All India Aakash Test Series for NEET - 2026

TEST - 4 (Code-E)

Click here for Code-F Sol

Test Date : 18/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (4)

Hint: Equation of a plane progressive harmonic wave travelling along positive x-axis is given by, $y = A\sin(\omega t - kx + \phi)$

Sol.: After looking at the snapshot, at $t = 0$, $x = 0$, $y = -0.5$ and wave is travelling along positive x-axis hence, equation will be $\sin\left(\omega t - kx - \frac{\pi}{6}\right)$

2. Answer (1)

Hint: Phase difference between two particles separated by certain distance, Δx would be, $\Delta\phi = \frac{2\pi}{\lambda} \times \Delta x$

Sol.: Path difference between the two given points

$$= \frac{\lambda}{2} - \frac{\lambda}{8} + \frac{\lambda}{4} = \frac{4\lambda - \lambda + 2\lambda}{8} = \frac{5\lambda}{8}$$

$$\Rightarrow \quad \Delta\phi = \frac{2\pi}{\lambda} \times \frac{5\lambda}{8} = \frac{5\pi}{4}$$

3. Answer (3)

Hint: For SHM, $a = -\omega^2 x$

Sol.: a versus x graph will be straight line passing through origin having negative slope.

4. Answer (4)

Hint and Sol.: For a particle executing SHM

$y = A\sin\omega t$

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

So, Kinetic energy K is given by

$$K = \frac{1}{2} mA^2\omega^2 \cos^2 \omega t$$

If a particle executes SHM with frequency f then its kinetic energy oscillates with frequency $2f$.

5. Answer (2)

Hint: Time period of simple pendulum, $T = 2\pi\sqrt{\frac{\ell}{g_{\text{eff}}}}$

Sol.: When lift moves upward with constant velocity v, $T = 2\pi\sqrt{\frac{\ell}{g}}$

When lift moves upward with constant acceleration $\frac{g}{4}$

$$g_{\text{eff}} = g + \frac{g}{4} = \frac{5g}{4}$$

$$\Rightarrow \quad T \times \sqrt{g} = T'\sqrt{\frac{5g}{4}} \Rightarrow T' = \frac{2T}{\sqrt{5}}$$

6. Answer (4)

Hint: Time period of a spring-mass system, $T = 2\pi\sqrt{\frac{m}{k}}$

Sol.: Since the block is compressed to distance $2a$ and released, hence time taken to reach mean position is $\frac{T}{4}$. From mean position to cover the distance half the amplitude, time taken will be $\frac{T}{12}$.

Total time = $\frac{T}{4} + \frac{T}{12} = \frac{3T + T}{12} = \frac{4T}{12} = \frac{T}{3}$

$$\Rightarrow \quad \frac{1}{3} \times 2\pi\sqrt{\frac{m}{k}} = \frac{2\pi}{3}\sqrt{\frac{m}{k}}$$

7. Answer (1)

Hint and Sol.: Both (A) and (R) are false. Work done is a path function, hence it does not depend only on initial and final position.

8. Answer (2)

Hint: Use first law of thermodynamics

Sol.: $\Delta Q = \Delta U + \Delta w$, $(\Delta U)_1 = (\Delta U)_2$ but $(\Delta w)_2 > (\Delta w)_1$

$\Rightarrow$ $(\Delta Q)_2 > (\Delta Q)_1$ for same temperature difference

$$\Rightarrow \quad \frac{C_1}{C_2} < 1$$

9. Answer (3)

Hint: For an adiabatic process, $PV^{\gamma} = C$

Sol.: $PV^{\gamma} = C$ and $PV = nRT$

$$\Rightarrow P\left[\frac{nRT}{P}\right]^{\gamma} = C$$

$$\Rightarrow \frac{T^{\gamma}}{P^{\gamma-1}} = C_0$$

$$\Rightarrow T^{\gamma} \propto P^{\gamma-1}$$

$$\Rightarrow P \propto (T)^{\frac{\gamma}{\gamma-1}}$$

$$\gamma_{\text{diatomic}} = \frac{7}{5}$$

$$\Rightarrow \alpha = \frac{\frac{7}{5}}{\frac{7}{5}-1} = \frac{\frac{7}{5}}{\frac{2}{5}} = \frac{7}{2}$$

10. Answer (1)

Hint: Use, $\eta_{\text{Carnot}} = 1 - \frac{T_2}{T_1}$

Sol.: $\eta_{\text{Carnot}} = 1 - \frac{300}{600} = 1 - \frac{1}{2} = \frac{1}{2}$

11. Answer (3)

Hint and Sol.:

- $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

  hence, $V_{\text{rms}} \propto \sqrt{T}$
- Temperature may increase or decrease while heat is being extracted from a system.

12. Answer (2)

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

where d = diameter of molecule of gas

13. Answer (3)

Hint: Use, $C_V = \frac{fR}{2}$ and $C_P - C_V = R$

Sol.: $\gamma = \frac{\frac{fR}{2} + R}{\frac{fR}{2}} = \frac{(f+2)\frac{R}{2}}{\frac{fR}{2}} = 1 + \frac{2}{f}$

14. Answer (1)

Hint: Use ideal gas equation

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

$$\Rightarrow V \times \left[\frac{nRT}{V}\right]^2 = C$$

$$\Rightarrow \frac{T^2}{V} = C_0$$

$$\Rightarrow \frac{T_0^2}{V_0} = \frac{T^2}{3V_0}$$

$$\Rightarrow T^2 = 3T_0^2$$

$$\Rightarrow T = \sqrt{3}T_0$$

15. Answer (1)

Hint: Use, $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

Sol.: $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

Since, $M_{H_2} < M_{O_2}$

$$\Rightarrow v_{H_2} > v_{O_2}$$

$$\Rightarrow v_1 > v_2$$

16. Answer (4)

Hint: Use, $C_{V,\text{mix}} = \frac{n_1C_{V_1} + n_2C_{V_2}}{n_1 + n_2}$

Sol.: $C_{V,\text{mix}} = \frac{2 \times \frac{3R}{2} + 3 \times \frac{5R}{2}}{5} = \frac{\frac{6R}{2} + \frac{15R}{2}}{5} = \frac{21R}{10}$

$= 2.1R$

17. Answer (1)

Hint and Sol.: Both (A) and (R) are correct but (R) is not correct explanation as there is no restriction to change in length, hence no stress would be developed.

18. Answer (2)

Hint: Use Newton's law of cooling

Sol.: We know that, rate of cooling $\propto \left|\frac{T_1 + T_2}{2} - T_0\right|$

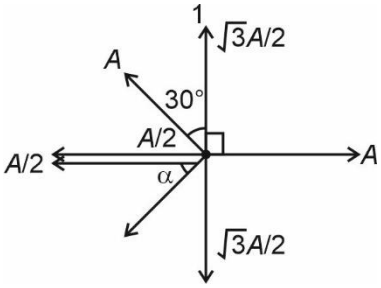
Rate of cooling is proportional to temperature difference of body and surrounding.

Hence, $t_1 < t_2 < t_3$

19. Answer (2)

Hint: Use the concept of phasors

Sol.:



$$A_{req} = \sqrt{\left(\frac{\sqrt{3}A}{2}\right) + \left(\frac{A}{2}\right)^2} = A$$

$\tan\alpha = 60°$

$\Rightarrow \phi = 240°$

20. Answer (3)

Hint and Sol.: $x = a\sin(\omega t) + b\cos(\omega t)$

$\Rightarrow x = \sqrt{a^2 + b^2}\sin(\omega t + \phi)$

$\Rightarrow A = \sqrt{a^2 + b^2}$

21. Answer (4)

Hint and Sol.: The logarithmic and exponential function will represent non-periodic motion.

22. Answer (1)

Hint: Velocity of transverse wave on string, $v = \sqrt{\frac{T}{\mu}}$

Sol.: $v = \sqrt{\frac{T}{\mu}}$

$\Rightarrow v \propto \sqrt{T}$

$\Rightarrow \frac{v_i}{v_F} = \sqrt{\frac{T}{3T}} = \frac{1}{\sqrt{3}}$

23. Answer (1)

Hint and Sol.:

Beat frequency = $|f_1 - f_2| = |450 - 446| = 4$ Hz

24. Answer (4)

Hint: Average velocity $= \frac{\text{Total displacement}}{\text{Total time}}$

Sol.: Since net displacement in one time period is zero, hence average velocity would be zero.

25. Answer (2)

Hint: Use, $F = \frac{9}{5}C + 32$

Sol.: $\Delta F = \frac{9}{5}\Delta C \Rightarrow \Delta F = \frac{9}{5} \times 45 = 81°$

26. Answer (4)

Hint: Use Wien's displacement law

Sol.: $\lambda_0 \times T = \frac{\lambda_0}{2} \times T'$

$\Rightarrow T' = 2T$

Also, $P \propto T^4$

$\Rightarrow \frac{P'}{P} = \frac{16T^4}{T^4}$

$\Rightarrow P' = 16P$

$\Rightarrow n = 16$

27. Answer (4)

Hint: Maximum particle velocity, $v_{max} = A\omega$

Sol.: $V_{max} = A\omega$, $V_{wave} = \frac{\omega}{k}$

$\Rightarrow$ Ratio $= \frac{A\omega}{\frac{\omega}{k}} = kA$

28. Answer (1)

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

Sol.: $v_{sound} = \sqrt{\frac{\gamma RT}{M}}$, at NTP temperature will be fixed

$\Rightarrow v \propto \frac{1}{\sqrt{M}}$, $M_{mix} = \frac{4}{5} \times 2 + \frac{1}{5} \times 32 = 8$ g

$\Rightarrow 1328 \times \sqrt{2} = v\sqrt{8}$

$\Rightarrow v = 664$ m/s

29. Answer (2)

Hint: In closed organ pipe, only odd harmonics exist

Sol.: According to question, $7f_0 - 3f_0 = 200$

$\Rightarrow 4f_0 = 200$

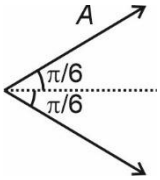
$\Rightarrow f_0 = 50$ Hz

30. Answer (2)

Hint: Use the concept of phasors

Sol.:

$$y_1 = A\sin\left(\omega t - Kx - \frac{\pi}{6}\right) \text{ and } y_2 = A\sin\left(\omega t - Kx + \frac{\pi}{6}\right)$$



$\Rightarrow \quad y_{res} = \sqrt{3}A\sin(\omega t - Kx)$

31. Answer (3)

Hint and Sol.: The speed of sound depends on elastic property of medium, hence it is highest in solids.

32. Answer (3)

Hint and Sol.: The particle starts its motion from extreme position, hence it will be at mean position at $\frac{3T}{4}$ where net force equals zero. At $t = T$, the particle is at one extreme, hence acceleration would be maximum. For, PE = KE, $x = \pm\frac{A}{\sqrt{2}}$

$\Rightarrow$ Hence statements a, b and c are correct

33. Answer (2)

Hint: Use first law of thermodynamics

Sol.: $\Delta w = \frac{1}{2}\times 4\times 40 = -80$ J

$Q_{BC} = 120$ J

$Q_{AB} = W_{AB} + (\Delta U)_{AB}$

$= 20(4) + 20 = 100$ J

$Q_{AB} + Q_{BC} + Q_{CA} = \Delta w$

$100 + 120 + Q_{CA} = -80$, $Q_{CA} = -300$ J

34. Answer (1)

Hint: Use first law of thermodynamics

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

$\Rightarrow \quad \Delta U = \Delta Q - \Delta w$

$\Rightarrow \quad \Delta U = 150 - 80 = 70$ J

35. Answer (3)

Hint: Process AB is an isothermal process.

Sol.: Work done in isothermal process.

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

$$W_{A-B} = nRT\ln\left|\frac{P_1}{P_2}\right| = 3 \times R \times 2T_0\ln(2)$$

$= 6RT_0\ln(2)$

36. Answer (1)

Hint: Use Fourier's law of conduction

Sol.: $\frac{\Delta Q}{\Delta t} = \frac{K\times A\times(T_2 - T_0)}{d} = \frac{3K\times A\times(T_0 - T_1)}{3d}$

$\Rightarrow \quad T_2 - T_0 = T_0 - T_1$

$\Rightarrow \quad T_2 + T_1 = 2T_0$

$\Rightarrow \quad T_0 = \frac{T_2 + T_1}{2}$

37. Answer (2)

Hint: Use, $Q = ms\Delta T$

Sol.: Here specific heat is variable. So, for unit mass

$\Rightarrow \quad dQ = 1 \times (at^2 + bt + c)dt$

$\Rightarrow \quad dQ = at^2dt + btdt + cdt$

$$\Rightarrow \quad Q = \left[\frac{at^3}{3}\right]_0^{t_0} + \left[\frac{bt^2}{2}\right]_0^{t_0} + [ct]_0^{t_0}$$

$$\Rightarrow \quad Q = \frac{at_0^3}{3} + \frac{bt_0^2}{2} + ct_0$$

38. Answer (3)

Hint: Use principle of calorimetry.

Sol.: Heat lost = Heat gained

$\Rightarrow \quad x \times 540 = y \times 80 + y \times 1 \times 100$

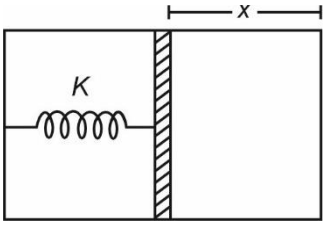
$\Rightarrow \quad 540x = 180y$

$\Rightarrow \quad \frac{x}{y} = \frac{1}{3}$

39. Answer (3)

Hint: Use first law of thermodynamics and $PV = nRT$.

Sol.:



Let dQ heat is given to the system, then spring is compressed by dx and change in PE of spring

$$U = \frac{1}{2}Kx^2$$

$$\Rightarrow F = \left|\frac{dU}{dx}\right| = Kx$$

Now using FLOT

$dQ = dU + dW$

$CdT = nC_V dT + Kxdx$ …(i)

But $Kx = PA$ and $PV = nRT$

$$\Rightarrow PAx = nRT \Rightarrow PA = \frac{nRT}{x}$$

$$\Rightarrow Kx = \frac{nRT}{x}$$

$\Rightarrow Kx^2 = nRT \Rightarrow 2Kxdx = nRdT$ …(ii)

From equation (i) and (ii)

$$CdT = nC_V dT + \frac{nRdT}{2} = \frac{5}{2}nRdT + \frac{nRdT}{2}$$

$$\Rightarrow C = 3nR = \frac{3P_0V_0}{T_0}$$

40. Answer (1)

Hint: Use Fourier's law of conduction

Sol.: $\frac{dQ}{dT} = \frac{-K \times A \times dT}{dr}$

$$\left[\frac{dQ}{dT} = P\right]$$

$$\Rightarrow \quad P = \frac{-K \times 4\pi r^2 \times dT}{dr}$$

$$\Rightarrow \quad \frac{dr}{r^2} = \frac{-K \times 4\pi \times dT}{P}$$

$$\Rightarrow \quad \int_a^b \frac{dr}{r^2} = -\frac{4\pi K}{P} \times \int_{T_1}^{T_2} dT$$

$$\Rightarrow \quad P = \frac{4\pi Kab(T_1 - T_2)}{b - a}$$, where P will be the power of the source.

