02/05/2025

Phase-1
CODE-A

Aakash
Medical | IIT-JEE | Foundations

Corporate Office: AESL, 3rd Floor, Incuspaze Campus-2, Plot no. 13, Sector-18, Udyog Vihar, Gurugram, Haryana-122015

MM : 720

Pre-NEET Test for NEET-2025

Time : 180 Mins.

Answers

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

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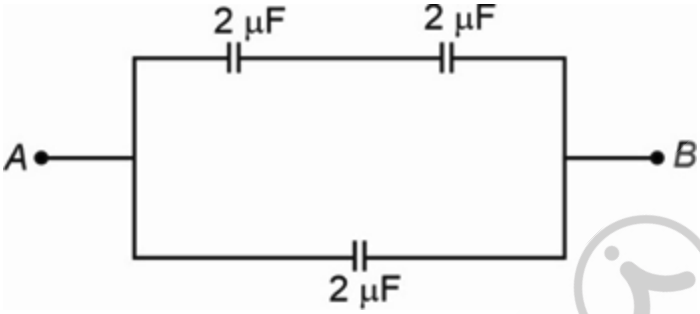
Hints and Solutions

PHYSICS

(1) **Answer :** (2)
Solution:
Moment of inertia of rod about point *A* is
$I_A = I_{com} + md^2$
$63 = \frac{m(4)^2}{12} + m(1)^2$
$63 = m\left[\frac{7}{3}\right]$
$m = 27$ kg .

(2) **Answer :** (3)
Solution:
The circuit can be redrawn as



$C_{AB} = 3$ μF

(3) **Answer :** (2)
Solution:
Since transformer is ideal
$\therefore P_{in} = P_0$
$200 \times i_P = 50$
$i_P = \frac{50}{200} = \frac{1}{4}$
= 0.25 A

(4) **Answer :** (4)
Solution:
Angular fringe width $\beta = \frac{\lambda}{d}$
$\Rightarrow \ d\uparrow \ \Rightarrow \ \beta\downarrow$
and $\lambda\downarrow \ \Rightarrow \ \beta\downarrow$

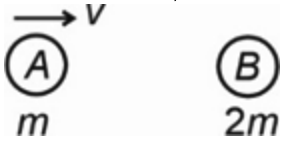
(5) **Answer :** (2)
Solution:
Inductive reactance $X_L = \omega L$
$= 2\pi fL$
$= 2\pi \times 50 \times 10 \times 10^{-3}$
$= 1000\pi \times 10^{-3}$
$= \pi\ \Omega$
$i_{rms} = \frac{V_{rms}}{X_L} = \frac{220}{\pi} = \frac{220\times 7}{22} = 70$ A
$i_0 = \sqrt{2} i_{rms}$
$= 70\sqrt{2}$ A
= 98.98 A

(6) **Answer :** (1)
Solution:

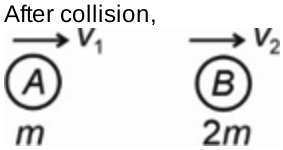
$\vec{a} = \frac{d\vec{v}}{dt}$

Slope of velocity time graph is acceleration. First slope of *v-t* curve will be positive and constant, then it will be zero and again it will positive and constant.

(7) **Answer :** (2)
Solution:
Before collision,



After collision,



$\Rightarrow e = 1 = \frac{v_2 - v_1}{v}$

$\Rightarrow v_2 - v_1 = v$ ...(i)

Apply momentum conservation of system:

$P_i = P_f$

$mv = mv_1 + 2mv_2$

$\Rightarrow v_1 + 2v_2 = v$ ...(ii)

On solving equation (i) and (ii)

$3v_2 = 2v$

$v_2 = \frac{2v}{3}$

(8) **Answer :** (2)
Solution:
Work energy theorem,
Work = ΔK.E.

$\Rightarrow \quad K_f - K_i = \vec{F} \cdot \Delta\vec{x}$

$K_f - K_i = (2\hat{i} - 3\hat{j}) \cdot (3\hat{i})$

$K_f - \frac{1}{2} \times 2 \times 4 = 6$

$K_f = 6 + 4$

= 10 J

(9) **Answer :** (4)
Solution:

Monoatomic gas has 3 degrees of freedom, therefore energy per molecule is $\frac{3}{2}K_BT$

The average distance a molecule travel without colliding is called the mean free path.

(10) **Answer :** (4)
Solution:
For interference pattern to be observed, the sources must be coherent.
Hence the superposition of a, b and d would result in interference.

(11) **Answer :** (3)
Solution:
For uniformly charged solid sphere

$V_A = \frac{3}{2}V_B$

$|V_A - V_B| = \frac{V_B}{2}$

$= \frac{1}{2} \times \frac{kq}{R}$

$= \frac{1}{2} \times \frac{9 \times 10^9 \times 2 \times 10^{-6}}{9 \times 10^{-2}}$

= 10^5 V

(12) **Answer :** (2)
Solution:
Path *ab* is an isobaric process.

∴ Work done by gas $W = P(V_b - V_a)$

$= 100 \times 10^3 \times [0.4 - 0.1] \times 10^{-3}$

$= 100 \times 0.3$

$= 30$ J

(13) **Answer :** (2)

Solution:

For paramagnetic material

$1 < \mu_r < 1 + \varepsilon$

(14) **Answer :** (3)

Solution:

In horizontal circular motion,

$T = \frac{mv^2}{r}$

For constant m and r, $T \propto v^2$

$T' = 4T$ (Given)

$\Rightarrow v' = 2v$

$= 2 \times 20$

$= 40$ m s^{-1}

(15) **Answer :** (3)

Solution:

$\varepsilon_{eq} = 20 - 10 = 10$ V

$R_{eq} = 2 + 2 + 1 = 5\ \Omega$

$i = \frac{\varepsilon_{eq}}{R_{eq}} = \frac{10}{5} = 2$ A

$\Rightarrow V = 20 - 2i$

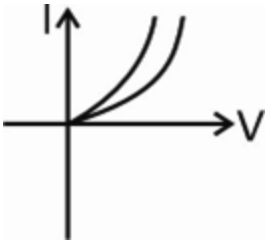
$= 20 - 4$

$= 16$ V

(16) **Answer :** (3)

Solution:

A. LED characteristic



B. In reverse biased *pn* junction diode, the current measured in (μA), is due to minority charge carrier.

(17) **Answer :** (1)

Solution:

Magnetic field due to semi-circular section at centre $B = \frac{\mu_0 i}{4R}$

$B_0 = \left[\frac{\mu_0 I}{4R_1} - \frac{\mu_0 I}{4R_2}\right] \odot$

$= \frac{I}{4}\left[\frac{4\pi}{6\pi} - \frac{4\pi}{4\pi}\right] \times 10^{-7} \odot$

$= \frac{I}{4}\left[\frac{2}{3} - 1\right] \times 10^{-7} \odot$

$= -\frac{I}{12} \times 10^{-7} \odot$

(18) **Answer :** (3)

Solution:

Self inductance of a coil

$L = \mu_0 \mu_r n^2 V$

$= \frac{\mu_0 \mu_r N^2}{L^2} AL$

$= \frac{\mu_0 \mu_r N^2 A}{L}$

(19) **Answer :** (3)

Solution:

Efficiency $\eta = \frac{60}{100} = \frac{3}{5}$

⇒ Efficiency of Carnot engine

$\eta = 1 - \frac{T_L}{T_H}$

$\frac{3}{5} = 1 - \frac{300}{T_H}$

⇒ 750 K = T_H

⇒ T_H = 750 – 273

= 477°C

(20) Answer : (3)

Solution:

We know that, elastic potential energy per unit volume

= $\frac{1}{2}$stress × strain

Also, $Y = \frac{\text{stress}}{\text{strain}}$

$\Rightarrow U = \frac{1}{2} \times Y \times (\text{strain})^2$

$= \frac{1}{2} \times 2 \times 10^{11} \left(\frac{2\times10^{-3}}{50\times10^{-2}}\right)^2$

$= 10^{11} \times \left[\frac{2}{500}\right]^2$

= 1.6 × 10^6 J/m^3

(21) Answer : (1)

Solution:

Since capacitor is connected to battery.

⇒ therefore its potential is same

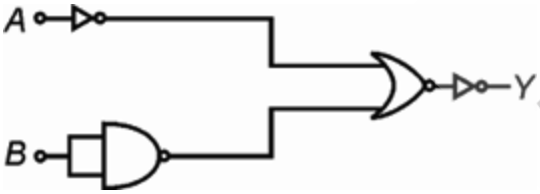
⇒ capacitance $C' = KC$ ⇒ increases

⇒ $U = \frac{1}{2}C'V^2$ ⇒ increases

⇒ $Q = C'V$ ⇒ increases

(22) Answer : (1)

Solution:



$Y = \overline{\overline{A} + \overline{B}}$

$= \overline{A} + \overline{B}$

$= \overline{A \cdot B}$

= NAND gate

(23) Answer : (2)

Solution:

For objective lens,

u = –8 cm, f = 5 cm

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} - \frac{1}{-8} = \frac{1}{5}$

$\frac{1}{v} = \frac{1}{5} - \frac{1}{8}$

$v = +\frac{40}{3}$

$|m_0| = \frac{v}{u} = \frac{40}{3\times8} = \frac{5}{3}$

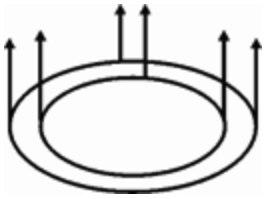
For relaxed eye condition, $m_e = \frac{D}{f_e}$

$M = m_0 \times m_e$

$= \frac{5}{3} \times \frac{25}{10} = \frac{25}{6}$

(24) Answer : (3)

Solution:



Excess force = $T \times 2\pi R \times 2$

$= \frac{7}{100} \times 2 \times \frac{22}{7} \times \frac{5}{100} \times 2$

= 0.044

= 44 mN

(25) Answer : (3)

Solution:

Since all transitions are to $n_1 = 2$ (Balmer Series), the order of increasing frequency follows:

$3 \to 2 < 4 \to 2 < 5 \to 2 < 6 \to 2$

(26) Answer : (4)

Solution:

$F = 6\pi\eta r v$

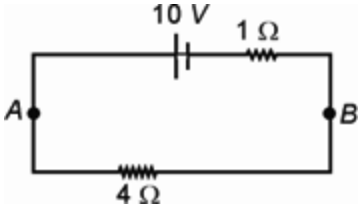
$\eta = \left[\frac{F}{rv}\right] = \left[\frac{\text{kg m} \times \text{s}}{\text{s}^2 \times \text{m} \times \text{m}}\right] = \left[\text{ML}^{-1}\text{T}^{-1}\right]$

(27) Answer : (4)

Solution:

At steady state, capacitor behave as an infinite resistance.

∴ Circuit can be redrawn as



$i = \frac{10}{4+1} = 2$ A

V_{AB} = 8 V

Charge stored $Q = C\,V_{AB}$

= 2 × 8 = 16 μC

(28) Answer : (1)

Solution:

Amount of energy required = ($S \times \Delta A$) × 2

$= 0.03 \times 4\pi \left[\text{r}_2^2 - \text{r}_1^2\right] \times 2$

$= 0.03 \times 4\pi \left[\left(16 - 4\right) \times 10^{-4}\right] \times 2$

= 9.04×10^{-4} J

(29) Answer : (2)

Solution:

$U = -PE\cos\theta$

$-4 = -P \times 2 \times 10^4 \times \frac{1}{2}$

$\Rightarrow \; P = \frac{4}{10^4}$

$q.l = \frac{4}{10^4}$

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

$q = 2 \times 10^{-2}$

q = 20 mC

(30) Answer : (4)

Solution:

$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

For Brackett, ($n_1 = 4$, $n_2 = \infty$)

$\frac{1}{\lambda_0} = R\left[\frac{1}{16} - 0\right] = \frac{R}{16}$

$\lambda_0 = \frac{16}{R}$ ...(1)

For Lyman series, (n_1 = 1, n_2 = ∞)

$\frac{1}{\lambda} = R[1-0] = R$

$\Rightarrow \quad \lambda = \frac{1}{R}$

$\lambda = \frac{\lambda_0}{16}$ [From eq. (1)]

(31) Answer : (4)
Solution:
• EM waves are transverse in nature.
• There is no phase difference between electric field and magnetic field vector.
• The energy is equally distributed among electric field and magnetic field.

(32) Answer : (1)
Solution:
$x = 8\sin(2\pi t) + 6\sin\left(2\pi t + \frac{\pi}{2}\right)$

$x = 10\sin(2\pi t + \phi)$

On comparing with standard equation of SHM, $x = A\sin(\omega t + \phi)$

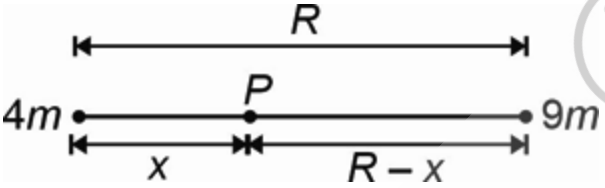
A = 10 m,

and $\omega = 2\pi$

$\frac{2\pi}{T} = 2\pi$

T = 1 s

(33) Answer : (2)
Solution:



Let gravitational field at point P is zero.

So, $\frac{-G(4m)}{x^2} = \frac{-G(9m)}{(R-x)^2}$

$\Rightarrow \quad \frac{2}{x} = \frac{3}{R-x}$

$\Rightarrow \quad 2R - 2x = 3x$

$\Rightarrow \quad x = \frac{2R}{5}$

$\therefore \quad V_P = \frac{-G(4m)}{x} - \frac{G(9m)}{(R-x)}$

$= \frac{-G(4m)}{\frac{2R}{5}} - \frac{G(9m)}{\frac{3R}{5}}$

$= \frac{-10Gm}{R} - \frac{15Gm}{R}$

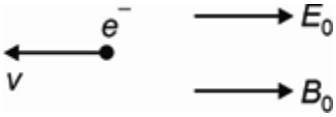
$= \frac{-25Gm}{R}$

(34) Answer : (1)
Solution:
Direction of angular momentum of particle is along the axis of rotation of circular path.

