All India Aakash Test Series for NEET - 2026

OPEN MOCK TEST - 6

Click here for Code-B sol.

Test Date : 26/04/2026

ANSWERS

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

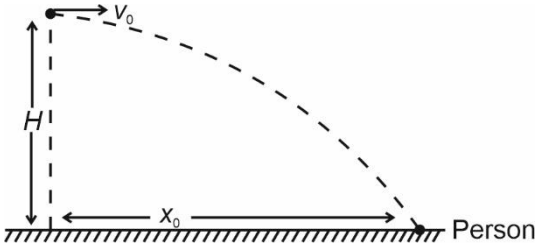
HINTS & SOLUTIONS

[PHYSICS]

1. Answer (3)

Hint: Use formulae : $t = \sqrt{\frac{2H}{g}}$ and $x = u \times t$

Sol.:



Time of flight of the food packet, $t = \sqrt{\frac{2H}{g}}$

Horizontal distance to be covered in this time t,

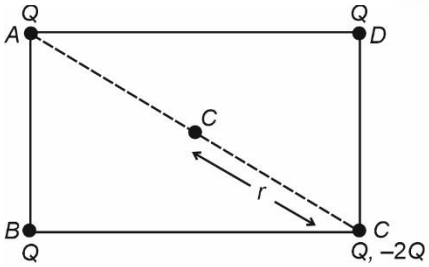
$x_0 = u \times t$

$$x_0 = v_0\sqrt{\frac{2H}{g}}$$

2. Answer (3)

Hint: Use principle of superposition.

Sol.: Consider two point charges Q and $-2Q$ at vertex C. Due to positive charge Q, net field will become zero. Hence



$$E = \frac{2kQ}{r^2}$$

$$r = \frac{1}{2}\sqrt{a^2 + b^2}$$

$$\therefore E = 2 \times \frac{1}{4\pi\varepsilon_0} \times \frac{Q}{\left(\frac{1}{2}\sqrt{a^2 + b^2}\right)^2} = \frac{2Q}{\pi\varepsilon_0\left(a^2 + b^2\right)}$$

3. Answer (3)

Hint & Sol.: The motion of a rigid body which is not pivoted in some way is either a pure translation or a combination of translation and rotation.

4. Answer (1)

Hint: Adiabatic process: PV^{γ} = constant

Sol.: P_i = 1 atm, $V_i = V_0$

$$P_iV_i^{\gamma} = P_fV_f^{\gamma} \Rightarrow 1 \times V_0^{\gamma} = P_f\left(\frac{V_0}{8}\right)^{\gamma}$$

$$P_f = 1 \times (8)^{\frac{4}{3}} = 1 \times \left(2^3\right)^{\frac{4}{3}}$$

P_f = 16 atm

5. Answer (2)

Hint: Apply lens formula and magnification formula.

Sol.: Lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} - \frac{1}{\frac{-3f_0}{2}} = \frac{1}{f_0}$$

$$\frac{1}{v} = \frac{1}{f_0} - \frac{1}{\frac{3}{2}f_0} \Rightarrow v = 3f_0$$

Magnification formula:

$$\frac{h_i}{h_0} = \frac{v}{u} \Rightarrow \frac{r_1}{r_0} = \frac{3f_0}{\frac{-3}{2}f_0} = -2$$

$\therefore$ Radius of image = 2 × radius of object

$$\frac{\text{Area of image}}{\text{Area of object}} = \frac{\pi r_1^2}{\pi r_0^2}$$

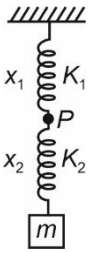
$$\frac{A_{\text{image}}}{a} = (2)^2 \Rightarrow A_{\text{image}} = 4a$$

6. Answer (4)

Hint: Use relation $K_1x_1 = K_2x_2$

Sol.:

FBD of block m :



$F_2 = mg$

$K_2x_2 = mg$

$$x_2 = \frac{mg}{2K} \quad \ldots(i)$$

FBD of point P:

$F_1 = F_2$

$K_1x_1 = K_2x_2$

$Kx_1 = 2Kx_2 \Rightarrow x_1 = 2x_2$

$$x_1 = 2\times\frac{mg}{2K} = \frac{mg}{K} \quad \ldots(ii)$$

$$x_1 + x_2 = \frac{mg}{K} + \frac{mg}{2K} = \frac{3mg}{2K}$$

7. Answer (4)

Hint & Sol.: de Broglie wavelength is given by

$$\lambda = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$$

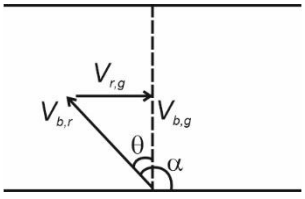
8. Answer (3)

Hint & Sol.: γ-rays have the highest penetrating power.

9. Answer (1)

Hint: For the given condition, the drift can be minimised to zero.

Sol.:



To make drift zero:

$$\sin\theta = \frac{v_{r,g}}{v_{b,r}} = \frac{v_0}{2v_0}$$

$$\sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$$

$$\alpha = 90^\circ + \theta = 120^\circ$$

10. Answer (2)

Hint: Properties of an electric conductor.

Sol.:

- Net charge on a neutral conductor has to be zero.
- Potential of a neutral conductor can be non-zero.
- In electrostatic condition, electric field inside a conductor is zero.

11. Answer (4)

Hint: Work done by magnetic field is zero, hence gain in speed will be due to work done by gravity only.

Sol.: Work done by all forces = Δ(K.E.)

$$W_{mg} + 0 = \frac{1}{2}mv^2 - 0$$

$$mgy = \frac{1}{2}mv^2$$

For vertical displacement y, $v = \sqrt{2gy}$

$$F_{\text{magnetic}} = q\left(\vec{v}\times\vec{B}\right)$$

$$F_m = qvB\sin 90^\circ = q\left(\sqrt{2gy}\right)B$$

12. Answer (2)

Hint: To convert a galvanometer into a voltmeter, a resistance has to be connected in series with it.

Sol.:

Using equation, $V = iR$

$0.4 = (50 \times 10^{-6})\,(80 + R')$

$$\frac{0.4\times10^6}{50} = 80 + R'$$

$R' + 80 = 8000 \Rightarrow R' = 7920\ \Omega$

13. Answer (4)

Hint: Time period of simple pendulum, $T = 2\pi\sqrt{\frac{l}{g}}$

Sol.: $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T_1 = 2\pi\sqrt{\frac{256}{g}}$

$T_1 = \frac{2\pi}{\sqrt{g}} \times 16$ …(i)

$T_2 = \frac{2\pi}{\sqrt{g}} \times 14$ …(ii)

Let n_1 and n_2 be integers, then

$n_1T_1 = n_2T_2$

$n_1 \times \frac{2\pi}{\sqrt{g}} \times 16 = n_2 \times \frac{2\pi}{\sqrt{g}} \times 14$

$\frac{n_1}{n_2} = \frac{14}{16} = \frac{7}{8}$

longer pendulum will take 7 oscillations while smaller pendulum will take 8 oscillations to be in phase again.

14. Answer (1)

Hint & Sol.: Covering one slit with a thin transparent film introduces an additional optical path, and thus shifting the central maximum.

15. Answer (1)

Hint: Find the time until the trains collide and multiply it with the speed of the bird to find the total distance flown by the bird.

Sol.: Relative speed of trains = (72 + 54) × $\frac{5}{18}$ = 35 m/s

Time until collision = $\frac{1.75 \times 1000}{35}$ = 50 s

Total distance flown by the bird

$= \left(90 \times \frac{5}{18}\right) \times 50$ = 1250 m or 1.25 km.

16. Answer (4)

Hint: Apply principle of calorimetry.

Sol.: Let final temperature of the mixture be T. Heat lost by copper = heat gained by water

200 × 0.39 × (150 – T) = 100 × 4.18 (T –25)

78 (150 – T) = 418 (T – 25)

11700 – 78 T = 418 T – 10450

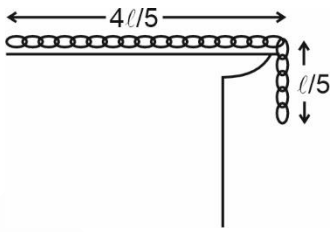
11700 + 10450 = 418 T + 78 T

$T = \frac{22150}{496}$ = 44.66°C

17. Answer (3)

Hint: Take reference for potential energy at the table.

Sol.:



$PE_{initial} = \frac{-mg}{5} \times \frac{\frac{\ell}{5}}{2} = \frac{-mgl}{50}$ … (i)

$PE_{final} = -mg\frac{\ell}{2}$ …(ii)

Since, only gravity is doing work, hence total mechanical energy will remain conserved.

$KE_i + PE_i = KE_f + PE_f$

$0 + \left(\frac{-mg\ell}{50}\right) = KE_f + \left(\frac{-mg\ell}{2}\right)$

$KE_f = \frac{mg\ell}{2} - \frac{mg\ell}{50} = \frac{24}{50}mg\ell$

$KE_f = \frac{12}{25}mg\ell$

18. Answer (1)

Hint: Use Bernoulli's principle.

Sol.: Bernoulli's equation, $P + \frac{1}{2}\rho v^2$ = constant

So, if velocity is lower then pressure would be higher.

19. Answer (2)

Hint & Sol.: Orbital speed = $\sqrt{\frac{GM}{R}} = \sqrt{gR}$

20. Answer (3)

Hint: Energy formula for hydrogen atom:

$E_n = \frac{-13.6}{n^2}$eV

Sol.: Ground state: $E_1 = -13.6$ eV

$n = 4$ level: $E_4 = \frac{-13.6}{4^2}$ eV

$E = E_4 - E_1 = 13.6\left(1-\frac{1}{16}\right) = \frac{13.6\times 15}{16}$ eV ...(i)

Energy required to remove electron from $n = 4$:

$E' = 0-\left(-\frac{13.6}{16}\right) = \frac{13.6}{16}$ ...(ii)

$\therefore \frac{E}{E'} = \frac{13.6\times\frac{15}{16}}{\frac{13.6}{16}} = 15$

21. Answer (1)

Hint: Force is equal for both the wire segments.

Sol.: Elongation, $\Delta l = \frac{FL}{AY}$

Here, $\Delta l \propto \frac{1}{A}$

$\therefore \frac{\Delta l_1}{\Delta l_2} = \left(\frac{R_2}{R_1}\right)^2 = \frac{1}{4}$

22. Answer (3)

Hint & Sol.: In an adiabatic free expansion, the gas expands into a vacuum i.e., zero external pressure. Therefore $W = 0$, also $Q = 0$, because the process is adiabatic.

Since, $Q = \Delta U + W$ and $Q = 0 = W$

$\therefore \Delta U = 0$

Since $U \propto T$, the temperature remains constant too.

23. Answer (4)

Hint: Use formula, resistance $R = \frac{\rho l}{A}$

Sol.: $R = \frac{\rho l}{A} \Rightarrow R = \frac{\rho l^2}{V}$

Putting given values in the formula, we get

$3 = \frac{\rho l^2}{3} \Rightarrow l^2 = \frac{9}{\rho}$

$l = \frac{3}{\sqrt{\rho}}$ metre

24. Answer (3)

Hint: Intensity of an electromagnetic wave is given by $\frac{1}{2}\varepsilon_0 E_0^2 c$

Sol.: $\eta = \frac{\text{Power output}}{\text{Power input}}$

$\eta = \frac{P}{P_0} \Rightarrow P = \eta P_0$ ...(i)

Intensity at distance r:

$I = \frac{P}{4\pi r^2}$ ...(ii)

Intensity of an EM wave = $\frac{1}{2}\varepsilon_0 E_0^2 c$ ...(iii)

Using equations (i), (ii) and (iii), we can write

$\frac{1}{2}\varepsilon_0 E_0^2 c = \frac{\eta P_0}{4\pi r^2} \Rightarrow E_0 = \left(\frac{\eta P_0}{2\pi r^2 \varepsilon_0 c}\right)^{\frac{1}{2}}$

25. Answer (3)

Hint: Einstein's photoelectric equation:

$h\nu = h\nu_0 + KE_{max}$

Sol.:

(a) $KE_{max} = h\nu - h\nu_0$

Compare with $y = mx + c$

Therefore, graph of KE_{max} vs ν is a straight line with slope h

(b) $h\nu = h\nu_0 + eV_0$

$V_0 = \frac{h\nu}{e} - \frac{h\nu_0}{e}$

slope = $\frac{h}{e}$

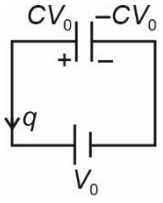
(c) $\phi = h\nu_0 \Rightarrow \nu_0 = \frac{\phi}{h}$

(d) Saturation photocurrent depends on photon intensity of incident light.

26. Answer (1)

Hint: Work done by battery = $\Delta V \times q$

Sol.: Initial charge on the positive plate of the capacitor = $2CV_0$ ...(i)



Final charge on the positive plate = CV_0 …(ii)

Charge is moving from positive to negative terminal of the battery.

Work done by the battery = $\Delta V \times q$

$W_b = -V_0 \times CV_0 = -CV_0^2$

27. Answer (3)

Hint & Sol.: An ideal transformer has no losses, hence input power is equal to output power due to perfect efficiency.

28. Answer (1)

Hint & Sol.: Induced emf = $\frac{-d\phi}{dt}$

It means induced emf is directly proportional to rate of change of magnetic flux.

All other statements are correct.

29. Answer (4)

Hint: Physical quantity with highest power would be responsible for maximum error.

Sol.: $P = \frac{A^2\sqrt{B}}{CD^{-4}}$

$\frac{\Delta P}{P} = \frac{2\Delta A}{A} + \frac{1}{2}\frac{\Delta B}{B} + \frac{\Delta C}{C} + 4\frac{\Delta D}{D}$

Since % error is same for all the quantities, hence quantity D will bring the maximum percentage error.

30. Answer (2)

Hint & Sol.: Fundamental frequency of closed organ pipe, $f_c = \frac{v}{4L}$

Fundamental frequency of open organ pipe, $f_o = \frac{v}{2L}$

$\therefore \frac{f_c}{f_o} = \frac{v}{4L} \times \frac{2L}{v} = \frac{1}{2}$

31. Answer (2)

Hint & Sol.: In forward bias, the diode starts conducting significantly only after the applied voltage exceeds the cut-in voltage, typically about 0.7 V for Si and 0.3 V for Ge.

32. Answer (1)

Hint & Sol.: Figure of merit, $K = \frac{I}{\theta}$

33. Answer (3)

Hint & Sol.: According to Biot-Savart's law $d\vec{B} = \frac{\mu_0}{4\pi}\frac{id\vec{l} \times \vec{r}}{r^3}$ which is applicable for infinitesimal current element. It is analogous to Coulomb's law, where electric field is produced by scalar source q.

34. Answer (1)

Hint: Maximum acceleration in SHM is given by

$a_{max} = -\omega^2 A = -\left(\frac{K}{m}\right)A$

Sol.: Given m is same and a_{max} is same for both

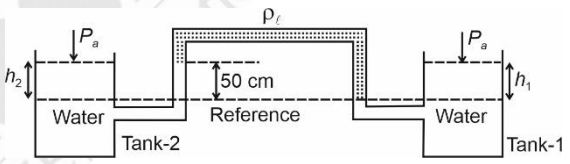
$a_1 = a_2 \Rightarrow \frac{K_1}{m_1}A_A = \frac{K_2}{m_2}A_B$

$\frac{A_A}{A_B} = \frac{K_2}{K_1}$

35. Answer (3)

Hint: Use formula $\Delta P = \rho gh$

Sol.:



Let atmospheric pressure be P_a.

h_1 is the height of water above reference level in tank 1, h_2 is the height of water above reference level in tank 2.

ρ is the density of water and ρ_l is the density of liquid in manometer.