41. Answer (3)

Hint and Sol.: Given $dQ = 4dU$

$$\Rightarrow \quad nC\Delta T = 4 \times n \times C_V \times \Delta T$$

$$\Rightarrow \quad C = \frac{4 \times 3R}{2} = 6R$$

42. Answer (4)

Hint and Sol.: Since $\Delta V = 0$

$\Rightarrow \Delta W = 0$ while ΔP, ΔQ, ΔU are non-zero

43. Answer (2)

Hint and Sol.: During adiabatic compression of an ideal gas work is done on the system which increases internal energy of the system.

44. Answer (1)

Hint: $\Delta U = nC_V\Delta T$

Sol.: $$\Delta U = \alpha \times \frac{R}{\gamma - 1}(T_2 - T_1) = \frac{1}{\gamma - 1}(P_2V_2 - P_1V_1)$$

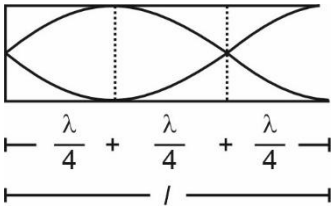
$$= \frac{P_2V_2 - P_1V_1}{\gamma - 1}$$

45. Answer (1)

Hint: In closed organ pipe.

$\lambda_n = \frac{4l}{(2n-1)}$; for n[th] mode of vibration.

Sol.: The third harmonic or 2[nd] mode of vibration $n = 2$.



$$\lambda = \frac{4l}{3} \text{ or } l = \frac{3\lambda}{4}$$

From given equation;

$y = 3\sin\pi x\cos\pi t$

$K = \pi$ and $\omega = \pi$

$$\Rightarrow K = \frac{2\pi}{\lambda} = \pi \Rightarrow \lambda = 2 \text{ m}$$

[CHEMISTRY]

46. Answer (2)

Hint: Henry's law : $P = K_H \chi$

Sol.: $P = K_H \chi$

$$\chi = \frac{1}{K_H} \times P \ldots(i)$$

$y = m \times x \quad \ldots(ii)$

On comparing (i) and (ii)

$$\text{Slope} = m = \frac{1}{K_H}$$

Decreasing order of slope:

A > B > C

Decreasing order of K_H :

C > B > A

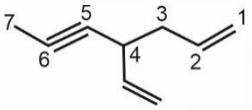
47. Answer (3)

Hint: A catalyst does not alter ΔG of a reaction.

Sol.: A catalyst can only change the rate of reaction of spontaneous reaction.

48. Answer (4)

Hint: Parent chain must contain maximum number of multiple bonds along with highest number of carbon atoms in it.

Sol.: 

4-Ethenylhept-1-en-5-yne

49. Answer (1)

Hint: $i = 1 + (n - 1)\alpha$

i = van't Hoff factor

n = Number of ions

α = Degree of dissociation

Sol.:

(a) $i = 1 + 4 \times 0.6 = 3.4$

(b) $i = 1 + 1 \times 0.9 = 1.9$

(c) $i = 1 + 3 \times 0.7 = 3.1$

(d) $i = 1 + 1 \times 0.5 = 1.5$

50. Answer (2)

Hint: Rate law expression is given by slow step (rate determining step).

Sol.: Rate = $k [N_2O_2] [H_2]$

$$K_{eq} = \frac{[N_2O_2]}{[NO]^2}$$

$$[N_2O_2] = K_{eq}[NO]^2$$

Rate = $k K_{eq} [NO]^2 [H_2]$

Rate = $k' [NO]^2 [H_2]$

Overall order = 3

51. Answer (4)

Hint: Presence of enolisable hydrogen is required.

Sol.: α-H cannot be taken from bridgehead position.

52. Answer (3)

Hint: Binary mixture of A and B shows negative deviation from Raoult's law.

Sol.:

- Solution which shows negative deviation from Raoult's law can form maximum boiling azeotropic mixture.
- $\Delta_{mix}H < 0$ and $\Delta_{mix}V < 0$
- Mixture of n-hexane and n-heptane forms ideal solution.
- Mixture of ethanol and acetone shows negative deviation from Raoult's law.
- Interparticle attractive forces between A and B is stronger than those between A-A and B-B.

53. Answer (2)

Hint: 188 g AgBr contains 80 g bromine

Sol.: 188 g AgBr contains 80 g Br

0.846 g AgBr contains $\frac{80 \times 0.846}{188}$ g of Br

Percentage of bromine in the compound

$$= \frac{80 \times 0.846 \times 100}{188 \times 0.8} = 45\%$$

54. Answer (4)

Hint: Nitrogen, sulphur, halogens (Cl, Br, I) and phosphorus present in an organic compound are detected by Lassaigne's test.

Sol.: Lead sulphide is black in colour.

55. Answer (3)

Hint: $i = 1 + (n - 1)\alpha$

$[H^+] = C\alpha$

Sol.: pH = 1

$[H^+] = 10^{-1} = C\alpha$

$$\alpha = \frac{10^{-1}}{1}$$

$i = 1 + (n - 1)\alpha$

$n = 2$

$i = 1 + (2 - 1)\ 10^{-1}$

$i = 1 + 0.1$

$i = 1.1$

56. Answer (3)

Hint: rate = $k\ [NO]^x[Cl_2]^y$

Sol.: x = order w.r.t. NO and y = order w.r.t. Cl_2

(i) $1.2 \times 10^{-4} = k\ (0.01)^x\ (0.01)^y$

(ii) $2.4 \times 10^{-4} = k\ (0.01)^x\ (0.02)^y$

Dividing the equation (i) by (ii)

$$\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^y$$

$y = 1$

(iii) $9.6 \times 10^{-4} = k\ (0.02)^x\ (0.02)^y$

Dividing the equation (ii) by (iii)

$$\frac{1}{4} = \left(\frac{1}{2}\right)^x$$

$$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x$$

$x = 2$

Putting values of x and y in equation (i)

$1.2 \times 10^{-4} = k\ (0.01)^2\ (0.01)^1$

$$k = \frac{1.2 \times 10^{-4}}{10^{-2} \times 10^{-4}}$$

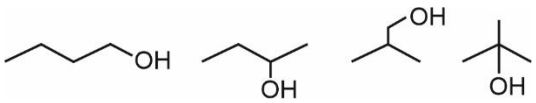
$k = 1.2 \times 10^2$

$k = 120\ mol^{-2}\ L^2\ s^{-1}$

57. Answer (4)

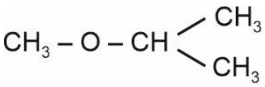
Hint: $C_4H_{10}O$ has zero degree of unsaturation. Alcohols and ethers are possible for the given molecular formula.

Sol.: Alcohols with $C_4H_{10}O$ molecular formula



Ethers with $C_4H_{10}O$ molecular formula

$CH_3 - O - CH_2 - CH_2 - CH_3$



$CH_3 - CH_2 - O - CH_2 - CH_3$

58. Answer (2)

Hint and Sol.: On using catalyst activation energy decreases from E_a to E'_a

$E_a - E_a' = 24.492\ kJmol^{-1}$

$$\ln k = \ln A - \frac{E_a}{RT}$$

$$\ln k' = \ln A - \frac{E_a'}{RT}$$

$$\ln\left(\frac{k'}{k}\right) = \frac{\left(E_a - E_a'\right)}{RT}$$

$$= \frac{24.942 \times 10^3}{8.314 \times 750}$$

$= 4$

$$\frac{k'}{k} = e^4$$

59. Answer (1)

Hint: For first order reaction;

$$kt = 2.303 \log \frac{P_i \text{ of } N_2O_5}{P_f \text{ of } N_2O_5}$$

Sol.:

	N_2O_5	$\rightarrow$	$2NO_2$	+	$\frac{1}{2}O_2$
t = 0	40		–		–
t = 50 min	40 – x		2x		$\frac{x}{2}$

Total pressure at 50 min = $40 - x + 2x + \frac{x}{2}$

$$70 = 40 + \frac{x \times 3}{2}$$

$$\frac{3x}{2} = 30$$

$$\boxed{x = 20}$$

Pressure of N_2O_5 at 50 min = 40 – 20 = 20

50 min is $t_{½}$

100 min is $2t_{½}$

Pressure of N_2O_5 at 100 min = 10 mm Hg

Total pressure at 100 min = $40 + \frac{x \times 3}{2}$

At 100 min, 40 – x = 10

x = 30

Total pressure at 100 min = $40 + \frac{3 \times 30}{2}$

= 85 mm Hg

60. Answer (1)

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

Sol.:

$Fe_4[Fe(CN)_6]_3 \cdot xH_2O$	Prussian blue
$[Fe(CN)_5NOS]^{4-}$	Violet
$[Fe(SCN)]^{2+}$	Blood red
$(NH_4)_3PO_4 \cdot 12MoO_3$	Yellow

61. Answer (1)

Hint: Solvent determines the physical state in which solution exists.

Sol.:

Mixture	Solute	Solvent	Physical state of solution
Sodium amalgam	Hg(l)	Na(s)	Solid

62. Answer (3)

Hint: For first order kinetics,

$$kt = \ln\frac{[A_0]}{[A_t]} \left(\begin{matrix} [A]_0 \text{ is initial concentration} \\ [A]_t \text{ is concetration after time 't'} \end{matrix} \right)$$

Sol.: $k = \frac{2.303}{200}\log\frac{100}{10}$

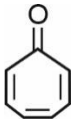
$$k = \frac{2.303}{200}\text{min}^{-1}$$

$$t_{½} = \frac{0.693}{k} = \frac{0.693 \times 200}{2.303}$$

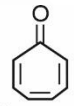
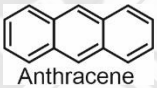
= 60.18 min

$= 1.003$ hour $\simeq 1$ hour

63. Answer (4)

Hint: Structure of tropone is 

Sol.:

(a)	 Tropone	Non-benzenoid aromatic
(b)	 Tetrahydrofuran	Heterocyclic non-aromatic
(c)	 Thiophene	Heterocyclic aromatic
(d)	 Anthracene	Benzenoid aromatic

64. Answer (1)

Hint: 9.8% H_2SO_4 by mass means 9.8 g of H_2SO_4 is present in 100 g of solution.

Sol.: Mole of $H_2SO_4 = \frac{9.8}{98} = 0.1$

Mass of solvent = 100 – 9.8 = 90.2 g

Molality = $\frac{0.1 \times 1000}{90.2}$ = 1.1 m

65. Answer (3)

Hint: $k = Ae^{-E_a/RT}$

Sol.: $e^{-E_a/RT}$ = fraction of molecules having energies equal to or greater than activation energy.

$$e^{-E_a/RT} = e^{\frac{-40 \times 10^3}{2 \times 300}}$$

$= e^{-66.67}$

66. Answer (1)

Hint: Number of equivalents of H_2SO_4 = Number of equivalents of NH_3 + Number of equivalents of NaOH

Sol.: Total number of equivalents of H_2SO_4

$= \frac{20\times0.1\times2}{1000} = 4 \times 10^{-3}$

Number of equivalents of NaOH

$= \frac{10\times0.1\times1}{1000} = 10^{-3}$

Equivalents of $NH_3 = 4 \times 10^{-3} - 1 \times 10^{-3}$

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

Mass of $N = 14 \times 3 \times 10^{-3}$ g

% of $N = \frac{14\times3\times10^{-3}}{0.2}\times100 = 21\%$

67. Answer (3)

Hint: $Y_A = \frac{P_A}{P_T} = \frac{P_A^\circ\chi_A}{P_A^\circ\chi_A + P_B^\circ\chi_B}$

Sol.: $Y_A = \frac{P_A}{P_T} = \frac{P_A^\circ\chi_A}{P_A^\circ\chi_A + P_B^\circ\chi_B}$

$\frac{1}{Y_A} = \frac{P_A^\circ\chi_A + P_B^\circ\chi_B}{P_A^\circ\chi_A}$

$\frac{1}{Y_A} = 1 + \frac{P_B^\circ\chi_B}{P_A^\circ\chi_A}$

$\frac{P_A^\circ}{P_B^\circ} = \frac{1}{3} \quad \frac{\chi_A}{\chi_B} = \frac{2}{7}$

$\frac{1}{Y_A} = 1 + \frac{3\times7}{2} = \frac{21}{2} + 1 = \frac{21+2}{2} = \frac{23}{2}$

$Y_A = \frac{2}{23}$

68. Answer (1)

Hint and Sol.:

- Molecularity cannot be zero or a non integer.
- N_2O decomposition is an example of first order reaction.

69. Answer (2)

Hint: At high pressure, decomposition of gaseous NH_3 on Pt surface is a zero order reaction.

Sol.: Metal surface gets saturated with gas molecules at high pressure. So, any change in reaction conditions is unable to alter the amount of NH_3 on the surface of catalyst making rate of reaction independent of its concentration.

70. Answer (4)

Hint: 233 g of $BaSO_4$ contains 32 g of sulphur.

Sol.:

233 g of $BaSO_4$ contains 32 g of sulphur.

1.398 g of $BaSO_4$ contains $\frac{32\times1.398}{233}$ g of sulphur

Percentage of sulphur = $\frac{32\times1.398\times100}{233\times1.25}$

= 15.36%

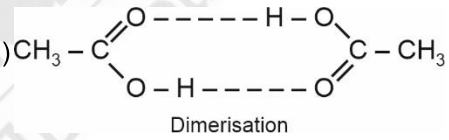
71. Answer (3)

Hint: When solute undergoes either association or dissociation in solvent, molar mass calculated using colligative property is different from the normal molar mass.

Sol.:

(a) $CH_3COOH(aq.) \rightleftharpoons CH_3COO^-(aq.) + H^+(aq.)$

(d)



Dimerisation

(e) $K_2SO_4(aq.) \rightleftharpoons 2K^+(aq.) + SO_4^{2-}(aq.)$

72. Answer (1)

Hint: $k = Ae^{-E_a/RT}$

$\log k = \log A - \frac{E_a}{2.303RT}$

Sol.: $\log k = \log A - \frac{E_a}{2.303RT}$ ...(i)

$\log k = 5 - \frac{3000}{T}$ ...(ii)

On comparing equation (i) and (ii)

$\log A = 5$

$A = 10^5$

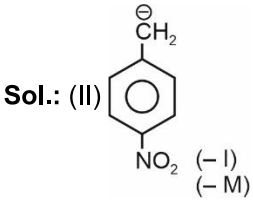
$\frac{E_a}{2.303R} = 3000$

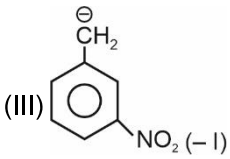
$E_a = 57.44$ kJ/mol

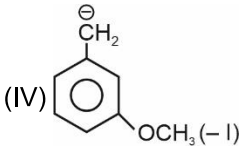
73. Answer (4)

Hint: Electron withdrawing group increases the stability of carbanion.

Sol.: (II)







–I effect of $–OCH_3$ is less than that of –I effect of $–NO_2$.

74. Answer (4)

Hint: Mixture of chloroform and acetone forms a solution which shows negative deviation from Raoult's law.

Sol.: Only non-ideal solution can form azeotropic mixture.

- Reverse osmosis is a non-spontaneous process.

75. Answer (2)

Hint: Δ_rH = Enthalpy of reaction = $(E_a)_f – (E_a)_b$

Sol.: $\Delta_rH = H_P – H_r$

Since, $H_P < H_r$

Δ_rH = (–)ve, exothermic reaction

Threshold energy is the total energy from zero upto transition state.

76. Answer (2)

Hint: Liquids need to boil at a temperature lower than their normal boiling points to avoid decomposition.

Sol.: Pressure is reduced at the surface of liquid by the help of vacuum pump to lower down boiling point.

