones.

Sol.: Sternum is a flat bone on ventral midline of the thorax. Facial region is formed by 14 skeletal elements in which 6 bones are paired and two bones are unpaired. The number of cervical vertebrae are seven in almost all mammals including humans but in *Manatee* only six cervical vertebrae are present. Each vertebra has a central canal (neural canal) through which the spinal cord passes.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2027

TEST - 3 (Code-D)

Click here for Code-C Sol.

Test Date : 28/12/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint: $\int_0^P d\vec{p} = \int_0^t \vec{F} \cdot dt$

Sol.: $\vec{F} = \left(3t\hat{i} + 6t^2\hat{j}\right)$ N

$$\int d\vec{p} = 3\left[\frac{t^2}{2}\right]_0^2 \hat{i} + 6\left[\frac{t^3}{3}\right]_0^2 \hat{j}$$

$$= \frac{3}{2}[4-0]\hat{i} + \frac{6}{3}[8-0]\hat{j}$$

$$\Delta\vec{p} = 6\vec{i} + 16\hat{j}$$

$$|\Delta\vec{p}| = \sqrt{36+256}$$

≈ 17 kg m/s

2. Answer (4)

Hint & Sol.: If $\vec{F}$ is parallel or antiparallel to motion then it changes magnitude of $\vec{v}$ only but not direction.

If $\vec{F}$ is $\perp$ to motion, it changes direction of $\vec{v}$ and not magnitude of $\vec{v}$

If $\vec{F}$ acts at an angle to motion, it changes both magnitude and direction of $\vec{v}$

3. Answer (3)

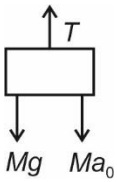
Hint & Sol.: If $\vec{F}_x = 0$, $\frac{dP_x}{dt} = 0$ then P_x = constant

$$\vec{I} = \Delta\vec{P} = \int \vec{F} dt$$

4. Answer (4)

Hint: $\vec{F}_{pseudo}$ = – (mass of body) × (acceleration of frame)

Sol.:



$T - Mg - Ma_0 = 0$

$T = Mg + Ma_0 = 4(10 + 1)$

$= 44$ N

5. Answer (1)

Hint & Sol.:

Ball bearing are used in machines to reduce power dissipation in form of heat by minimizing friction.

Static friction opposes impending relative motion

6. Answer (4)

Hint & Sol.: Scalar product is commutative i.e.,

$\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A} = AB\cos\theta$

$\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$

$\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$

7. Answer (4)

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

Sol.: For road $\vec{S}$ = zero

$\therefore$ W = zero

8. Answer (3)

Hint: P.E is defined for conservative forces only.

Sol.: As gravitational force is conservative, so work done against it is stored in form of potential energy.

Work done by conservative forces is independent of path.

9. Answer (2)

Hint: Work done = $\int \vec{F} \cdot \overrightarrow{dx}$ =Area under F-x curve

Sol.: $W = \frac{1}{2} \times (80+40) \times 10$

= 120 × 5 = 600 J

10. Answer (3)

Hint: $T.E = P.E + K.E$

Sol.: $E_1 = P.E + K.E$

$$= P.E + \frac{1}{2}P.E$$

$$= \frac{3}{2}mgh$$

$E_2 = P.E + K.E$

$= 3P.E$

$= 3mgh'$

$$3mgh' = \frac{3}{2}mgh$$

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

11. Answer (2)

Hint: Use equation $P = \frac{dW}{dt}$

Sol.: $dW = Pdt \Rightarrow \int dW = \int Pdt$

Work = Area under *P*-*t* curve

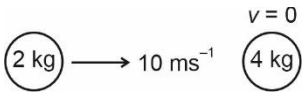
$= \frac{1}{2} \times 2 \times 40 + (6-2) \times 40$

= 200 J

12. Answer (1)

Hint: Apply momentum conservation and use equation of restitution, $e = \frac{\text{velocity of separation}}{\text{velocity of approach}}$.

Sol.: Before collision:



After collision:

$e = \frac{1}{2} = \frac{v_2 - v_1}{10} \Rightarrow v_2 - v_1 = 5$ ...(1)

Apply momentum conservation,

$2 \times 10 = 2v_1 + 4v_2$

$\Rightarrow v_1 + 2v_2 = 10$ ...(2)

On solving equations (1) and (2)

$v_1 = 0$ and $v_2 = 5$ m s^{-1}

13. Answer (3)

Hint: Motion of the particle in vertical direction remains unaffected.

Sol.: $T = \frac{2u\sin\theta}{g} = 6$ s

Horizontal velocity before collision = 40 m/s

Horizontal velocity after collision = 20 m/s

Time to reach at wall = 2 s

Remaining time = 4 s

Horizontal distance travelled by the particle after collision = 20 × 4 = 80 m.

14. Answer (2)

Hint: If $\vec{F} \perp \vec{S}$ then $\vec{F} \cdot \vec{S} = 0$

Sol.: $\vec{S} = \alpha\hat{i} + \alpha\hat{j} + \hat{k}$

$\vec{F} \cdot \vec{S} = \alpha^2 + 2\alpha - 15 = 0$

$\alpha = \frac{-2 \pm \sqrt{4 - 4(-15)}}{2} = -5$ and 3

15. Answer (4)

Hint: Work done = Zero

If $\vec{F}_{net} = 0$ or $\vec{S} = 0$ or $\theta = 90°$

Sol.: When body is moving with uniform velocity net force is zero so W.D = 0 and displacement of wall is zero so W.D is zero.

16. Answer (2)

Hint: Work done by normal reaction, $W = \vec{N} \cdot \vec{S} = NS\cos(\theta)$

Sol.: Block is moving in horizontal direction.

Work done = *N*Scos (90 – α)

$= mg\cos\alpha \cdot vt\cos(90 - \alpha) = \frac{mgvt\sin 2\alpha}{2}$

$= 150\sin 2\alpha$

17. Answer (3)

Hint: Total mechanical energy remains conserved.

Sol.: When block descends 20 mm, spring further stretches by 40 mm.

$\therefore$ Decrease in P.E of block

= Increase in K.E of block + Increase in elastic P.E of spring

$\Rightarrow 10 \times 10 \times 0.02 = \frac{1}{2} \times 10 \times v^2 + \frac{1}{2} \times 500 \times \left[(0.04 + 0.04)^2 - (0.04)^2\right]$

$2 = 5v^2 + 1.2$

$v^2 = \frac{16}{100}$

$v = \frac{4}{10} = \frac{2}{5}$ m/s

18. Answer (3)

Hint: Use equations: $P = \vec{F} \cdot \vec{v}$, $a = \frac{vdv}{dx}$

Sol.: $F = \frac{P}{v}$

$F = ma$

$m\frac{vdv}{dx} = \frac{P}{v}$

$\int_0^v v^2 dv = \frac{P}{m}\int_0^x dx$

$\frac{v^3}{3} = \frac{P}{m}x$

$$v^3 = \frac{3P}{m}x \Rightarrow v = \left(\frac{3P}{m}\right)^{1/4} x^{1/3}$$

$$v = \frac{dx}{dt}$$

$$\int \frac{dx}{x^{1/3}} = \int \left(\frac{3P}{m}\right)^{1/3} dt$$

$$x \propto t^{3/2}$$

19. Answer (1)

Hint & Sol.:

- In one dimensional elastic collision between equal masses, velocities get interchanged.
- Exchange of velocities directly results from conservation laws inelastic collision when masses are equal.