$P_a + \rho gh_1 - \rho_l g \times (50) + \rho g \times 50 = P_a + \rho gh_2$

$\rho h_1 - \rho_l \times 50 + \rho \times 50 = \rho h_2$

$h_1 - 45 + 50 = h_2$

$h_2 - h_1 = 5$ cm

36. Answer (1)

Hint & Sol.: Useful power = (Efficiency × Energy per fission) × (Number of fissions per second)

$1000 \times 10^6 = \frac{20}{100} \times 200 \times 10^6 \times 1.6 \times 10^{-19} \times n$

$n = \frac{125}{8} \times 10^{19}$

37. Answer (4)

Hint: Use formula for velocity, $v = \frac{dx}{dt}$

Sol.: $v = \frac{dx}{dt} = 10t - 4$

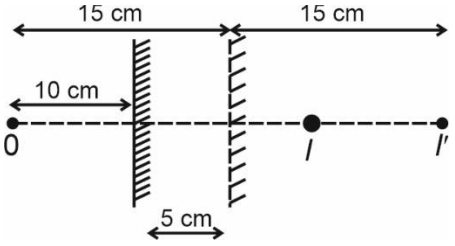
$v = 0 = 10t - 4$

$t = 0.4$ second

38. Answer (2)

Hint: Image distance is equal to object distance from a plane mirror.

Sol.:

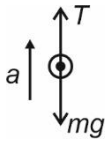


Total distance between object and image = 30 cm

39. Answer (3)

Hint: Tension in the string should not exceed its maximum limit.

Sol.:



$T - mg = ma$

$a = \frac{T - mg}{m}$

$a_{max} = \frac{T_{max} - mg}{m}$

$= \frac{350 - 150}{15} = \frac{200}{15} = \frac{40}{3}\text{ m s}^{-2}$

40. Answer (1)

Hint: Moment of inertia of a uniform rod about an axis passing through its one end

$I = \frac{ML^2}{3}$

Sol.: $I = 2 \cdot \left[\frac{1}{3} \times \frac{M}{2} \times \frac{L^2}{4}\right]$

$= \frac{ML^2}{12}$

41. Answer (4)

Hint: Escape velocity $v_e = \sqrt{\frac{2GM}{R}}$

Sol.: $v_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G}{R}\frac{4\pi R^3 \rho}{3}} = R\sqrt{\frac{8\pi G\rho}{3}}$

Hence, $\frac{v_e}{v_p} = \frac{R_e}{R_p}\sqrt{\frac{\rho_e}{\rho_p}} = \frac{1}{3}\sqrt{\frac{1}{3}} = \frac{1}{3\sqrt{3}}$

42. Answer (4)

Hint: Total internal energy of the mixture of gases

$U_{total} = U_{O_2} + U_{Ar}$

Sol.: $U_{O_2} = 3 \times \frac{5}{2}RT = \frac{15}{2}RT$

$U_{Ar} = 5 \times \frac{3}{2}RT = \frac{15}{2}RT$

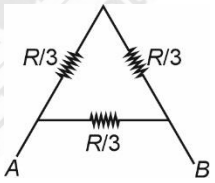
Hence, $U_{total} = \frac{15}{2}RT + \frac{15}{2}RT$

$= 15RT$

43. Answer (3)

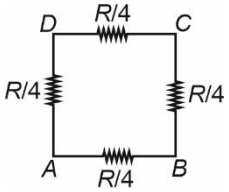
Hint: Use series and parallel combination of resistances.

Sol.: For triangle:



$R_{AB} = \frac{\frac{R}{3} \times \frac{2R}{3}}{\frac{R}{3} + \frac{2R}{3}} = \frac{2R}{9}$

For square:



$R_{AB} = \frac{\frac{R}{4} \times \frac{3R}{4}}{\frac{R}{4} + \frac{3R}{4}} = \frac{3R}{16}$

Hence, required ratio = $\frac{2R}{9} \times \frac{16}{3R} = \frac{32}{27}$

44. Answer (4)

Hint & Sol.:

- Concave lens forms virtual image of any real object placed in front of it.
- Focal length of a lens depends on the refractive index of medium of lens as well as on the surrounding medium.

45. Answer (4)

Hint & Sol.: Voltage across 400 Ω resistance will be $V_1 = \frac{400}{400+100} \times 12 = \frac{4}{5} \times 12 = \frac{48}{5}$ V

Here, $V_1 > V_2$ (Zener breakdown voltage)

∴ Zener diode breakdown occurs and voltage across 400 Ω resistance = V_2 = 4 V

Hence, ammeter reading $= \frac{V_2}{400} = \frac{4}{400} = \frac{1}{100}$ A

= 10 mA

[CHEMISTRY]

46. Answer (3)

Hint: Less substituted alkene is formed as a major product with bulky strong base.

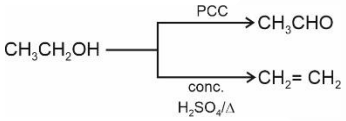
Sol.: Acetone is a polar aprotic solvent.

47. Answer (3)

Hint: Formaldehyde on reaction with Grignard reagent gives 1° alcohol.

Sol.: $HCHO \xrightarrow[2.H_2O/H^+]{1.CH_3MgBr,\text{dry ether}} \underset{(Z)}{CH_3CH_2OH}$

- Z is a 1° alcohol.
- Z will not give instant turbidity with Lucas reagent.
- Z gives positive iodoform test.

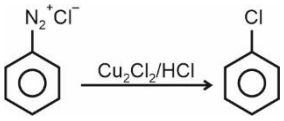


48. Answer (4)

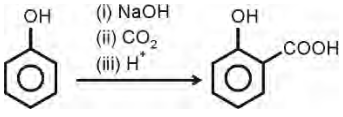
Hint: Carboxylic acids having alpha hydrogen can undergo α-halogenation reaction with Red P/X_2.

Sol.: HVZ reaction

$R-CH_2-COOH \xrightarrow[(2)H_2O]{(1)\text{Red P}+X_2} \underset{\underset{X}{|}}{R-CH-COOH}$



Sandmeyer reaction



Kolbe's reaction

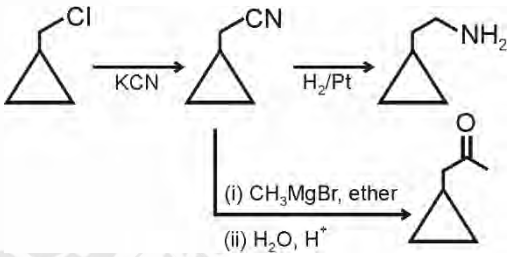
$3CH_3Br + SbF_3 \longrightarrow 3CH_3F + SbBr_3$

Swarts reaction

49. Answer (1)

Hint: Alkyl cyanides can undergo catalytic reduction to give amines.

Sol.:



50. Answer (4)

Hint: Picric acid is even stronger acid than formic acid.

Sol.: Phenol : pK_a = 10

Benzoic acid : pK_a = 4.19

Formic acid : pK_a = 3.75

Picric acid : pK_a < 1

51. Answer (2)

Hint: High boiling points of alcohols because of involving hydrogen bonding.

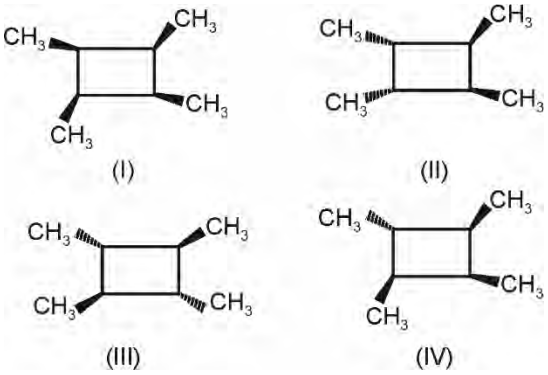
Sol.:

Molecules	Boiling point (K)
Ethanol	351 K
Methoxy methane	248 K
Propane	231 K
Butan-1-ol	390 K

52. Answer (1)

Hint: Geometrical isomerism exist in a system where rotation around the bond is restricted.

Sol.:

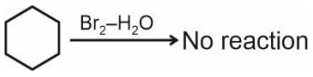


53. Answer (3)

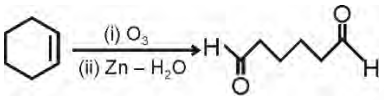
Hint: Alkenes on reductive ozonolysis can produce aldehydes and ketones.

Sol.:

- Statement (I)



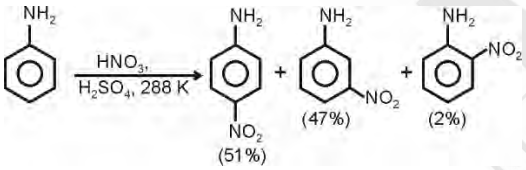
- Statement (II)



54. Answer (3)

Hint: In the strongly acidic medium, aniline is protonated to form the anilinium ion, which is meta directing.

Sol.:



55. Answer (3)

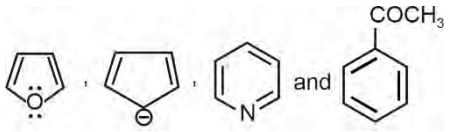
Hint: C is acetone.

Sol.:

- A is $CH_3 - C \equiv CH$
- B is $CH_3 - \underset{OH}{C} = \underset{H}{CH}$
- C is $CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$

56. Answer (4)

Hint: Cyclic planar species having $(4n + 2)\pi$ electrons in conjugation will be aromatic.

Sol.:  are the species of $(4n + 2)$ conjugated π-electrons.

57. Answer (1)

Hint: Essential amino acid cannot be synthesised in body.

Sol.: Lysine is an essential amino acid.

58. Answer (1)

Hint: Common ion effect

Sol.: $H_2S \rightleftharpoons 2H^+ + S^{2-}$

$HCl \longrightarrow H^+ + Cl^-$

Due to common ion effect of H^+, the concentration of S^{2-} ion decreases and this would prevent the precipitation of group IV cations.

59. Answer (1)

Hint: $i = 1 + (n - 1)\alpha$, i of CH_3COOH can be calculated using ΔT_f.

Sol.: For aqueous solution of urea,

$\Delta T_f = 1.86 = 1 \times K_f \times 1$

$K_f = 1.86°C$ kg/mol

For aqueous CH_3COOH solution

$\Delta T_f = 0.02 = i \times 1.86 \times 10^{-2}$

$$i = \frac{2 \times 10^{-2}}{1.86 \times 10^{-2}} = 1.075$$

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

$1.075 = 1 + (2 - 1)\alpha$

$0.075 = \alpha$

$\% \alpha = 7.5\%$ dissociation

60. Answer (3)

Hint: $\alpha = \dfrac{\Lambda_m}{\Lambda^\circ_m}$

$$K_a = \frac{c\alpha^2}{1-\alpha}$$

Sol.: $\alpha = \dfrac{\Lambda_m}{\Lambda^\circ_m} = \dfrac{39.5}{395} = 0.1$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{10^{-2} \times 2 \times 10^{-3}}{1-0.1} = \frac{2 \times 10^{-5}}{0.9}$$

$= 2.22 \times 10^{-5}$

61. Answer (2)

Hint: For 1st order reaction

$$kt = \ln\frac{A_0}{A_t}$$

Sol.:

		$A(g) \longrightarrow$	$2B(g)$	$+ C(g)$
$t = 0$		P_i	–	–
t		$P_i - x$	$2x$	x

$P_t = P_i + 2x$

$$x = \frac{P_t - P_i}{2}$$

$$k = \frac{2.303}{t}\log\frac{P_i}{P_i - x} = \frac{2.303}{t}\log\frac{P_i}{P_i - \left(\frac{P_t - P_i}{2}\right)}$$

$$k = \frac{2.303}{t}\log\frac{2P_i}{3P_i - P_t}$$

62. Answer (2)

Hint: Ozone is a violet black solid.

Sol.: Zn reacts with dilute HNO_3 to give N_2O gas.

63. Answer (1)

Hint: SiO_2 is a covalent three-dimensional network solid.

Sol.: TlI_3 does not exist.

64. Answer (4)

Hint: Gd^{3+} ion has $4f^7$ electronic configuration.

Sol.:

Element	Electronic configuration
Eu	$4f^7\ 6s^2$
Gd	$4f^7\ 5d^1\ 6s^2$
Tb	$4f^9\ 6s^2$

65. Answer (4)

Hint: $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

Sol.: $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

Number of mole of CO_2 = Number of mole of $CaCO_3$

$$= \frac{10}{22.4}\text{ mol}$$

$$\text{Mass of } CaCO_3 = \frac{10}{22.4} \times 100\,\text{g}$$

$$= \frac{\text{Mass of sample} \times 80}{100} = \frac{10 \times 100}{22.4}$$

Mass of sample = 55.8 g

66. Answer (1)

Hint: Atomic number of Mn is 25 and its Electronic configuration is

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Sol.: One electron each from every subshell would have $m_\ell = 0$ and $m_s = +\frac{1}{2}$

67. Answer (3)

Hint: During reversible isothermal expansion

$$W = -2.303nRT\log\left(\frac{V_2}{V_1}\right)$$

Sol.: $W = -2.303 \times 2 \times 8.314 \times 10^{-3} \times 300 \log 10$

= 11.488 kJ

68. Answer (4)

Hint: For an acidic buffer, $pH = pK_a + \log\frac{[Salt]}{[acid]}$

Sol.:

The solution is an acidic buffer

$$pH = pK_a + \log\frac{[Salt]}{[acid]}$$

$$pH = 4.75 + \log\frac{0.4}{0.3}$$

= 4.75 + log4 – log3

= 4.75 + 0.13

= 4.88

69. Answer (3)

Hint & Sol.: Balanced reaction will be

$$6I^-(aq) + 2MnO_4^-(aq) + 4H_2O(l) \rightarrow 3I_2(s) + 2MnO_2 + 8OH^-(aq)$$

a = 6, b = 2, c = 4, d = 3, e = 2, f = 8

70. Answer (1)

Hint: Atomic number 36 is of Krypton (Kr) and 48 is of cadmium (Cd) and both are 5th period elements.

Sol.: Z [49] $5s^2\ 5p^1$, 5th period

group number = 10 + 2 + 1 = 13

Z [92] $5f^3\ 6d^1\ 7s^2$, 7th period

All *f*-block elements are in 3rd group

Z [38] $5s^2$, 5th period and 2nd group

Z [57] $5d^1\ 6s^2$, 6th period and 3rd group

71. Answer (4)

Hint: C_2^{2-} is isoelectronic with N_2 in which Last electron of C_2^{2-} enters into $\sigma 2p_z$.

Sol.: $C_2^{2-} : \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2$

$= \pi 2p_y^2 < \sigma 2p_z^2 < \pi^* 2p_x = \pi^* 2p_y$

$\pi^* 2p_x$ and $\pi^* 2p_y$ are LUMO orbitals in C_2^{2-}.

72. Answer (1)

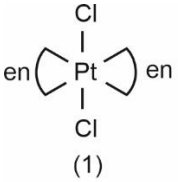
Hint: More is the negative charge on metal, better is the back bonding and longer will be the 'C–O' bond length.

Sol.: In $[Fe(CO)_4]^{2-}$, back bonding is highest. So, longer 'C–O' bond length will be observed.

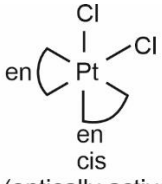
73. Answer (1)

Hint: If two bidentate ligand are at adjacent position, then complex will be optically active.

Sol.:



(1)



cis

(optically active)

(2, 3)

74. Answer (1)

Hint: Solutions of positive deviation from Raoult's law have $\Delta_{mix} H > 0$.

Sol.: Ethanol addition into water decrease intermolecular interaction which results $\Delta_{mix} H > 0$.

75. Answer (4)

Hint: $E^\circ_{cell} = E^\circ_c - E^\circ_a$

Sol.: $E^\circ_{cell} = 0.8 + 0.25 = 1.05\,V$

76. Answer (3)

Hint: Unit of rate of reaction will be same irrespective to the order.

Sol.: $r = \dfrac{\text{change in concentration}}{\text{time}}$

$= \dfrac{\text{mol L}^{-1}}{\text{s}}$

$= \text{mol L}^{-1}\ \text{s}^{-1}$

77. Answer (4)

Hint: B in B_2H_6 is sp^3 hybridised.

Sol.:

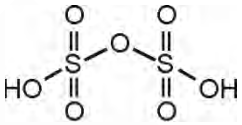
(a)	B in B_2H_6	sp^3
(b)	C in fullerene	sp^2
(c)	Br in BrF_3	sp^3d
(d)	Xe in XeF_6	sp^3d^3

78. Answer (3)

Hint: Just like O_2, S_2 is also paramagnetic species.