77. Answer (1)

Hint: Fluid inside the blood cell is equivalent to that of 0.9% (mass/volume) of NaCl solution.

Sol.: The given solution is hypertonic, water will flow out of the cells and they would shrink.

78. Answer (3)

Hint: Benzyl radical is more stable due to resonance.

Sol.:

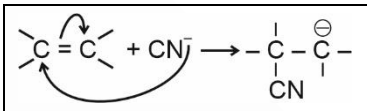
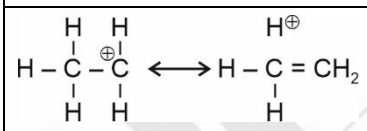
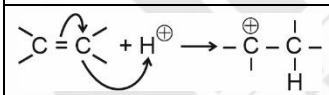
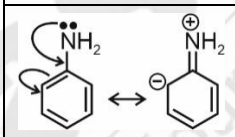
- More is the hyperconjugation, more is the stability of the radical, hence (a) is more stable than (b).
- Correct order of stability will be

(c) > (a) > (b) > (d)

79. Answer (1)

Hint: Hyperconjugation is also known as no bond resonance.

Sol.:

	–E
	Hyperconjugation
	+E
	+R

80. Answer (4)

Hint: The compounds which do not change to ammonium sulphate on treatment with concentrated sulphuric acid will not be estimated by Kjeldahl method.

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

81. Answer (1)

Hint: $t_{½} = \frac{A_0}{2k}$

Sol.: $A_t = A_0 – kt$

$70 = 100 – k \times 20$

$20\ k = 30$

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

$t_{½} = \frac{A_0}{2k} = \frac{100 \times 2}{2 \times 3}$

= 33.33 s

82. Answer (1)

Hint: Structure with more number of double bonds has more stability.

Sol.: Correct stability order will be

I > II > III

Similar charges should be kept away to have more stability and opposite charges should be kept together to get more stability.

83. Answer (2)

Hint: Moles of $HNO_3 = 800 \times 3 \times 10^{-3} = 2.4$

Sol.: Mass of HNO_3 in the given solution

$= 2.4 \times 63$

$= 151.2$ g

Mass of concentrated HNO_3 required

$= \frac{100 \times 151.2}{70}$

$= 216$ g

84. Answer (2)

Hint: Hyperconjugation effect involves delocalisation of σ electrons of C–H bond of an alkyl group directly attached to an atom of an unsaturated system.

Sol.: Lowest set of locant rule is applied in the nomenclature of tri-substituted benzene.

85. Answer (3)

Hint: $\Delta T_b = iK_b m$

$i = 1 + (n-1)\alpha$

Sol.: $\Delta T_b \propto i \cdot m$

(i) $i = 1 + (n-1)\alpha$

$i = 1 + 2 \times 0.2 = 1.4$

$\Delta T_b = 1.4 \times 0.1 \times K_b$

$\Delta T_b = 0.14\ K_b$

(ii) $i = 1 + (n-1)\alpha$

$= 1 + 1 \times 0.1 = 1.1$

$\Delta T_b = 1.1 \times 0.2 \times K_b$

$\Delta T_b = 0.22\ K_b$

(iii) $i = 1 + 3 \times 0.1$

$\Delta T_b = 1.3 \times 0.3 \times K_b$

$i = 1.3$

$\Delta T_b = 0.39\ K_b$

(iv) $i = 1 + 2 \times 0.3$

$\Delta T_b = 1.6 \times 0.1 \times K_b$

$i = 1 + 0.6 = 1.6$

$\Delta T_b = 0.16\ K_b$

86. Answer (1)

Hint and Sol.: $k = \frac{2.303}{(t_2 - t_1)} \log\left(\frac{r_1}{r_2}\right)$

$k = \frac{2.303}{60 - 30} \log\left(\frac{0.03}{0.02}\right)$

$k = \frac{2.303 \times 0.176}{30}$

$t_{1/2} = \frac{0.693}{k}$

$= \frac{0.693 \times 30}{2.303 \times 0.176}$

$= \frac{9}{0.17} = 51.29 \text{ min} \simeq 51 \text{ min}$

87. Answer (1)

Hint: If the difference in boiling points of two liquids is not much, simple distillation cannot be used to separate them.

Sol.: Commonly used adsorbents in adsorption chromatography are silica gel and alumina.

88. Answer (1)

Hint: The value of K_f and K_b depends upon the nature of solvent.

Sol.: K_f is given by

$K_f = \frac{R \times M_1 \times T_f^2}{10^3 \times \Delta_{fus}H}$

89. Answer (2)

Hint: Rate of reaction is inversely related to concentration of A.

Sol.: Rate(R) = $k [A]^x [B]^y$ …(i)

$\frac{R}{2} = k[2A]^x [B]^y$ …(ii)

Dividing equation (i) and (ii)

$2 = \left(\frac{1}{2}\right)^x$

$x = -1$

$R'' = 2R = k[2A]^x[2B]^y$ …(iii)

Dividing equation (i) and (iii)

$$\frac{1}{2}=\left(\frac{1}{2}\right)^{x}\left(\frac{1}{2}\right)^{y}$$

$$\frac{1}{2}=\left(\frac{1}{2}\right)^{-1}\left(\frac{1}{2}\right)^{y}$$

$$\frac{1}{2}=(2)\times\left(\frac{1}{2}\right)^{y}$$

$$\frac{1}{4}=\left(\frac{1}{2}\right)^{y}$$

y = 2

Overall order = x + y

= 2 – 1 = 1

90. Answer (2)

Hint: A reagent that takes away an electron pair from reactive site is electrophile.

Sol.: NH_3, OH^- and $(CH_3)_2NH$ cannot behave as electrophile.

[BOTANY]

91. Answer (1)

Hint: Substrate level phosphorylation reactions can directly yield GTP/ATP.

Sol.: Succinyl CoA $\rightarrow$ Succinic acid can directly yield GTP.

92. Answer (4)

Hint: Tomato is a C_3 plant.

Sol.: RuBisCO is found in mesophyll cells of C_3 plants.

93. Answer (1)

Hint: This reaction is catalysed by succinate dehydrogenase.

Sol.: Succinate dehydrogenase is common for ETS and TCA cycle. It catalyses conversion of succinate to fumarate.

94. Answer (3)

Hint: Non-cyclic photophosphorylation requires the functioning of both PS I and PS II.

Sol.: Non-cyclic photophosphorylation requires external electron donor i.e., H_2O.

95. Answer (3)

Hint: Fats and proteins have RQ values < 1.

Sol.: Organic acids have RQ greater than 1 and glucose have RQ equal to 1.

96. Answer (1)

Hint: ABA is a growth inhibiting hormone.

Sol.: Auxins promote flowering in pineapples. Ethylene is used to initiate flowering and for synchronising fruit-set in pineapples.

97. Answer (2)

Hint: The TCA cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid.

Sol.: TCA cycle takes place in mitochondrial matrix where acetyl CoA combines with OAA to form a 6C compound citric acid.

98. Answer (2)

Hint: Xanthophylls appear yellow in the chromatogram.

Sol.: Xanthophylls can act as an accessory pigment. It prevents photooxidation of chlorophyll *a*.

99. Answer (3)

Hint: Auxin helps to prevent fruit and leaf drop at early stages but promote the abscission of older mature leaves and fruits.

Sol.: Both auxin and ethylene can stimulate root growth.

100. Answer (4)

Hint: Phosphoglycolate is formed during photorespiration.

Sol.: Phosphoglycolate is formed when RuBisCO interacts with oxygen. 3-phosphoglycerate is the product of carboxylation step of the Calvin cycle.

101. Answer (4)

Hint: ABA is a growth inhibitor.

Sol.: ABA induces senescence and abscission.

102. Answer (2)

Hint: $FADH_2$ and NADH + H^+ are produced during Krebs cycle.

Sol.: ATP and NADPH are the high energy chemical intermediates formed during light reaction of photosynthesis.

103. Answer (1)

Hint: The PGR that is discovered while studying foolish seedling disease of rice is GA

Sol.: Gibberellins also promote bolting (internode elongation just prior to flowering) in beet, cabbages and many plants with rosette habit. They promote stem elongation.

104. Answer (4)

Hint: Maize is a C_4 plant.

Sol.: Maize shows resistivity towards high temperature. It also shows greater productivity of biomass due to lack of photorespiration. It also shows CO_2 saturation at about 360 $\mu l L^{-1}$.

105. Answer (1)

Hint: The cells of meristems have the capacity to divide and self-perpetuate.

Sol.: Plant growth is unique because plants retain the capacity for unlimited growth throughout their life. This ability of the plants is due to the presence of meristems at certain locations in their body.

106. Answer (4)

Hint: In fermentation, the incomplete oxidation of glucose is achieved under anaerobic conditions.

Sol.: In fermentation, there is a net gain of only two molecules of ATP for each molecule of glucose degraded to pyruvic acid.

107. Answer (3)

Hint: He also found that the green parts in plants is where glucose is made, and that the glucose is usually stored as starch.

Sol.: Julius von Sachs provided evidence for production of glucose when plants grow.

108. Answer (3)

Hint: Macro and micro essential elements are nutrients.

Sol.: Nutrients (macro and micro essential elements) are required by plants for the synthesis of protoplasm and act as source of energy. r is the relative growth rate and is also the measure of the ability of the plant to produce new plant material, referred to as efficiency index.

109. Answer (1)

Hint: The plant cells grow in size by cell enlargement which in turn requires water.

Sol.: Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source. Cells positioned away from root apical meristems differentiate as root-cap cells, while those pushed to the periphery mature as epidermis.

110. Answer (4)

Hint: It is caused by stress hormone.

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

111. Answer (3)

Hint: Orientation of plants is a plant factor.

Sol.: Temperature is an external factor affecting photosynthesis.

112. Answer (4)

Hint: It is induced by the gaseous PGR.

Sol.: Influences of ethylene on plants include apical hook formation in dicot seedlings.

113. Answer (3)

Hint: Formation of proton gradient across the thylakoid membrane is required for chemiosmosis.

Sol.: During light reaction, ATP synthesis in the chloroplasts is a direct outcome of the breakdown of the proton gradient causing a conformational change in the CF_1 particle.

114. Answer (1)

Hint: It is a 3C compound.

Sol.: Pyruvate is the key product of glycolysis.

115. Answer (3)

Hint: It is a modified form of adenine.

Sol.: Cytokinins have specific effects on cytokinesis, and were discovered as kinetin (a modified form of adenine, a purine) from the autoclaved herring sperm DNA.

116. Answer (3)

Hint: The disaccharide i.e. composed of glucose and fructose is sucrose.

Sol.: The correct sequence of events are as follows:

Sucrose $\xrightarrow{\text{Invertase}}$ Glucose + Fructose

Glucose $\xrightarrow{\text{Hexokinase}}$ Glucose-6-phosphate

Fructose-6-phosphate $\xrightarrow{\text{Phosphofructokinase}}$ Fructose-1,6-bisphosphate

Fructose-1,6-bisphosphate $\xrightarrow{\text{Aldolase}}$ Glyceraldehyde-3-phosphate+Dihydroxyacetone phosphate

2-phosphoglycerate $\xrightarrow{\text{Enolase}}$ Phosphoenolpyruvate

117. Answer (1)

Hint: Removal of shoot tips (decapitation) usually results in the growth of lateral buds.

Sol.: Removal of shoot tips (decapitation) suppresses the effect of auxin.

118. Answer (3)

Hint: In a photosystem, reaction centre is made up of chlorophyll *a*.

Sol.: In a photosystem, all the pigments (except one molecule of chlorophyll *a*) forms antennae.

119. Answer (1)

Hint: H.H. Cousins discovered ethylene.

Sol.: Miller et al. (1955), later identified and crystallised the cytokinesis promoting active substance that they termed kinetin.

120. Answer (4)

Hint: Auxin controls xylem differentiation and helps in cell division.

Sol.: Cytokinin promotes nutrient mobilization which helps in the delay of leaf senescence. Ethylene promotes rapid internode/petiole elongation in deep water rice plants. Gibberellin cause fruits like apple to elongate and improve its shape.

121. Answer (2)

Hint: C_2H_4 is a gaseous hormone.

Sol.: GA is a terpene derivative.

122. Answer (1)

Hint: In C_4 plants, RuBisCO does not show oxygenase activity.

Sol.: In C_4 plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO_2 at the enzyme site (RuBisCO).

123. Answer (2)

Hint: If fatty acids were to be respired they would first be degraded to acetyl CoA and enter the pathway.

Sol.: Glycerol would enter the pathway after being converted to PGAL.

124. Answer (1)

Hint: Its role is limited to the terminal stage of the process.

Sol.: Oxygen acts as the final hydrogen acceptor in mitochondrial ETS.

125. Answer (2)

Hint: The constantly dividing cells, both at the root apex and the shoot apex, represent the meristematic phase of growth.

Sol.: Increased vacuolation, cell enlargement and new cell wall deposition are the characteristics of the cells in elongation phase.

126. Answer (2)

Hint: Sorghum is a C_4 plant but bell pepper is a C_3 plant.

Sol.: For bell pepper, current availability of CO_2 levels is limiting. At low light conditions, neither C_3 or C_4 plants respond to high CO_2 conditions. In both the groups, water stress leads to reduction in the CO_2 availability. In sorghum, RuBisCO does not show oxygenase activity. Pyruvate kinase being an enzyme of glycolysis, is found in all cells.

127. Answer (3)

Hint: In cotton, the leaves of the juvenile plant are different in shape from those in mature plants.

Sol.: Difference in shapes of leaves produced in air and those produced in water in buttercup, represent the heterophyllous development due to environment.

128. Answer (1)

Hint: Light reactions are also known as photochemical reactions and dark reactions are known as carbon reactions.

Sol.: Within the chloroplasts, the membranes are sites for the light reaction, while the chemosynthetic pathway occurs in the stroma.

129. Answer (1)

Hint: This hormone was discovered by E. Kurosawa.

Sol.: GA_3 is used to speed up the malting process in brewing industry.

130. Answer (3)

Hint: The initial stage of cellular respiration is glycolysis.

Sol.: For each ATP produced, $4H^+$ passes through F_0 from the intermembrane space to the matrix down the electrochemical proton gradient. The continued oxidation of acetyl CoA via the TCA cycle requires the continued replenishment of oxaloacetic acid, the first member of the cycle.

131. Answer (4)

Hint: Changing the environmental conditions, such as light and temperature are other methods to overcome seed dormancy.

Sol.: Effect of inhibitory substances can be removed by subjecting the seeds to chilling conditions or by application of certain chemicals like gibberellic acid and nitrates. Impermeable and hard seed coat; presence of chemical inhibitors such as abscisic acids, phenolic acids, para-ascorbic acid; and immature embryos are some of the reasons which causes seed dormancy.

132. Answer (3)

Hint: Mint plant was used by Joseph Priestley.

Sol.: Using a prism T. W. Engelmann split light into its spectral components and then illuminated a green alga, *Cladophora*, placed in a suspension of aerobic bacteria. The bacteria were used to detect the sites of O_2 evolution. He observed that the bacteria accumulated mainly in the region of blue and red light of the split spectrum. A first action spectrum of photosynthesis was thus described.

133. Answer (4)

Hint: Hatch and Slack pathway begins with carboxylation in mesophyll cells.

Sol.: Sequence of steps of Hatch and Slack pathway:

d. Carboxylation reaction catalysed by PEP carboxylase

b. Conversion of first stable product into malic acid

c. Transport of 4-carbon organic acid into the cells encaging RuBisCO

e. Decarboxylation of C_4 acid

a. Conversion of 3 carbon molecule to primary CO_2 acceptor

134. Answer (4)

Hint: Glyceraldehyde-3-phosphate is an intermediate of glycolysis, while fumaric acid is an intermediate of Krebs cycle.