(35) Answer : (3)
Solution:

$^{290}_{82}X \xrightarrow{2\alpha} {}^{282}_{78}Y \xrightarrow{\beta^+} {}^{282}_{77}Z \xrightarrow{\beta^-} {}^{282}_{78}P \xrightarrow{\alpha} {}^{278}_{76}Q$

(36) Answer : (2)
Solution:
Given condition is shown in figure



• Force due to magnetic field is zero and due to electric field, $\vec{F}_e = q\vec{E} = -e\vec{E}$ i.e. opposite to direction of field.

(37) Answer : (3)
Solution:

$R = \frac{\rho l}{A}$ ...(1)

and $R_B = \frac{\rho l_B}{A_B}$

$= \frac{\rho(2l_A)}{9A_A}$

$= \frac{2}{9} \times 36$

= 8 Ω

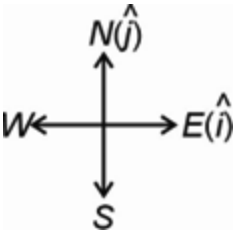
(38) Answer : (4)
Solution:

$H = \frac{u^2 \sin^2\theta}{2g}$

$= \frac{200\times200}{2\times10} \times \left(\frac{3}{5}\right)^2$

$= \frac{200\times200\times9}{20\times25} = 720 \text{ m}$

(39) Answer : (3)
Solution:



$\Delta\vec{P} = \vec{P}_f - \vec{P}_i$

$= -mu\left(\hat{j}\right) - mu\left(i\right)$

$= mu\left(-\hat{j} - \hat{i}\right)$

& $\vec{F} = \frac{\Delta\vec{P}}{\Delta t}$

$\therefore$ $\vec{F}$ is parallel to $\Delta\vec{P}$

(40) Answer : (3)
Solution:

Change in momentum $\Delta P = \int F\,dt =$ Area under *F-t* curve

$= \frac{1}{2} \times 2 \times 10 - \frac{1}{2} \times 4 \times 20$

=10 – 40 = –30 N s

(41) Answer : (2)
Solution:

By photoelectric equation

$(KE)_{max} = hf - hf_{th}$

$= h(3\nu_0) - h(\nu_0) = 2h\nu_0$

(42) Answer : (2)
Solution:

We know, $f = \frac{v}{\lambda}$

Velocity of sound, $v \propto \sqrt{T}$

$\therefore$ $\frac{f_2}{f_1} = \sqrt{\frac{T_2}{T_1}}$

$f_2 = f_1\sqrt{\frac{T_2}{T_1}}$

$= 200\sqrt{\frac{400}{300}} = \frac{400}{\sqrt{3}}$ Hz

(43) Answer : (1)

Solution:

$V = -kx^2y$

$\vec{E} = \frac{-\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}$

$= -\left[-k2xy\right]\hat{i} - \left[-kx^2\right]\hat{j}$

$\vec{E} = k2xy\,\hat{i} + kx^2\hat{j}$

$\therefore\ \vec{E}_{\text{at}(2,1,0)} = k \times 2 \times 2 \times 1\,\hat{i} + k(2)^2\hat{j}$

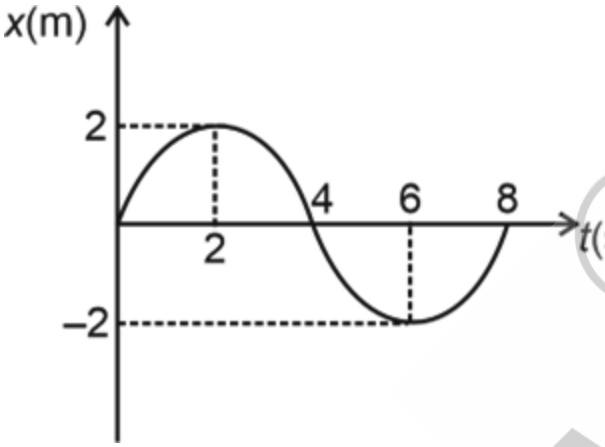
$= 4k\hat{i} + 4k\hat{j}$

(44) Answer : (1)

Solution:

Position of particle as function of time

$x = A\sin\omega t$



From figure, $A = 2$

$\omega = \frac{2\pi}{T} = \frac{2\pi}{8} = \frac{\pi}{4}$

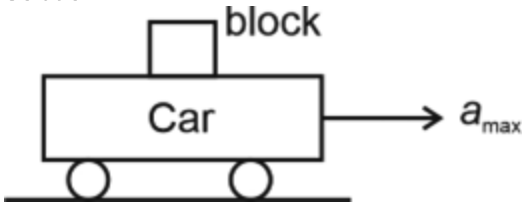
$v = A\omega\cos\omega t$

At $t = 4$ s, velocity is maximum

$v = -A\omega = -2 \times \frac{\pi}{4} == -\frac{\pi}{2}$ m s^{-1}

(45) Answer : (2)

Solution:



$\Rightarrow (fs)_{max} = ma_m$

$\Rightarrow \mu mg = ma_m$

$\Rightarrow a_m = \mu g$

$= 0.25 \times 10 = 2.5$ m s^{-2}

CHEMISTRY

(46) Answer : (3)

Solution:

- Number of atoms in 28 g of N_2 ⇒ $\frac{28}{28} = \frac{x}{2N_A}$

$x = 2N_A$

- Number of atoms in 22 g of CO_2 ⇒ $\frac{22}{44} = \frac{x}{3N_A}$

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

- Number of atoms in 16 g of O_2 ⇒ $\frac{16}{32} = \frac{x}{2N_A}$

$x = N_A$

- Number of atoms in 32 g of O_3 ⇒ $\frac{32}{48} = \frac{x}{3N_A}$

$x = 2N_A$

(47) Answer : (1)
Solution:

$r_n = a_0 \times \frac{n^2}{Z}$ as well as Z increases, radii of 2nd Bohr orbit decreases, so correct order is = $r_H > r_{He^+} > r_{Li^{2+}}$

(48) Answer : (4)
Solution:

• For one electron system, the energy of the orbitals increases as follows:
1s < 2s = 2p < 3s = 3p = 3d
• For multielectron system, the energy of the orbitals in the same subshell decrease with increase in the atomic number (Z_{eff})

(49) Answer : (2)
Solution:

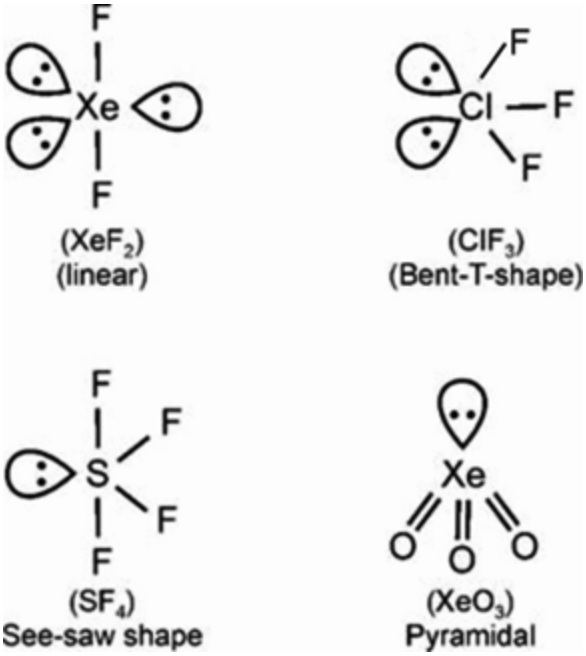
unnilquadium (104) → Rutherfordium
unnilseptium (107) → Bohrium
unnilennium (109) → Meitnerium
ununnillium (110) → Darmstadtium

(50) Answer : (4)
Solution:

Group 16 element	$\Delta_{eg}H$ (in KJ mol^{-1})
O	–141
S	–200
Se	–195
Te	–190
Po	–174

Group 1 element	$\Delta_{eg}H$ (in KJ mol^{-1})
H	–73
Li	–60
Na	–53
K	–48
Rb	–47
Cs	–46

(51) Answer : (2)
Solution:



(52) **Answer :** (3)
Solution:

Species	Bond order
N_2	3.0
O_2^-	1.5
N_2^+	2.5
B_2	1.0
CO	3.0
O_2^+	2.5
C_2^{2-}	3.0

(53) **Answer :** (3)
Solution:
In molecules with an odd number of electron like NO and NO_2 act as odd electron species.

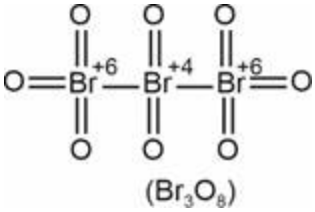
(54) **Answer :** (2)
Solution:
$\Delta H° = \Delta U° + \Delta n_g RT$
$= -20 + (0)RT = -20$ kJ
$\Delta G° = \Delta H° - T\Delta S°$
$\Delta G° = [-20 - (298 \times 10^{-3} \times (-80))]$
$= 3.84$ kJ

(55) **Answer :** (4)
Solution:
$\Delta H = \Sigma(BE)_R - \Sigma(BE)_P$
$\Delta H = \frac{1}{2} \times BE_{X-X} + \frac{1}{2} BE_{Y-Y} - BE_{X-Y}$
$-100 = \frac{1}{2} \times 20 + \frac{1}{2} \times 40 - BE_{X-Y}$
$BE_{X-Y} = 130$ kJ/mol

(56) **Answer :** (1)
Solution:
· For exothermic reaction, temperature increase will shift the reaction in backward direction
· For endothermic reaction, temperature increase will shift the reaction in forward direction.

(57) **Answer :** (2)

Solution:



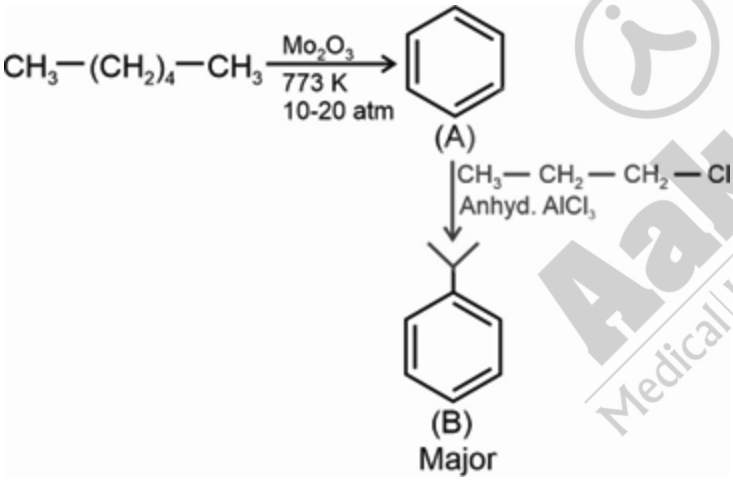
(58) **Answer :** (3)
Solution:
SiO_2 is acidic while SnO is amphoteric

(59) **Answer :** (2)
Solution:
Electron donating group increases the stability of carbocation while electron releasing group decreases the stability of carbocation.

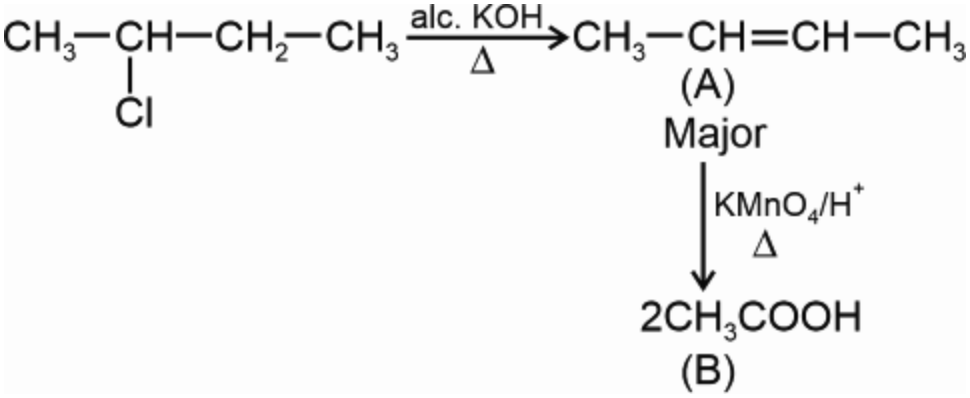
(60) **Answer :** (2)
Solution:
Kjeldahl's method is not applicable to compounds containing nitrogen in nitro and azo groups and nitrogen present in the ring.
Aniline is benzenoid aromatic compound while pyridine is heterocyclic aromatic compound.

(61) **Answer :** (3)
Solution:
Order → –COOR > COCl > – $CONH_2$ > –CN

(62) **Answer :** (4)
Solution:



(63) **Answer :** (2)
Solution:



(64) **Answer :** (2)
Solution:

i = 1 – α + nα
i = 1 – 0.2 + 2 × 0.2
i = 1 – 0.2 + 0.4 ⇒ 1.2
$\Delta T_b = iK_bm = 1.2 \times 0.52 \times 0.2$
= 0.1248 K
$\Delta T_b = T_b - T_b^\circ$
$T_b = 100 + 0.1248$
= 100.12 °C

(65) Answer : (4)
Solution:
Mole fraction of water = 1 – 0.1 ⇒ 0.9
mass of $H_2O = 0.9 \times 18$
$m = \frac{0.1 \times 1000}{16.2} = 6.17\ m$

(66) Answer : (1)
Solution:
$\Delta G^o = -nFE^\circ$
$= -6 \times 96500 \times 1.84$
$= 1065.36\ kJ\ mol^{-1}$