Sol.: At ~ 1000 K, sulphur exists as S_2.

• $H_2S_2O_7$ (Oleum)



79. Answer (1)

Hint: Cu does not react with dil. HCl to form H_2 gas.

Sol.: $E^\circ_{Cu^{2+}/Cu}$ is positive as the high energy to transform Cu(s) to Cu^{2+} (aq.) is not compensated by its hydration enthalpy.

80. Answer (2)

Hint: Nobel gases have positive electron gain enthalpies.

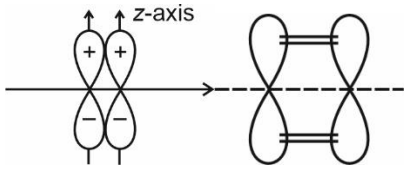
Sol.:

Noble gas	Electron gain enthalpy
He	48 kJ/mol
Ne	116 kJ/mol
Ar	96 kJ/mol
Xe	77 kJ/mol

81. Answer (3)

Hint: π bond is formed by sideways overlapping.

Sol.:



The atomic orbitals are overlapping sideways, so, π bond will be formed.

82. Answer (3)

Hint: Reducing character of hydrides of group 15 elements increases due to decrease bond dissociation enthalpies.

Sol.:

Hydride	Bond angle (°)
NH_3	107.8
PH_3	93.6
AsH_3	91.8
SbH_3	91.3

83. Answer (3)

Hint: Number of electron = number of moles × N_A × 32

Sol.: Number of electrons = $\frac{6}{60}\times 6.02\times 10^{23}\times 32$

$= 192.64 \times 10^{22}$

$= 19.3 \times 10^{23}$

84. Answer (2)

Hint: $r_n = \frac{52.9\times n^2}{Z}$ pm

Sol.: 2nd Bohr orbit of H atom

$(r_2)_H = \frac{52.9\times 4}{1} = 52.9\times 4\,\text{pm}$

- 1st Bohr orbit of Li^{2+} ion

$(r_1)_{Li^{2+}} = \frac{52.9\times 1}{3} = \frac{52.9}{3}\text{pm}$

- 3rd Bohr orbit of He^+ ion

$(r_3)_{He^+} = \frac{52.9\times 9}{2}$

- Ratio of radii will be

24 : 2 : 27

85. Answer (1)

Hint: For adiabatic process, $\Delta S_{surrounding} = 0$

Sol.: For reversible process

$\Delta S_{sys} + \Delta S_{surr} = 0$

$\because \Delta S_{surr} = 0$

So, $\Delta S_{sys} = 0$

86. Answer (4)

Hint : Only gaseous component will be considered for K_p calculation.

Sol.: $\underset{\substack{t=0 \\ t=t_{eq}}}{A_2BC(s)} \rightleftharpoons \underset{\substack{0 \\ x}}{AB(g)} + \underset{\substack{0 \\ x}}{AC(g)}$ (a mol; a–x)

Partial pressure of $AB = \frac{x}{2x}\times P = \frac{P}{2}$

Partial pressure of $AC = \frac{x}{2x}\times P = \frac{P}{2}$

$K_p = P_{AB}\times P_{AC}$

$= \frac{P}{2}\times\frac{P}{2} = \frac{P^2}{4}$

87. Answer (3)

Hint: Layer test is done for Br^- and I^- ions.

Sol.: Violet colouration in organic layer shows the presence of iodide ions.

88. Answer (1)

Hint: Thyroxine is an iodinated derivative of amino acid tyrosine.

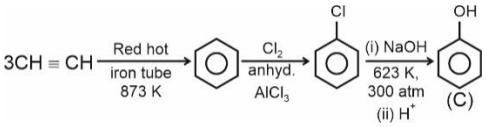
Sol.:

- Glucocorticoids control the carbohydrate metabolism.
- Glucagon hormone tends to increase the glucose level in the blood.

89. Answer (1)

Hint: Alkyne undergoes cyclic polymerisation to produce aromatic hydrocarbon in the presence of red hot iron tube on heating.

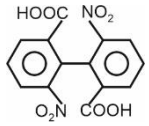
Sol.:



90. Answer (1)

Hint: Ortho substituted biphenyl molecules can show geometrical isomerism. If POS (plane of symmetry) and COS (centre of symmetry) are absent in it.

Sol.:



does not has POS and COS, so will be optically active.

[BIOLOGY]

91. Answer (3)

Hint: Recombination is an enzyme mediated process and occur in third sub stage of prophase I.

Sol.: Recombination between homologous chromosomes is completed by the end of pachytene.

92. Answer (4)

Hint: PEPcase is 3 carbon containing enzyme found in mesophyll cell of C_4 plants.

Sol.: The primary CO_2 acceptor is a 3-carbon molecule phosphoenol pyruvate present in the mesophyll cell. The enzyme is responsible for fixation of CO_2.

93. Answer (2)

Hint: Photochemical phase of photosynthesis starts with absorption of different wavelengths of light.

Sol.: Light reactions or the 'photochemical' phase include light absorption, release of electrons from P_{680}, splitting of water replenishing electrons in the reaction centre of PS II, then formation of high energy chemical intermediates, *i.e.*, ATP and NADPH.

94. Answer (1)

Hint: There can be a net gain of 38 ATP molecules during aerobic respiration of one molecule of glucose.

Sol.: In fermentation, less than seven percent of energy in glucose is released and not all of it is trapped as ATP, because the NADH cannot be oxidised through oxidative phosphorylation as fermentation occurs in anaerobic condition, thus NADH reducing power is used up to convert pyruvate into lactate/alcohol, yielding 2 ATP per glycolysis.

95. Answer (4)

Hint: Both maize and sugarcane are C_4 plants.

Sol.: Maize is a C_4 plant. In maize leaves, bundle sheath cells are characterised by large number of chloroplast, thick walls which is impervious to gaseous exchange and no intercellular spaces.

In C_3 plant, some O_2 bind to RuBisCO and hence CO_2 fixation is decreased.

C_3 plants respond to increased CO_2 concentration and saturation is seen only beyond 450 $\mu l L^{-1}$.

C_3 plants respond to higher CO_2 concentration by showing increased rate of photosynthesis, leading to higher productivity.

96. Answer (3)

Hint: The M Phase starts with the nuclear division, *i.e.* karyokinesis and usually ends with division of cytoplasm *i.e.* cytokinesis.

Sol.: The correct sequence of the stages of cell division is as follows:

Gap_1 phase $\rightarrow$ Synthesis phase $\rightarrow$ Gap_2 Phase $\rightarrow$ Karyokinesis $\rightarrow$ Cytokinesis

Hence correct order will be B$\rightarrow$ D$\rightarrow$ E$\rightarrow$ A$\rightarrow$ C

97. Answer (3)

Hint: The organisms that are chief producer in the ocean are diatoms.

Sol.: Diatoms belongs to the kingdom Protista. They are unicellular eukaryotic organism. They are found in fresh water as well as in ocean.

98. Answer (4)

Hint: *Spirogyra* is not a unicellular organism.

Sol.: Kingdom Protista has brought together *Chlamydomonas, Chlorella* with *Paramoecium* and *Amoeba*.

99. Answer (3)

Hint: Fusion is indicated by enclosing the figure within bracket and adhesion by a line drawn above the symbols of the floral parts.

Sol.: A floral diagram provides information about the number of parts of a flower, their arrangement and the relation they have with one another. Floral formula also shows cohesion and adhesion within parts of whorls and between whorls.

100. Answer (4)

Hint: Potato family have cymose inflorescence.

Sol.: When the shoot apical meristem converts into a flower, it loses the ability to grow further, making the growth determinate.

101. Answer (4)

Hint: In dicot plant, the tangential as well as the radial wall of the endodermal cells have a deposition of water impermeable, waxy material suberin in the form of casparian strips.

Sol.: In dicot roots, casparian strips are present.

102. Answer (2)

Hint: Palisade parenchyma are situated near to the upper epidermis of the leaf.

Sol.: The adaxially placed palisade parenchyma is made up of elongated cells, which are arranged vertically and parallel to each other.

103. Answer (2)

Hint: ETS of mitochondria have two complexes that transfer e^- to ubiquinone.

Sol.: ETS of mitochondria have one protein complex that carries out facilitated diffusion of protons while transferring e^- to ubiquinone i.e. complex I.

104. Answer (3)

Hint: In brown algae, the union of gametes may take place in water or within the oogonium.

Sol.: *Sargassum* is the brown alga in which sexual reproduction takes place by fusion of an egg and motile male gamete.

105. Answer (2)

Hint: In gymnosperm, the male and female gametophytes do not have an independent free-living existence.

Sol.: In gymnosperm, the multicellular female gametophyte is also retained within megasporangium.

The pollen grain is released from the microsporangium.

They are carried by air currents and come in contact with the opening of the ovules borne on megasporophylls.

The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.

Following fertilisation, zygote develops into an embryo and the ovules into seeds.

106. Answer (3)

Hint: Compound epithelium

Sol.: Compound epithelium is made of more than one layer (multi-layer) of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. They cover the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

Cuboidal epithelium has cube-like cells with central nuclei.

Columnar epithelium has tall and slender cells with basal nuclei.

107. Answer (4)

Hint: Present in earthworms

Sol.: Excretion in cockroaches is performed by Malpighian tubules. Each tubule is lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut. Therefore, this insect is called uricotelic. In addition, the fat bodies, nephrocytes and urecose glands (present only in males) also help in excretion.

108. Answer (2)

Hint: Assists in mating

Sol.: Frogs exhibit sexual dimorphism. Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the forelimbs which are absent in female frogs. In both male and female frogs, the hind limbs end in five digits and they are larger and muscular than the forelimbs that end in four digits. Nictitating membrane and tympanum are present in both the sexes.

109. Answer (2)

Hint: Identify a platyhelminth.

Sol.: Platyhelminths have dorso-ventrally flattened body, hence are called flatworms. These are mostly endoparasites found in animals; including human beings. Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ-level of body organisation.

Ascaris and *Ancylostoma* are roundworms (pseudocoelomates) while *Pheretima* is an annelid (coelomate).

110. Answer (1)

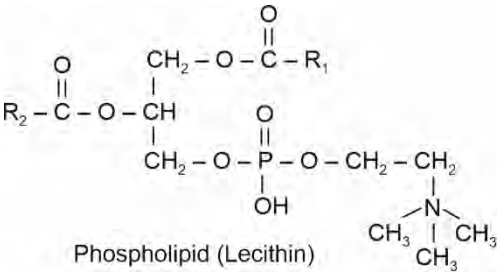
Hint: One of them is an amphibian.

Sol.: *Bangarus* is a reptile while *Hyla* is an amphibian. Body of amphibians is divisible into head and trunk. Reptiles are mostly terrestrial animals and their body is covered by dry and cornified skin, epidermal scales or scutes. They do not have external ear openings. Tympanum represents ear. In reptiles, fertilisation is internal while fertilisation is external in amphibians.

111. Answer (4)

Hint: Lecithin is a phospholipid.

Sol.:



Phospholipid (Lecithin)

112. Answer (2)

Hint: Respiratory rhythm centre

Sol.: A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and hydrogen ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Respiratory rhythm centre is present in medulla oblongata. Another centre present in the pons region of the brain called pneumotaxic centre can moderate the functions of the respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate.

The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

113. Answer (4)

Hint: Exclude the phagocytic cells.

Sol.: Neutrophils are the most abundant cells (60-65 per cent) of the total WBCs and basophils are the least (0.5-1 per cent) among them. Neutrophils and monocytes (6-8 per cent) are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin, *etc.*, and are involved in inflammatory reactions. Eosinophils (2-3 per cent) resist infections and are also associated with allergic reactions.

114. Answer (2)

Hint: Maintains pH and ionic balance of blood

Sol.: Substances like glucose, amino acids, Na^+, *etc.*, in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport. Reabsorption of water also occurs passively in the initial segments of the nephron. The descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. The ascending limb of loop of Henle is impermeable to water but allows transport of electrolytes actively or passively.

The osmolarity of the filtrate present in DCT is hypotonic to that of the fluid present in the medullary interstitium.

115. Answer (4)

Hint: Equal to 14

Sol.: In an adult human:-

Number of cranial bones = 8

Number of ribs = 12 pairs

Number of lumbar vertebrae = 5

Number of phalanges in one hind limb = 14

116. Answer (3)

Hint: ABA act as general plant growth inhibitor and an inhibitor of plant metabolism.

Sol.: The group of PGRs are involved in growth promoting activities, such as cell division, cell enlargement, flowering, fruiting and seed formation. These are also called plant growth promoters, e.g., auxins, gibberellins and cytokinin.

Gibberellins promote bolting. ABA is a carotenoid derived phytohormone.

117. Answer (4)

Hint: Flowers pollinated by abiotic agents do not require colorful petals and sepals.

Sol.: Both wind and water pollinated flowers do not produce nectar and they are dependent on the abiotic factors rather than attracting animal pollinators like insects or birds.

118. Answer (2)

Hint: Cells of tapetum possess dense cytoplasm and generally have more than one nucleus.

Sol.: The innermost wall layer of microsporangium is tapetum which nourishes the developing pollen grains.

119. Answer (3)

Hint: Seed is often described as the fertilized ovule.

Sol.: In angiosperms, the final product of sexual reproduction is a fertilized ovule.

120. Answer (4)

Hint: In human blood type, there are three different alleles and there are six different genotypes of the human ABO blood group with four different phenotypes.

Sol.: $I^A I^B \times I^A I^B$ and $I^A I^O \times I^O I^B$ genotypes of parents will produce prgeny with at least of three types of blood group.

121. Answer (1)

Hint: Inheritance of flower colour in *Antirrhinum* is a good example of incomplete dominance.

Sol.: When a cross is made between true-breeding red-flowered plant (RR) and true-breeding white-flowered plants (rr), the F_1 (Rr) had pink flower. When the F_1 was self-pollinated the F_2 had flowers in the following ratio 1 (RR) Red: 2 (Rr) Pink: 1 (rr) white. That means 50% of the progenies will have pink flower.

122. Answer (2)

Hint: In XX-XO type of sex determination, the males have only one X chromosome besides the autosomes.

Sol.: Grasshopper is an example of XX-XO type of sex determination.

123. Answer (4)

Hint: Euchromatin are said to be transcriptionally active chromatin whereas heterochromatin is inactive.

Sol.: In a typical nucleus, some regions of chromatin are loosely packed (and stains light) and are referred to as euchromatin. The chromatin that is more densely packed and stains dark are called as heterochromatin. Euchromatin is said to be transcriptionally active chromatin, whereas heterochromatin is inactive. Entire chromatin is replicated in s phase.

124. Answer (2)

Hint: Statins are commercialized as blood cholesterol lowering agent and it is produced by yeast.

Sol.: Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents.

125. Answer (1)

Hint: Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis.

Sol.: Production is expressed in terms of weight (gm^{-2}) or energy ($kcal\ m^{-2}$).

126. Answer (2)

Hint: Tonoplast is the outer membrane of the vacuole.

Sol.: In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradient into vacuole, hence their concentration is significantly higher in the vacuole than in the cytoplasm.

127. Answer (3)

Hint: Mitochondria and chloroplast are the semi-autonomous organelle and they have the ability to synthesize their own protein.

Sol.: Since the functions of mitochondria, chloroplast and peroxisomes are not coordinated with ER, Golgi apparatus, lysosomes and vacuole, these are not considered as a part of endomembrane system.

128. Answer (4)

Hint: Ribosomes are commonly found in both prokaryotes and eukaryotes.

Sol.: Ribosomes are composed of ribonucleic acid and proteins.

129. Answer (3)

Hint: Inclusion bodies include phosphate granules, cyanophycean granules and glycogen granules.

Sol.: Contractive vacuole is an example of vacuole and it is a part of endomembrane system.

130. Answer (2)

Hint: Antonie Von Leeuwenhoek was the first one to describe live cell.

Sol.: Robert Brown discovered nucleus. Matthias Schleiden a botanist, who observed that plants are composed of different kind of cells. Theodore Schwann concluded based on his studies on plant tissue, that the presence of cell wall is unique character of plant cell.