Sol.: If Glyceraldehyde-3-phosphate is used as an intermediate then five molecules of NADH + H^+ are produced, but if fumaric acid is used as an intermediate then one molecule of NADH + H^+ is produced, thus, four more molecules will be produced.

135. Answer (1)

Hint: The figure represents the geometric growth.

Sol.: In most systems, the initial growth is slow (lag phase), and it increases rapidly thereafter – at an exponential rate (log or exponential phase). In geometric growth, both the progeny cells following mitotic cell division retain the ability to divide and continue to do so. However, with limited nutrient supply, the growth slows down leading to a stationary phase. If we plot the parameter of growth against time, we get a typical sigmoid or S-curve. A sigmoid curve is a characteristic of living organism growing in a natural environment.

[ZOOLOGY]

136. Answer (2)

Hint: *Saccoglossus* is an example

Sol.: Phylum Hemichordata consists of a small group of worm-like animals with organ-system level of organisation. The body is cylindrical and is composed of an anterior proboscis, a collar and a long trunk. Their excretory organ is proboscis gland.

137. Answer (4)

Hint: Sea hare is a mollusc.

Sol.:

- The anterior head region of molluscs have sensory tentacles.
- The body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.
- Molluscs are terrestrial or aquatic having an organ-system level of organisation.

138. Answer (3)

Hint: Scientific name of honeybee.

Sol.: Economically important insects :– *Apis*, *Bombyx* and *Laccifer*

Vectors – *Anopheles*, *Culex* and *Aedes* (Mosquitoes)

- Living fossil – *Limulus*
- Gregarious pest – *Locusta*

139. Answer (4)

Hint: Phylum Aschelminthes

Sol.: Aschelminths are dioecious, *i.e.*, males and females are distinct, often females are longer than males. Fertilisation is internal and development may be direct or indirect. Their alimentary canal is complete with a well-developed muscular pharynx. An excretory tube removes body wastes from the body cavity through the excretory pore.

They do not have well-developed circulatory or respiratory system.

140. Answer (3)

Hint: Common name of *Cucumaria* is sea cucumber.

Sol.: *Chaetopleura* (Chiton): The zygote develops into trochophore larva. It is a marine mollusc.

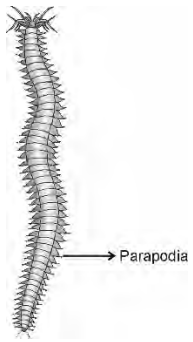
The excretory organs are present. Sexes are separate.

Cucumaria (Sea cucumber): Development is indirect with auricularia larva. They are found at the sea-bottoms in shallow tropical waters (Echinoderms are exclusively marine).

141. Answer (3)

Hint: Parapodia are the hollow locomotory structures.

Sol.: Parapodia are the lateral appendages present in aquatic annelids like *Nereis*, which help in swimming.



142. Answer (3)

Hint: Organisms of kingdom Animalia are multicellular.

Sol.: Sponges are primitive multicellular organisms with cellular level of organisation.

Choanocytes or collar cells line the spongocoel and the canals.

143. Answer (2)

Hint: Members of the second largest phylum exhibit bilateral symmetry.

Sol.: Animals like annelids, arthropods, *etc*., where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

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

Closed type of blood circulation is a type of circulation in which the blood is circulated through a series of vessels of varying diameters.

When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry. *E.g.,* most of the coelenterates, adult echinoderms and ctenophores.

144. Answer (3)

Hint: Identify a bony fish.

Sol.: Cartilaginous male fishes bear claspers on their pelvic fins.

Eg.:- *Trygon* (sting ray), *Carcharodon* (Great white shark), *Torpedo* (electric fish)

Clarias (Magur) is a bony fish.

145. Answer (3)

Hint: It is a mollusc.

Sol.: Pearl oysters are sedentary bivalves found in seas.

They are molluscs hence, unsegmented.

They are economically important for the jewellery market and employment in coastal communities.

146. Answer (3)

Hint: *Palaeomon* is a crustacean.

Sol.:

Limbless amphibian	*Ichthyophis*
Oviparous mammal	*Ornithorhynchus*
Aquatic arthropod	*Palaeomon*
Fish with pre-hensile tail	*Hippocampus*

147. Answer (2)

Hint: Members of class Anthozoa lacks metagenesis.

Sol.: Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like *Hydra*, *Adamsia*, *Pennatula etc*. whereas, the latter is umbrella-shaped and free swimming like *Aurelia* or jelly fish. Those cnidarians which exist in both forms exhibit alternation of generation (metagenesis), *i.e*., polyps produce medusae asexually and medusae form the polyp sexually (*e.g*., *Obelia*).

148. Answer (2)

Hint: Urochordates are invertebrates.

Sol.: *Ascidia* is an urochordate and an invertebrate.

Paired lateral fins are present in cartilaginous fishes.

The body of cyclostomes is devoid of scales and paired fins.

149. Answer (4)

Hint: Humans have four complete chambers in their heart.

Sol.: Mammals are homeotherms. Heart is four-chambered and complete double circulation is present in all the members of class Mammalia.

- They are viviparous with few exceptions and development is direct.
- Their skin is unique in possessing hair
- Respiration is by lungs.
- Different types of teeth are characteristic of mammals.

150. Answer (2)

Hint: Identify the members of class Amphibia and Reptilia.

Sol.: In members of the class Amphibia and Reptilia, tympanum represents the ear. Tree frog, frog and toad are amphibian. Lamprey is a cyclostome and katla is a fish which lack external ears and flying fox is a mammal possessing external ears or pinnae. Wall lizard is a reptile.

151. Answer (3)

Hint: Cetaceans are aquatic mammals.

Sol.: Not all mammals have hair and pinnae.

Buccopharyngeal respiration is seen in frogs.

Frogs also respire *via* skin.

152. Answer (3)

Hint: First pair of wings arises from 2^{nd} thoracic segment.

Sol.: Thorax of cockroach contains 3 segments. Each thoracic segment bears a pair of walking legs. The first pair of wings arises from mesothorax and the second pair from metathorax. Forewings called tegmina are opaque, dark and leathery and cover the hind wings, when at rest. The hind wings are transparent, membranous and are used in flight. The mouthparts consist of a labrum (upper lip), a pair of mandibles, a pair of maxillae and a labium (lower lip).

153. Answer (3)

Hint: The 7^{th} sternum is boat-shaped.

Sol.: The abdomen in both male and female cockroaches consists of 10 segments. In females, the 7^{th} sternum is boat shaped and together with the 8^{th} and 9^{th} sterna forms a brood pouch or genital pouch whose anterior part contains female gonopore.

154. Answer (3)

Hint: Cockroach can survive without head for about a week.

Sol.: Head of cockroach is triangular in shape and lies anteriorly at right angles to the longitudinal body axis. Brain is represented by supra-oesophageal ganglion that supplies nerves to antennae, compound eyes and labrum.

Sub-oesophageal ganglion supplies nerves to labium, mandible and maxillae.

155. Answer (3)

Hint: Equal to the number of digits in a hindlimb of frog.

Sol.: Sensory structures of cockroach are maxillae (contain gustatory and olfactory receptors), antennae, anal cerci (help in monitoring the environment) and walking legs (help to detect tactile stimulus).

156. Answer (2)

Hint: True for Malpighian tubules

Sol.: At the junction of midgut and hindgut, a ring of 100-150 yellow-coloured thin filamentous Malpighian tubules is present. Each tubule is lined by glandular and ciliated cells. They help in removal of excretory products from haemolymph not from alimentary canal.

A ring of 6-8 blind tubules called hepatic or gastric caecae is present at the junction of foregut and midgut, which secrete digestive juices.

157. Answer (2)

Hint: Spermatheca is absent in male cockroach.

Sol.: A pair of spermatheca is present in the 6th abdominal segment of female cockroach which opens into the genital chamber.

The development of *P.americana* is paurometabolous, meaning there is development through nymphal stages. The next to last nymphal stage has wing pads but only adult cockroaches have wings.

Urecose gland helps in excretion but it is absent in females.

158. Answer (1)

Hint: Hepatic portal system.

Sol.: Special venous connection between liver and intestine as well as the kidney and lower parts of the body are present in frogs. The former is called hepatic portal system and the latter is called renal portal system.

159. Answer (3)

Hint: Cutaneous respiration is seen during hibernation.

Sol.: The frogs swim in water by powerful backward thrusts of its hindlimbs which act like propellers. The hindlimbs end with five digits.

In water, adult frogs respire *via* skin.

Frogs can croak underwater as well as on land.

It is louder in males due to the presence of vocal sacs that act as resonators.

160. Answer (4)

Hint: Equal to the number of cranial bones in human.

Sol.: The prominent endocrine glands found in frogs are pituitary, thyroid, parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads.

161. Answer (2)

Hint: Cranial nerves arise from brain.

Sol.:

- The nervous system is organised into a central and a peripheral nervous system.
- There are 10 pairs of cranial nerves arising from the brain.
- Brain is enclosed in a bony structure called cranium (Brain box).
- The brain is divided into forebrain, midbrain and hind brain.
- Hind brain consists of cerebellum and medulla oblongata but lacks pons.

162. Answer (3)

Hint: Adult frogs are carnivores.

Sol.: The alimentary canal of adult frogs is short because frogs are carnivores and hence, the length of intestine is reduced.

Tadpoles are herbivores and have a longer digestive tract to digest cellulose than adults.

163. Answer (3)

Hint: True for platyhelminths.

Sol.: The body temperature of frogs varies with temperature *i.e.*, they are poikilotherms. They belong to the superclass Tetrapoda.

Sexes are separate *i.e.*, they are dioecious.

164. Answer (3)

Hint: Bidder's canal opens into urinogenital duct.

Sol.: In case of frogs, male reproductive system consists of a pair of testes. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with urinogenital duct that comes out of the kidneys and opens into cloaca.

165. Answer (4)

Hint: Part of forebrain.

Sol.:

Humans	**Frogs**
Enucleated RBCs	Nucleated RBCs
Salivary glands – Present	Salivary glands – Absent
Diaphragm – Present	Diaphragm – Absent
Cerebral hemispheres – Present	Cerebral hemispheres – Present

166. Answer (2)

Hint: Hormones regulate functions of target tissue.

Sol.:

Hormones produce their effects on target tissue by binding to specific proteins called hormone receptors located in the target tissue only.

Binding of a hormone to its receptors leads to the formation of a hormone-receptor complex.

Each receptor can be identified by only one hormone and hence receptors are specific.

Hormone-Receptor complex formation leads to certain biochemical changes in the target tissue.

Target tissue metabolism and hence physiological functions are regulated by hormones.

167. Answer (4)

Hint: It is a glucocorticoid.

Sol.: Steroid hormones are not water soluble, they are considered as lipid soluble hormones, like cortisol, testosterone, estradiol, *etc*.

168. Answer (1)

Hint: Cell mediated immunity is a type of acquired immunity.

Sol.: The thymus plays a major role in development of the immune system by secreting hormones called thymosins. Thymosins promote the production of antibodies to provide humoral immunity.

Thymosins play a major role in the differentiation of T-lymphocytes, which help B-cells to produce antibodies and provide humoral immunity.

169. Answer (3)

Hint: Cortisol suppresses immune reactions.

Sol.: Glucocorticoids, particularly cortisol, produces anti-inflammatory reactions and suppresses the immune response. Cortisol stimulates the RBC production. Cortisol is also involved in maintaining the cardio-vascular system as well as the kidney function.

170. Answer (2)

Hint: Source of trophic hormones

Sol.: Trophic cells secrete trophic hormones like GH, PRL, TSH, ACTH, LH and FSH.

Pars nervosa also known as posterior pituitary, stores and releases two hormones called oxytocin and vasopressin (ADH).

171. Answer (3)

Hint: ADH increases blood pressure.

Sol.: ANF is secreted in response to increased blood pressure, which causes dilation of the blood vessels, this reduces the blood pressure. On the other hand vasopressin (ADH) is a vasoconstrictor hence, increases the blood pressure.

172. Answer (1)

Hint: LH and FSH are trophic hormones.

Sol.: Somatostatin from the hypothalamus inhibits the release of growth hormone from the pituitary. The releasing and inhibiting hormones of hypothalamus originating in the hypothalamic neurons, pass through axons and released from their nerve endings. CRH stands for corticotrophin releasing hormone. These hormones reach the pituitary gland through a portal circulation and regulate the functions of anterior pituitary. Gonadotrophins (LH and FSH) are secreted by anterior pituitary gland.

173. Answer (4)

Hint: GHRH causes increased secretion of GH/GF.

Sol.: Several non-endocrine tissues secrete hormones called growth factors. These factors are essential for the normal growth of tissues and their repairing/regeneration.

174. Answer (1)

Hint: Equal to number of fins in humans

Sol.: Gonadal activity is regulated by complex system of hormones, primarily controlled by the hypothalamic-pituitary-gonadal axis. So it includes all the mentioned hormones like GnRH from the hypothalamus, which stimulates the pituitary to release LH and FSH. These gonadotrophins then target the gonads to stimulate the production of sex hormones like testosterone, estrogen and progesterone.

Thyroid hormones and melatonin also influence menstrual cycle in females.

175. Answer (1)

Hint: Secreted from pars intermedia

Sol.: Pars intermedia is almost merged with pars distalis in humans. It secretes only one hormone called melanocyte stimulating hormone (MSH). However, in humans, the pars intermedia is almost merged with pars distalis.

Pars nervosa stores and releases two hormones called oxytocin and vasopressin, which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

176. Answer (2)

Hint: Causes acromegaly

Sol.: Excess secretion of growth hormone in adults especially in middle age can result in severe disfigurement (especially of the face) called acromegaly, which may lead to serious complications and premature death; if unchecked.

177. Answer (2)

Hint: Equal to the numbers of coxal bones in humans.

Sol.: All the mentioned hormones are related with glucose metabolism except aldosterone which is a mineralocorticoid and TCT (thyrocalcitonin) which regulates the blood calcium levels.

178. Answer (1)

Hint: Location of pancreas

Sol.: Pancreas is a composite gland which consists of 'Islets of Langerhans'. The two main types of cells in the Islets of Langerhans are called α-cells and β-cells. Glucagon secreted from α-cells acts mainly on hepatocytes and stimulates glycogenolysis. Pancreas is a digestive gland and is located in the abdominal cavity between the C-shaped curve of duodenum.

- Four parathyroid glands are present on the backside of the thyroid gland in the neck region.
- The pineal gland is located on the dorsal side of forebrain.
- The pituitary gland is located in a bony cavity called sella tursica.

179. Answer (4)

Hint: Decreased release of ADH results in diabetes insipidus.

Sol.: Decreased release of ADH results in diabetes insipidus which results in a diminished ability of the kidney to conserve water leading to water loss and dehydration.

Prolonged hyperglycemia leads to disorder named diabetes mellitus which is associated with the loss of glucose through urine and formation of harmful compounds known as ketone bodies.

Low secretion of GH results in stunted growth resulting in pituitary dwarfism.

Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth, mental retardation, *etc*.

180. Answer (4)

Hint: Corpus luteum secretes mainly progesterone.

Sol.: After ovulation, the ruptured Graafian follicle is converted to a structure called corpus luteum, which secretes mainly progesterone.

Progesterone supports pregnancy. It also acts on the mammary glands and stimulates the formation of alveoli and milk secretion.