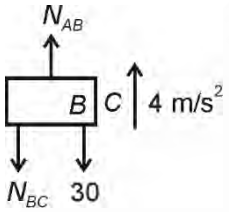
20. Answer (2)

Hint & Sol.:

a. Net force on block B

$F_{net} = ma = 12$ N

b.



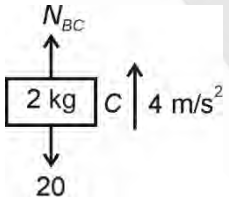
$\Rightarrow N_{AB} - N_{BC} - 30 = m_B \times 4$

$N_{BC} = 28$ N (derived in part c)

$\Rightarrow N_{AB} - 28 - 30 = 12$

$\Rightarrow N_{AB} = 70$ N

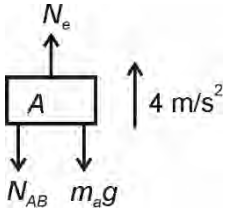
c.



$N_{BC} - 20 = 2 \times 4$

$N_{BC} = 28$ N

d.



$N_e - 70 - 50 = 5 \times 4$

$N_e = 140$ N

21. Answer (4)

Hint: For crossing bridge in minimum time, it has to travel with maximum acceleration

Sol.: a = maximum acceleration produced in car

$ma = \mu N$

$ma = \mu mg$

$a = \mu g = 10$ m/s²

For crossing bridge in minimum time, it has to travel with maximum acceleration

$u = 0$, $s = 500$ m, $a = 10$ m/s²

$$500 = \frac{1}{2} \times 10 \times t^2$$

$t = 10$ s

22. Answer (2)

Hint: Here, energy lost during collision is given by,

$$E = \frac{1}{2}\frac{m_1 m_2}{m_1 + m_2}(u_1 - u_2)^2$$

Sol.: $$E = \frac{1}{2} \times \frac{m \times m}{m + m}(u_0)^2$$

$$E = \frac{1}{4}mu_0^2$$

$$E = \frac{1}{2} \times \frac{1}{2}mu_0^2$$

$$E = \frac{K_0}{2}$$

22. Answer (3)

Hint & Sol.: Retarding force $F = ma = mg\sin\theta + \mu mg\cos\theta$

$$a = g(\sin 37^\circ + \mu \cos 37^\circ)$$

$$= 10\left(\frac{3}{5} + \frac{2}{5}\right)$$

$= 10$ m/s²

$$s = \frac{u^2}{2a} = \frac{40 \times 40}{2 \times 10}$$

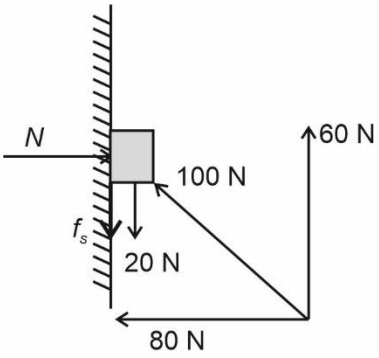
$= 80$ m

24. Answer (1)

Hint: Friction force always tries to oppose the relative motion.

Sol.: $N = F\cos 37^\circ = 80$ N

$(F_{net})_{up} = F\sin 37^\circ - mg = 40$ N



$f_{lim} = \mu N = 40$ N

Friction = 40 N, downward

25. Answer (3)

Hint & Sol.: If a body is acted upon by a single external force, it cannot remain in equilibrium.

If a body is in equilibrium under the action of only two external forces, the forces must be equal and opposite.

26. Answer (1)

Hint: Use principle of conservation of energy.

Sol.: Let the string slack at height, h then

$v^2 = u^2 - 2gh$

Also, $T - mg\cos\theta = \frac{mv^2}{r}$, as string slacks, $T = 0$

$\Rightarrow \cos\theta = -\frac{v^2}{Rg}$ and $h = R(1 - \cos\theta)$

$\Rightarrow h = R + \frac{R \times v^2}{Rg} \Rightarrow h = R + \frac{1}{g}(4gR - 2gh)$

$\Rightarrow h = R + 4R - 2h \Rightarrow 3h = 5R \Rightarrow h = \frac{5R}{3}$

27. Answer (1)

Hint & Sol.: In horizontal direction, $(F_{net})_{ext} = ma$

$a = \frac{80 - 30}{20} = 2.5$ m/s^2

For block of mass 10 kg

$N - 30 = 10a$

$N = 55$ N

28. Answer (3)

Hint: $F_{thrust} = \frac{vdm}{dt}$

Sol.: $\frac{vdm}{dt} = ma$

$200 \times 5 = 2500 \times a$

$a = \frac{2}{5}$ m/s^2

29. Answer (1)

Hint & Sol.: In some cases, μ_s and μ_k can exceed unity as some materials like silicon rubber can exhibit coefficients of friction greater than 1.

Mechanical advantage is equal to load over effort.

30. Answer (3)

Hint: Velocity of points A and B along rod is equal

Sol.: $v_B \cos 60° = v_A \cos 30°$

$v_B \times \frac{1}{2} = 5 \times \frac{\sqrt{3}}{2}$

$v_B = 5\sqrt{3}$ m/s

31. Answer (4)

Hint & Sol.: Taking components of string force in horizontal direction: $T_1 \cos 30° = T_2 \cos 30°$

$\Rightarrow T_1 = T_2$

32. Answer (2)

Hint: Frictional force will provide necessary centripetal acceleration.

Sol.: For maximum speed,

$F_{max} = \frac{mv^2}{r} \Rightarrow \mu \times N = \frac{mv^2}{r}$ and $N = mg$

$\Rightarrow v_{max} = \sqrt{\mu rg} = \sqrt{\frac{1}{2} \times 20 \times 10} = 10$ m/s

33. Answer (2)

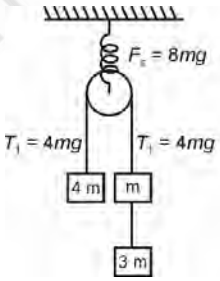
Hint: Just after string is cut:

(1) spring force remains same

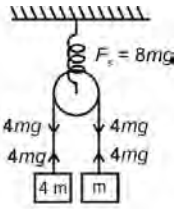
(2) string force can change instantaneously

Sol.:

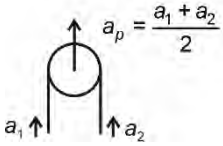
Before



After



After cutting string (1):



$F_s = 8mg$

Acceleration of mass $4m$:

$a_{4m} = 0$

Acceleration of mass m:

$$a_m = \frac{4mg - mg}{m} = 3g$$

Acceleration of pulley:

$$a_P = \frac{0 + 3g}{2}$$

$$a_P = \frac{3g}{2}$$

34. Answer (1)

Hint: Apply conservation of mechanical energy.