131. Answer (1)

Hint: Function of medulla oblongata

Sol.: The medulla oblongata of the brain is connected to the spinal cord. The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions. Three major regions make up the brain stem; mid brain, pons and medulla oblongata.

Along with the hypothalamus, limbic system is involved in the regulation of sexual behaviour, expression of emotional reactions, *etc*.

132. Answer (3)

Hint: Throne of immunity

Sol.: The pineal gland is located on the dorsal side of forebrain. The thyroid gland is composed of two lobes which are located on either side of the trachea. The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta. Our body has a pair of adrenal glands, one above of each kidney.

133. Answer (2)

Hint: During the ovulatory phase, there is rupture of Graafian follicle.

Sol.: A large number of primary follicles degenerate during the phase from birth to puberty. Therefore, at puberty, only 60,000-80,000 primary follicles are left in each ovary. The secondary oocyte forms a new membrane called zona pellucida surrounding it. Ovulatory phase is an ovarian event. The menstrual phase is followed by the follicular phase. During this phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle and simultaneously, the endometrium of uterus regenerates through proliferation.

134. Answer (4)

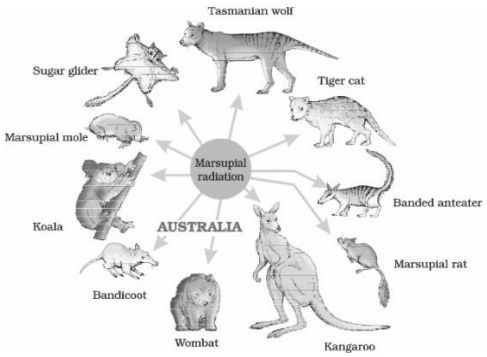
Hint: Saheli is a non-steroidal pill.

Sol.: 'Saheli'–a new oral contraceptive for the females–was developed by scientists at Central Drug Research Institute (CDRI) in Lucknow, India. It contains a non-steroidal preparation *i.e.*, centchroman which is a selective estrogen receptor modulator. Saheli does not inhibit ovulation. It only inhibits implantation. Progestogens alone or in combinations with estrogen can be used by females as injections or implants under the skin. Their mode of action is similar to that of pills but their effective periods are much longer.

135. Answer (3)

Hint: Exclude the placental mammals

Sol.:



136. Answer (1)

Hint: Chemical structure of morphine

Sol.: Morphine belongs to the category of opioids and is a very effective sedative and painkiller, and is very useful in patients who have undergone surgery. Heroin is a depressant and slows down body functions. Coca alkaloid is obtained from *Erythroxylum coca*. Cannabinoids are a group of chemicals which interact with cannabinoid receptors present principally in the brain.

Morphine can be taken *via* injection.

137. Answer (2)

Hint: Number of fragments produced by a circular DNA after restriction digestion = Number of restriction sites present on it.

Sol.: When a linear DNA is cut at one restriction site, it will result in two fragments, while when a circular DNA is cut at one restriction site, it results in only one fragment. In the given case, sample 'A' DNA, when cut by R.E. at two different sites, gives two fragments, hence, it is a circular DNA, while sample 'B' DNA after digestion gives 3 fragments, so it is a linear DNA.

As plasmids are circular DNA, so sample 'B' cannot be a plasmid.

138. Answer (2)

Hint: Equal to the number of bones in each limb of a man.

Sol.: The recombinant therapeutics do not induce unwanted immunological responses as is common in case of similar products isolated from non-human sources. At present, about 30 recombinant therapeutics have been approved for human-use the world over. In India, 12 of these are presently being marketed.

139. Answer (3)

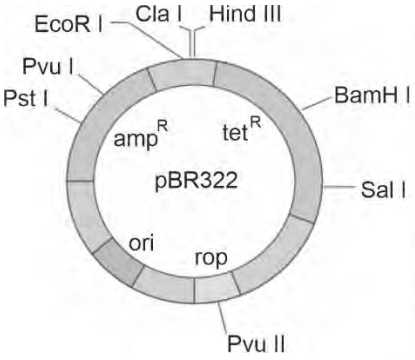
Hint: Possesses lysins

Sol.: Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. The acrosome is filled with enzymes that help in fertilisation of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitates sperm motility essential for fertilisation.

140. Answer (4)

Hint: No insertional inactivation

Sol.: As the restriction site of *Hin*d III does not lie within any antibiotic resistance gene that is present in pBR322, so the recombinants will be resistant to both ampicillin and tetracycline.



141. Answer (1)

Hint: Rosie produced the human protein-enriched milk in the same year in which an American company got patent rights on Basmati rice.

Sol.: In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 grams per litre).

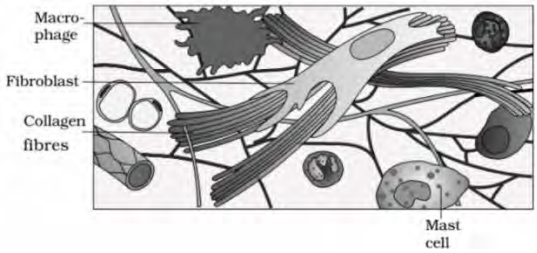
The first clinical gene therapy was given in 1990 to a 4-year-old girl with adenosine deaminase (ADA) deficiency.

In 1983, Eli Lilly, an American company, prepared two DNA sequences corresponding to 'A' and 'B', chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains.

142. Answer (2)

Hint: Feature of areolar tissue

Sol.:



Loose connective tissue has cells and fibres loosely arranged in a semi-fluid ground substance, for example, areolar tissue present beneath the skin. Often, it serves as a support framework for epithelium. It contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.

143. Answer (4)

Hint: Gives positive iodine test

Sol.: Glucose is a monosaccharide. Lipids are found in both saturated and unsaturated forms.

Collagen is the most abundant protein in the animal world. Proteins are heteropolymers.

Glycogen has a highly branched structure formed by α-1, 4 and α-1, 6 glycosidic bonds.

144. Answer (3)

Hint: Identify arthropods

Sol.: *Laccifer, Locusta, Limulus, Aedes, Apis* – Phylum Arthropoda

Asterias, Antedon – Phylum Echinodermata

Ancylostoma – Phylum Aschelminthes

Aplysia – Phylum Mollusca

Pleurobrachia – Phylum Ctenophora

145. Answer (3)

Hint: Effect of temperature below the optimum value.

Sol.: Enzymes generally function in a narrow range of temperature and pH. Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and optimum pH. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

146. Answer (3)

Hint: Total lung capacity

Sol.: Total Lung Capacity (TLC): Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

FRC includes ERV + RV.

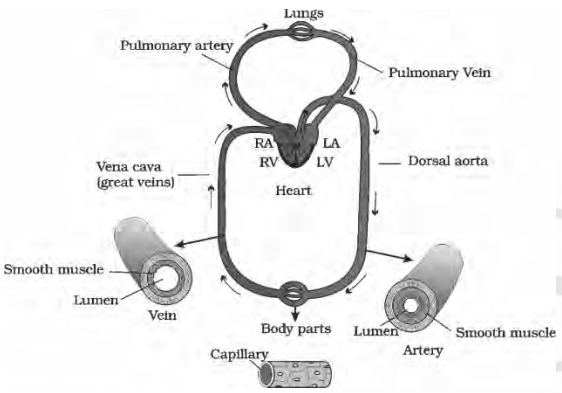
VC includes ERV + TV + IRV.

IC includes TV + IRV.

147. Answer (2)

Hint: Dorsal aorta is an artery.

Sol.:



Dorsal aorta is a part of systemic circulation.

Arteries have thicker tunica media as compared to veins.

148. Answer (2)

Hint: Released by adrenal cortex

Sol.: An excessive loss of fluid from the body can activate receptors which stimulate the hypothalamus to release antidiuretic hormone (ADH) or vasopressin from the neurohypophysis.

A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II.

Angiotensin II also activates the adrenal cortex to release aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR.

ANF is a vasodilator that decreases the blood pressure.

149. Answer (1)

Hint: Multipolar neurons

Sol.: Based on the number of axon and dendrites, the neurons are divided into three types, *i.e.*, multipolar (with one axon and two or more dendrites; found in the cerebral cortex), bipolar (with one axon and one dendrite, found in the retina of eye) and unipolar (cell body with one axon only; found usually in the embryonic stage).

150. Answer (4)

Hint: Weakening of bones.

Sol.: Osteoporosis: An age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is its common cause. When PTH levels are consistently high, this can lead to excessive bone resorption (breakdown), resulting in decreased bone density and increased risk of fractures, a hallmark of osteoporosis.

151. Answer (1)

Hint: Include the hormone released by α-cells of Islets of Langerhans.

Sol.: Catecholamines stimulate the breakdown of glycogen resulting in an increased concentration of glucose in blood. Cortisol is the main glucocorticoid that stimulates gluconeogenesis, lipolysis and proteolysis. Glucagon acts mainly on the liver cells (hepatocytes) and stimulates glycogenolysis resulting in an increased blood sugar level (hyperglycaemia).

152. Answer (4)

Hint: Not a reliable indicator of virginity or sexual experience

Sol.: The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.

The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts.

The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris.

153. Answer (1)

Hint: Included under the barrier method of contraception

Sol.: Use of condoms has increased in recent years due to its additional benefit of protecting the users from contracting STIs and AIDS. Nirodh is a popular brand of male condom.

Progestasert is a hormone releasing IUD. Saheli is a non-steroidal contraceptive pill.

154. Answer (3)

Hint: Developed along different directions due to adaptations to different needs.

Sol.: Whales, bats, cheetah and humans (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structures – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Hence, in these animals, the same structure developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry.

155. Answer (4)

Hint: Muscidae.

Sol.: *Entamoeba histolytica* is a protozoan parasite in the large intestine of human which causes amoebiasis (amoebic dysentery). Symptoms of this disease include constipation, abdominal pain and cramps, stools with excess mucous and blood clots. Houseflies act as mechanical carriers for this disease.

156. Answer (3)

Hint: Meiosis involves two sequential cycles of karyokinesis and cytokinesis.

Sol.: Except chromosome duplication and histone protein synthesis, rest all phenomenon occur twice in meiosis.

157. Answer (3)

Hint: Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion.

Sol.: Insertion or deletion of three or its multiple bases insert or delete in one or multiple codons, hence one or multiple amino acids, and reading frame remains unaltered from that point onwards.

158. Answer (2)

Hint: T.H. Morgan has used *Drosophila* to study inheritance pattern.

Sol.: Meselson and Stahl used *E.coli* for his experiment, Hershey and Chase used Bacteriophage and *E.coli*. Taylor *et. al* used Faba beans to prove semi conservative mode of replication in eukaryotes.

159. Answer (2)

Hint: The enzyme DNA dependent RNA polymerase is involved in the process of transcription.

Sol.: The enzyme DNA dependent RNA polymerase is responsible for the

- Unwinding of the DNA helix
- Synthesis of all RNA molecules
- Polymerisation of ribonucleotides
- It synthesises RNA in 5'→3' direction

160. Answer (4)

Hint: Charging of tRNA is also known as aminoacylation.

Sol.: Charging of tRNA is catalysed by aminoacyl tRNA synthetase (not a ribozyme) and it requires energy.

161. Answer (4)

Hint: The disorder is getting passed to both son and daughter irrespective of sex.

Sol.: The trait under study is autosomal recessive.

162. Answer (2)

Hint: Biochemical oxygen demand is the amount of oxygen that would be consumed if all the organic matter in one litre of water is oxidized by the bacteria.

Sol.: More the organic matter in sewage water, more will be the BOD of that water. Hence, BOD is the indirect measure of the organic matter present in the water.

BOD of primary effluent will be more than secondary effluent.

163. Answer (4)

Hint: Darwin finches present in the Galapagos Island are the example of the competitive co-existence.

Sol.: Mutualism- Fig and fig wasp

Commensalism- Orchids growing on other plants

Parasitism - *Cuscuta* growing on hedge plants

164. Answer (3)

Hint: When move higher in taxonomic hierarchy, number of common characteristic goes on decreasing.

Sol.: Higher the category, greater is the difficulty of determining the relationship to other taxa at the same level. Hence, the problem of classification becomes more complex.

165. Answer (3)

Hint: Logistic growth of a population is represented by the sigmoid curve.

Sol.: Logistic growth of a population takes place when resources in a habitat are limited.

166. Answer (2)

Hint: The species which are not native to a particular place is known as exotic species.

Sol.: Cichlid fish is the native species of Lake Victoria of East Africa.

167. Answer (3)

Hint: The process of copying of genetic information from one strand of the DNA into RNA is known as transcription and it occurs in the cytoplasm with the help of transcription enzymes.

Sol.: Transport of mRNA to cytoplasm is a part of translation. Base pairing of two complementary RNA strands do not occur during post-transcriptional modification.

168. Answer (1)

Hint: Growth in higher plants is indeterminate.

Sol.: Both growth and differentiation in higher plants are open.

Dedifferentiation is the pre-requisite for the re-differentiation.

169. Answer (1)

Hint: In an upright pyramid, the base is broader than the top.

Sol.: Grassland and pond ecosystem have upright pyramid of number.

170. Answer (3)

Hint: Ramdeo Misra is known as Father of Ecology in India

Sol.: Ernst Mayr is known as "The Darwin of the 20th century'

171. Answer (1)

Hint: Cannot pass through cell membranes

Sol.: Since DNA is a hydrophilic molecule, it cannot pass through cell membranes. In order to force bacteria to take up the plasmid, the bacterial cells must first be made 'competent' to take up DNA. This is done by treating them with a specific concentration of a divalent cation, such as calcium, which increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

172. Answer (3)

Hint: *Agrobacterium tumefaciens*

Sol.: Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant (tobacco).

Agrobacterium tumefaciens, a pathogen of several dicot plants, is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumor and direct these tumor cells to produce the chemicals required by the pathogen. The tumor inducing (Ti) plasmid of *Agrobacterium tumefaciens* has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants.

173. Answer (1)

Hint: Identify a cartilaginous fish.

Sol.: Cartilaginous fishes are marine animals with streamlined body and have cartilaginous endoskeleton. Notochord is persistent throughout their life. Gill slits are separate and without operculum (gill cover). They show internal fertilisation and many of them are viviparous.

Pterophyllum is a bony fish. *Pteropus* is a mammal and *Psittacula* is a bird.

174. Answer (4)

Hint: True for nurse cells

Sol.: The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis. After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.

Capacitation refers to physiological changes in the sperms that occur before fertilisation in the female reproductive tract.

175. Answer (2)

Hint: A small part of the vas deferens is removed or tied up

Sol.: In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum. Surgical intervention blocks gamete transport and thereby prevents conception.

176. Answer (3)

Hint: Worked on populations

Sol.: The work of Thomas Malthus on populations influenced Darwin. Alfred Wallace, a naturalist, worked in Malay Archipelago. Charles Darwin believed that natural selection leads to evolution. Louis Pasteur by careful experimentation demonstrated that life comes only from pre-existing life.

177. Answer (4)

Hint: Vaccination induces the body to produce antibodies.

Sol.: When a host is exposed to antigens, which may be in the form of living or dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity.

When ready-made antibodies are directly given to protect the body against foreign agents, it is called passive immunity.

In vaccination, a preparation of antigenic proteins of pathogen or inactivated/weakened pathogen (vaccine) are introduced into the body. The antibodies produced in the body against these antigens would neutralise the pathogenic agents during actual infection.

178. Answer (2)

Hint: Exclude the events that occur during normal inspiration

Sol.: Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, *i.e.*, there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure.

179. Answer (3)

Hint: Recall the properties of a prosthetic group.

Sol.: Haem is the prosthetic group of the enzyme catalyse and peroxidase.

It is an organic compound.

It is present in the active site of the enzymes.

Prosthetic groups are tightly bound to the apoenzyme.

Removal of co-factors affects enzyme activity.

180. Answer (4)

Hint: Eliminate the methods used exclusively for plants.

Sol.: Biolistics or gene gun is a direct method of gene transfer used exclusively for plants.

In biolistics, cells are bombarded with high-velocity micro-particles of gold or tungsten.

Retrovirus mediated is an indirect method of gene transfer.