Estrogen regulates female sexual behaviour and causes development of growing ovarian follicles.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

TEST - 4 (Code-F)

Click here for Code-E Sol.

Test Date : 18/01/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (4)

Hint: Equation of a plane progressive harmonic wave travelling along positive x-axis is given by, $y = A\sin(\omega t - kx + \phi)$

Sol.: After looking at the snapshot, at $t = 0$, $x = 0$, $y = -0.5$ and wave is travelling along positive x-axis hence, equation will be $\sin\left(\omega t - kx - \frac{\pi}{6}\right)$

2. Answer (1)

Hint: Phase difference between two particles separated by certain distance, Δx would be, $\Delta\phi = \frac{2\pi}{\lambda} \times \Delta x$

Sol.: Path difference between the two given points

$$= \frac{\lambda}{2} - \frac{\lambda}{8} + \frac{\lambda}{4} = \frac{4\lambda - \lambda + 2\lambda}{8} = \frac{5\lambda}{8}$$

$$\Rightarrow \quad \Delta\phi = \frac{2\pi}{\lambda} \times \frac{5\lambda}{8} = \frac{5\pi}{4}$$

3. Answer (3)

Hint: For SHM, $a = -\omega^2 x$

Sol.: a versus x graph will be straight line passing through origin having negative slope.

4. Answer (4)

Hint and Sol.: For a particle executing SHM

$y = A\sin\omega t$

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

So, Kinetic energy K is given by

$$K = \frac{1}{2} mA^2\omega^2 \cos^2 \omega t$$

If a particle executes SHM with frequency f then its kinetic energy oscillates with frequency $2f$.

5. Answer (2)

Hint: Time period of simple pendulum, $T = 2\pi\sqrt{\frac{\ell}{g_{\text{eff}}}}$

Sol.: When lift moves upward with constant velocity v, $T = 2\pi\sqrt{\frac{\ell}{g}}$

When lift moves upward with constant acceleration $\frac{g}{4}$

$$g_{\text{eff}} = g + \frac{g}{4} = \frac{5g}{4}$$

$$\Rightarrow \quad T \times \sqrt{g} = T'\sqrt{\frac{5g}{4}} \Rightarrow T' = \frac{2T}{\sqrt{5}}$$

6. Answer (4)

Hint: Time period of a spring-mass system, $T = 2\pi\sqrt{\frac{m}{k}}$

Sol.: Since the block is compressed to distance $2a$ and released, hence time taken to reach mean position is $\frac{T}{4}$. From mean position to cover the distance half the amplitude, time taken will be $\frac{T}{12}$.

Total time = $\frac{T}{4} + \frac{T}{12} = \frac{3T + T}{12} = \frac{4T}{12} = \frac{T}{3}$

$$\Rightarrow \quad \frac{1}{3} \times 2\pi\sqrt{\frac{m}{k}} = \frac{2\pi}{3}\sqrt{\frac{m}{k}}$$

7. Answer (1)

Hint and Sol.: Both (A) and (R) are false. Work done is a path function, hence it does not depend only on initial and final position.

8. Answer (2)

Hint: Use first law of thermodynamics

Sol.: $\Delta Q = \Delta U + \Delta w$, $(\Delta U)_1 = (\Delta U)_2$ but $(\Delta w)_2 > (\Delta w)_1$

$\Rightarrow$ $(\Delta Q)_2 > (\Delta Q)_1$ for same temperature difference

$$\Rightarrow \quad \frac{C_1}{C_2} < 1$$

9. Answer (3)

Hint: For an adiabatic process, $PV^{\gamma} = C$

Sol.: $PV^{\gamma} = C$ and $PV = nRT$

$$\Rightarrow P\left[\frac{nRT}{P}\right]^{\gamma} = C$$

$$\Rightarrow \frac{T^{\gamma}}{P^{\gamma-1}} = C_0$$

$$\Rightarrow T^{\gamma} \propto P^{\gamma-1}$$

$$\Rightarrow P \propto (T)^{\frac{\gamma}{\gamma-1}}$$

$$\gamma_{\text{diatomic}} = \frac{7}{5}$$

$$\Rightarrow \alpha = \frac{\frac{7}{5}}{\frac{7}{5}-1} = \frac{\frac{7}{5}}{\frac{2}{5}} = \frac{7}{2}$$

10. Answer (1)

Hint: Use, $\eta_{\text{Carnot}} = 1 - \frac{T_2}{T_1}$

Sol.: $\eta_{\text{Carnot}} = 1 - \frac{300}{600} = 1 - \frac{1}{2} = \frac{1}{2}$

11. Answer (3)

Hint and Sol.:

- $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

  hence, $V_{\text{rms}} \propto \sqrt{T}$
- Temperature may increase or decrease while heat is being extracted from a system.

12. Answer (2)

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

where d = diameter of molecule of gas

13. Answer (3)

Hint: Use, $C_V = \frac{fR}{2}$ and $C_P - C_V = R$

Sol.: $\gamma = \frac{\frac{fR}{2} + R}{\frac{fR}{2}} = \frac{(f+2)\frac{R}{2}}{\frac{fR}{2}} = 1 + \frac{2}{f}$

14. Answer (1)

Hint: Use ideal gas equation

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

$$\Rightarrow V \times \left[\frac{nRT}{V}\right]^2 = C$$

$$\Rightarrow \frac{T^2}{V} = C_0$$

$$\Rightarrow \frac{T_0^2}{V_0} = \frac{T^2}{3V_0}$$

$$\Rightarrow T^2 = 3T_0^2$$

$$\Rightarrow T = \sqrt{3}T_0$$

15. Answer (1)

Hint: Use, $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

Sol.: $V_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

Since, $M_{H_2} < M_{O_2}$

$$\Rightarrow v_{H_2} > v_{O_2}$$

$$\Rightarrow v_1 > v_2$$

16. Answer (4)

Hint: Use, $C_{V,\text{mix}} = \frac{n_1C_{V_1} + n_2C_{V_2}}{n_1 + n_2}$

Sol.: $C_{V,\text{mix}} = \frac{2 \times \frac{3R}{2} + 3 \times \frac{5R}{2}}{5} = \frac{\frac{6R}{2} + \frac{15R}{2}}{5} = \frac{21R}{10}$

$= 2.1R$

17. Answer (1)

Hint and Sol.: Both (A) and (R) are correct but (R) is not correct explanation as there is no restriction to change in length, hence no stress would be developed.

18. Answer (2)

Hint: Use Newton's law of cooling

Sol.: We know that, rate of cooling $\propto \left[\frac{T_1 + T_2}{2} - T_0\right]$

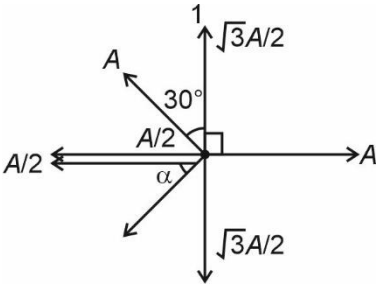
Rate of cooling is proportional to temperature difference of body and surrounding.

Hence, $t_1 < t_2 < t_3$

19. Answer (2)

Hint: Use the concept of phasors

Sol.:



$$A_{req} = \sqrt{\left(\frac{\sqrt{3}A}{2}\right) + \left(\frac{A}{2}\right)^2} = A$$

$\tan\alpha = 60°$

$\Rightarrow \phi = 240°$

20. Answer (3)

Hint and Sol.: $x = a\sin(\omega t) + b\cos(\omega t)$

$$\Rightarrow x = \sqrt{a^2 + b^2}\sin(\omega t + \phi)$$

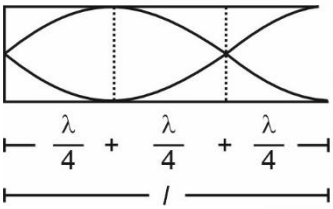
$$\Rightarrow A = \sqrt{a^2 + b^2}$$

21. Answer (1)

Hint: In closed organ pipe.

$\lambda_n = \frac{4l}{(2n-1)}$; for nth mode of vibration.

Sol.: The third harmonic or 2nd mode of vibration $n = 2$.



$$\lambda = \frac{4l}{3} \text{ or } l = \frac{3\lambda}{4}$$

From given equation;

$y = 3\sin\pi x\cos\pi t$

$K = \pi$ and $\omega = \pi$

$$\Rightarrow K = \frac{2\pi}{\lambda} = \pi \Rightarrow \lambda = 2 \text{ m}$$

22. Answer (1)

Hint: $\Delta U = nC_V\Delta T$

Sol.: $\Delta U = \alpha \times \frac{R}{\gamma - 1}(T_2 - T_1) = \frac{1}{\gamma - 1}(P_2V_2 - P_1V_1)$

$$= \frac{P_2V_2 - P_1V_1}{\gamma - 1}$$

23. Answer (2)

Hint and Sol.: During adiabatic compression of an ideal gas work is done on the system which increases internal energy of the system.

24. Answer (4)

Hint and Sol.: Since $\Delta V = 0$

$\Rightarrow \Delta W = 0$ while ΔP, ΔQ, ΔU are non-zero

25. Answer (3)

Hint and Sol.: Given $dQ = 4dU$

$\Rightarrow nC\Delta T = 4 \times n \times C_V \times \Delta T$

$$\Rightarrow C = \frac{4 \times 3R}{2} = 6R$$

26. Answer (1)

Hint: Use Fourier's law of conduction

Sol.: $\frac{dQ}{dT} = \frac{-K \times A \times dT}{dr}$

$\left[\frac{dQ}{dT} = P\right]$

$$\Rightarrow P = \frac{-K \times 4\pi r^2 \times dT}{dr}$$

$$\Rightarrow \frac{dr}{r^2} = \frac{-K \times 4\pi \times dT}{P}$$

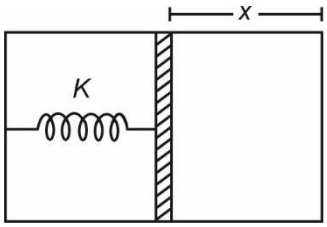
$$\Rightarrow \int_a^b \frac{dr}{r^2} = -\frac{4\pi K}{P} \times \int_{T_1}^{T_2} dT$$

$\Rightarrow P = \frac{4\pi Kab(T_1 - T_2)}{b - a}$, where P will be the power of the source.

27. Answer (3)

Hint: Use first law of thermodynamics and $PV = nRT$.

Sol.:



Let dQ heat is given to the system, then spring is compressed by dx and change in PE of spring

$$U = \frac{1}{2}Kx^2$$

$\Rightarrow F = \left|\frac{dU}{dx}\right| = Kx$

Now using FLOT

$dQ = dU + dW$

$CdT = nC_V dT + Kxdx$ …(i)

But $Kx = PA$ and $PV = nRT$

$\Rightarrow PAx = nRT \Rightarrow PA = \frac{nRT}{x}$

$\Rightarrow Kx = \frac{nRT}{x}$

$\Rightarrow Kx^2 = nRT \Rightarrow 2Kxdx = nRdT$ …(ii)

From equation (i) and (ii)

$CdT = nC_V dT + \frac{nRdT}{2} = \frac{5}{2}nRdT + \frac{nRdT}{2}$

$\Rightarrow C = 3nR = \frac{3P_0V_0}{T_0}$

28. Answer (3)

Hint: Use principle of calorimetry.

Sol.: Heat lost = Heat gained

$\Rightarrow x \times 540 = y \times 80 + y \times 1 \times 100$

$\Rightarrow 540x = 180y$

$\Rightarrow \frac{x}{y} = \frac{1}{3}$

29. Answer (2)

Hint: Use, $Q = ms\Delta T$

Sol.: Here specific heat is variable. So, for unit mass

$\Rightarrow dQ = 1 \times (at^2 + bt + c)dt$

$\Rightarrow dQ = at^2dt + btdt + cdt$

$\Rightarrow Q = \left[\frac{at^3}{3}\right]_0^{t_0} + \left[\frac{bt^2}{2}\right]_0^{t_0} + [ct]_0^{t_0}$

$\Rightarrow Q = \frac{at_0^3}{3} + \frac{bt_0^2}{2} + ct_0$

30. Answer (1)

Hint: Use Fourier's law of conduction

Sol.: $\frac{\Delta Q}{\Delta t} = \frac{K \times A \times (T_2 - T_0)}{d} = \frac{3K \times A \times (T_0 - T_1)}{3d}$

$\Rightarrow T_2 - T_0 = T_0 - T_1$

$\Rightarrow T_2 + T_1 = 2T_0$

$\Rightarrow T_0 = \frac{T_2 + T_1}{2}$

31. Answer (3)

Hint: Process AB is an isothermal process.

Sol.: Work done in isothermal process.

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

$W_{A-B} = nRT\ln\left[\frac{P_1}{P_2}\right] = 3 \times R \times 2T_0\ln(2)$

$= 6RT_0\ln(2)$

32. Answer (1)

Hint: Use first law of thermodynamics

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

$\Rightarrow \Delta U = \Delta Q - \Delta w$

$\Rightarrow \Delta U = 150 - 80 = 70$ J

33. Answer (2)

Hint: Use first law of thermodynamics

Sol.: $\Delta w = \frac{1}{2} \times 4 \times 40 = -80$ J

$Q_{BC} = 120$ J

$Q_{AB} = W_{AB} + (\Delta U)_{AB}$

$= 20(4) + 20 = 100$ J

$Q_{AB} + Q_{BC} + Q_{CA} = \Delta w$

$100 + 120 + Q_{CA} = -80$, $Q_{CA} = -300$ J

34. Answer (3)

Hint and Sol.: The particle starts its motion from extreme position, hence it will be at mean position at $\frac{3T}{4}$ where net force equals zero. At $t = T$, the particle is at one extreme, hence acceleration would be maximum. For, PE = KE, $x = \pm\frac{A}{\sqrt{2}}$

$\Rightarrow$ Hence statements a, b and c are correct

35. Answer (3)

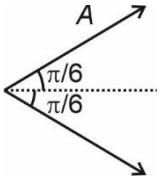
Hint and Sol.: The speed of sound depends on elastic property of medium, hence it is highest in solids.

36. Answer (2)

Hint: Use the concept of phasors

Sol.:

$$y_1 = A\sin\left(\omega t - Kx - \frac{\pi}{6}\right) \text{ and } y_2 = A\sin\left(\omega t - Kx + \frac{\pi}{6}\right)$$



$\Rightarrow \quad y_{res} = \sqrt{3}A\sin(\omega t - Kx)$

37. Answer (2)

Hint: In closed organ pipe, only odd harmonics exist

Sol.: According to question, $7f_0 - 3f_0 = 200$

$\Rightarrow \quad 4f_0 = 200$

$\Rightarrow \quad f_0 = 50$ Hz

38. Answer (1)

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

Sol.: $v_{sound} = \sqrt{\frac{\gamma RT}{M}}$, at NTP temperature will be fixed

$\Rightarrow \quad v \propto \frac{1}{\sqrt{M}}$, $M_{mix} = \frac{4}{5}\times 2 + \frac{1}{5}\times 32 = 8$ g

$\Rightarrow \quad 1328\times\sqrt{2} = v\sqrt{8}$

$\Rightarrow \quad v = 664$ m/s

39. Answer (4)

Hint: Maximum particle velocity, $v_{max} = A\omega$

Sol.: $V_{max} = A\omega$, $V_{wave} = \frac{\omega}{k}$

$\Rightarrow \quad \text{Ratio} = \frac{A\omega}{\frac{\omega}{k}} = kA$

40. Answer (4)

Hint: Use Wien's displacement law

Sol.: $\lambda_0 \times T = \frac{\lambda_0}{2}\times T'$

$\Rightarrow \quad T' = 2T$

Also, $P \propto T^4$

$\Rightarrow \quad \frac{P'}{P} = \frac{16T^4}{T^4}$

$\Rightarrow \quad P' = 16P$

$\Rightarrow \quad n = 16$

41. Answer (2)

Hint: Use, $F = \frac{9}{5}C + 32$

Sol.: $\Delta F = \frac{9}{5}\Delta C \Rightarrow \Delta F = \frac{9}{5}\times 45 = 81°$

42. Answer (4)

Hint: Average velocity $= \frac{\text{Total displacement}}{\text{Total time}}$

Sol.: Since net displacement in one time period is zero, hence average velocity would be zero.