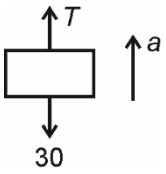
Sol.: $2mgl = \frac{1}{2}mv^2$

$$v = 2\sqrt{gl}$$

35. Answer (2)

Hint: Use, $F_{net} = ma$

Sol.:



$$\Rightarrow a = \frac{60 - 30}{3} = \frac{30}{3} = 10 \text{ m s}^{-2}, \text{ upwards}$$

36. Answer (3)

Hint: Use work-energy theorem

Sol.: $w_f + w_g = \Delta$K.E.

$$\Rightarrow -f_A x + mgx = \frac{1}{2}(m_T)v^2$$

$$\Rightarrow -\frac{1}{2}\times 2\times 10\times\frac{4}{100} + 4\times 10\times\frac{4}{100} = \frac{1}{2}\times 6\times v^2$$

$$\Rightarrow \frac{-4}{10} + \frac{16}{10} = 3v^2$$

$$\Rightarrow \frac{12}{10} = 3v^2$$

$$\Rightarrow v^2 = \frac{4}{10} = \frac{2}{5} \Rightarrow v = \sqrt{\frac{2}{5}} \text{ m s}^{-1}$$

37. Answer (3)

Hint: Block 2 kg moves with constant acceleration.

Sol.:

$$5g - T = 5a$$
$$T - 2g = 2a$$
$$3g = 7a$$

$$a = \frac{3g}{7}$$

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

$$25 = \frac{1}{2}\times\frac{3\times 10}{7}\times t^2$$

$$\frac{25\times 7}{15} = t^2$$

$$t = \sqrt{\frac{35}{3}} \text{ s}$$

38. Answer (4)

Hint: Use equation $F = \frac{mv^2}{r}$

Sol.: Let speeds at lowest and highest points be u and v respectively

$$T_L = mg + \frac{mu^2}{l} \quad \text{...(i)}$$

$$T_H = \frac{mv^2}{l} - mg \quad \text{...(ii)}$$

By conservation of mechanical energy,

$$\frac{mu^2}{2} - \frac{mv^2}{2} = mg(2l) \quad \text{...(iii)}$$

Solving equations (i), (ii) and (iii), we get

$T_L - T_H = 6mg$

39. Answer (1)

Hint: Power of the engine is getting utilised to increase the potential energy of the truck.

Sol.: Force against which work is done $F = mg\sin\theta$

$$= 10000\times 10\times\frac{1}{1000} = 100 \text{ N}$$

Speed $v = 36\times\frac{5}{18} = 10$ m/s

$P = 100 \times 10 = 1000$ W

$= 1$ kW

40. Answer (3)

Hint: At equilibrium position, net force on the block is zero.

Sol.: $\therefore Kx = mg$

$$\frac{4mgx}{x_0} = mg$$

$$\Rightarrow x = \frac{x_0}{4}$$

$\therefore$ $(W.D)_{gravity} = mgx$

$$= \frac{mgx_0}{4}$$

41. Answer (3)

Hint: $s = ut + \frac{1}{2}at^2$, $W_g = mg \times s$.

Sol.: $s_1 = 5$ m

$s_2 = 15$ m

$s_3 = 25$ m

W.D by gravity = $mg \times s$

$W_1 : W_2 : W_3 : ..... = 1 : 3 : 5 : ....$

42. Answer (2)

Hint: $F = -\frac{dU}{dx}$

Sol.: For *O* to *a* part, *F* is constant and has a –ve value while for rest part it is zero as *U* becomes constant.

43. Answer (2)

Hint: Power required $P = \frac{W + KE}{\Delta t}$

Sol.: $P_r = \frac{mgh}{\Delta t} + \frac{\Delta KE}{\Delta t}$

$P_r = 3 \times 10 \times 10 + \frac{1}{2}\frac{mv^2}{t}$

$P_r = 300 + \frac{1}{2} \times 3 \times 100$

$P_r = 300 + 150$

$P_r = 450$ W

$\Rightarrow$ $\therefore$ Power of motor $P_m = \frac{P_r}{\eta} = \frac{450}{0.6} = 750$ W

44. Answer (3)

Hint: Apply conservation of mechanical energy

Sol.: $\frac{1}{2}mv^2 = \frac{1}{2}kx_{max}^2$

$x_{max} = \sqrt{\frac{m}{k}}v$

45. Answer (2)

Hint: For equilibrium point $\frac{dU}{dx} = 0$, and for stable equilibrium potential energy is minimum.

Sol.: At $x = 0$, the particle is in unstable equilibrium because, at $x = 0$, $\frac{dU}{dx} = 0$ and $\frac{d^2U}{dx^2} < 0$ while at $x = \pm a$ particle is in stable equilibrium.

[CHEMISTRY]

46. Answer (1)

Hint: $N \equiv N \rightarrow O$

Sol.: BeH_2 and BCl_3 have less than eight electrons on central atoms. So, they have incomplete octet. PF_5 and SF_6 have more than eight electrons on central atoms. So, they have expanded octet.

47. Answer (2)

Hint: Highest occupied molecular orbital of C_2^{2-} is $\sigma 2p_z$.

Sol.: C_2 and B_2 have only π bond(s) according to molecular orbital theory.

48. Answer (3)

Hint: $\overset{+}{N}H_4$ is sp^3 hybridised.

Sol.:

Species	Hybridization of central atom
SF_4	sp^3d
XeF_4	sp^3d^2
IF_7	sp^3d^3

49. Answer (3)

Hint: Species with *sp* hybridisation will have 180° bond angle.

Sol.:

Molecules	Bond angles
CO_2	180°
BF_3	120°
CH_4	109.5°
NH_3	107°
H_2O	104.5°

50. Answer (3)

Hint: Bond order of O_2 is 2 and N_2 is 3

Sol.:

Species	Bond order
N_2^-	2.5
O_2^-	1.5
O_2^{2-}	1.0
O_2	2.0
N_2	3.0

51. Answer (1)

Hint: According to Fajans, the greater the charge on the cation, the greater the covalent character of an ionic bond.

Sol.: Zn^{2+} has more polarising power than Ca^{2+} because Zn^{2+} has pseudo inert gas electronic configuration.

52. Answer (3)

Hint: O_3 molecule has two canonical forms.

Sol.: There is no such equilibrium between the canonical forms of a molecule.

53. Answer (4)

Hint: Orbital dipole moment due to lone pair also contributes to dipole moment.

Sol.: In case of NH_3 the orbital dipole due to lone pair is in the same direction as resultant dipole moment of N–H bonds, whereas in NF_3 the orbital dipole is in direction opposite to the resultant dipole moment of three N–F bonds. Hence, NH_3 is more polar than NF_3.

54. Answer (3)

Hint: p-Nitrophenol forms intermolecular H-bond.

Sol.: Dipole moment of H_2O is 1.85 D while that of NH_3 is 1.47 D.