(67) Answer : (2)
Solution:
$H_2O + 1e^- \rightarrow \frac{1}{2}H_2 + OH^-$

1F, electricity evolves 1 g H_2 gas at cathode

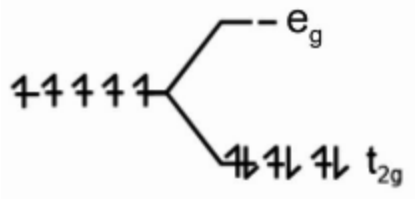
(68) Answer : (1)
Solution:
$r = -\frac{d[H_2O_2]}{dt} = \frac{2d[O_2]}{dt}$
$\frac{-d[H_2O_2]}{dt} = 2 \times 0.4$
$= 0.8\ mol\ L^{-1}\ s^{-1}$

(69) Answer : (3)
Solution:
When concentration of A is constant then rate of reaction becomes half.
$\left(\frac{0.2}{0.4}\right)^n = \frac{4 \times 10^{-3}}{2 \times 10^{-3}}$
$\left(\frac{1}{2}\right)^n = \left(2\right)$
$(2^{-1})^n = (2)^1$
n = –1
When concentration of B is constant then rate of reaction
$\left(\frac{0.2}{0.4}\right)^n = \left(\frac{2 \times 10^{-3}}{16 \times 10^{-3}}\right)$
$\left(\frac{1}{2}\right)^n = \left(\frac{1}{8}\right)$
$\left(\frac{1}{2}\right)^n = \left(\frac{1}{2}\right)^3$
n = 3

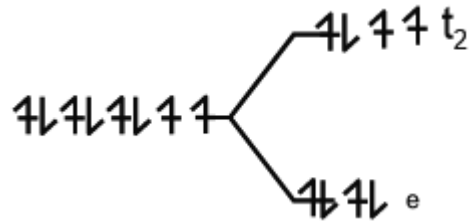
(70) Answer : (4)
Solution:
Scandium shows only +3 oxidation state. While Cu shows +1 and +2 oxidation states.

(71) Answer : (4)
Solution:
Neptunium (Np) → +3 to +7 oxidation states
Americium (Am) → +3 to +6 oxidation states

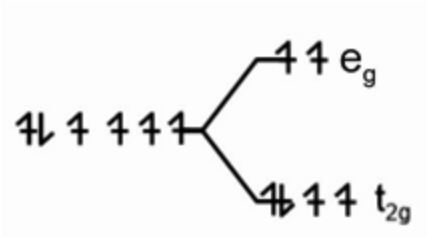
(72) Answer : (2)
Solution:
In $[Co(NH_3)_6]^{3+}$;



In $[NiCl_4]^{2-}$;



In $[CoF_6]^{3-}$;

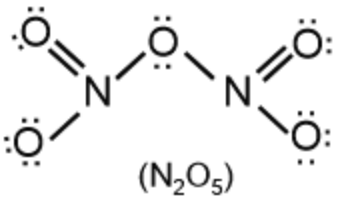


(73) Answer : (1)
Solution:

- $[CrCl_2(ox)_2]^{3-}$ has cis and trans geometrical isomers. cis –$[CrCl_2(ox)_2]^{3-}$ show optical isomerism
- $C_2O_4^{2-}$ and en are bidentate ligands

(74) Answer : (2)
Solution:

- $4H_3PO_3 \rightarrow 3H_3PO_4 + PH_3$

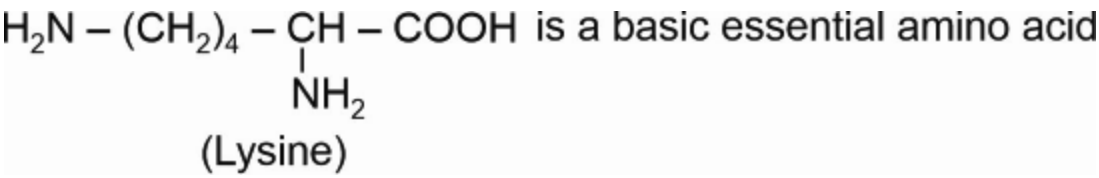


(75) Answer : (1)
Solution:
Acidic character increases from H_2O to H_2Te because bond enthalpy for the dissociation of H-E bond decrease down the group (E = group 16 elements)

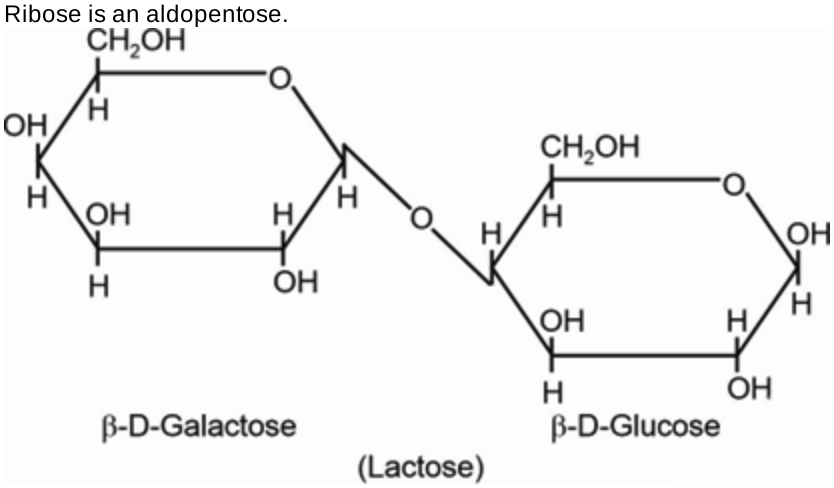
(76) Answer : (3)
Solution:
$IF_5 + H_2O \rightarrow HF + HIO_3$
Bond dissociation enthalpy of Cl_2 is higher than fluorine

Species	**Bond dissociation enthalpy/(kJ mol^{-1})**
Cl_2	242.6
F_2	158.8

(77) Answer : (3)
Solution:

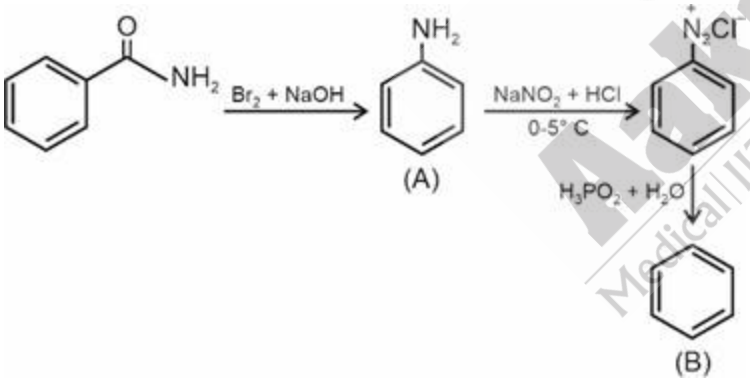


(78) Answer : (4)
Solution:
Ribose is an aldopentose.