43. Answer (1)

Hint and Sol.:

Beat frequency = $|f_1 - f_2| = |450 - 446| = 4$ Hz

44. Answer (1)

Hint: Velocity of transverse wave on string, $v = \sqrt{\frac{T}{\mu}}$

Sol.: $v = \sqrt{\frac{T}{\mu}}$

$\Rightarrow \quad v \propto \sqrt{T}$

$\Rightarrow \quad \frac{v_i}{v_F} = \sqrt{\frac{T}{3T}} = \frac{1}{\sqrt{3}}$

45. Answer (4)

Hint and Sol.: The logarithmic and exponential function will represent non-periodic motion.

[CHEMISTRY]

46. Answer (2)

Hint: A reagent that takes away an electron pair from reactive site is electrophile.

Sol.: NH_3, OH^- and $(CH_3)_2NH$ cannot behave as electrophile.

47. Answer (2)

Hint: Rate of reaction is inversely related to concentration of A.

Sol.: Rate(R) = k $[A]^x$ $[B]^y$ …(i)

$$\frac{R}{2} = k[2A]^x\ [B]^y \quad \ldots(ii)$$

Dividing equation (i) and (ii)

$$2 = \left(\frac{1}{2}\right)^x$$

x = –1

$$R'' = 2R = k[2A]^x[2B]^y \quad \ldots(iii)$$

Dividing equation (i) and (iii)

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x\left(\frac{1}{2}\right)^y$$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^{-1}\left(\frac{1}{2}\right)^y$$

$$\frac{1}{2} = (2)\times\left(\frac{1}{2}\right)^y$$

$$\frac{1}{4} = \left(\frac{1}{2}\right)^y$$

y = 2

Overall order = x + y

= 2 – 1 = 1

48. Answer (1)

Hint: The value of K_f and K_b depends upon the nature of solvent.

Sol.: K_f is given by

$$K_f = \frac{R\times M_1\times T_f^2}{10^3\times\Delta_{fus}H}$$

49. Answer (1)

Hint: If the difference in boiling points of two liquids is not much, simple distillation cannot be used to separate them.

Sol.: Commonly used adsorbents in adsorption chromatography are silica gel and alumina.

50. Answer (1)

Hint and Sol.: $k = \frac{2.303}{(t_2 - t_1)}\log\left(\frac{r_1}{r_2}\right)$

$$k = \frac{2.303}{60-30}\log\left(\frac{0.03}{0.02}\right)$$

$$k = \frac{2.303\times 0.176}{30}$$

$$t_{1/2} = \frac{0.693}{k}$$

$$= \frac{0.693\times 30}{2.303\times 0.176}$$

$$= \frac{9}{0.17} = 51.29\ \text{min} \simeq 51\ \text{min}$$

51. Answer (3)

Hint: $\Delta T_b = iK_bm$

$i = 1 + (n-1)\alpha$

Sol.: $\Delta T_b \propto i\cdot m$

(i) $i = 1 + (n-1)\alpha$

i = 1 + 2 × 0.2 = 1.4

$\Delta T_b = 1.4\times 0.1\times K_b$

ΔT_b = 0.14 K_b

(ii) $i = 1 + (n-1)\alpha$

= 1 + 1 × 0.1 = 1.1

$\Delta T_b = 1.1\times 0.2\times K_b$

ΔT_b = 0.22 K_b

(iii) $i = 1 + 3\times 0.1$

$\Delta T_b = 1.3\times 0.3\times K_b$

i = 1.3

ΔT_b = 0.39 K_b

(iv) $i = 1 + 2\times 0.3$

$\Delta T_b = 1.6\times 0.1\times K_b$

i = 1 + 0.6 = 1.6

ΔT_b = 0.16 K_b

52. Answer (2)

Hint: Hyperconjugation effect involves delocalisation of σ electrons of C–H bond of an alkyl group directly attached to an atom of an unsaturated system.

Sol.: Lowest set of locant rule is applied in the nomenclature of tri-substituted benzene.

53. Answer (2)

Hint: Moles of $HNO_3 = 800 \times 3 \times 10^{-3} = 2.4$

Sol.: Mass of HNO_3 in the given solution

$= 2.4 \times 63$

$= 151.2$ g

Mass of concentrated HNO_3 required

$= \frac{100 \times 151.2}{70}$

$= 216$ g

54. Answer (1)

Hint: Structure with more number of double bonds has more stability.

Sol.: Correct stability order will be

I > II > III

Similar charges should be kept away to have more stability and opposite charges should be kept together to get more stability.

55. Answer (1)

Hint: $t_{½} = \frac{A_0}{2k}$

Sol.: $A_t = A_0 - kt$

$70 = 100 - k \times 20$

$20\ k = 30$

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

$t_{½} = \frac{A_0}{2k} = \frac{100 \times 2}{2 \times 3}$

$= 33.33$ s

56. Answer (4)

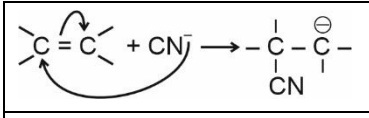
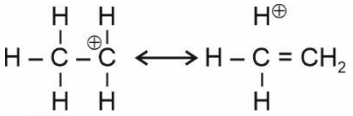
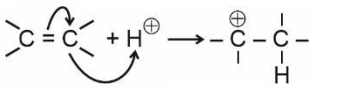
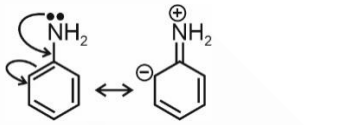
Hint: The compounds which do not change to ammonium sulphate on treatment with concentrated sulphuric acid will not be estimated by Kjeldahl method.

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

57. Answer (1)

Hint: Hyperconjugation is also known as no bond resonance.

Sol.:

	–E
	Hyperconjugation
	+E
	+R

58. Answer (3)

Hint: Benzyl radical is more stable due to resonance.

Sol.:

- More is the hyperconjugation, more is the stability of the radical, hence (a) is more stable than (b).
- Correct order of stability will be

  (c) > (a) > (b) > (d)

59. Answer (1)

Hint: Fluid inside the blood cell is equivalent to that of 0.9% (mass/volume) of NaCl solution.

Sol.: The given solution is hypertonic, water will flow out of the cells and they would shrink.

60. Answer (2)

Hint: Liquids need to boil at a temperature lower than their normal boiling points to avoid decomposition.

Sol.: Pressure is reduced at the surface of liquid by the help of vacuum pump to lower down boiling point.

61. Answer (2)

Hint: $\Delta_r H$ = Enthalpy of reaction = $(E_a)_f - (E_a)_b$

Sol.: $\Delta_r H = H_P - H_r$

Since, $H_P < H_r$

$\Delta_r H$ = (–)ve, exothermic reaction

Threshold energy is the total energy from zero upto transition state.

62. Answer (4)

Hint: Mixture of chloroform and acetone forms a solution which shows negative deviation from Raoult's law.

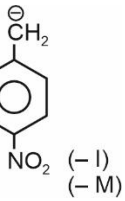
Sol.: Only non-ideal solution can form azeotropic mixture.

- Reverse osmosis is a non-spontaneous process.

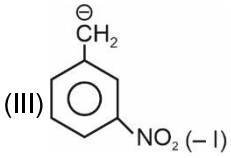
63. Answer (4)

Hint: Electron withdrawing group increases the stability of carbanion.

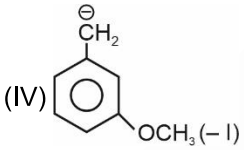
Sol.: (II)



(III)



(IV)



–I effect of $-OCH_3$ is less than that of –I effect of $-NO_2$.

64. Answer (1)

Hint: $k = Ae^{-E_a/RT}$

$$\log k = \log A - \frac{E_a}{2.303RT}$$

Sol.: $\log k = \log A - \frac{E_a}{2.303RT}$ …(i)

$$\log k = 5 - \frac{3000}{T} \quad \text{…(ii)}$$

On comparing equation (i) and (ii)

$\log A = 5$

$A = 10^5$

$$\frac{E_a}{2.303R} = 3000$$

$E_a = 57.44$ kJ/mol

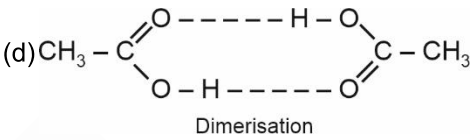
65. Answer (3)

Hint: When solute undergoes either association or dissociation in solvent, molar mass calculated using colligative property is different from the normal molar mass.

Sol.:

(a) $CH_3COOH(aq.) \rightleftharpoons CH_3COO^-(aq.) + H^+(aq.)$

(d)



Dimerisation

(e) $K_2SO_4(aq.) \rightleftharpoons 2K^+(aq.) + SO_4^{2-}(aq.)$

66. Answer (4)

Hint: 233 g of $BaSO_4$ contains 32 g of sulphur.

Sol.:

233 g of $BaSO_4$ contains 32 g of sulphur.

1.398 g of $BaSO_4$ contains $\frac{32 \times 1.398}{233}$ g of sulphur

Percentage of sulphur = $\frac{32 \times 1.398 \times 100}{233 \times 1.25}$

= 15.36%

67. Answer (2)

Hint: At high pressure, decomposition of gaseous NH_3 on Pt surface is a zero order reaction.

Sol.: Metal surface gets saturated with gas molecules at high pressure. So, any change in reaction conditions is unable to alter the amount of NH_3 on the surface of catalyst making rate of reaction independent of its concentration.

68. Answer (1)

Hint and Sol.:

- Molecularity cannot be zero or a non integer.
- N_2O decomposition is an example of first order reaction.

69. Answer (3)

Hint: $Y_A = \frac{P_A}{P_T} = \frac{P_A^\circ \chi_A}{P_A^\circ \chi_A + P_B^\circ \chi_B}$

Sol.: $Y_A = \frac{P_A}{P_T} = \frac{P_A^\circ \chi_A}{P_A^\circ \chi_A + P_B^\circ \chi_B}$

$$\frac{1}{Y_A} = \frac{P_A^\circ \chi_A + P_B^\circ \chi_B}{P_A^\circ \chi_A}$$

$$\frac{1}{Y_A} = 1 + \frac{P_B^\circ \chi_B}{P_A^\circ \chi_A}$$

$$\frac{P_A^\circ}{P_B^\circ} = \frac{1}{3} \qquad \frac{\chi_A}{\chi_B} = \frac{2}{7}$$

$$\frac{1}{Y_A} = 1 + \frac{3\times 7}{2} = \frac{21}{2} + 1 = \frac{21+2}{2} = \frac{23}{2}$$

$$Y_A = \frac{2}{23}$$

70. Answer (1)

Hint: Number of equivalents of H_2SO_4 = Number of equivalents of NH_3 + Number of equivalents of NaOH

Sol.: Total number of equivalents of H_2SO_4

$= \frac{20\times 0.1\times 2}{1000} = 4 \times 10^{-3}$

Number of equivalents of NaOH

$= \frac{10\times 0.1\times 1}{1000} = 10^{-3}$

Equivalents of $NH_3 = 4 \times 10^{-3} - 1 \times 10^{-3}$

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

Mass of N = $14 \times 3 \times 10^{-3}$ g

% of N = $\frac{14\times 3\times 10^{-3}}{0.2}\times 100 = 21\%$

71. Answer (3)

Hint: $k = Ae^{-E_a/RT}$

Sol.: $e^{-E_a/RT}$ = fraction of molecules having energies equal to or greater than activation energy.

$e^{-E_a/RT} = e^{\frac{-40\times 10^3}{2\times 300}}$

$= e^{-66.67}$

72. Answer (1)

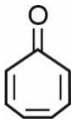
Hint: 9.8% H_2SO_4 by mass means 9.8 g of H_2SO_4 is present in 100 g of solution.

Sol.: Mole of $H_2SO_4 = \frac{9.8}{98} = 0.1$

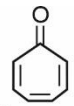
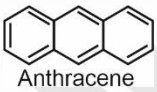
Mass of solvent = 100 – 9.8 = 90.2 g

Molality = $\frac{0.1\times 1000}{90.2}$ = 1.1 m

73. Answer (4)

Hint: Structure of tropone is 

Sol.:

(a)	 Tropone	Non-benzenoid aromatic
(b)	 Tetrahydrofuran	Heterocyclic non-aromatic
(c)	 Thiophene	Heterocyclic aromatic
(d)	 Anthracene	Benzenoid aromatic

74. Answer (3)

Hint: For first order kinetics,

$$kt = \ln\frac{[A_0]}{[A_t]} \left(\begin{matrix} [A]_0 \text{ is initial concentration} \\ [A]_t \text{ is concetration after time 't'} \end{matrix} \right)$$

Sol.: $k = \frac{2.303}{200}\log\frac{100}{10}$

$k = \frac{2.303}{200}\text{min}^{-1}$

$t_{½} = \frac{0.693}{k} = \frac{0.693\times 200}{2.303}$

= 60.18 min

$= 1.003 \text{ hour} \simeq 1 \text{ hour}$

75. Answer (1)

Hint: Solvent determines the physical state in which solution exists.

Sol.:

Mixture	Solute	Solvent	Physical state of solution
Sodium amalgam	Hg(l)	Na(s)	Solid

76. Answer (1)

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

Sol.:

$Fe_4[Fe(CN)_6]_3 \cdot xH_2O$	Prussian blue
$[Fe(CN)_5NOS]^{4-}$	Violet
$[Fe(SCN)]^{2+}$	Blood red
$(NH_4)_3PO_4 \cdot 12MoO_3$	Yellow

77. Answer (1)

Hint: For first order reaction;

$$kt = 2.303 \log \frac{P_i \text{ of } N_2O_5}{P_f \text{ of } N_2O_5}$$

Sol.:

	N_2O_5	$\rightarrow$	$2NO_2$	+	$\frac{1}{2}O_2$
t = 0	40		–		–
t = 50 min	40 – x		2x		$\frac{x}{2}$

Total pressure at 50 min = $40 - x + 2x + \frac{x}{2}$

$$70 = 40 + \frac{x \times 3}{2}$$

$$\frac{3x}{2} = 30$$

$$\boxed{x = 20}$$

Pressure of N_2O_5 at 50 min = 40 – 20 = 20

50 min is $t_{½}$

100 min is $2t_{½}$

Pressure of N_2O_5 at 100 min = 10 mm Hg

Total pressure at 100 min = $40 + \frac{x \times 3}{2}$

At 100 min, 40 – x = 10

x = 30

Total pressure at 100 min = $40 + \frac{3 \times 30}{2}$

= 85 mm Hg

78. Answer (2)

Hint and Sol.: On using catalyst activation energy decreases from E_a to E'_a

$$E_a - E_a' = 24.492 \text{ kJmol}^{-1}$$

$$\ln k = \ln A - \frac{E_a}{RT}$$

$$\ln k' = \ln A - \frac{E_a'}{RT}$$

$$\ln\left(\frac{k'}{k}\right) = \frac{\left(E_a - E_a'\right)}{RT}$$

$$= \frac{24.942 \times 10^3}{8.314 \times 750}$$

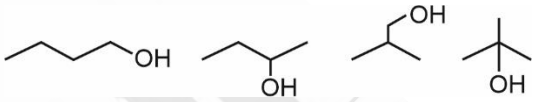
= 4

$$\frac{k'}{k} = e^4$$

79. Answer (4)

Hint: $C_4H_{10}O$ has zero degree of unsaturation. Alcohols and ethers are possible for the given molecular formula.