In micro-injection, the gene of interest is injected directly in the nucleus of an animal cell.

❑ ❑ ❑

All India Aakash Test Series for NEET - 2026

OPEN MOCK TEST - 6

Click here for Code-A sol.

Test Date : 26/04/2026

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (4)

Hint & Sol.: Voltage across 400 Ω resistance will be $V_1 = \frac{400}{400+100} \times 12 = \frac{4}{5} \times 12 = \frac{48}{5}$ V

Here, $V_1 > V_2$ (Zener breakdown voltage)

$\therefore$ Zener diode breakdown occurs and voltage across 400 Ω resistance = V_2 = 4 V

Hence, ammeter reading $= \frac{V_2}{400} = \frac{4}{400} = \frac{1}{100}$ A

= 10 mA

2. Answer (4)

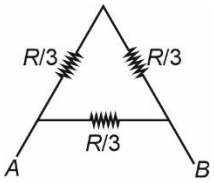
Hint & Sol.:

- Concave lens forms virtual image of any real object placed in front of it.
- Focal length of a lens depends on the refractive index of medium of lens as well as on the surrounding medium.

3. Answer (3)

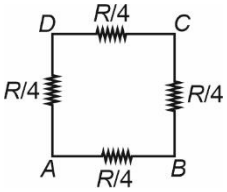
Hint: Use series and parallel combination of resistances.

Sol.: For triangle:



$$R_{AB} = \frac{\frac{R}{3} \times \frac{2R}{3}}{\frac{R}{3} + \frac{2R}{3}} = \frac{2R}{9}$$

For square:



$$R_{AB} = \frac{\frac{R}{4} \times \frac{3R}{4}}{\frac{R}{4} + \frac{3R}{4}} = \frac{3R}{16}$$

Hence, required ratio = $\frac{2R}{9} \times \frac{16}{3R} = \frac{32}{27}$

4. Answer (4)

Hint: Total internal energy of the mixture of gases

$U_{total} = U_{O_2} + U_{Ar}$

Sol.: $U_{O_2} = 3 \times \frac{5}{2}RT = \frac{15}{2}RT$

$U_{Ar} = 5 \times \frac{3}{2}RT = \frac{15}{2}RT$

Hence, $U_{total} = \frac{15}{2}RT + \frac{15}{2}RT$

= 15*RT*

5. Answer (4)

Hint: Escape velocity $v_e = \sqrt{\frac{2GM}{R}}$

Sol.: $v_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G}{R}\frac{4\pi R^3 \rho}{3}} = R\sqrt{\frac{8\pi G\rho}{3}}$

Hence, $\frac{v_e}{v_p} = \frac{R_e}{R_p}\sqrt{\frac{\rho_e}{\rho_p}} = \frac{1}{3}\sqrt{\frac{1}{3}} = \frac{1}{3\sqrt{3}}$

6. Answer (1)

Hint: Moment of inertia of a uniform rod about an axis passing through its one end

$I = \frac{ML^2}{3}$

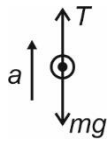
Sol.: $I = 2 \cdot \left[\frac{1}{3} \times \frac{M}{2} \times \frac{L^2}{4}\right]$

$= \frac{ML^2}{12}$

7. Answer (3)

Hint: Tension in the string should not exceed its maximum limit.

Sol.:



$T - mg = ma$

$a = \frac{T - mg}{m}$

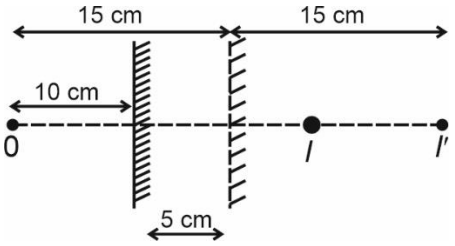
$$a_{max} = \frac{T_{max} - mg}{m}$$

$$= \frac{350 - 150}{15} = \frac{200}{15} = \frac{40}{3} \text{ m s}^{-2}$$

8. Answer (2)

Hint: Image distance is equal to object distance from a plane mirror.

Sol.:



Total distance between object and image = 30 cm

9. Answer (4)

Hint: Use formula for velocity, $v = \frac{dx}{dt}$

Sol.: $v = \frac{dx}{dt} = 10t - 4$

$v = 0 = 10t - 4$

$t = 0.4$ second

10. Answer (1)

Hint & Sol.: Useful power = (Efficiency × Energy per fission) × (Number of fissions per second)

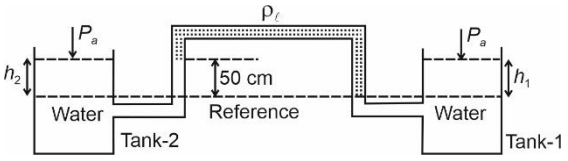
$$1000 \times 10^6 = \frac{20}{100} \times 200 \times 10^6 \times 1.6 \times 10^{-19} \times n$$

$$n = \frac{125}{8} \times 10^{19}$$

11. Answer (3)

Hint: Use formula $\Delta P = \rho gh$

Sol.:



Let atmospheric pressure be P_a.

h_1 is the height of water above reference level in tank 1, h_2 is the height of water above reference level in tank 2.

ρ is the density of water and ρ_l is the density of liquid in manometer.

$P_a + \rho g h_1 - \rho_l g \times (50) + \rho g \times 50 = P_a + \rho g h_2$

$\rho h_1 - \rho_l \times 50 + \rho \times 50 = \rho h_2$

$h_1 - 45 + 50 = h_2$

$h_2 - h_1 = 5$ cm

12. Answer (1)

Hint: Maximum acceleration in SHM is given by

$$a_{max} = -\omega^2 A = -\left(\frac{K}{m}\right)A$$

Sol.: Given m is same and a_{max} is same for both

$$a_1 = a_2 \Rightarrow \frac{K_1}{m_1} A_A = \frac{K_2}{m_2} A_B$$

$$\frac{A_A}{A_B} = \frac{K_2}{K_1}$$

13. Answer (3)

Hint & Sol.: According to Biot-Savart's law $d\vec{B} = \frac{\mu_0}{4\pi} \frac{id\vec{l} \times \vec{r}}{r^3}$ which is applicable for infinitesimal current element. It is analogous to Coulomb's law, where electric field is produced by scalar source q.

14. Answer (1)

Hint & Sol.: Figure of merit, $K = \frac{I}{\theta}$

15. Answer (2)

Hint & Sol.: In forward bias, the diode starts conducting significantly only after the applied voltage exceeds the cut-in voltage, typically about 0.7 V for Si and 0.3 V for Ge.

16. Answer (2)

Hint & Sol.: Fundamental frequency of closed organ pipe, $f_c = \frac{v}{4L}$

Fundamental frequency of open organ pipe, $f_o = \frac{v}{2L}$

$$\therefore \frac{f_c}{f_o} = \frac{v}{4L} \times \frac{2L}{v} = \frac{1}{2}$$

17. Answer (4)

Hint: Physical quantity with highest power would be responsible for maximum error.

Sol.: $P = \frac{A^2\sqrt{B}}{CD^{-4}}$

$$\frac{\Delta P}{P} = \frac{2\Delta A}{A} + \frac{1}{2}\frac{\Delta B}{B} + \frac{\Delta C}{C} + 4\frac{\Delta D}{D}$$

Since % error is same for all the quantities, hence quantity D will bring the maximum percentage error.

18. Answer (1)

Hint & Sol.: Induced emf = $\frac{-d\phi}{dt}$

It means induced emf is directly proportional to rate of change of magnetic flux.

All other statements are correct.

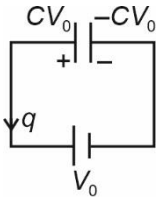
19. Answer (3)

Hint & Sol.: An ideal transformer has no losses, hence input power is equal to output power due to perfect efficiency.

20. Answer (1)

Hint: Work done by battery = $\Delta V \times q$

Sol.: Initial charge on the positive plate of the capacitor = $2CV_0$ …(i)



Final charge on the positive plate = CV_0 …(ii)

Charge is moving from positive to negative terminal of the battery.

Work done by the battery = $\Delta V \times q$

$W_b = -V_0 \times CV_0 = -CV_0^2$

21. Answer (3)

Hint: Einstein's photoelectric equation:

$h\nu = h\nu_0 + KE_{max}$

Sol.:

(a) $KE_{max} = h\nu - h\nu_0$

Compare with $y = mx + c$

Therefore, graph of KE_{max} vs ν is a straight line with slope h

(b) $h\nu = h\nu_0 + eV_0$

$$V_0 = \frac{h\nu}{e} - \frac{h\nu_0}{e}$$

slope = $\frac{h}{e}$

(c) $\phi = h\nu_0 \Rightarrow \nu_0 = \frac{\phi}{h}$

(d) Saturation photocurrent depends on photon intensity of incident light.

22. Answer (3)

Hint: Intensity of an electromagnetic wave is given by $\frac{1}{2}\varepsilon_0 E_0^2 c$

Sol.: $\eta = \frac{\text{Power output}}{\text{Power input}}$

$\eta = \frac{P}{P_0} \Rightarrow P = \eta P_0$ …(i)

Intensity at distance r :

$I = \frac{P}{4\pi r^2}$ …(ii)

Intensity of an EM wave = $\frac{1}{2}\varepsilon_0 E_0^2 c$ …(iii)

Using equations (i), (ii) and (iii), we can write

$$\frac{1}{2}\varepsilon_0 E_0^2 c = \frac{\eta P_0}{4\pi r^2} \Rightarrow E_0 = \left(\frac{\eta P_0}{2\pi r^2 \varepsilon_0 c}\right)^{\frac{1}{2}}$$

23. Answer (4)

Hint: Use formula, resistance $R = \frac{\rho l}{A}$

Sol.: $R = \frac{\rho l}{A} \Rightarrow R = \frac{\rho l^2}{V}$

Putting given values in the formula, we get

$3 = \frac{\rho l^2}{3} \Rightarrow l^2 = \frac{9}{\rho}$

$l = \frac{3}{\sqrt{\rho}}$ metre

24. Answer (3)

Hint & Sol.: In an adiabatic free expansion, the gas expands into a vacuum i.e., zero external pressure. Therefore $W = 0$, also $Q = 0$, because the process is adiabatic.

Since, $Q = \Delta U + W$ and $Q = 0 = W$

$\therefore \Delta U = 0$

Since $U \propto T$, the temperature remains constant too.

25. Answer (1)

Hint: Force is equal for both the wire segments.

Sol.: Elongation, $\Delta l = \frac{FL}{AY}$

Here, $\Delta l \propto \frac{1}{A}$

$\therefore \frac{\Delta l_1}{\Delta l_2} = \left(\frac{R_2}{R_1}\right)^2 = \frac{1}{4}$

26. Answer (3)

Hint: Energy formula for hydrogen atom:

$E_n = \frac{-13.6}{n^2}\text{eV}$

Sol.: Ground state: $E_1 = -13.6$ eV

$n = 4$ level: $E_4 = \frac{-13.6}{4^2}\text{eV}$

$E = E_4 - E_1 = 13.6\left(1-\frac{1}{16}\right) = \frac{13.6\times 15}{16}\text{eV}$ ...(i)

Energy required to remove electron from $n = 4$:

$E' = 0-\left(-\frac{13.6}{16}\right) = \frac{13.6}{16}$ ...(ii)

$\therefore \frac{E}{E'} = \frac{13.6\times\frac{15}{16}}{\frac{13.6}{16}} = 15$

27. Answer (2)

Hint & Sol.: Orbital speed = $\sqrt{\frac{GM}{R}} = \sqrt{gR}$

28. Answer (1)

Hint: Use Bernoulli's principle.

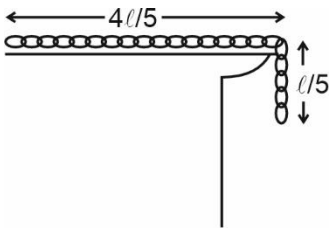
Sol.: Bernoulli's equation, $P + \frac{1}{2}\rho v^2$ = constant

So, if velocity is lower then pressure would be higher.

29. Answer (3)

Hint: Take reference for potential energy at the table.

Sol.:



$\text{PE}_{\text{initial}} = \frac{-mg}{5}\times\frac{\frac{\ell}{5}}{2} = \frac{-mgl}{50}$ ... (i)

$\text{PE}_{\text{final}} = -mg\frac{\ell}{2}$ ...(ii)

Since, only gravity is doing work, hence total mechanical energy will remain conserved.

$KE_i + PE_i = KE_f + PE_f$

$0+\left(\frac{-mg\ell}{50}\right) = KE_f + \left(\frac{-mg\ell}{2}\right)$

$KE_f = \frac{mg\ell}{2} - \frac{mg\ell}{50} = \frac{24}{50}mg\ell$

$KE_f = \frac{12}{25}mg\ell$

30. Answer (4)

Hint: Apply principle of calorimetry.

Sol.: Let final temperature of the mixture be T. Heat lost by copper = heat gained by water

$200 \times 0.39 \times (150 - T) = 100 \times 4.18\,(T - 25)$

$78\,(150 - T) = 418\,(T - 25)$

$11700 - 78\,T = 418\,T - 10450$

$11700 + 10450 = 418\,T + 78\,T$

$T = \frac{22150}{496} = 44.66°\text{C}$

31. Answer (1)

Hint: Find the time until the trains collide and multiply it with the speed of the bird to find the total distance flown by the bird.

Sol.: Relative speed of trains = $(72 + 54) \times \frac{5}{18}$ = 35 m/s

Time until collision = $\frac{1.75\times 1000}{35} = 50$ s

Total distance flown by the bird

$= \left(90\times\frac{5}{18}\right)\times 50$ = 1250 m or 1.25 km.

32. Answer (1)

Hint & Sol.: Covering one slit with a thin transparent film introduces an additional optical path, and thus shifting the central maximum.

33. Answer (4)

Hint: Time period of simple pendulum, $T = 2\pi\sqrt{\frac{l}{g}}$

Sol.: $T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T_1 = 2\pi\sqrt{\frac{256}{g}}$

$T_1 = \frac{2\pi}{\sqrt{g}} \times 16$ …(i)

$T_2 = \frac{2\pi}{\sqrt{g}} \times 14$ …(ii)

Let n_1 and n_2 be integers, then

$n_1T_1 = n_2T_2$

$n_1 \times \frac{2\pi}{\sqrt{g}} \times 16 = n_2 \times \frac{2\pi}{\sqrt{g}} \times 14$

$\frac{n_1}{n_2} = \frac{14}{16} = \frac{7}{8}$

longer pendulum will take 7 oscillations while smaller pendulum will take 8 oscillations to be in phase again.

34. Answer (2)

Hint: To convert a galvanometer into a voltmeter, a resistance has to be connected in series with it.

Sol.:

Using equation, $V = iR$

$0.4 = (50 \times 10^{-6})(80 + R')$

$\frac{0.4 \times 10^6}{50} = 80 + R'$

$R' + 80 = 8000 \Rightarrow R' = 7920\ \Omega$

35. Answer (4)

Hint: Work done by magnetic field is zero, hence gain in speed will be due to work done by gravity only.

Sol.: Work done by all forces = Δ(K.E.)

$W_{mg} + 0 = \frac{1}{2}mv^2 - 0$

$mgy = \frac{1}{2}mv^2$

For vertical displacement y, $v = \sqrt{2gy}$

$F_{\text{magnetic}} = q(\vec{v} \times \vec{B})$

$F_m = qvB\sin 90° = q\left(\sqrt{2gy}\right)B$

36. Answer (2)

Hint: Properties of an electric conductor.

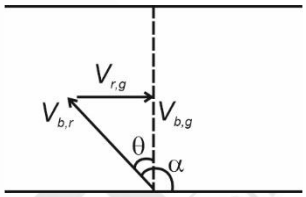
Sol.:

- Net charge on a neutral conductor has to be zero.
- Potential of a neutral conductor can be non-zero.
- In electrostatic condition, electric field inside a conductor is zero.

37. Answer (1)

Hint: For the given condition, the drift can be minimised to zero.