55. Answer (2)

Hint & Sol.:

Elements	$\Delta_{eg}H$ (kJ mol^{-1})
He	+48
Ne	+116
Ar	+96
Xe	+77

56. Answer (4)

Hint & Sol.: The first ionization energy of N is greater than that of O, because in nitrogen atom, three 2*p* electrons reside in different atomic orbital whereas in the oxygen atom, two of the four 2*p* electrons must occupy the same 2*p* orbital resulting in an increased electron-electron repulsion.

57. Answer (2)

Hint: *s* and *p*-block elements are representative elements.

Sol.: (A) $\rightarrow$ [Ar] $4s^1 \rightarrow$ K [*s*-block element]

(B) $\rightarrow$ [Ar] $3d^5 4s^1 \rightarrow$ Cr [*d*-block element]

(C) $\rightarrow$ [Kr] $4d^{10}5s^2 5p^5 \rightarrow$ I [*p*-block element]

(D) $\rightarrow$ [Ar] $3d^{10}4s^1 \rightarrow$ Cu [*d*-block element]

(E) $\rightarrow$ [Rn] $5f^0 6d^2 7s^2 \rightarrow$ Th [*f*-block element]

58. Answer (2)

Hint: F is the most electronegative atom.

Sol.:

Element	Electronegativity values (on Pauling scale)
F	4
O	3.5
S	2.5
P	2.1

59. Answer (1)

Hint: IUPAC official name of element with atomic number 101 is Mendelevium.

Sol.:

Atomic number	IUPAC official name
102	Nobelium
103	Lawrencium
104	Rutherfordium

60. Answer (4)

Hint: Due to more penetration of electron in 's' orbital, Mg has higher ionisation enthalpy than Al.

Sol.: Due to half filled subshell p has higher first ionisation enthalpy than s

So, the correct order is

Na < Al < Mg < Si < S < P

61. Answer (1)

Hint & Sol.: The size of anion is larger than that of parent atom because addition of one or more electrons result in increased repulsion among the electrons and a decrease in effective nuclear charge.

62. Answer (2)

Hint: O has least negative electron gain enthalpy (–141 kJ mol^{-1}) among group 16 elements.

Sol.: F has less negative electron gain enthalpy than Cl but more negative electron gain enthalpy than others group 17 elements.

63. Answer (4)

Hint: $2C(g) + 3H_2(g) + \frac{1}{2}O_2(g) \rightarrow C_2H_5OH(l)$ ...(i)

Sol.: $H_2 + \frac{1}{2}O_2 \rightarrow H_2O;\ \Delta_C H = -241.8\ \text{kJ mol}^{-1}$ ... (ii)

$C + O_2 \rightarrow CO_2;\ \Delta_C H = -393.5\ \text{kJ mol}^{-1}$ ...(iii)

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O;\ \Delta_C H = -1234.7\ \text{kJ mol}^{-1}$ ...(iv)

Using equation 3 × (ii) – (iv) + 2 × (iii) gives equation (i)

$\Delta_f H_{(C_2H_5OH)} = -277.7 \text{ kJ mol}^{-1}$

64. Answer (2)

Hint: With the help of Born-Haber cycle we can determine lattice enthalpy.

Sol.: From Born-Haber cycle,

Lattice enthalpy = $\Delta_f H^\ominus - \Delta_{sub} H^\ominus - \Delta_i H^\ominus - \frac{1}{2}\Delta_{bond} H^\ominus + \Delta_{eg} H^\ominus$

= –411 – 107 – 502 – 121 + 355

= –786 kJ/mol

65. Answer (2)

Hint: During boiling of egg, entropy increases due to denaturation of protein.

Sol.:
- When temperature is increased, then entropy is increased.
- $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$

  Entropy increases due to release of gases.
- $2Cl(g) \rightarrow Cl_2(g)$

  Entropy decreased due to decreased number of moles of gas.

66. Answer (2)

Hint: At equilibrium; $\Delta G = 0$

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

$0 = \Delta H - T\Delta S$

$\Delta H = T\Delta S$

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

$= \frac{400 \times 10^3}{0.2 \times 10^3}$

= 2000 K

67. Answer (3)

Hint & Sol.: In reversible process, the surroundings are always in equilibrium with the system.

68. Answer (3)

Hint: $w = -2.303nRT \log \frac{V_2}{V_1}$

Sol.: w = –2.303 × 2 × R × 300 × log10

= –600 × 2.303R

69. Answer (2)

Hint: $\Delta_r H = \sum \Delta_f H(\text{Products}) - \sum \Delta_f H(\text{reactants})$

Sol.: $\Delta_r H = \Delta_f H(CO_2) + 2 \times \Delta_f H(H_2O) - \Delta_f H(CH_4)$

= – 393.5 + 2 × (–286.2) – (–74.8) = –891.1 kJ/mol

70. Answer (4)

Hint & Sol.: B.E. of C–H bond = $\frac{360}{4} = 90 \text{ kcal mol}^{-1}$

Bond dissociation energy (C_2H_6) = 6 × BE(C–H) + B.E.(C–C)

620 = 6 × 90 + B.E.(C–C)

$B.E_{(C-C)}$ = 620 – 540 = 80 kcal/mol

71. Answer (1)

Hint: $\Delta H = \Delta U + \Delta n_g RT$

Sol.:

Reaction	(ΔH – ΔU)
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	–2RT
$H_2(g) + I_2(g) \rightarrow 2HI(g)$	0
$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	RT
$PCl_3(g) + Cl_2(g) \rightarrow PCl_5(g)$	–RT

72. Answer (3)

Hint: In CH_4 energies required to break the individual C–H bonds in each successive step is different.

Sol.: The enthalpy of solution is the enthaly change associated with the addition of a specified amount of solute to the specified amount of solvent at a constant temperature and pressure.

73. Answer (1)

Hint: Heat added to a system at lower temperature causes greater randomness than when the same quantity of heat is added to it at higher temperature.

$\Delta S = \frac{q_{rev}}{T}$

Sol.: $T\Delta S_{sys}$ is the energy which is not available to do useful work.

74. Answer (1)

Hint: $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ and $\Delta H^\circ = \Delta U^\circ + \Delta n_g RT$

Sol.: $\Delta H^\circ = \Delta U^\circ + \Delta n_g RT = -10 - 1 \times 8.314 \times 10^{-3} \times 298 = -12.48$ kJ

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ = -12.48 - 298 \times (-50 \times 10^{-3})$

= –12.48 + 14.9

= 2.42 kJ

75. Answer (4)

Hint: Work done by the system is –ve

Sol.: $\Delta U = q + w$

= 100 + (–50)

= 50 J

76. Answer (2)

Hint & Sol.: The standard enthalpy of formation is zero for C(graphite).

77. Answer (3)

Hint: $q = nC_m\Delta T$

Sol.: $q = \frac{54}{27} \times 24 \times 10 = 480$ J

78. Answer (1)

Hint: $\Delta_{tran}S = \frac{\Delta_{tran}H}{T}$

Sol.: $\Delta_{tran}S = \frac{x \times 10^3}{300}$

$= 3.3x$ Jmol^{-1}K^{-1}

79. Answer (2)

Hint: State functions are those functions which depend upon only initial and final state.