Sol.: Alcohols with $C_4H_{10}O$ molecular formula



Ethers with $C_4H_{10}O$ molecular formula

$CH_3 - O - CH_2 - CH_2 - CH_3$

$CH_3 - CH_2 - O - CH_2 - CH_3$

80. Answer (3)

Hint: rate = $k[NO]^x[Cl_2]^y$

Sol.: x = order w.r.t. NO and y = order w.r.t. Cl_2

(i) $1.2 \times 10^{-4} = k(0.01)^x (0.01)^y$

(ii) $2.4 \times 10^{-4} = k(0.01)^x (0.02)^y$

Dividing the equation (i) by (ii)

$$\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^y$$

y = 1

(iii) $9.6 \times 10^{-4} = k(0.02)^x (0.02)^y$

Dividing the equation (ii) by (iii)

$$\frac{1}{4} = \left(\frac{1}{2}\right)^x$$

$$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x$$

x = 2

Putting values of x and y in equation (i)

$1.2 \times 10^{-4} = k(0.01)^2 (0.01)^1$

$$k = \frac{1.2\times10^{-4}}{10^{-2}\times10^{-4}}$$

$k = 1.2 \times 10^2$

$k = 120\ mol^{-2}\ L^2\ s^{-1}$

81. Answer (3)

Hint: $i = 1 + (n - 1)\alpha$

$[H^+] = C\alpha$

Sol.: pH = 1

$[H^+] = 10^{-1} = C\alpha$

$$\alpha = \frac{10^{-1}}{1}$$

$i = 1 + (n - 1)\alpha$

$n = 2$

$i = 1 + (2 - 1)\ 10^{-1}$

$i = 1 + 0.1$

$i = 1.1$

82. Answer (4)

Hint: Nitrogen, sulphur, halogens (Cl, Br, I) and phosphorus present in an organic compound are detected by Lassaigne's test.

Sol.: Lead sulphide is black in colour.

83. Answer (2)

Hint: 188 g AgBr contains 80 g bromine

Sol.: 188 g AgBr contains 80 g Br

0.846 g AgBr contains $\frac{80\times0.846}{188}$ g of Br

Percentage of bromine in the compound

$$= \frac{80\times0.846\times100}{188\times0.8} = 45\%$$

84. Answer (3)

Hint: Binary mixture of A and B shows negative deviation from Raoult's law.

Sol.:

- Solution which shows negative deviation from Raoult's law can form maximum boiling azeotropic mixture.
- $\Delta_{mix}H < 0$ and $\Delta_{mix}V < 0$
- Mixture of n-hexane and n-heptane forms ideal solution.
- Mixture of ethanol and acetone shows negative deviation from Raoult's law.
- Interparticle attractive forces between A and B is stronger than those between A-A and B-B.

85. Answer (4)

Hint: Presence of enolisable hydrogen is required.

Sol.: α-H cannot be taken from bridgehead position.

86. Answer (2)

Hint: Rate law expression is given by slow step (rate determining step).

Sol.: Rate = $k\ [N_2O_2]\ [H_2]$

$$K_{eq} = \frac{[N_2O_2]}{[NO]^2}$$

$$[N_2O_2] = K_{eq}[NO]^2$$

Rate = $k\ K_{eq}\ [NO]^2\ [H_2]$

Rate = $k'\ [NO]^2\ [H_2]$

Overall order = 3

87. Answer (1)

Hint: $i = 1 + (n - 1)\alpha$

i = van't Hoff factor

n = Number of ions

α = Degree of dissociation

Sol.:

(a) $i = 1 + 4 \times 0.6 = 3.4$

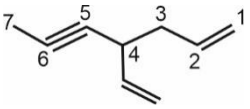
(b) $i = 1 + 1 \times 0.9 = 1.9$

(c) $i = 1 + 3 \times 0.7 = 3.1$

(d) $i = 1 + 1 \times 0.5 = 1.5$

88. Answer (4)

Hint: Parent chain must contain maximum number of multiple bonds along with highest number of carbon atoms in it.

Sol.: 

4-Ethenylhept-1-en-5-yne

89. Answer (3)

Hint: A catalyst does not alter ΔG of a reaction.

Sol.: A catalyst can only change the rate of reaction of spontaneous reaction.

90. Answer (2)

Hint: Henry's law : $P = K_H \chi$

Sol.: $P = K_H \chi$

$\chi = \frac{1}{K_H} \times P$ ...(i)

$y = m \times x$ ...(ii)

On comparing (i) and (ii)

Slope = $m = \frac{1}{K_H}$

Decreasing order of slope:

A > B > C

Decreasing order of K_H :

C > B > A

[BOTANY]

91. Answer (1)

Hint: The figure represents the geometric growth.

Sol.: In most systems, the initial growth is slow (lag phase), and it increases rapidly thereafter – at an exponential rate (log or exponential phase). In geometric growth, both the progeny cells following mitotic cell division retain the ability to divide and continue to do so. However, with limited nutrient supply, the growth slows down leading to a stationary phase. If we plot the parameter of growth against time, we get a typical sigmoid or S-curve. A sigmoid curve is a characteristic of living organism growing in a natural environment.

92. Answer (4)

Hint: Glyceraldehyde-3-phosphate is an intermediate of glycolysis, while fumaric acid is an intermediate of Krebs cycle.

Sol.: If Glyceraldehyde-3-phosphate is used as an intermediate then five molecules of NADH + H^+ are produced, but if fumaric acid is used as an intermediate then one molecule of NADH + H^+ is produced, thus, four more molecules will be produced.

93. Answer (4)

Hint: Hatch and Slack pathway begins with carboxylation in mesophyll cells.

Sol.: Sequence of steps of Hatch and Slack pathway:

d. Carboxylation reaction catalysed by PEP carboxylase

b. Conversion of first stable product into malic acid

c. Transport of 4-carbon organic acid into the cells encaging RuBisCO

e. Decarboxylation of C_4 acid

a. Conversion of 3 carbon molecule to primary CO_2 acceptor

94. Answer (3)

Hint: Mint plant was used by Joseph Priestley.

Sol.: Using a prism T. W. Engelmann split light into its spectral components and then illuminated a green alga, *Cladophora*, placed in a suspension of aerobic bacteria. The bacteria were used to detect the sites of O_2 evolution. He observed that the bacteria accumulated mainly in the region of blue and red light of the split spectrum. A first action spectrum of photosynthesis was thus described.

95. Answer (4)

Hint: Changing the environmental conditions, such as light and temperature are other methods to overcome seed dormancy.

Sol.: Effect of inhibitory substances can be removed by subjecting the seeds to chilling conditions or by application of certain chemicals like gibberellic acid and nitrates. Impermeable and hard seed coat; presence of chemical inhibitors such as abscisic acids, phenolic acids, para-ascorbic acid; and immature embryos are some of the reasons which causes seed dormancy.

96. Answer (3)

Hint: The initial stage of cellular respiration is glycolysis.

Sol.: For each ATP produced, $4H^+$ passes through F_0 from the intermembrane space to the matrix down the electrochemical proton gradient. The continued oxidation of acetyl CoA via the TCA cycle requires the continued replenishment of oxaloacetic acid, the first member of the cycle.

97. Answer (1)

Hint: This hormone was discovered by E. Kurosawa.

Sol.: GA_3 is used to speed up the malting process in brewing industry.

98. Answer (1)

Hint: Light reactions are also known as photochemical reactions and dark reactions are known as carbon reactions.

Sol.: Within the chloroplasts, the membranes are sites for the light reaction, while the chemosynthetic pathway occurs in the stroma.

99. Answer (3)

Hint: In cotton, the leaves of the juvenile plant are different in shape from those in mature plants.

Sol.: Difference in shapes of leaves produced in air and those produced in water in buttercup, represent the heterophyllous development due to environment.

100. Answer (2)

Hint: Sorghum is a C_4 plant but bell pepper is a C_3 plant.

Sol.: For bell pepper, current availability of CO_2 levels is limiting. At low light conditions, neither C_3 or C_4 plants respond to high CO_2 conditions. In both the groups, water stress leads to reduction in the CO_2 availability. In sorghum, RuBisCO does not show oxygenase activity. Pyruvate kinase being an enzyme of glycolysis, is found in all cells.

101. Answer (2)

Hint: The constantly dividing cells, both at the root apex and the shoot apex, represent the meristematic phase of growth.

Sol.: Increased vacuolation, cell enlargement and new cell wall deposition are the characteristics of the cells in elongation phase.

102. Answer (1)

Hint: Its role is limited to the terminal stage of the process.

Sol.: Oxygen acts as the final hydrogen acceptor in mitochondrial ETS.

103. Answer (2)

Hint: If fatty acids were to be respired they would first be degraded to acetyl CoA and enter the pathway.

Sol.: Glycerol would enter the pathway after being converted to PGAL.

104. Answer (1)

Hint: In C_4 plants, RuBisCO does not show oxygenase activity.

Sol.: In C_4 plants, photorespiration does not occur. This is because they have a mechanism that increases the concentration of CO_2 at the enzyme site (RuBisCO).

105. Answer (2)

Hint: C_2H_4 is a gaseous hormone.

Sol.: GA is a terpene derivative.

106. Answer (4)

Hint: Auxin controls xylem differentiation and helps in cell division.

Sol.: Cytokinin promotes nutrient mobilization which helps in the delay of leaf senescence. Ethylene promotes rapid internode/petiole elongation in deep water rice plants. Gibberellin cause fruits like apple to elongate and improve its shape.

107. Answer (1)

Hint: H.H. Cousins discovered ethylene.

Sol.: Miller et al. (1955), later identified and crystallised the cytokinesis promoting active substance that they termed kinetin.

108. Answer (3)

Hint: In a photosystem, reaction centre is made up of chlorophyll *a*.

Sol.: In a photosystem, all the pigments (except one molecule of chlorophyll *a*) forms antennae.

109. Answer (1)

Hint: Removal of shoot tips (decapitation) usually results in the growth of lateral buds.

Sol.: Removal of shoot tips (decapitation) suppresses the effect of auxin.

110. Answer (3)

Hint: The disaccharide i.e. composed of glucose and fructose is sucrose.

Sol.: The correct sequence of events are as follows:

$$\text{Sucrose} \xrightarrow{\text{Invertase}} \text{Glucose + Fructose}$$

$$\text{Glucose} \xrightarrow{\text{Hexokinase}} \text{Glucose-6-phosphate}$$

Fructose-6-phosphate $\xrightarrow{\text{Phosphofructokinase}}$ Fructose-1,6-bisphosphate

Fructose-1,6-bisphosphate $\xrightarrow{\text{Aldolase}}$ Glyceraldehyde-3-phosphate+Dihydroxyacetone phosphate

2-phosphoglycerate $\xrightarrow{\text{Enolase}}$ Phosphoenolpyruvate

111. Answer (3)

Hint: It is a modified form of adenine.

Sol.: Cytokinins have specific effects on cytokinesis, and were discovered as kinetin (a modified form of adenine, a purine) from the autoclaved herring sperm DNA.

112. Answer (1)

Hint: It is a 3C compound.

Sol.: Pyruvate is the key product of glycolysis.

113. Answer (3)

Hint: Formation of proton gradient across the thylakoid membrane is required for chemiosmosis.

Sol.: During light reaction, ATP synthesis in the chloroplasts is a direct outcome of the breakdown of the proton gradient causing a conformational change in the CF_1 particle.

114. Answer (4)

Hint: It is induced by the gaseous PGR.

Sol.: Influences of ethylene on plants include apical hook formation in dicot seedlings.

115. Answer (3)

Hint: Orientation of plants is a plant factor.

Sol.: Temperature is an external factor affecting photosynthesis.

116. Answer (4)

Hint: It is caused by stress hormone.

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

117. Answer (1)

Hint: The plant cells grow in size by cell enlargement which in turn requires water.

Sol.: Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source. Cells positioned away from root apical meristems differentiate as root-cap cells, while those pushed to the periphery mature as epidermis.

118. Answer (3)

Hint: Macro and micro essential elements are nutrients.

Sol.: Nutrients (macro and micro essential elements) are required by plants for the synthesis of protoplasm and act as source of energy. r is the relative growth rate and is also the measure of the ability of the plant to produce new plant material, referred to as efficiency index.

119. Answer (3)

Hint: He also found that the green parts in plants is where glucose is made, and that the glucose is usually stored as starch.

Sol.: Julius von Sachs provided evidence for production of glucose when plants grow.

120. Answer (4)

Hint: In fermentation, the incomplete oxidation of glucose is achieved under anaerobic conditions.

Sol.: In fermentation, there is a net gain of only two molecules of ATP for each molecule of glucose degraded to pyruvic acid.

121. Answer (1)

Hint: The cells of meristems have the capacity to divide and self-perpetuate.

Sol.: Plant growth is unique because plants retain the capacity for unlimited growth throughout their life. This ability of the plants is due to the presence of meristems at certain locations in their body.

122. Answer (4)

Hint: Maize is a C_4 plant.

Sol.: Maize shows resistivity towards high temperature. It also shows greater productivity of biomass due to lack of photorespiration. It also shows CO_2 saturation at about 360 $\mu l L^{-1}$.

123. Answer (1)

Hint: The PGR that is discovered while studying foolish seedling disease of rice is GA

Sol.: Gibberellins also promote bolting (internode elongation just prior to flowering) in beet, cabbages and many plants with rosette habit. They promote stem elongation.

124. Answer (2)

Hint: $FADH_2$ and NADH + H^+ are produced during Krebs cycle.

Sol.: ATP and NADPH are the high energy chemical intermediates formed during light reaction of photosynthesis.

125. Answer (4)

Hint: ABA is a growth inhibitor.

Sol.: ABA induces senescence and abscission.

126. Answer (4)

Hint: Phosphoglycolate is formed during photorespiration.

Sol.: Phosphoglycolate is formed when RuBisCO interacts with oxygen. 3-phosphoglycerate is the product of carboxylation step of the Calvin cycle.

127. Answer (3)

Hint: Auxin helps to prevent fruit and leaf drop at early stages but promote the abscission of older mature leaves and fruits.

Sol.: Both auxin and ethylene can stimulate root growth.

128. Answer (2)

Hint: Xanthophylls appear yellow in the chromatogram.

Sol.: Xanthophylls can act as an accessory pigment. It prevents photooxidation of chlorophyll *a*.

129. Answer (2)

Hint: The TCA cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid.

Sol.: TCA cycle takes place in mitochondrial matrix where acetyl CoA combines with OAA to form a 6C compound citric acid.

130. Answer (1)

Hint: ABA is a growth inhibiting hormone.

Sol.: Auxins promote flowering in pineapples. Ethylene is used to initiate flowering and for synchronising fruit-set in pineapples.

131. Answer (3)

Hint: Fats and proteins have RQ values < 1.