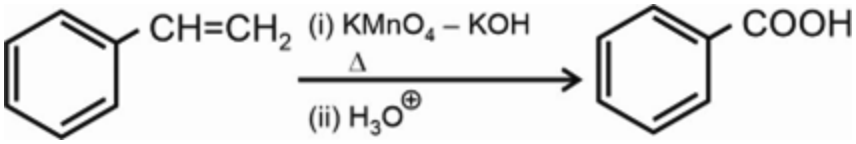
(79) Answer : (1)
Solution:
Aliphatic and aromatic primary amines give isocyanide test.
Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

(80) Answer : (1)
Solution:

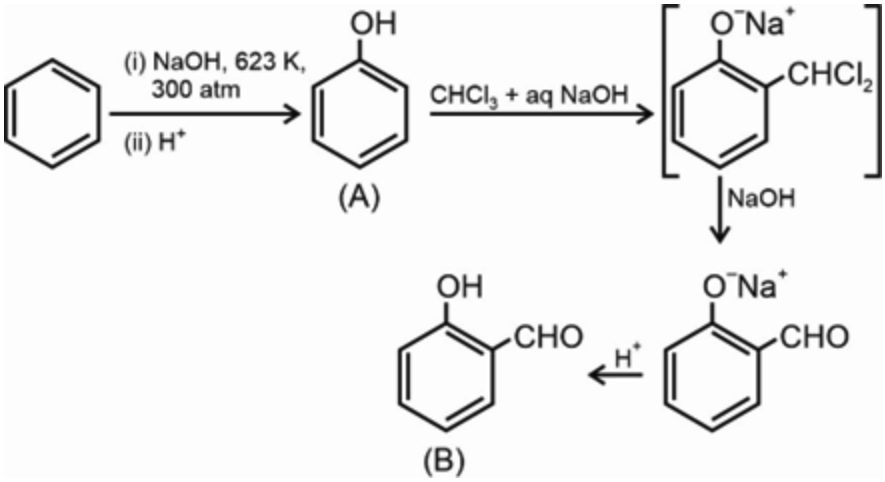


(81) Answer : (3)
Solution:
The presence of electron withdrawing group on the phenyl of aromatic carboxylic acid increases their acidity while electron donating groups decrease their acidity

(82) Answer : (3)
Solution:



(83) Answer : (4)
Solution:



(84) Answer : (3)
Solution:

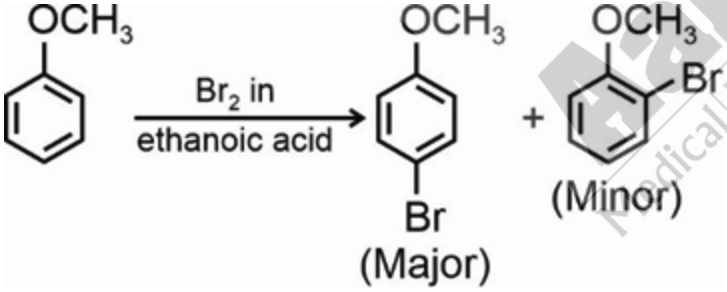
$$CH_3\,CH_2\,COOH \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} CH_3\,CH_2\,CH_2\,OH$$

$$CH_3\,CH_2\,CHO \xrightarrow{NaBH_4} CH_3\,CH_2\,CH_2\,OH$$

$$CH_3-CHO \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgCl} CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$

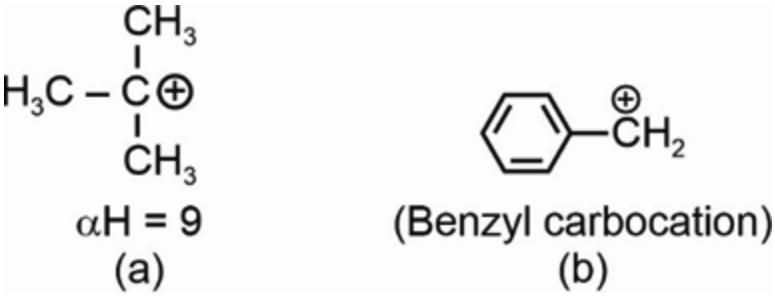
$$CH_3-CH=CH_2 \xrightarrow[(ii)\ H_2O_2,\ OH^-]{(i)\ B_2H_6,\ THF} CH_3-CH_2-CH_2-OH$$

(85) Answer : (2)
Solution:



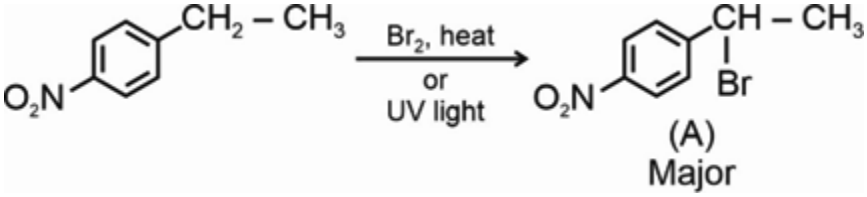
(86) Answer : (4)
Solution:
Aldehydes and ketones having at least one methyl group linked to the carbonyl carbon atom give haloform reaction.

(87) Answer : (2)
Solution:
Rate of S_N1 reaction depends on the stability of carbocation. More stable is the carbocation, faster is S_N1 reaction.



(88) Answer : (1)

Solution:



(89) Answer : (4)
Solution:

Group reagent	Group
H_2S in presence of dilute HCl	Group-II
H_2S in presence of NH_4OH	Group-IV
$(NH_4)_2CO_3$ in presence of NH_4OH	Group-V
NH_4OH in presence of NH_4Cl	Group-III

(90) Answer : (2)
Solution:

$$BaSO_4 \rightleftharpoons \underset{S}{Ba^{2+}} + \underset{S+0.1}{SO_4^{2-}}$$

$K_{sp} = S(S + 0.1)$

$1.1 \times 10^{-10} = S^2 + 0.1\ S$

$1.1 \times 10^{-10} = 0.1\ S$ [$\because S^2$ is very small]

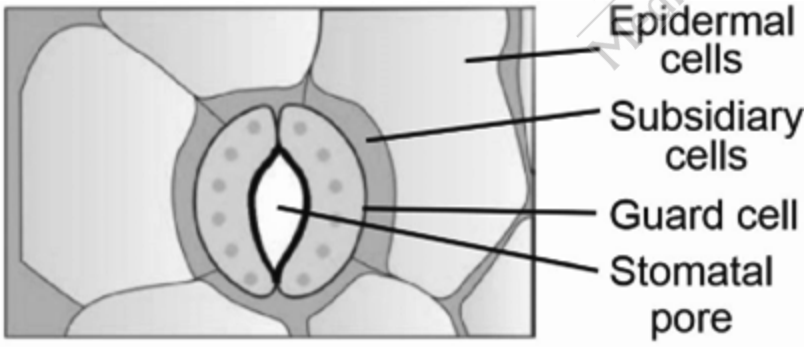
$S = 11 \times 10^{-10}$ M

$= 1.1 \times 10^{-9}$ M

BIOLOGY

(91) Answer : (4)
Solution:
For fixation of one molecule of glucose by Calvin cycle, 18 ATP molecules and 12 NADPH molecules are required.