Sol.:



To make drift zero:

$\sin\theta = \frac{v_{r,g}}{v_{b,r}} = \frac{v_0}{2v_0}$

$\sin\theta = \frac{1}{2} \Rightarrow \theta = 30°$

$\alpha = 90° + \theta = 120°$

38. Answer (3)

Hint & Sol.: γ-rays have the highest penetrating power.

39. Answer (4)

Hint & Sol.: de Broglie wavelength is given by

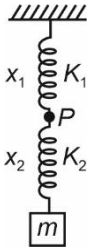
$\lambda = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$

40. Answer (4)

Hint: Use relation $K_1x_1 = K_2x_2$

Sol.:

FBD of block m :



$F_2 = mg$

$K_2x_2 = mg$

$x_2 = \frac{mg}{2K}$ …(i)

FBD of point P:

$F_1 = F_2$

$K_1x_1 = K_2x_2$

$Kx_1 = 2Kx_2 \Rightarrow x_1 = 2x_2$

$x_1 = 2\times\frac{mg}{2K} = \frac{mg}{K}$ …(ii)

$x_1 + x_2 = \frac{mg}{K} + \frac{mg}{2K} = \frac{3mg}{2K}$

41. Answer (2)

Hint: Apply lens formula and magnification formula.

Sol.: Lens formula:

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} - \frac{1}{\frac{-3f_0}{2}} = \frac{1}{f_0}$

$\frac{1}{v} = \frac{1}{f_0} - \frac{1}{\frac{3}{2}f_0} \Rightarrow v = 3f_0$

Magnification formula:

$\frac{h_i}{h_0} = \frac{v}{u} \Rightarrow \frac{r_1}{r_0} = \frac{3f_0}{\frac{-3}{2}f_0} = -2$

$\therefore$ Radius of image = 2 × radius of object

$\frac{\text{Area of image}}{\text{Area of object}} = \frac{\pi r_1^2}{\pi r_0^2}$

$\frac{A_{\text{image}}}{a} = (2)^2 \Rightarrow A_{\text{image}} = 4a$

42. Answer (1)

Hint: Adiabatic process: PV^γ = constant

Sol.: P_i = 1 atm, $V_i = V_0$

$P_iV_i^\gamma = P_fV_f^\gamma \Rightarrow 1\times V_0^\gamma = P_f\left(\frac{V_0}{8}\right)^\gamma$

$P_f = 1\times(8)^{\frac{4}{3}} = 1\times\left(2^3\right)^{\frac{4}{3}}$

P_f = 16 atm

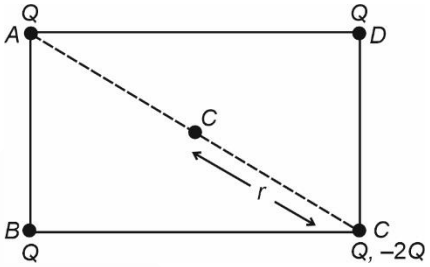
43. Answer (3)

Hint & Sol.: The motion of a rigid body which is not pivoted in some way is either a pure translation or a combination of translation and rotation.

44. Answer (3)

Hint: Use principle of superposition.

Sol.: Consider two point charges Q and $-2Q$ at vertex C. Due to positive charge Q, net field will become zero. Hence



$E = \frac{2kQ}{r^2}$

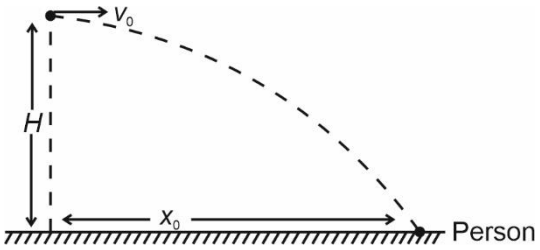
$r = \frac{1}{2}\sqrt{a^2+b^2}$

$\therefore E = 2\times\frac{1}{4\pi\varepsilon_0}\times\frac{Q}{\left(\frac{1}{2}\sqrt{a^2+b^2}\right)^2} = \frac{2Q}{\pi\varepsilon_0\left(a^2+b^2\right)}$

45. Answer (3)

Hint: Use formulae : $t = \sqrt{\frac{2H}{g}}$ and $x = u \times t$

Sol.:



Time of flight of the food packet, $t = \sqrt{\frac{2H}{g}}$

Horizontal distance to be covered in this time t,

$x_0 = u \times t$

$x_0 = v_0\sqrt{\frac{2H}{g}}$

[CHEMISTRY]

46. Answer (3)

Hint: Less substituted alkene is formed as a major product with bulky strong base.

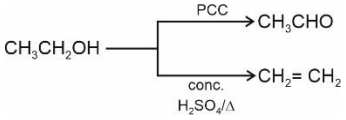
Sol.: Acetone is a polar aprotic solvent.

47. Answer (3)

Hint: Formaldehyde on reaction with Grignard reagent gives 1° alcohol.

Sol.: $HCHO \xrightarrow[2.H_2O/H^+]{1.CH_3MgBr,\text{dry ether}} \underset{(Z)}{CH_3CH_2OH}$

- Z is a 1° alcohol.
- Z will not give instant turbidity with Lucas reagent.
- Z gives positive iodoform test.

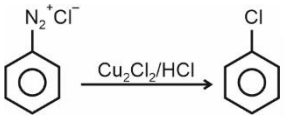


48. Answer (4)

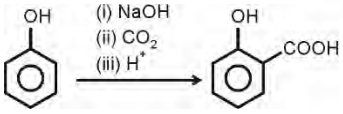
Hint: Carboxylic acids having alpha hydrogen can undergo α-halogenation reaction with Red P/X_2.

Sol.: HVZ reaction

$$R-CH_2-COOH \xrightarrow[(2)H_2O]{(1)\text{Red}P+X_2} \underset{\underset{X}{|}}{R-CH-COOH}$$



Sandmeyer reaction



Kolbe's reaction

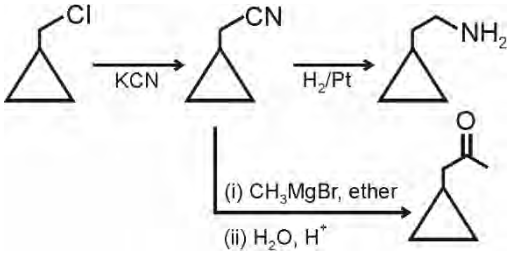
$$3CH_3Br + SbF_3 \longrightarrow 3CH_3F + SbBr_3$$

Swarts reaction

49. Answer (1)

Hint: Alkyl cyanides can undergo catalytic reduction to give amines.

Sol.:



50. Answer (4)

Hint: Picric acid is even stronger acid than formic acid.

Sol.: Phenol : $pK_a = 10$

Benzoic acid : $pK_a = 4.19$

Formic acid : $pK_a = 3.75$

Picric acid : $pK_a < 1$

51. Answer (2)

Hint: High boiling points of alcohols because of involving hydrogen bonding.

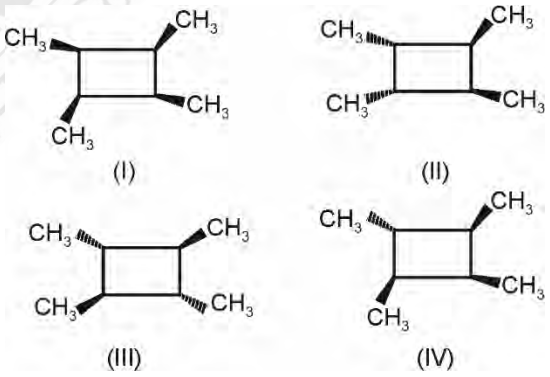
Sol.:

Molecules	Boiling point (K)
Ethanol	351 K
Methoxy methane	248 K
Propane	231 K
Butan-1-ol	390 K

52. Answer (1)

Hint: Geometrical isomerism exist in a system where rotation around the bond is restricted.

Sol.:

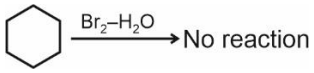


53. Answer (3)

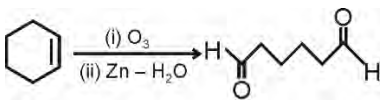
Hint: Alkenes on reductive ozonolysis can produce aldehydes and ketones.

Sol.:

- Statement (I)



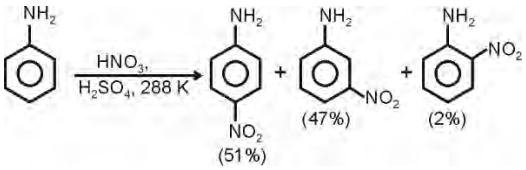
- Statement (II)



54. Answer (3)

Hint: In the strongly acidic medium, aniline is protonated to form the anilinium ion, which is meta directing.

Sol.:



55. Answer (3)

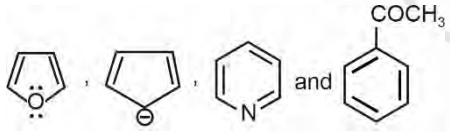
Hint: C is acetone.

Sol.:

- A is $CH_3 - C \equiv CH$
- B is $CH_3 - \underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}} = CH$
- C is $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$

56. Answer (4)

Hint: Cyclic planar species having $(4n + 2)\pi$ electrons in conjugation will be aromatic.

Sol.:  and

are the species of $(4n + 2)$ conjugated π-electrons.

57. Answer (1)

Hint: Essential amino acid cannot be synthesised in body.

Sol.: Lysine is an essential amino acid.

58. Answer (1)

Hint: Common ion effect

Sol.: $H_2S \rightleftharpoons 2H^+ + S^{2-}$

$HCl \longrightarrow H^+ + Cl^-$

Due to common ion effect of H^+, the concentration of S^{2-} ion decreases and this would prevent the precipitation of group IV cations.

59. Answer (1)

Hint: i = 1 + (n –1) α, i of CH_3COOH can be calculated using ΔT_f.

Sol.: For aqueous solution of urea,

$\Delta T_f = 1.86 = 1 \times K_f \times 1$

$K_f = 1.86°C$ kg/mol

For aqueous CH_3COOH solution

$\Delta T_f = 0.02 = i \times 1.86 \times 10^{-2}$

$$i = \frac{2\times10^{-2}}{1.86\times10^{-2}} = 1.075$$

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

$1.075 = 1 + (2 - 1)\,\alpha$

$0.075 = \alpha$

$\% \alpha = 7.5\%$ dissociation

60. Answer (3)

Hint: $\alpha = \dfrac{\Lambda_m}{\Lambda^\circ_m}$

$$K_a = \frac{c\alpha^2}{1-\alpha}$$

Sol.: $\alpha = \dfrac{\Lambda_m}{\Lambda^\circ_m} = \dfrac{39.5}{395} = 0.1$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{10^{-2}\times2\times10^{-3}}{1-0.1} = \frac{2\times10^{-5}}{0.9}$$

$= 2.22 \times 10^{-5}$

61. Answer (2)

Hint: For 1st order reaction

$$kt = \ln\frac{A_0}{A_t}$$

Sol.:

		$A(g)$	$\longrightarrow 2B(g)$	$+ C(g)$
$t = 0$		P_i	–	–
t		$P_i - x$	$2x$	x

$P_t = P_i + 2x$

$$x = \frac{P_t - P_i}{2}$$

$$k = \frac{2.303}{t}\log\frac{P_i}{P_i - x} = \frac{2.303}{t}\log\frac{P_i}{P_i - \left(\frac{P_t - P_i}{2}\right)}$$

$$k = \frac{2.303}{t}\log\frac{2P_i}{3P_i - P_t}$$

62. Answer (2)

Hint: Ozone is a violet black solid.

Sol.: Zn reacts with dilute HNO_3 to give N_2O gas.

63. Answer (1)

Hint: SiO_2 is a covalent three-dimensional network solid.

Sol.: TlI_3 does not exist.

64. Answer (4)

Hint: Gd^{3+} ion has $4f^7$ electronic configuration.

Sol.:

Element	Electronic configuration
Eu	$4f^7\ 6s^2$
Gd	$4f^7\ 5d^1\ 6s^2$
Tb	$4f^9\ 6s^2$

65. Answer (4)

Hint: $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

Sol.: $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

Number of mole of CO_2 = Number of mole of $CaCO_3$

$$= \frac{10}{22.4}\ \text{mol}$$

$$\text{Mass of } CaCO_3 = \frac{10}{22.4} \times 100\,\text{g}$$

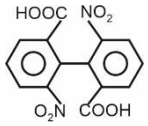
$$= \frac{\text{Mass of sample} \times 80}{100} = \frac{10 \times 100}{22.4}$$

Mass of sample = 55.8 g

66. Answer (1)

Hint: Ortho substituted biphenyl molecules can show geometrical isomerism. If POS (plane of symmetry) and COS (centre of symmetry) are absent in it.

Sol.:

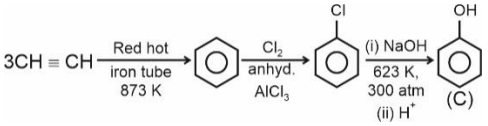


does not has POS and COS, so will be optically active.

67. Answer (1)

Hint: Alkyne undergoes cyclic polymerisation to produce aromatic hydrocarbon in the presence of red hot iron tube on heating.

Sol.:



68. Answer (1)

Hint: Thyroxine is an iodinated derivative of amino acid tyrosine.

Sol.:

- Glucocorticoids control the carbohydrate metabolism.
- Glucagon hormone tends to increase the glucose level in the blood.

69. Answer (3)

Hint: Layer test is done for Br^- and I^- ions.

Sol.: Violet colouration in organic layer shows the presence of iodide ions.

70. Answer (4)

Hint : Only gaseous component will be considered for K_p calculation.

Sol.:

$$\underset{\substack{t=0 \\ t=t_{eq}}}{A_2BC(s)} \rightleftharpoons \underset{\substack{0 \\ x}}{AB(g)} + \underset{\substack{0 \\ x}}{AC(g)}$$

$$\text{Partial pressure of } AB = \frac{x}{2x} \times P = \frac{P}{2}$$

$$\text{Partial pressure of } AC = \frac{x}{2x} \times P = \frac{P}{2}$$

$$K_p = P_{AB} \times P_{AC}$$

$$= \frac{P}{2} \times \frac{P}{2} = \frac{P^2}{4}$$

71. Answer (1)

Hint: For adiabatic process, $\Delta S_{surrounding} = 0$

Sol.: For reversible process

$\Delta S_{sys} + \Delta S_{surr} = 0$

$\because\ \Delta S_{surr} = 0$

So, $\Delta S_{sys} = 0$

72. Answer (2)

Hint: $r_n = \frac{52.9 \times n^2}{Z}\text{pm}$

Sol.: 2nd Bohr orbit of H atom

$$(r_2)_H = \frac{52.9 \times 4}{1} = 52.9 \times 4\,\text{pm}$$

- 1st Bohr orbit of Li^{2+} ion

$$(r_1)_{Li^{2+}} = \frac{52.9 \times 1}{3} = \frac{52.9}{3}\text{pm}$$

- 3rd Bohr orbit of He^+ ion

$$(r_3)_{He^+} = \frac{52.9 \times 9}{2}$$

- Ratio of radii will be

24 : 2 : 27

73. Answer (3)

Hint: Number of electron = number of moles × N_A × 32

Sol.: Number of electrons = $\frac{6}{60} \times 6.02 \times 10^{23} \times 32$

$= 192.64 \times 10^{22}$

$= 19.3 \times 10^{23}$

74. Answer (3)

Hint: Reducing character of hydrides of group 15 elements increases due to decrease bond dissociation enthalpies.

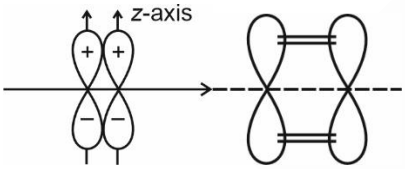
Sol.:

Hydride	Bond angle (°)
NH_3	107.8
PH_3	93.6
AsH_3	91.8
SbH_3	91.3

75. Answer (3)

Hint: π bond is formed by sideways overlapping.

Sol.:



The atomic orbitals are overlapping sideways, so, π bond will be formed.

76. Answer (2)

Hint: Nobel gases have positive electron gain enthalpies.

Sol.:

Noble gas	Electron gain enthalpy
He	48 kJ/mol
Ne	116 kJ/mol
Ar	96 kJ/mol
Xe	77 kJ/mol

77. Answer (1)

Hint: Cu does not react with dil. HCl to form H_2 gas.