Sol.: Organic acids have RQ greater than 1 and glucose have RQ equal to 1.

132. Answer (3)

Hint: Non-cyclic photophosphorylation requires the functioning of both PS I and PS II.

Sol.: Non-cyclic photophosphorylation requires external electron donor i.e., H_2O.

133. Answer (1)

Hint: This reaction is catalysed by succinate dehydrogenase.

Sol.: Succinate dehydrogenase is common for ETS and TCA cycle. It catalyses conversion of succinate to fumarate.

134. Answer (4)

Hint: Tomato is a C_3 plant.

Sol.: RuBisCO is found in mesophyll cells of C_3 plants.

135. Answer (1)

Hint: Substrate level phosphorylation reactions can directly yield GTP/ATP.

Sol.: Succinyl CoA $\rightarrow$ Succinic acid can directly yield GTP.

[ZOOLOGY]

136. Answer (4)

Hint: Corpus luteum secretes mainly progesterone.

Sol.: After ovulation, the ruptured Graafian follicle is converted to a structure called corpus luteum, which secretes mainly progesterone.

Progesterone supports pregnancy. It also acts on the mammary glands and stimulates the formation of alveoli and milk secretion.

Estrogen regulates female sexual behaviour and causes development of growing ovarian follicles.

137. Answer (4)

Hint: Decreased release of ADH results in diabetes insipidus.

Sol.: Decreased release of ADH results in diabetes insipidus which results in a diminished ability of the kidney to conserve water leading to water loss and dehydration.

Prolonged hyperglycemia leads to disorder named diabetes mellitus which is associated with the loss of glucose through urine and formation of harmful compounds known as ketone bodies.

Low secretion of GH results in stunted growth resulting in pituitary dwarfism.

Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth, mental retardation, *etc*.

138. Answer (1)

Hint: Location of pancreas

Sol.: Pancreas is a composite gland which consists of 'Islets of Langerhans'. The two main types of cells in the Islets of Langerhans are called α-cells and β-cells. Glucagon secreted from α-cells acts mainly on hepatocytes and stimulates glycogenolysis. Pancreas is a digestive gland and is located in the abdominal cavity between the C-shaped curve of duodenum.

- Four parathyroid glands are present on the backside of the thyroid gland in the neck region.
- The pineal gland is located on the dorsal side of forebrain.
- The pituitary gland is located in a bony cavity called sella tursica.

139. Answer (2)

Hint: Equal to the numbers of coxal bones in humans.

Sol.: All the mentioned hormones are related with glucose metabolism except aldosterone which is a mineralocorticoid and TCT (thyrocalcitonin) which regulates the blood calcium levels.

140. Answer (2)

Hint: Causes acromegaly

Sol.: Excess secretion of growth hormone in adults especially in middle age can result in severe disfigurement (especially of the face) called acromegaly, which may lead to serious complications and premature death; if unchecked.

141. Answer (1)

Hint: Secreted from pars intermedia

Sol.: Pars intermedia is almost merged with pars distalis in humans. It secretes only one hormone called melanocyte stimulating hormone (MSH). However, in humans, the pars intermedia is almost merged with pars distalis.

Pars nervosa stores and releases two hormones called oxytocin and vasopressin, which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

142. Answer (1)

Hint: Equal to number of fins in humans

Sol.: Gonadal activity is regulated by complex system of hormones, primarily controlled by the hypothalamic-pituitary-gonadal axis. So it includes all the mentioned hormones like GnRH from the hypothalamus, which stimulates the pituitary to release LH and FSH. These gonadotrophins then target the gonads to stimulate the production of sex hormones like testosterone, estrogen and progesterone.

Thyroid hormones and melatonin also influence menstrual cycle in females.

143. Answer (4)

Hint: GHRH causes increased secretion of GH/GF.

Sol.: Several non-endocrine tissues secrete hormones called growth factors. These factors are essential for the normal growth of tissues and their repairing/regeneration.

144. Answer (1)

Hint: LH and FSH are trophic hormones.

Sol.: Somatostatin from the hypothalamus inhibits the release of growth hormone from the pituitary. The releasing and inhibiting hormones of hypothalamus originating in the hypothalamic neurons, pass through axons and released from their nerve endings. CRH stands for corticotrophin releasing hormone. These hormones reach the pituitary gland through a portal circulation and regulate the functions of anterior pituitary. Gonadotrophins (LH and FSH) are secreted by anterior pituitary gland.

145. Answer (3)

Hint: ADH increases blood pressure.

Sol.: ANF is secreted in response to increased blood pressure, which causes dilation of the blood vessels, this reduces the blood pressure. On the other hand vasopressin (ADH) is a vasoconstrictor hence, increases the blood pressure.

146. Answer (2)

Hint: Source of trophic hormones

Sol.: Trophic cells secrete trophic hormones like GH, PRL, TSH, ACTH, LH and FSH.

Pars nervosa also known as posterior pituitary, stores and releases two hormones called oxytocin and vasopressin (ADH).

147. Answer (3)

Hint: Cortisol suppresses immune reactions.

Sol.: Glucocorticoids, particularly cortisol, produces anti-inflammatory reactions and suppresses the immune response. Cortisol stimulates the RBC production. Cortisol is also involved in maintaining the cardio-vascular system as well as the kidney function.

148. Answer (1)

Hint: Cell mediated immunity is a type of acquired immunity.

Sol.: The thymus plays a major role in development of the immune system by secreting hormones called thymosins. Thymosins promote the production of antibodies to provide humoral immunity.

Thymosins play a major role in the differentiation of T-lymphocytes, which help B-cells to produce antibodies and provide humoral immunity.

149. Answer (4)

Hint: It is a glucocorticoid.

Sol.: Steroid hormones are not water soluble, they are considered as lipid soluble hormones, like cortisol, testosterone, estradiol, *etc*.

150. Answer (2)

Hint: Hormones regulate functions of target tissue.

Sol.:

Hormones produce their effects on target tissue by binding to specific proteins called hormone receptors located in the target tissue only.

Binding of a hormone to its receptors leads to the formation of a hormone-receptor complex.

Each receptor can be identified by only one hormone and hence receptors are specific.

Hormone-Receptor complex formation leads to certain biochemical changes in the target tissue.

Target tissue metabolism and hence physiological functions are regulated by hormones.

151. Answer (4)

Hint: Part of forebrain.

Sol.:

Humans	**Frogs**
Enucleated RBCs	Nucleated RBCs
Salivary glands – Present	Salivary glands – Absent
Diaphragm – Present	Diaphragm – Absent
Cerebral hemispheres – Present	Cerebral hemispheres – Present

152. Answer (3)

Hint: Bidder's canal opens into urinogenital duct.

Sol.: In case of frogs, male reproductive system consists of a pair of testes. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally, it communicates with urinogenital duct that comes out of the kidneys and opens into cloaca.

153. Answer (3)

Hint: True for platyhelminths.

Sol.: The body temperature of frogs varies with temperature *i.e.*, they are poikilotherms. They belong to the superclass Tetrapoda.

Sexes are separate *i.e*., they are dioecious.

154. Answer (3)

Hint: Adult frogs are carnivores.

Sol.: The alimentary canal of adult frogs is short because frogs are carnivores and hence, the length of intestine is reduced.

Tadpoles are herbivores and have a longer digestive tract to digest cellulose than adults.

155. Answer (2)

Hint: Cranial nerves arise from brain.

Sol.:

- The nervous system is organised into a central and a peripheral nervous system.
- There are 10 pairs of cranial nerves arising from the brain.
- Brain is enclosed in a bony structure called cranium (Brain box).
- The brain is divided into forebrain, midbrain and hind brain.
- Hind brain consists of cerebellum and medulla oblongata but lacks pons.

156. Answer (4)

Hint: Equal to the number of cranial bones in human.

Sol.: The prominent endocrine glands found in frogs are pituitary, thyroid, parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads.

157. Answer (3)

Hint: Cutaneous respiration is seen during hibernation.

Sol.: The frogs swim in water by powerful backward thrusts of its hindlimbs which act like propellers. The hindlimbs end with five digits.

In water, adult frogs respire *via* skin.

Frogs can croak underwater as well as on land.

It is louder in males due to the presence of vocal sacs that act as resonators.

158. Answer (1)

Hint: Hepatic portal system.

Sol.: Special venous connection between liver and intestine as well as the kidney and lower parts of the body are present in frogs. The former is called hepatic portal system and the latter is called renal portal system.

159. Answer (2)

Hint: Spermatheca is absent in male cockroach.

Sol.: A pair of spermatheca is present in the 6^{th} abdominal segment of female cockroach which opens into the genital chamber.

The development of *P.americana* is paurometabolous, meaning there is development through nymphal stages. The next to last nymphal stage has wing pads but only adult cockroaches have wings.

Urecose gland helps in excretion but it is absent in females.

160. Answer (2)

Hint: True for Malpighian tubules

Sol.: At the junction of midgut and hindgut, a ring of 100-150 yellow-coloured thin filamentous Malpighian tubules is present. Each tubule is lined by glandular and ciliated cells. They help in removal of excretory products from haemolymph not from alimentary canal.

A ring of 6-8 blind tubules called hepatic or gastric caecae is present at the junction of foregut and midgut, which secrete digestive juices.

161. Answer (3)

Hint: Equal to the number of digits in a hindlimb of frog.

Sol.: Sensory structures of cockroach are maxillae (contain gustatory and olfactory receptors), antennae, anal cerci (help in monitoring the environment) and walking legs (help to detect tactile stimulus).

162. Answer (3)

Hint: Cockroach can survive without head for about a week.

Sol.: Head of cockroach is triangular in shape and lies anteriorly at right angles to the longitudinal body axis. Brain is represented by supra-oesophageal ganglion that supplies nerves to antennae, compound eyes and labrum.

Sub-oesophageal ganglion supplies nerves to labium, mandible and maxillae.

163. Answer (3)

Hint: The 7^{th} sternum is boat-shaped.

Sol.: The abdomen in both male and female cockroaches consists of 10 segments. In females, the 7^{th} sternum is boat shaped and together with the 8^{th} and 9^{th} sterna forms a brood pouch or genital pouch whose anterior part contains female gonopore.

164. Answer (3)

Hint: First pair of wings arises from 2^{nd} thoracic segment.

Sol.: Thorax of cockroach contains 3 segments. Each thoracic segment bears a pair of walking legs. The first pair of wings arises from mesothorax and the second pair from metathorax. Forewings called tegmina are opaque, dark and leathery and cover the hind wings, when at rest. The hind wings are transparent, membranous and are used in flight. The mouthparts consist of a labrum (upper lip), a pair of mandibles, a pair of maxillae and a labium (lower lip).

165. Answer (3)

Hint: Cetaceans are aquatic mammals.

Sol.: Not all mammals have hair and pinnae.

Buccopharyngeal respiration is seen in frogs.

Frogs also respire *via* skin.

166. Answer (2)

Hint: Identify the members of class Amphibia and Reptilia.

Sol.: In members of the class Amphibia and Reptilia, tympanum represents the ear. Tree frog, frog and toad are amphibian. Lamprey is a cyclostome and katla is a fish which lack external ears and flying fox is a mammal possessing external ears or pinnae. Wall lizard is a reptile.

167. Answer (4)

Hint: Humans have four complete chambers in their heart.

Sol.: Mammals are homeotherms. Heart is four-chambered and complete double circulation is present in all the members of class Mammalia.

- They are viviparous with few exceptions and development is direct.
- Their skin is unique in possessing hair
- Respiration is by lungs.
- Different types of teeth are characteristic of mammals.

168. Answer (2)

Hint: Urochordates are invertebrates.

Sol.: *Ascidia* is an urochordate and an invertebrate.

Paired lateral fins are present in cartilaginous fishes.

The body of cyclostomes is devoid of scales and paired fins.

169. Answer (2)

Hint: Members of class Anthozoa lacks metagenesis.

Sol.: Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like *Hydra*, *Adamsia*, *Pennatula etc*. whereas, the latter is umbrella-shaped and free swimming like *Aurelia* or jelly fish. Those cnidarians which exist in both forms exhibit alternation of generation (metagenesis), *i.e*., polyps produce medusae asexually and medusae form the polyp sexually (*e.g*., *Obelia*).

170. Answer (3)

Hint: *Palaeomon* is a crustacean.

Sol.:

Limbless amphibian	*Ichthyophis*
Oviparous mammal	*Ornithorhynchus*
Aquatic arthropod	*Palaeomon*
Fish with pre-hensile tail	*Hippocampus*

171. Answer (3)

Hint: It is a mollusc.

Sol.: Pearl oysters are sedentary bivalves found in seas.

They are molluscs hence, unsegmented.

They are economically important for the jewellery market and employment in coastal communities.

172. Answer (3)

Hint: Identify a bony fish.

Sol.: Cartilaginous male fishes bear claspers on their pelvic fins.

Eg.:- *Trygon* (sting ray), *Carcharodon* (Great white shark), *Torpedo* (electric fish)

Clarias (Magur) is a bony fish.

173. Answer (2)

Hint: Members of the second largest phylum exhibit bilateral symmetry.

Sol.: Animals like annelids, arthropods, *etc*., where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

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

Closed type of blood circulation is a type of circulation in which the blood is circulated through a series of vessels of varying diameters.

When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry. *E.g.,* most of the coelenterates, adult echinoderms and ctenophores.

174. Answer (3)

Hint: Organisms of kingdom Animalia are multicellular.

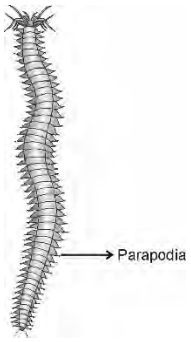
Sol.: Sponges are primitive multicellular organisms with cellular level of organisation.

Choanocytes or collar cells line the spongocoel and the canals.

175. Answer (3)

Hint: Parapodia are the hollow locomotory structures.

Sol.: Parapodia are the lateral appendages present in aquatic annelids like *Nereis*, which help in swimming.



176. Answer (3)

Hint: Common name of *Cucumaria* is sea cucumber.

Sol.: *Chaetopleura* (Chiton): The zygote develops into trochophore larva. It is a marine mollusc.

The excretory organs are present. Sexes are separate.

Cucumaria (Sea cucumber): Development is indirect with auricularia larva. They are found at the sea-bottoms in shallow tropical waters (Echinoderms are exclusively marine).

177. Answer (4)

Hint: Phylum Aschelminthes

Sol.: Aschelminths are dioecious, *i.e.*, males and females are distinct, often females are longer than males. Fertilisation is internal and development may be direct or indirect. Their alimentary canal is complete with a well-developed muscular pharynx. An excretory tube removes body wastes from the body cavity through the excretory pore.

They do not have well-developed circulatory or respiratory system.

178. Answer (3)

Hint: Scientific name of honeybee.

Sol.: Economically important insects :– *Apis*, *Bombyx* and *Laccifer*

Vectors – *Anopheles*, *Culex* and *Aedes* (Mosquitoes)

- Living fossil – *Limulus*
- Gregarious pest – *Locusta*

179. Answer (4)

Hint: Sea hare is a mollusc.

Sol.:

- The anterior head region of molluscs have sensory tentacles.
- The body of molluscs is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.
- Molluscs are terrestrial or aquatic having an organ-system level of organisation.

180. Answer (2)

Hint: *Saccoglossus* is an example

Sol.: Phylum Hemichordata consists of a small group of worm-like animals with organ-system level of organisation. The body is cylindrical and is composed of an anterior proboscis, a collar and a long trunk. Their excretory organ is proboscis gland.

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