Sol.: q and w are path functions

q + w = ΔU is a state function

H – TS = G is a state function

80. Answer (2)

Hint & Sol.: $CuSO_4(s) \rightarrow CuSO_4(aq)$ ...(i)

$CuSO_4 \cdot 5H_2O(s) \rightarrow CuSO_4(aq) + 5H_2O$ ...(ii)

The hydration of $CuSO_4$ is given by

$CuSO_4(s) + 5H_2O \rightarrow CuSO_4 \cdot 5H_2O(s)$ ...(iii)

Applying (iii) = (i) – (ii)

= –66 – (+12)

= –78 kJ/mol

81. Answer (1)

Hint: $\Delta H_f = \sum BE_{(reactants)} - \sum BE_{(product)}$

Sol.: $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O$

$\Delta H = BE(H_2) + \frac{1}{2}BE(O_2) - 2BE(O-H)$

$= 433 + \frac{1}{2} \times 492 - 2 \times 464$

= –249 kJ/mol

82. Answer (1)

Hint: HCl + NaOH $\rightarrow$ NaCl + H_2O

Sol.: Millmoles of HCl = 200 × 0.2 $\Rightarrow$ 40 mmol

Millmoles of NaOH = 400 × 0.1 $\Rightarrow$ 40 mmol

Millmoles of H_2O formed = 40 mmol

Enthalpy of neutralization will be

$= \frac{40}{1000} \times -57.1$ kJ

= –2.28 kJ

83. Answer (1)

Hint: For monoatomic gas $\gamma = 1.66$

Sol.: $\gamma = \frac{C_P}{C_V} = \frac{0.125}{0.075} = \frac{5}{3} = 1.67$

84. Answer (4)

Hint: If ΔG is +ve, reaction is always non-spontaneous

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

If ΔH is +ve and ΔS is –ve then

ΔG is always +ve at all temperatures.

85. Answer (3)

Hint: $\Delta G^\circ = -2.303$ RTlog K

Sol.: $\Delta G^\circ = -2.303 \times 8.314 \times 300 \times \log 10^3$

= –17.2 kJ mol^{-1}

86. Answer (2)

Hint: Properties which do not depend upon the amount of substance is called intensive properties

Sol.: Molar heat capacity and density are intensive properties.

87. Answer (4)

Hint: Work done is equal to area enclosed by ABCA.

Sol.: Area $= \frac{1}{2} \times AB \times AC$

$= \frac{1}{2} \times 2P_1 \times 4V_1$

$= 4P_1V_1$

88. Answer (3)

Hint: For vacuum, $w = -P_{ex} \times \Delta U = 0$

for adiabatic process, q = 0

so $\Delta U = q + w = 0$

Sol.: The magnitude of work done by an ideal gas in the adiabatic expansion is more in a reversible process than that in irreversible process. Therefore the final temperature of an ideal gas in adiabatic expansion is less in reversible expansion than irreversible expansion.

89. Answer (1)

Hint: $q_{sys} = \Delta U - w(w = -P_{ext} \cdot \Delta V)$

Sol.: $q_{sys} = \Delta U - (-P_{ext} \cdot \Delta V)$

$q_{sys} = P_{ext}\Delta V$

= 0 + 2(3 – 1)

= 4 L atm

$$\Delta S_{surr} = \frac{(q_{rev})_{surr}}{T} = \frac{-q_{sys}}{T}$$

$$= \frac{-4 \times 101.3}{300} \text{ J} \quad = -1.35 \text{ JK}^{-1}$$

90. Answer (3)

Hint: $\Delta H = \Delta U + (P_2V_2 - P_1V_1)$

Sol.: $\Delta H = \Delta U + (P_2V_2 - P_1V_1)$

= 20 + 4 × 6 – 2 × 1

= 20 + 24 – 2

= 42 L atm

[BOTANY]

91. Answer (2)

Hint: Creutzfeldt-Jacob disease is caused by prions.

Sol.: Creutzfeldt-Jacob disease is caused by abnormally folded proteins called prions.

92. Answer (3)

Hint: Coprophilous fungus grows on dung.

Sol.: Parasite – Live on living plants and animals.

Lichens – Symbiotic association of algae and fungi.

Mycorrhiza – Symbiotic association of fungi with plant roots.

93. Answer (4)

Hint: Zoospores are asexual naked spores produced within a sporangium.

Sol.: Zygospore is a sexual spore that is formed by the fusion of two gametes.

94. Answer (4)

Hint: A bud is present in the axil of petiole in both simple and compound leaves, but not in the axil of leaflets of the compound leaves.

Sol.: A leaf is said to be simple, when its lamina is entire or when incised, the incision do not touch the midrib.

95. Answer (2)

Hint: The given features are true for Dinoflagellates.

Sol.: Dinoflagellates can be yellow, green, brown, blue or red, depending on the main pigments present in their cells.

96. Answer (3)

Hint: In cladode, stem is modified into a leaf like structure for photosynthesis while leaves are reduced to scales or spines.

Sol.: Plants present in arid regions, modify their stem into flattened (*Opuntia*) or fleshy cylindrical structure (*Euphorbia*) called phylloclade.

97. Answer (2)

Hint: Accumulation of deposits of the cell wall of diatoms over billions of years is referred to as 'diatomaceous earth'.

Sol.: Cell wall of diatoms form two thin overlapping shells which fit together as in a soap box.

98. Answer (3)

Hint: Thorns are the modification of axillary buds.

Sol.: Thorns are found in many plants such as, *Citrus*, *Bougainvillea*.Spines are found in cactus.

99. Answer (1)

Hint: Bacteria are the sole members of the kingdom, Monera.

Sol.: Bacterial structure is very simple but they are very complex in behaviour.

100. Answer (3)

Hint: *Mycoplasma* lack cell wall and are insensitive to penicillin.

Sol.: *Mycoplasma* are facultative anaerobes.

101. Answer (1)

Hint: In sac fungi, ascus is the site of karyogamy.

Sol.: The site of karyogamy and meiosis in smut fungi is basidium.

102. Answer (2)

Hint: Region of meristematic activity have soft delicate cells that can get damaged due to friction.

Sol.: Root cap protects the tender apex of the root as it makes its way through the soil. It is made up of parenchymatous cells.

103. Answer (4)

Sol.: Viruses have protein coat called capsid, made of small subunits called capsomeres that protects the nucleic acid.

104. Answer (2)

Hint: In monocots, the leaves show parallel venation.

Sol.: Reticulate venation is found in the leaves of dicot, *e.g.*, banyan

105. Answer (4)

Hint: Oomycetes are also called algal fungi.

Sol.: Eubacteria are also called true bacteria.

106. Answer (4)

Hint: Ascocarps are found in the members of Ascomycetes.

Sol.: *Aspergillus* produces ascocarps.

107. Answer (1)

Hint: *Alternaria* is considered as an imperfect fungus.

Sol.: *Neurospora* is used extensively in biochemical and genetic work.

108. Answer (2)

Hint: Fruiting bodies are the result of sexual reproduction.

Sol.: Deuteromycetes is commonly known as imperfect fungi because only the asexual or vegetative phase of these fungi are known.