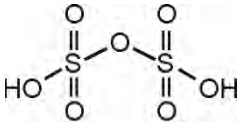
Sol.: $E^{\circ}_{Cu^{2+}/Cu}$ is positive as the high energy to transform Cu(s) to Cu^{2+} (aq.) is not compensated by its hydration enthalpy.

78. Answer (3)

Hint: Just like O_2, S_2 is also paramagnetic species.

Sol.: At ~ 1000 K, sulphur exists as S_2.

• $H_2S_2O_7$ (Oleum)



79. Answer (4)

Hint: B in B_2H_6 is sp^3 hybridised.

Sol.:

(a)	B in B_2H_6	sp^3
(b)	C in fullerene	sp^2
(c)	Br in BrF_3	sp^3d
(d)	Xe in XeF_6	sp^3d^3

80. Answer (3)

Hint: Unit of rate of reaction will be same irrespective to the order.

Sol.: $r = \frac{\text{change in concentration}}{\text{time}}$

$= \frac{\text{mol L}^{-1}}{\text{s}}$

$= \text{mol L}^{-1}\,\text{s}^{-1}$

81. Answer (4)

Hint: $E^{\circ}_{cell} = E^{\circ}_{c} - E^{\circ}_{a}$

Sol.: $E^{\circ}_{cell} = 0.8 + 0.25 = 1.05\,V$

82. Answer (1)

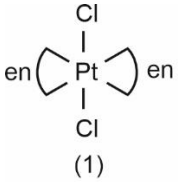
Hint: Solutions of positive deviation from Raoult's law have $\Delta_{mix} H > 0$.

Sol.: Ethanol addition into water decrease intermolecular interaction which results $\Delta_{mix} H > 0$.

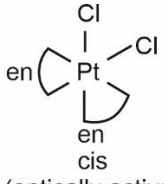
83. Answer (1)

Hint: If two bidentate ligand are at adjacent position, then complex will be optically active.

Sol.:



(1)



cis
(optically active)
(2, 3)

84. Answer (1)

Hint: More is the negative charge on metal, better is the back bonding and longer will be the 'C–O' bond length.

Sol.: In $[Fe(CO)_4]^{2-}$, back bonding is highest. So, longer 'C–O' bond length will be observed.

85. Answer (4)

Hint: C_2^{2-} is isoelectronic with N_2 in which Last electron of C_2^{2-} enters into $\sigma 2p_z$.

Sol.: $C_2^{2-} : \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \pi 2p_x^2$

$= \pi 2p_y^2 < \sigma 2p_z^2 < \pi^* 2p_x = \pi^* 2p_y$

$\pi^* 2p_x$ and $\pi^* 2p_y$ are LUMO orbitals in C_2^{2-}.

86. Answer (1)

Hint: Atomic number 36 is of Krypton (Kr) and 48 is of cadmium (Cd) and both are 5th period elements.

Sol.: Z [49] $5s^2\ 5p^1$, 5th period

group number = 10 + 2 + 1 = 13

Z [92] $5f^3\ 6d^1\ 7s^2$, 7th period

All *f*-block elements are in 3rd group

Z [38] $5s^2$, 5th period and 2nd group

Z [57] $5d^1\ 6s^2$, 6th period and 3rd group

87. Answer (3)

Hint & Sol.: Balanced reaction will be

$$6I^-(aq) + 2MnO_4^-(aq) + 4H_2O(l) \rightarrow 3I_2(s) + 2MnO_2 + 8OH^-(aq)$$

a = 6, b = 2, c = 4, d = 3, e = 2, f = 8

88. Answer (4)

Hint: For an acidic buffer, $pH = pK_a + \log \frac{[Salt]}{[acid]}$

Sol.:

The solution is an acidic buffer

$$pH = pK_a + \log\frac{[Salt]}{[acid]}$$

$$pH = 4.75 + \log\frac{0.4}{0.3}$$

= 4.75 + log4 – log3

= 4.75 + 0.13

= 4.88

89. Answer (3)

Hint: During reversible isothermal expansion

$$W = -2.303nRT\log\left(\frac{V_2}{V_1}\right)$$

Sol.: $W = -2.303 \times 2 \times 8.314 \times 10^{-3} \times 300 \log 10$

= 11.488 kJ

90. Answer (1)

Hint: Atomic number of Mn is 25 and its Electronic configuration is

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Sol.: One electron each from every subshell would have $m_\ell = 0$ and $m_s = +\frac{1}{2}$

[BIOLOGY]

91. Answer (2)

Hint: In gymnosperm, the male and female gametophytes do not have an independent free-living existence.

Sol.: In gymnosperm, the multicellular female gametophyte is also retained within megasporangium.

The pollen grain is released from the microsporangium.

They are carried by air currents and come in contact with the opening of the ovules borne on megasporophylls.

The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.

Following fertilisation, zygote develops into an embryo and the ovules into seeds.

92. Answer (3)

Hint: In brown algae, the union of gametes may take place in water or within the oogonium.

Sol.: *Sargassum* is the brown alga in which sexual reproduction takes place by fusion of an egg and motile male gamete.

93. Answer (2)

Hint: ETS of mitochondria have two complexes that transfer e^- to ubiquinone.

Sol.: ETS of mitochondria have one protein complex that carries out facilitated diffusion of protons while transferring e^- to ubiquinone i.e. complex I.

94. Answer (2)

Hint: Palisade parenchyma are situated near to the upper epidermis of the leaf.

Sol.: The adaxially placed palisade parenchyma is made up of elongated cells, which are arranged vertically and parallel to each other.

95. Answer (4)

Hint: In dicot plant, the tangential as well as the radial wall of the endodermal cells have a deposition of water impermeable, waxy material suberin in the form of casparian strips.

Sol.: In dicot roots, casparian strips are present.

96. Answer (4)

Hint: Potato family have cymose inflorescence.

Sol.: When the shoot apical meristem converts into a flower, it loses the ability to grow further, making the growth determinate.

97. Answer (3)

Hint: Fusion is indicated by enclosing the figure within bracket and adhesion by a line drawn above the symbols of the floral parts.

Sol.: A floral diagram provides information about the number of parts of a flower, their arrangement and the relation they have with one another. Floral formula also shows cohesion and adhesion within parts of whorls and between whorls.

98. Answer (4)

Hint: *Spirogyra* is not a unicellular organism.

Sol.: Kingdom Protista has brought together *Chlamydomonas, Chlorella* with *Paramoecium* and *Amoeba*.

99. Answer (3)

Hint: The organisms that are chief producer in the ocean are diatoms.

Sol.: Diatoms belongs to the kingdom Protista. They are unicellular eukaryotic organism. They are found in fresh water as well as in ocean.

100. Answer (3)

Hint: The M Phase starts with the nuclear division, *i.e.* karyokinesis and usually ends with division of cytoplasm *i.e.* cytokinesis.

Sol.: The correct sequence of the stages of cell division is as follows:

Gap_1 phase $\rightarrow$ Synthesis phase $\rightarrow$ Gap_2 Phase $\rightarrow$ Karyokinesis $\rightarrow$ Cytokinesis

Hence correct order will be B$\rightarrow$ D$\rightarrow$ E$\rightarrow$ A$\rightarrow$ C

101. Answer (4)

Hint: Both maize and sugarcane are C_4 plants.

Sol.: Maize is a C_4 plant. In maize leaves, bundle sheath cells are characterised by large number of chloroplast, thick walls which is impervious to gaseous exchange and no intercellular spaces.

In C_3 plant, some O_2 bind to RuBisCO and hence CO_2 fixation is decreased.

C_3 plants respond to increased CO_2 concentration and saturation is seen only beyond 450 $\mu l L^{-1}$.

C_3 plants respond to higher CO_2 concentration by showing increased rate of photosynthesis, leading to higher productivity.

102. Answer (1)

Hint: There can be a net gain of 38 ATP molecules during aerobic respiration of one molecule of glucose.

Sol.: In fermentation, less than seven percent of energy in glucose is released and not all of it is trapped as ATP, because the NADH cannot be oxidised through oxidative phosphorylation as fermentation occurs in anaerobic condition, thus NADH reducing power is used up to convert pyruvate into lactate/alcohol, yielding 2 ATP per glycolysis.

103. Answer (2)

Hint: Photochemical phase of photosynthesis starts with absorption of different wavelengths of light.

Sol.: Light reactions or the 'photochemical' phase include light absorption, release of electrons from P_{680}, splitting of water replenishing electrons in the reaction centre of PS II, then formation of high energy chemical intermediates, *i.e.*, ATP and NADPH.

104. Answer (4)

Hint: PEPcase is 3 carbon containing enzyme found in mesophyll cell of C_4 plants.

Sol.: The primary CO_2 acceptor is a 3-carbon molecule phosphoenol pyruvate present in the mesophyll cell. The enzyme is responsible for fixation of CO_2.

105. Answer (3)

Hint: Recombination is an enzyme mediated process and occur in third sub stage of prophase I.

Sol.: Recombination between homologous chromosomes is completed by the end of pachytene.

106. Answer (4)

Hint: Equal to 14

Sol.: In an adult human:-

Number of cranial bones = 8

Number of ribs = 12 pairs

Number of lumbar vertebrae = 5

Number of phalanges in one hind limb = 14

107. Answer (2)

Hint: Maintains pH and ionic balance of blood

Sol.: Substances like glucose, amino acids, Na^+, *etc.*, in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport. Reabsorption of water also occurs passively in the initial segments of the nephron. The descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. The ascending limb of loop of Henle is impermeable to water but allows transport of electrolytes actively or passively.

The osmolarity of the filtrate present in DCT is hypotonic to that of the fluid present in the medullary interstitium.

108. Answer (4)

Hint: Exclude the phagocytic cells.

Sol.: Neutrophils are the most abundant cells (60-65 per cent) of the total WBCs and basophils are the least (0.5-1 per cent) among them. Neutrophils and monocytes (6-8 per cent) are phagocytic cells which destroy foreign organisms entering the body. Basophils secrete histamine, serotonin, heparin, *etc.*, and are involved in inflammatory reactions. Eosinophils (2-3 per cent) resist infections and are also associated with allergic reactions.

109. Answer (2)

Hint: Respiratory rhythm centre

Sol.: A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and hydrogen ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Respiratory rhythm centre is present in medulla oblongata. Another centre present in the pons region of the brain called pneumotaxic centre can moderate the functions of the respiratory rhythm centre. Neural signals from this centre can reduce the duration of inspiration and thereby alter the respiratory rate.

The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

110. Answer (4)

Hint: Lecithin is a phospholipid.

Sol.:

Phospholipid (Lecithin)

111. Answer (1)

Hint: One of them is an amphibian.

Sol.: *Bangarus* is a reptile while *Hyla* is an amphibian. Body of amphibians is divisible into head and trunk. Reptiles are mostly terrestrial animals and their body is covered by dry and cornified skin, epidermal scales or scutes. They do not have external ear openings. Tympanum represents ear. In reptiles, fertilisation is internal while fertilisation is external in amphibians.

112. Answer (2)

Hint: Identify a platyhelminth.

Sol.: Platyhelminths have dorso-ventrally flattened body, hence are called flatworms. These are mostly endoparasites found in animals; including human beings. Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ-level of body organisation.

Ascaris and *Ancylostoma* are roundworms (pseudocoelomates) while *Pheretima* is an annelid (coelomate).

113. Answer (2)

Hint: Assists in mating

Sol.: Frogs exhibit sexual dimorphism. Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the forelimbs which are absent in female frogs. In both male and female frogs, the hind limbs end in five digits and they are larger and muscular than the forelimbs that end in four digits. Nictitating membrane and tympanum are present in both the sexes.

114. Answer (4)

Hint: Present in earthworms

Sol.: Excretion in cockroaches is performed by Malpighian tubules. Each tubule is lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut. Therefore, this insect is called uricotelic. In addition, the fat bodies, nephrocytes and urecose glands (present only in males) also help in excretion.

115. Answer (3)

Hint: Compound epithelium

Sol.: Compound epithelium is made of more than one layer (multi-layer) of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechanical stresses. They cover the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

Cuboidal epithelium has cube-like cells with central nuclei.

Columnar epithelium has tall and slender cells with basal nuclei.

116. Answer (2)

Hint: Antonie Von Leeuwenhoek was the first one to describe live cell.

Sol.: Robert Brown discovered nucleus. Matthias Schleiden a botanist, who observed that plants are composed of different kind of cells. Theodore Schwann concluded based on his studies on plant tissue, that the presence of cell wall is unique character of plant cell.

117. Answer (3)

Hint: Inclusion bodies include phosphate granules, cyanophycean granules and glycogen granules.

Sol.: Contractive vacuole is an example of vacuole and it is a part of endomembrane system.

118. Answer (4)

Hint: Ribosomes are commonly found in both prokaryotes and eukaryotes.

Sol.: Ribosomes are composed of ribonucleic acid and proteins.

119. Answer (3)

Hint: Mitochondria and chloroplast are the semi-autonomous organelle and they have the ability to synthesize their own protein.

Sol.: Since the functions of mitochondria, chloroplast and peroxisomes are not coordinated with ER, Golgi apparatus, lysosomes and vacuole, these are not considered as a part of endomembrane system.

120. Answer (2)

Hint: Tonoplast is the outer membrane of the vacuole.

Sol.: In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradient into vacuole, hence their concentration is significantly higher in the vacuole than in the cytoplasm.

121. Answer (1)

Hint: Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis.

Sol.: Production is expressed in terms of weight (gm^{-2}) or energy ($kcal\ m^{-2}$).

122. Answer (2)

Hint: Statins are commercialized as blood cholesterol lowering agent and it is produced by yeast.

Sol.: Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents.

123. Answer (4)

Hint: Euchromatin are said to be transcriptionally active chromatin whereas heterochromatin is inactive.

Sol.: In a typical nucleus, some regions of chromatin are loosely packed (and stains light) and are referred to as euchromatin. The chromatin that is more densely packed and stains dark are called as heterochromatin. Euchromatin is said to be transcriptionally active chromatin, whereas heterochromatin is inactive. Entire chromatin is replicated in s phase.

124. Answer (2)

Hint: In XX-XO type of sex determination, the males have only one X chromosome besides the autosomes.

Sol.: Grasshopper is an example of XX-XO type of sex determination.

125. Answer (1)

Hint: Inheritance of flower colour in *Antirrhinum* is a good example of incomplete dominance.

Sol.: When a cross is made between true-breeding red-flowered plant (RR) and true-breeding white-flowered plants (rr), the F_1 (Rr) had pink flower. When the F_1 was self-pollinated the F_2 had flowers in the following ratio 1 (RR) Red: 2 (Rr) Pink: 1 (rr) white. That means 50% of the progenies will have pink flower.

126. Answer (4)

Hint: In human blood type, there are three different alleles and there are six different genotypes of the human ABO blood group with four different phenotypes.

Sol.: $I^A I^B \times I^A I^B$ and $I^A I^O \times I^O I^B$ genotypes of parents will produce prgeny with at least of three types of blood group.

127. Answer (3)

Hint: Seed is often described as the fertilized ovule.

Sol.: In angiosperms, the final product of sexual reproduction is a fertilized ovule.

128. Answer (2)

Hint: Cells of tapetum possess dense cytoplasm and generally have more than one nucleus.

Sol.: The innermost wall layer of microsporangium is tapetum which nourishes the developing pollen grains.

129. Answer (4)

Hint: Flowers pollinated by abiotic agents do not require colorful petals and sepals.

Sol.: Both wind and water pollinated flowers do not produce nectar and they are dependent on the abiotic factors rather than attracting animal pollinators like insects or birds.

130. Answer (3)

Hint: ABA act as general plant growth inhibitor and an inhibitor of plant metabolism.

Sol.: The group of PGRs are involved in growth promoting activities, such as cell division, cell enlargement, flowering, fruiting and seed formation. These are also called plant growth promoters, e.g., auxins, gibberellins and cytokinin.

Gibberellins promote bolting. ABA is a carotenoid derived phytohormone.

131. Answer (4)

Hint: Muscidae.