(92) Answer : (3)
Solution:



(93) Answer : (1)
Solution:
Rhizopus belongs to the class phycomycetes.
Ustilago belongs to the class basidiomycetes
Aspergillus belongs to the class ascomycetes
Trichoderma belongs to the class deuteromycetes

(94) Answer : (1)
Solution:
Datura has actinomorphic flowers. In *Cassia*, gulmohur and bean, zygomorphic flowers are observed.

(95) Answer : (2)
Solution:
When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected. We save the entire forest to save the tiger. This approach is called *in-situ* (on site) conservation.

(96) Answer : (4)
Solution:
In *Vallisneria*, the female flowers reach the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water. In *Zostera*, female flowers remain submerged in water and the pollen grains are released inside the water.

(97) Answer : (3)
Solution:
In *lac* operon, the z gene codes for β-galactosidase (β-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose.

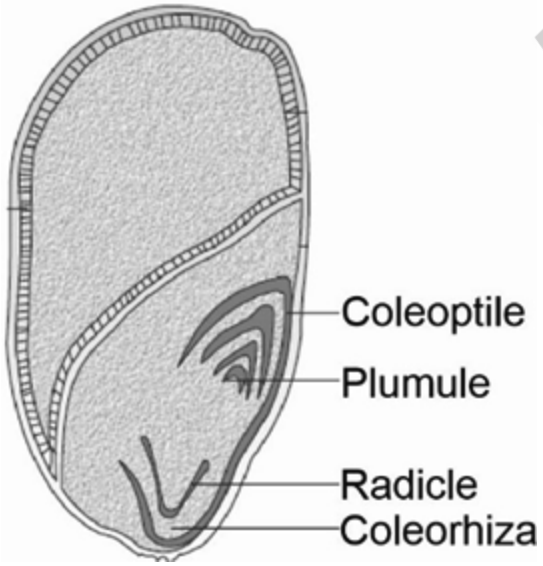
(98) Answer : (3)
Solution:

a. *Clostridium butylicum* – Used for the commercial production of organic acid (butyric acid)
b. *Saccharomyces cerevisiae* – Used for the commercial production of alcoholic beverage (ethanol)
c. *Trichoderma polysporum* – Used for the commercial production of immunosuppressive agent (cyclosporin A)
d. *Streptococcus sp.* – Used for the commercial production of clot buster molecules (statins)

(99) Answer : (3)
Solution:
In this equation,
N → Population density at time t
r → Intrinsic rate of natural increase
K → Carrying capacity

(100) Answer : (3)
Solution:
Auxin helps to initiate rooting in stem cuttings, an application widely used for plant propagation.

(101) Answer : (2)
Solution:
Plumule is destined to form shoot.
In the given diagram 'B' represents plumule.



(102) Answer : (4)
Solution:
Collenchyma also exemplifies simple permanent tissue.
Sieve tubes and companion cells are present in angiosperms but are absent in gymnosperms.

(103) Answer : (4)
Solution:

There are four major causes of biodiversity loss, namely habitat loss and fragmentation, over-exploitation, alien species invasions and co-extinctions. 'The Evil Quartet' is the sobriquet used to describe them.

(104) Answer : (2)
Solution:
The fungi constitute a unique kingdom of heterotrophic organisms.

(105) Answer : (4)
Solution:
Figure (a) depicts hypogynous flower that is found in peach.
Figure (b) depicts perigynous flower that is found in peach.

(106) Answer : (2)
Solution:
Lecithin is a small molecular weight phosphorylated organic compound found in cell membrane of living tissues. DNA is also a phosphorylated organic compound but it is a macromolecule found in nucleus. Glycerides have glycerol and fatty acid(s) moiety in their structures. IgG is an antibody and is chemically a glycoprotein.

(107) Answer : (1)
Solution:
The restriction endonucleases have usually 4-8 nucleotide sequences (bp) in their recognition sequences. Both *Eco*RI and *Hind*II have 6 bp in their recognition sequences.

(108) Answer : (3)
Solution:
Co-enzymes serve as co-factors in a number of enzyme catalysed reactions. The essential chemical components of many co-enzymes are vitamins, *e.g*., co-enzyme NAD and NADP contain the vitamin niacin. So, niacin is not a co-enzyme and NADP is not an enzyme but it acts as co-enzyme in various enzymatic reactions of the body.

(109) Answer : (3)
Solution:
The process of formation of somatic hybrids by fusion of protoplasts of two different plants is called somatic hybridisation. Removal of environmental pollutants by using living organisms (microbes) is called bioremediation. The method of producing thousands of plants through tissue culture is called micro-propagation. The capacity to generate whole plant from any cell/explant is called totipotency.

(110) Answer : (3)
Solution:
The statement II is incorrect because activated Bt toxin binds to the midgut epithelial cells to create pores that cause cell swelling and lysis and eventually cause death of the insect.

(111) Answer : (4)
Solution:
In a chromosome, there is specific DNA sequence called the origin of replication, which is responsible for initiating replication. Therefore, for multiplication of any alien piece of DNA in an organism it needs to be a part of chromosome which has a specific sequence known as origin of replication. Now, alien DNA can multiply within host cell and this process is called cloning.

(112) Answer : (1)
Solution:
The inhibitor which closely resembles with molecular structure of the substrate, competes with substrate-binding site of the enzyme and thus, inhibits the activity of enzyme reaction.

(113) Answer : (2)
Solution:
Antibodies fight against infectious agents. Receptors are responsible for sensory reception of heat, cold, touch, *etc*. Concanavalin A is a lectin and curcumin is a drug.

(114) Answer : (3)
Solution:
The method of producing thousands of plants through tissue culture is called micro-propagation. Each of these plants will be genetically identical to the original plant from which they were grown *i.e*., they are somaclones. Any part of plant which has ability to grow in a complete plant is called explant. Growing part of a plant contains meristematic tissue and so, called meristem. The plants formed by fusion of protoplasts of two cells are called somatic hybrids.

(115) Answer : (4)
Solution:
End of T-wave marks the end of ventricular systole. So, joint diastole starts after T-wave and ends with initiation of atrial systole that starts during P-wave. So, joint diastole is present between T-wave and P-wave of ECG of two adjacent cardiac cycles.

(116) Answer : (4)
Solution:
IUCN releases the red list to document the extinct and endangered species etc.

(117) Answer : (2)
Solution:
According to the law of dominance, in a dissimilar pair of factors, one member of the pair dominates the other. All other given facts can be explained with the help of 'Law of segregation'.

(118) Answer : (3)
Solution:
During differentiation, cells undergo few to major structural changes both in their cell walls and protoplasm. For example, to form a tracheary element, the cells would lose their protoplasm.

(119) Answer : (1)
Solution:
During prophase, the two asters together with spindle fibres form mitotic apparatus.