109. Answer (3)

Hint: In *Alstonia*, more than two leaves arise at a node and form a whorl.

Sol.: In opposite phyllotaxy, a pair of leaves arise at each node and lie opposite to each other as in *Calotropis* and guava plants.

110. Answer (1)

Hint: Dikaryophase is the stage intervening between plasmogamy and karyogamy.

Sol.: The correct sequential order of events in the sexual cycle of *Penicillium:*

Plasmogamy $\rightarrow$ Dikaryophase $\rightarrow$ Karyogamy $\rightarrow$ Meiosis

111. Answer (4)

Hint: Most fungi are saprophytes.

Sol.: Toadstools are poisonous mushrooms.

112. Answer (3)

Hint: The given organism is a dividing bacterium

Sol.: 'X' represents the non-cellulosic cell wall.

'Y' represents the cell membrane.

'Z' represents the circular DNA.

113. Answer (4)

Hint: Chrysophytes include diatoms, the chief producers in the oceans.

Sol.: Chrysophytes include diatoms and desmids. They are microscopic and float passively in water currents. Cell wall is present.

114. Answer (4)

Hint: In a pinnately compound leaf, a number of leaflets are present on a common axis, the rachis.

Sol.: Pinnately compound leaf is found in neem.

115. Answer (2)

Hint: *Ustilago* is a smut fungus.

Sol.: *Rhizopus* – Fungus on moist bread, *i.e.,* bread mould.

Albugo – Causes White rust of crucifers.

Agaricus – Possesses umbrella like basidiocarp.

116. Answer (3)

Hint: Wheat rust is caused by *Puccinia.*

Sol.: In basidiomycetes, mycelium is branched and septate. Asexual spores are generally not found.

117. Answer (1)

Hint: Two kingdom classification does not distinguish between unicellular and multicellular organisms.

Sol.: Linnaeus classified all living organism into two kingdoms – Plantae and Animalia, on the basis of cell wall, locomotion, mode of nutrition, response to external stimulus and contractile system.

118. Answer (2)

Hint: In cymose inflorescence, flowers are borne in the basipetal succession.

Sol.: In racemose inflorescence, the shoot axis continue to grow indefinitely.

119. Answer (1)

Hint: Motile structures are absent in slime moulds.

Sol.: Fungi like features in the slime moulds is the formation of fruiting bodies.

120. Answer (4)

Hint: Sac fungi are ascomycetes that consist of branched and septate hyphae.

Sol.: In ascomycetes, sexual spores are produced endogenously in sac like asci and are the sites of karyogamy and meiosis, whereas, in basidiomycetes, sexual spores are produced exogenously.

121. Answer (4)

Hint: All single-celled eukaryotes, according to the five kingdom classification, are placed under the Kingdom, Protista.

Sol.: Protists reproduce asexually, and sexually by a process involving cell fusion and zygote formation.

122. Answer (4)

Hint: Suckers are found in banana, pineapple, *Chrysanthemum*.

Sol.: In suckers, the lateral branches originate from the basal and underground portion of the main stem. They grow below the surface of the soil to some distance and then emerge out obliquely to form the aerial roots.

123. Answer (3)

Hint: Marine forms of amoeboid protozoans have silica shells on their surface.

Sol.: Flagellated protozoans – The parasitic forms cause disease such as sleeping sickness.

Ciliated protozoans – They have a cavity (gullet) that opens to the outside of the cell surface.

Sporozoans – They include diverse organisms that have an infectious spore-like stage in their life cycle.

124. Answer (4)

Hint: Archaebacteria that live in marshy areas are called methanogens.

Sol.: Methanogens are obligate anaerobes and grow on cellulose-rich food in the rumen of cattles.

125. Answer (1)

Hint: Tendril can be a modified stem or leaf.

Sol.: Tendrils develop from the axillary buds of stems. Some leaves can also modify into tendrils, as in Pea. In watermelon, stem tendrils are present.

126. Answer (2)

Hint: They do not utilise light as energy source.

Sol.: Chemosynthetic autotrophic bacteria play a great role in recycling nutrients like nitrogen, phosphorous, iron and sulphur.

127. Answer (3)

Hint: Some epidermal cells of root, present closest to the stem base, form root hairs.

Sol.: From maturation region, some of the epidermal cells form very fine and delicate, thread-like structures called root hairs.

128. Answer (2)

Hint: Under unfavourable conditions, bacteria form endospore.

Sol.: Binary fission is the most common type of reproduction in bacteria.

129. Answer (2)

Hint: Cyanobacteria lack flagellum throughout their life.

Sol.: Cyanobacteria have chlorophyll *a* pigment, similar to higher plants, to perform photosynthesis.

130. Answer (2)

Hint: Fungi do not perform photosynthesis.

Sol.: Fungi show saprophytic or parastic mode of nutrition.

131. Answer (1)

Hint: In plants, root system develops from radicle.

Sol.: In majority of dicotyledonous plants, the direct elongation of the radicle leads to the formation of primary root which grows inside the soil.

132. Answer (3)

Hint: Shoot or root tip of plants are not affected by viral infection.

Sol.: For a virus to replicate, its genome must be released into the cytoplasm of the host.

133. Answer (2)

Hint: Bacteria may be autotrophic or heterotrophic.

Sol.: Members of the kingdom Monera show autotrophic (chemosynthetic and photosynthetic) or heterotrophic mode of nutrition and aerobic or anaerobic mode of respiration.

134. Answer (1)

Hint: Phylogenetic relationship was not considered by Linnaeus.

Sol.: Presence or absence of cell wall was a common criteria that was used by both Linnaeus and Whittaker in their systems of classification.

135. Answer (4)

Hint: Kingdom Protista includes unicellular eukaryotes.

Sol.: Kingdom Animalia includes heterotrophic, eukaryotic, multicellular organisms lacking cell wall.

[ZOOLOGY]

136. Answer (2)

Hint: There are two unpaired facial bones.

Sol.: Sternum is a flat bone on ventral midline of the thorax. Facial region is formed by 14 skeletal elements in which 6 bones are paired and two bones are unpaired. The number of cervical vertebrae are seven in almost all mammals including humans but in *Manatee* only six cervical vertebrae are present. Each vertebra has a central canal (neural canal) through which the spinal cord passes.

137. Answer (4)

Hint: Head of meromyosin acts as an active ATPase.

Sol.: HMM consists of globular head and a short arm. Both are collectively called cross arm. Two binding sites for ATP and two binding sites for actin are present on head of cross arm. So, short arm is devoid of any binding sites.

138. Answer (1)

Hint: Equal to the total number of bones in pectoral girdle.

Sol.: Actin filament is formed by two 'F' actins helical wound to each other and are considered as filamentous proteins. Two filaments of another protein, tropomyosin also run close to the 'F' actins throughout its length. A complex protein troponin is distributed at regular intervals on the tropomyosin which are globular proteins.

139. Answer (4)

Hint: Ascending limb is permeable to electrolytes.