Sol.: *Entamoeba histolytica* is a protozoan parasite in the large intestine of human which causes amoebiasis (amoebic dysentery). Symptoms of this disease include constipation, abdominal pain and cramps, stools with excess mucous and blood clots. Houseflies act as mechanical carriers for this disease.

132. Answer (3)

Hint: Developed along different directions due to adaptations to different needs.

Sol.: Whales, bats, cheetah and humans (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structures – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Hence, in these animals, the same structure developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry.

133. Answer (1)

Hint: Included under the barrier method of contraception

Sol.: Use of condoms has increased in recent years due to its additional benefit of protecting the users from contracting STIs and AIDS. Nirodh is a popular brand of male condom.

Progestasert is a hormone releasing IUD. Saheli is a non-steroidal contraceptive pill.

134. Answer (4)

Hint: Not a reliable indicator of virginity or sexual experience

Sol.: The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.

The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts.

The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris.

135. Answer (1)

Hint: Include the hormone released by α-cells of Islets of Langerhans.

Sol.: Catecholamines stimulate the breakdown of glycogen resulting in an increased concentration of glucose in blood. Cortisol is the main glucocorticoid that stimulates gluconeogenesis, lipolysis and proteolysis. Glucagon acts mainly on the liver cells (hepatocytes) and stimulates glycogenolysis resulting in an increased blood sugar level (hyperglycaemia).

136. Answer (4)

Hint: Weakening of bones.

Sol.: **Osteoporosis:** An age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is its common cause. When PTH levels are consistently high, this can lead to excessive bone resorption (breakdown), resulting in decreased bone density and increased risk of fractures, a hallmark of osteoporosis.

137. Answer (1)

Hint: Multipolar neurons

Sol.: Based on the number of axon and dendrites, the neurons are divided into three types, *i.e.*, multipolar (with one axon and two or more dendrites; found in the cerebral cortex), bipolar (with one axon and one dendrite, found in the retina of eye) and unipolar (cell body with one axon only; found usually in the embryonic stage).

138. Answer (2)

Hint: Released by adrenal cortex

Sol.: An excessive loss of fluid from the body can activate receptors which stimulate the hypothalamus to release antidiuretic hormone (ADH) or vasopressin from the neurohypophysis.

A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release renin which converts angiotensinogen in blood to angiotensin I and further to angiotensin II.

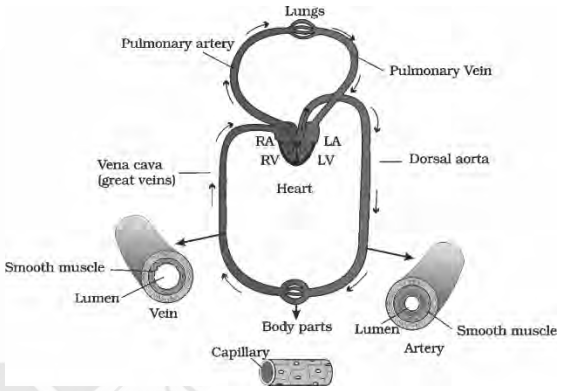
Angiotensin II also activates the adrenal cortex to release aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR.

ANF is a vasodilator that decreases the blood pressure.

139. Answer (2)

Hint: Dorsal aorta is an artery.

Sol.:



Dorsal aorta is a part of systemic circulation.

Arteries have thicker tunica media as compared to veins.

140. Answer (3)

Hint: Total lung capacity

Sol.: **Total Lung Capacity (TLC):** Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

FRC includes ERV + RV.

VC includes ERV + TV + IRV.

IC includes TV + IRV.

141. Answer (3)

Hint: Effect of temperature below the optimum value.

Sol.: Enzymes generally function in a narrow range of temperature and pH. Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and optimum pH. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

142. Answer (3)

Hint: Identify arthropods

Sol.: *Laccifer, Locusta, Limulus, Aedes, Apis* – Phylum Arthropoda

Asterias, Antedon – Phylum Echinodermata

Ancylostoma – Phylum Aschelminthes

Aplysia – Phylum Mollusca

Pleurobrachia – Phylum Ctenophora

143. Answer (4)

Hint: Gives positive iodine test

Sol.: Glucose is a monosaccharide. Lipids are found in both saturated and unsaturated forms.

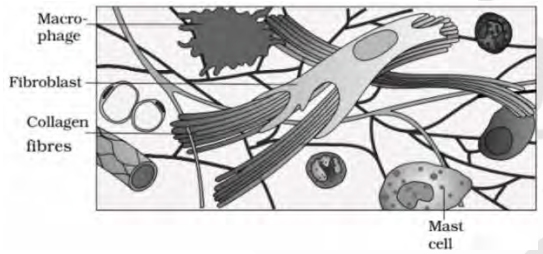
Collagen is the most abundant protein in the animal world. Proteins are heteropolymers.

Glycogen has a highly branched structure formed by α-1, 4 and α-1, 6 glycosidic bonds.

144. Answer (2)

Hint: Feature of areolar tissue

Sol.:



Loose connective tissue has cells and fibres loosely arranged in a semi-fluid ground substance, for example, areolar tissue present beneath the skin. Often, it serves as a support framework for epithelium. It contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.

145. Answer (1)

Hint: Rosie produced the human protein-enriched milk in the same year in which an American company got patent rights on Basmati rice.

Sol.: In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 grams per litre).

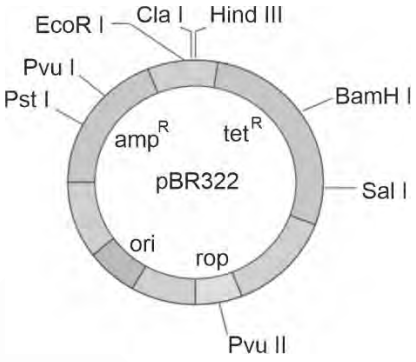
The first clinical gene therapy was given in 1990 to a 4-year-old girl with adenosine deaminase (ADA) deficiency.

In 1983, Eli Lilly, an American company, prepared two DNA sequences corresponding to 'A' and 'B', chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains.

146. Answer (4)

Hint: No insertional inactivation

Sol.: As the restriction site of *Hind* III does not lie within any antibiotic resistance gene that is present in pBR322, so the recombinants will be resistant to both ampicillin and tetracycline.



147. Answer (3)

Hint: Possesses lysins

Sol.: Human sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap-like structure, acrosome. The acrosome is filled with enzymes that help in fertilisation of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitates sperm motility essential for fertilisation.

148. Answer (2)

Hint: Equal to the number of bones in each limb of a man.

Sol.: The recombinant therapeutics do not induce unwanted immunological responses as is common in case of similar products isolated from non-human sources. At present, about 30 recombinant therapeutics have been approved for human-use the world over. In India, 12 of these are presently being marketed.

149. Answer (2)

Hint: Number of fragments produced by a circular DNA after restriction digestion = Number of restriction sites present on it.

Sol.: When a linear DNA is cut at one restriction site, it will result in two fragments, while when a circular DNA is cut at one restriction site, it results in only one fragment. In the given case, sample 'A' DNA, when cut by R.E. at two different sites, gives two fragments, hence, it is a circular DNA, while sample 'B' DNA after digestion gives 3 fragments, so it is a linear DNA.

As plasmids are circular DNA, so sample 'B' cannot be a plasmid.

150. Answer (1)

Hint: Chemical structure of morphine

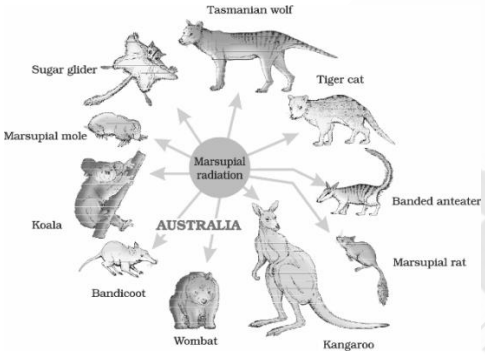
Sol.: Morphine belongs to the category of opioids and is a very effective sedative and painkiller, and is very useful in patients who have undergone surgery. Heroin is a depressant and slows down body functions. Coca alkaloid is obtained from *Erythroxylum coca*. Cannabinoids are a group of chemicals which interact with cannabinoid receptors present principally in the brain.

Morphine can be taken *via* injection.

151. Answer (3)

Hint: Exclude the placental mammals

Sol.:



152. Answer (4)

Hint: Saheli is a non-steroidal pill.

Sol.: 'Saheli'–a new oral contraceptive for the females–was developed by scientists at Central Drug Research Institute (CDRI) in Lucknow, India. It contains a non-steroidal preparation *i.e.*, centchroman which is a selective estrogen receptor modulator. Saheli does not inhibit ovulation. It only inhibits implantation. Progestogens alone or in combinations with estrogen can be used by females as injections or implants under the skin. Their mode of action is similar to that of pills but their effective periods are much longer.

153. Answer (2)

Hint: During the ovulatory phase, there is rupture of Graafian follicle.

Sol.: A large number of primary follicles degenerate during the phase from birth to puberty. Therefore, at puberty, only 60,000-80,000 primary follicles are left in each ovary. The secondary oocyte forms a new membrane called zona pellucida surrounding it. Ovulatory phase is an ovarian event. The menstrual phase is followed by the follicular phase. During this phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle and simultaneously, the endometrium of uterus regenerates through proliferation.

154. Answer (3)

Hint: Throne of immunity

Sol.: The pineal gland is located on the dorsal side of forebrain. The thyroid gland is composed of two lobes which are located on either side of the trachea. The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta. Our body has a pair of adrenal glands, one above of each kidney.

155. Answer (1)

Hint: Function of medulla oblongata

Sol.: The medulla oblongata of the brain is connected to the spinal cord. The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions. Three major regions make up the brain stem; mid brain, pons and medulla oblongata.

Along with the hypothalamus, limbic system is involved in the regulation of sexual behaviour, expression of emotional reactions, *etc*.

156. Answer (3)

Hint: Ramdeo Misra is known as Father of Ecology in India

Sol.: Ernst Mayr is known as "The Darwin of the 20th century'

157. Answer (1)

Hint: In an upright pyramid, the base is broader than the top.

Sol.: Grassland and pond ecosystem have upright pyramid of number.

158. Answer (1)

Hint: Growth in higher plants is indeterminate.

Sol.: Both growth and differentiation in higher plants are open.

Dedifferentiation is the pre-requisite for the re-differentiation.

159. Answer (3)

Hint: The process of copying of genetic information from one strand of the DNA into RNA is known as transcription and it occurs in the cytoplasm with the help of transcription enzymes.

Sol.: Transport of mRNA to cytoplasm is a part of translation. Base pairing of two complementary RNA strands do not occur during post-transcriptional modification.

160. Answer (2)

Hint: The species which are not native to a particular place is known as exotic species.

Sol.: Cichlid fish is the native species of Lake Victoria of East Africa.

161. Answer (3)

Hint: Logistic growth of a population is represented by the sigmoid curve.

Sol.: Logistic growth of a population takes place when resources in a habitat are limited.

162. Answer (3)

Hint: When move higher in taxonomic hierarchy, number of common characteristic goes on decreasing.

Sol.: Higher the category, greater is the difficulty of determining the relationship to other taxa at the same level. Hence, the problem of classification becomes more complex.

163. Answer (4)

Hint: Darwin finches present in the Galapagos Island are the example of the competitive co-existence.

Sol.: Mutualism- Fig and fig wasp

Commensalism- Orchids growing on other plants

Parasitism - *Cuscuta* growing on hedge plants

164. Answer (2)

Hint: Biochemical oxygen demand is the amount of oxygen that would be consumed if all the organic matter in one litre of water is oxidized by the bacteria.

Sol.: More the organic matter in sewage water, more will be the BOD of that water. Hence, BOD is the indirect measure of the organic matter present in the water.

BOD of primary effluent will be more than secondary effluent.

165. Answer (4)

Hint: The disorder is getting passed to both son and daughter irrespective of sex.

Sol.: The trait under study is autosomal recessive.

166. Answer (4)

Hint: Charging of tRNA is also known as aminoacylation.

Sol.: Charging of tRNA is catalysed by aminoacyl tRNA synthetase (not a ribozyme) and it requires energy.

167. Answer (2)

Hint: The enzyme DNA dependent RNA polymerase is involved in the process of transcription.

Sol.: The enzyme DNA dependent RNA polymerase is responsible for the

- Unwinding of the DNA helix
- Synthesis of all RNA molecules
- Polymerisation of ribonucleotides
- It synthesises RNA in 5'$\rightarrow$3' direction

168. Answer (2)

Hint: T.H. Morgan has used *Drosophila* to study inheritance pattern.

Sol.: Meselson and Stahl used *E.coli* for his experiment, Hershey and Chase used Bacteriophage and *E.coli*. Taylor *et. al* used Faba beans to prove semi conservative mode of replication in eukaryotes.

169. Answer (3)

Hint: Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion.

Sol.: Insertion or deletion of three or its multiple bases insert or delete in one or multiple codons, hence one or multiple amino acids, and reading frame remains unaltered from that point onwards.

170. Answer (3)

Hint: Meiosis involves two sequential cycles of karyokinesis and cytokinesis.

Sol.: Except chromosome duplication and histone protein synthesis, rest all phenomenon occur twice in meiosis.

171. Answer (4)

Hint: Eliminate the methods used exclusively for plants.

Sol.: Biolistics or gene gun is a direct method of gene transfer used exclusively for plants.

In biolistics, cells are bombarded with high-velocity micro-particles of gold or tungsten.

Retrovirus mediated is an indirect method of gene transfer.

In micro-injection, the gene of interest is injected directly in the nucleus of an animal cell.

172. Answer (3)

Hint: Recall the properties of a prosthetic group.

Sol.: Haem is the prosthetic group of the enzyme catalyse and peroxidase.

It is an organic compound.

It is present in the active site of the enzymes.

Prosthetic groups are tightly bound to the apoenzyme.

Removal of co-factors affects enzyme activity.

173. Answer (2)

Hint: Exclude the events that occur during normal inspiration

Sol.: Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, *i.e.*, there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure.

174. Answer (4)

Hint: Vaccination induces the body to produce antibodies.

Sol.: When a host is exposed to antigens, which may be in the form of living or dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity.

When ready-made antibodies are directly given to protect the body against foreign agents, it is called passive immunity.

In vaccination, a preparation of antigenic proteins of pathogen or inactivated/weakened pathogen (vaccine) are introduced into the body. The antibodies produced in the body against these antigens would neutralise the pathogenic agents during actual infection.

175. Answer (3)

Hint: Worked on populations

Sol.: The work of Thomas Malthus on populations influenced Darwin. Alfred Wallace, a naturalist, worked in Malay Archipelago. Charles Darwin believed that natural selection leads to evolution. Louis Pasteur by careful experimentation demonstrated that life comes only from pre-existing life.

176. Answer (2)

Hint: A small part of the vas deferens is removed or tied up

Sol.: In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum. Surgical intervention blocks gamete transport and thereby prevents conception.

177. Answer (4)

Hint: True for nurse cells

Sol.: The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis. After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.

Capacitation refers to physiological changes in the sperms that occur before fertilisation in the female reproductive tract.

178. Answer (1)

Hint: Identify a cartilaginous fish.

Sol.: Cartilaginous fishes are marine animals with streamlined body and have cartilaginous endoskeleton. Notochord is persistent throughout their life. Gill slits are separate and without operculum (gill cover). They show internal fertilisation and many of them are viviparous.

Pterophyllum is a bony fish. *Pteropus* is a mammal and *Psittacula* is a bird.

179. Answer (3)

Hint: *Agrobacterium tumefaciens*

Sol.: Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant (tobacco).

Agrobacterium tumefaciens, a pathogen of several dicot plants, is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumor and direct these tumor cells to produce the chemicals required by the pathogen. The tumor inducing (Ti) plasmid of *Agrobacterium tumefaciens* has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants.

180. Answer (1)

Hint: Cannot pass through cell membranes

Sol.: Since DNA is a hydrophilic molecule, it cannot pass through cell membranes. In order to force bacteria to take up the plasmid, the bacterial cells must first be made 'competent' to take up DNA. This is done by treating them with a specific concentration of a divalent cation, such as calcium, which increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

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