Sol.: NaCl is transported by ascending limb of Henle's loop which is exchanged with descending limb of vasa recta. NaCl is returned to the interstitium through ascending portion of vasa recta. Henle's loop and vasa recta through counter current mechanism, play a significant role to produce a concentrated urine in mammals.

140. Answer (3)

Hint: Lactic acid is present in sweat.

Sol.: Liver secretes bile-containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs. Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum.

141. Answer (4)

Hint: Osmotic change affects osmoreceptors.

Sol.: Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration.

142. Answer (2)

Hint: Clavicle is placed in our body in horizontal plane.

Sol.: In humans, the dorsal flat, triangular body of scapula has a slightly elevated ridge called the spine which projects as a flat expanded process called the acromion. Lateral end of clavicle (collar bone) articulates with acromion to form acromio-clavicular joint. Medial end of collar bone articulates with sternum to form sterno-clavicular joint.

143. Answer (1)

Hint: Consider the movements performed by involuntary muscles.

Sol.: Joints are essential for all types of movements involving the bony parts of the body. But joints are not involved in movements associated with cardiac and smooth muscles. Locomotory movements are no exception to joints. Joints are the points of contact between bones or between bones and cartilages. Joints act as fulcrum in the various locomotory movements.

144. Answer (4)

Hint: It is equal to the total number of false ribs.

Sol.: Total number of ear ossicles = 6

Total number of girdle bones = 6

Total number of cervical vertebrae = 7

Total number of tarsals = 14

Total number of cranial bones = 8

145. Answer (2)

Hint: One per cent of GFR per day is 1.8 L

Sol.: GFR/day = 180 L

Urine passed out per day = 180 L $\times$1/100 = 1800 mL

$\because$ 30 g of urea is present in 1800 mL of urine

$\therefore$ 1 g of urea will be present in 1800 mL/30 g = 60 mL of urine

146. Answer (1)

Hint: Hemodialysis is performed for such type of physiological conditions.

Sol.: Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia. Our lungs remove large amounts of CO_2 approximately 200 mL/min or 12 L / hour. A small amount of urea is excreted through sweat glands and salivary glands. Sebum is excreted out through sebaceous glands.

147. Answer (4)

Hint: Osmotic gradient

Sol.: Passage of molecules through porous cellophane membrane is independent of solubility of molecules. It depends upon concentration gradient of molecules between blood plasma and dialysing fluid.

148. Answer (2)

Hint: CNS passes on motor messages to initiate contraction of smooth muscle.

Sol.: When urine is accumulated in urinary bladder to a certain amount, the stretch receptors present on the wall of urinary bladder send signals to the CNS. Now CNS gives voluntary signals which passes through motor nerve fibres to urinary bladder and carries contraction of smooth muscles of urinary bladder and simultaneous relaxation of urethral sphincter causing the release of urine to outside through urethra.

149. Answer (2)

Hint: Wrist bones

Sol.:

Name of bone(s)		Common name(s)
1. Clavicle	-	Collar bone
2. Carpals	-	Wrist bones

3. Metacarpals - Palm bones
4. Sternum - Breast bone
5. Femur - Thigh bone

150. Answer (4)

Hint: It is secreted from atrial wall.

Sol.: Renin, vasopressin and aldosterone are synergestic w.r.t. increase in blood volume and blood pressure. They all concentrate the urine by retaining water and electrolytes in the body. Atrial natriuretic factor is responsible for loss of water and electrolytes through urine by increasing vasodilation of afferent arteriole and thus, favour the formation of large quantities of dilute urine.

151. Answer (2)

Hint: Myosin pulls attached actin filaments towards the centre of 'A' band.

Sol.: According to sliding filament theory, only actin filaments slide over myosin filaments which leads to decrease in length of sarcomere. Length of actin filaments, myosin filaments and 'A' band remains unchanged but length of 'I' band and 'H' zone decreases whereas length of overlapping zone between actin and myosin filaments increases during muscle contraction.

152. Answer (4)

Hint: Nitrogenous wastes are absent in dialysing fluid.

Sol.: Dialysing fluid contains all the constituents as in plasma except nitrogenous wastes. On an average, human kidneys can produce urine nearly four times concentrated than initial filtrate formed.

153. Answer (2)

Hint: Functional unit of a skeletal muscle fibre.

Sol.: Muscle fibre is the structural unit of a muscle. Sarcomere is considered as functional unit of muscle contraction. Any movement which leads to change in position of animal is called locomotion. Muscle fatigue is due to accumulation of lactic acid.

154. Answer (2)

Hint: Sacrum is connected with coxal bones on each side

Sol.: Pelvic girdle consists of two coxal bones, one on each side of the body. Each coxal bone is formed by fusion of ilium, ischium and pubis during embryonic development. Sacrum is connected with coxal bones on each side dorsally but ventrally they are joined with each other forming pubic symphysis.

155. Answer (1)

Hint: Most toxic nitrogenous waste

Sol.: Maximum reabsorption of nutrients, electrolytes and water occurs in PCT but this part is also responsible for secretion of H^+ and NH_3.

156. Answer (3)

Hint: Suffix 'itis' represents inflammation.

Sol.: Muscular dystrophy is a genetic disorder in which progressive degeneration of skeletal muscle takes place.

Tetany is characterised by rapid spasms in muscle due to low Ca^{+2} in body fluids.

Arthritis is inflammation of joints due to any reason but when it is due to accumulation of uric acid crystals in the region of joints, it is called gout.

157. Answer (2)

Hint: Bone forming suture with parietal bones.

Sol.: Sphenoid and ethmoid form the floor of cranial cavity. Occipital bone forms the posterior part of cranial cavity and frontal bone forms the anterior most part of the roof of cranial cavity as well as bony part of forehead.

158. Answer (3)

Hint: Smooth muscles are present in visceral organs.

Sol.: Smooth muscles are also known as non-striated involuntary muscles. These muscles are found in the wall of digestive tract and genital tract and are responsible for the transportation of food through digestive tract and gametes through the genital tract respectively.

159. Answer (2)

Hint: Equal to the total number of bones in pectoral girdle.

Sol.: Muscle fibres have special properties like excitability, extensibility, contractility and elasticity. Excitability is a common feature of both muscles and nerve fibres.

160. Answer (1)

Hint: Muscle classified on basis of their appearance.

Sol.: Based on their location, three types of muscles are identified: (i) skeletal, (ii) visceral and (iii) cardiac.

On the basis of their appearance, muscles are classified into two categories: (i) striated/striped and (ii) unstriated/unstriped. Based on the nature of regulation of their activities, muscles are also classified into two categories: (i) voluntary and (ii) involuntary.

161. Answer (3)

Hint: Tongue has voluntary muscles.

Sol.: Coordinated movements of cilia present in trachea are helpful in removing dust particles and some of the foreign substances inhaled along with atmospheric air. Passage of ova through the female reproductive tract is also facilitated by ciliary movements. In *Paramoecium*, cilia helps in the movement of food through cytopharynx and in locomotion as well. Tongue present in human's buccal cavity performs muscular movement due to presence of skeletal voluntary muscle in it.

162. Answer (2)

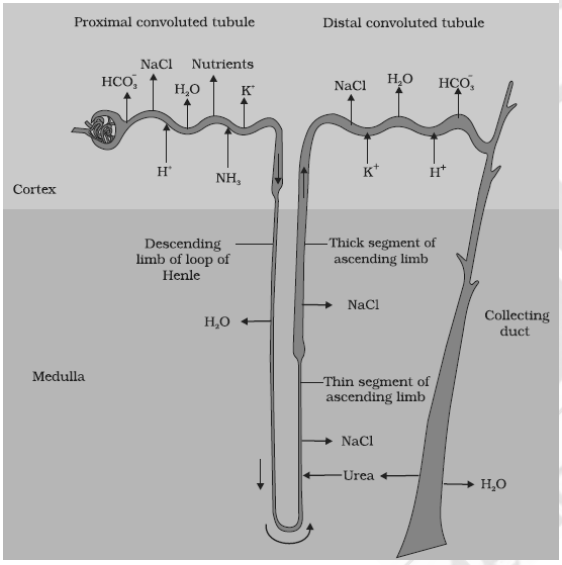
Hint: Cytoskeleton is helpful in locomotion.

Sol.: Amoeboid movement is exhibited by leucocytes, macrophages and *Amoeba*. It is affected by pseudopodia formed by streaming of protoplasm. Cytoskeletal elements like microfilaments are also involved in amoeboid movement. Actin and myosin filaments are found in sarcoplasm of muscles in a regular array.

163. Answer (2)

Hint: Selective secretion of H^+ is done to maintain pH and ionic balance.

Sol.:



164. Answer (2)

Hint: Cardiac muscles are striated and involuntary.

Sol.: All locomotions are movements but all movements are not locomotions. Cardiac muscles are striated but they are involuntary. Smooth muscles are involuntary but all involuntary muscles are not smooth, *e.g.* cardiac muscles.

165. Answer (1)

Hint: Least amount of water is required for elimination of uric acid.

Sol.: Ammonia is the most toxic and highly diffusible. So, it is not stored in the body and diffuses out in water as it is formed. Urea and uric acid, being lesser toxic can be retained in the body for certain time. Less water is required in elimination of urea and uric acid. So, production of urea and uric acid is a terrestrial adaptation for conservation of water.

166. Answer (4)

Hint: Ammonia is converted into urea in the liver of humans.

Sol.: In humans, urea is synthesized within liver by ornithine cycle from ammonia and CO_2. It is mostly eliminated from the body by kidneys but small amounts of urea is also excreted through sweat and saliva.

167. Answer (3)

Hint: Fibrous cartilage is present in pubic symphysis

Sol.: Pubic symphysis is a type of cartilaginous joint because fibrous cartilage is present in between two pelvic bones. Saddle joint and gliding joint are synovial joints. Bones fuse end to end in fibrous joint by dense fibrous connective tissue.

168. Answer (2)

Hint: Flame cells are found in platyhelminths.

Sol.: Protonephridia or flame cells are excretory structures in platyhelminths, *e.g.* *Planaria*. Malpighian tubules are the main excretory structures in insects.

Nephridia are the main excretory structures in annelids and green glands are the excretory structures in aquatic arthropods *e.g.*, Crustaceans (Prawns).

169. Answer (2)

Hint: Aquatic animals are generally ammonotelic.

Sol.: Amphioxus – Ammonotelic

Land snail, wall lizard, ostrich – Uricotelic

Toad, Monkey – Ureotelic

170. Answer (1)

Hint: In bony fishes, main excretory organ has no significant role in excretion of ammonia.

Sol.: Many bony fishes, aquatic insects and aquatic amphibians, generally excrete ammonia by diffusion across body surfaces (amphibians) or through gill surfaces (in fish) as ammonium ions. Kidneys do not play any significant role in its removal.

171. Answer (3)

Hint: Ammonia is the most toxic nitrogenous waste.

Sol.: Ammonia is the most toxic form and requires large amount of water for its elimination whereas uric acid being the least toxic can be removed with a minimum loss of water.

172. Answer (3)

Hint: Filtrate formed by both kidneys per day is about 180 L.

Sol.: In normal adult human about 180 L of glomerular filtrate is formed per day by both kidneys. So, only 90 L of glomerular filtrate is formed by each kidney per day.

173. Answer (1)

Hint: Actin filaments are present in 'I' band.

Sol.: Myofibrils have alternate dark and light bands on them because dark band contains thick myosin filaments and thin actin filaments while light band contains only thin actin filaments. So, skeletal muscle fibres are also called striated muscle fibres.

174. Answer (4)

Hint: Skeletal system also includes cartilages.

Sol.: Skeletal system consists of both bones and cartilages. It does not play any role in movements of body parts carried out by involuntary muscles. Our skull is dicondylic because two occipital condyles of occipital bone articulate with two facets present on superior surface of atlas.

175. Answer (2)

Hint: Collecting duct receives DCTs of many nephrons.

Sol.: Glomerular capillaries along with podocytes present in Bowman's capsule form filtration membrane which is responsible for filtration of blood. Glomerulus is a part of nephron but is not a part of renal tubule. Renal tubule is differentiated into Bowman's capsule, PCT, Loop of Henle and DCT. So, nephron consists of two parts renal corpuscle (glomerulus + Bowman's capsule) and renal tubule. So, collecting duct is not a part of nephron but helps in maintaining pH and ionic balance of the blood.

176. Answer (3)

Hint: Junction between neuron and sarcolemma of a muscle fibre.

Sol.: Stimulation of a muscle fibre by a motor neuron occurs at the neuromuscular junction. Junction between a motor neuron and sarcolemma of a muscle fibre is called neuro-muscular junction or motor-end plate.

177. Answer (4)

Hint: Formed by fusion of three bones

Sol.: Femur is commonly known as thigh bone which articulates with a cavity formed by fusion of three bones; ilium, ischium and pubis. Pubic symphysis is a type of cartilaginous joint between two pubic bones ventrally. Pubic symphysis does not participate in formation of acetabulum.

178. Answer (2)

Hint: Pivot joint is a freely movable joint.

Sol.: The 1st and 2nd vertebrae of vertebral column are called atlas and axis respectively which articulate with each other to form a pivot joint that is a type of synovial joint. So, synovial cavity with synovial fluid is present in joint space between atlas and axis. Adipose tissue is present beneath the skin, intercalated disc is present in cardiac muscle and interverterbal disc is present in between two adjacent vertebrae forming cartilaginous joint. An osteoligamentous ring is associated with formation of pivot joint.

179. Answer (3)

Hint: Participates in formation of juxta-glomerular apparatus

Sol.: JG cells of afferent arteriole are responsible for synthesis and release of renin which is responsible for increase in blood pressure and thus, GFR by acting through renin-angiotensin mechanism. Specialised cells of DCT along with JG cells form a complex structure called JGA that regulates blood pressure.

180. Answer (3)

Hint: Minimum water is required for its elimination among all the nitrogenous wastes

Sol.: Uric acid is the main nitrogenous excretory waste produced by birds and reptiles. It is least toxic and requires minimum amount of water for its elimination. Ammonia is the most toxic waste and requires large amount of water for its elimination.

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