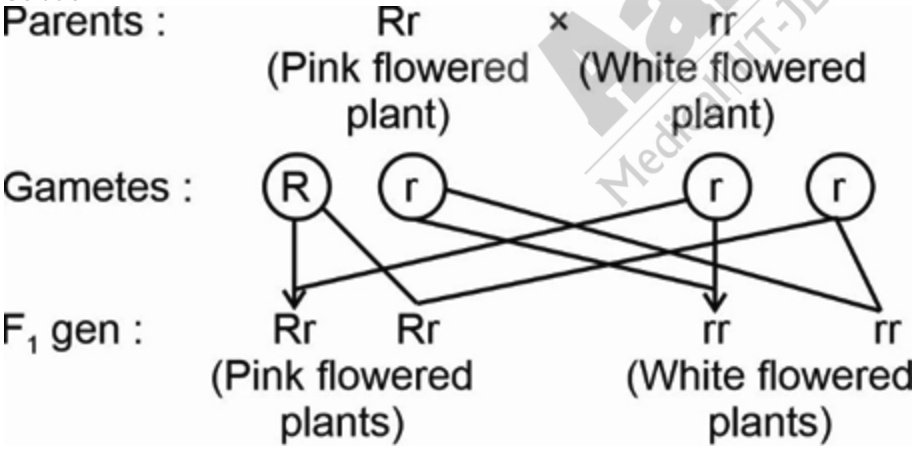
(120) Answer : (1)
Solution:
Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity.

(121) Answer : (1)
Solution:
The compaction of chromosomes continues throughout leptotene. In oocytes of some vertebrates, diplotene can last for months or years. Thus, both statement A and statement B are correct.

(122) Answer : (1)
Solution:
The nucleoli are spherical structures present in the nucleoplasm. The centrioles form the basal body of cilia or flagella. The leucoplasts are the colourless plastids of varied shapes and sizes with stored nutrients. The golgi apparatus principally performs the function of packaging materials, to be delivered either to the intra-cellular targets or secreted outside the cell.

(123) Answer : (1)
Solution:
When the bulliform cells are flaccid due to water stress, they make the leaves curl inwards to minimise water loss.

(124) Answer : (2)
Solution:



(125) Answer : (4)
Solution:
Coding strand does not code for anything.

(126) Answer : (2)
Solution:
Test cross is used to predict the genotype of the test organism. In a typical test cross, an organism showing a dominant phenotype (in this case TT/Tt genotype having tall plants) is crossed with the recessive parent (in this case tt genotype having dwarf plant).

(127) Answer : (3)
Solution:

Products of light reaction are ATP, NADPH and O_2.

(128) Answer : (3)
Solution:
A true-breeding line is the one that has undergone continuous self-pollination, shows the stable trait inheritance and expression for several generations. Genes are the units of inheritance. Cross of F_1 progeny with the recessive parent is test cross. Self-cross refers to mating between identical genotypes.

(129) Answer : (2)
Solution:
The DNA present in chloroplast is circular, double stranded.

(130) Answer : (2)
Solution:
David Tilman showed that increased diversity contributes to higher productivity. Alexander von Humboldt proposed that within a region species richness increased with increasing explored area. Edward Wilson popularised the term 'Biodiversity'. Paul Ehrlich used rivet popper hypothesis as an analogy.

(131) Answer : (1)
Solution:
Anal styles are found attached with 9^{th} sternum of male cockroach only. Gonapophyses are not jointed filamentous structures. Titillator is a part of left phallomere and is found only in male cockroach.

(132) Answer : (2)
Solution:
Vertebrate hearts or brains show homology because they have originated from a common ancestor. Homologous organs show divergent evolution and analogous organs show convergent evolution. Continental drift causes geological isolation and distribution of animals.

(133) Answer : (4)
Solution:
Human female accessory ducts include uterus, fallopian tubes and vagina. Infundibulum is funnel-shaped part of a fallopian tube. The edges of infundibulum possess finger-like projections called fimbriae.

(134) Answer : (3)
Solution:
The correct sequence of evolution of mammals from early reptiles is:
Early reptiles → Synapsids → Pelycosaurs → Therapsids → Mammals

(135) Answer : (4)
Solution:
FSH acts through membrane bound receptors. All other hormones given in the options are steroidal in their chemical nature. Their receptors are intracellular.

(136) Answer : (3)
Solution:

ADA deficiency	– Bone marrow transplantation
Transgenic mice	– Used in safety testing of polio vaccine
Heterologous host	– *E.coli* is a heterologous host for synthesis of human recombinant insulin
T-DNA	– Present in Ti plasmid of *A. tumefaciens*

(137) Answer : (1)
Solution:
Five factors are known to affect Hardy-Weinberg equilibrium. These are gene migration or gene flow, genetic drift (founder effect and bottle neck effect), mutation, genetic recombination and natural selection. Selective mating can also affect genetic equilibrium but random mating, constant gene pool and stable allelic frequencies cannot affect Hardy-Weinberg equilibrium.

(138) Answer : (4)
Solution:
Vitiligo, Systemic Lupus Erythematosus (SLE), and rheumatoid arthritis are auto-immune disorders. Asthma is an allergic disorder whereas osteoporosis is caused due to hyperparathyroidism. It is also a post menopausal complication in females.

(139) Answer : (4)
Solution:

Hepatitis-B	– Viral disease
Amoebiasis	– Protozoal disease

Elephantiasis – Helminthic disease
Diphtheria – Bacterial disease

(140) Answer : (1)
Solution:

Vital capacity	– 4100-4600 mL
Respiratory minute volume	– 6000-8000 mL
Total lung capacity	– 5100-5800 mL
Expiratory reserve volume	– 1000-1100 mL

(141) Answer : (1)
Solution:
Secretion of GnRH increases at puberty which stimulates pars distalis to produce gonadotropins (FSH and LH). LH acts on Leydig cells to increase synthesis and secretion of androgens that stimulates spermatogenesis. FSH acts on Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.

(142) Answer : (3)
Solution:
Air sacs are present in birds which supplement lungs in respiration. Collar cells or choanocytes are flagellated cells found in members of the phylum Porifera. Proboscis is first part of the body in members of phylum Hemichordata. Comb plates are characteristic feature of ctenophores.

(143) Answer : (1)
Solution:
The convention for naming restriction enzymes is the first capital letter of the name comes from the genus (*Escherichia*) and the 2^{nd} two small letters come from the species (*coli*) of the prokaryotic cell from which they were isolated. The next capital letter comes from strain (R for rough strain) and Roman number following the name indicate the order in which the enzymes were isolated from that strain of bacteria.

(144) Answer : (1)
Solution:

Hypothalamus	– Acts as a master clock of the body
Thalamus	– Acts as major coordinating centre for sensory and motor signalling
Cerebral cortex	– Contains association areas responsible for complex functions
Midbrain	– Receives and integrates visual, tactile and auditory inputs

(145) Answer : (4)
Solution:
LNG-20 and progestasert are hormone releasing IUDs. In lactating mothers, levels of prolactin is increased which inhibits secretion of GnRH from hypothalamus that leads to prevention of ovulation. So, this method of contraception is called lactational amenorrhoea.

(146) Answer : (3)
Solution:
Sterile air bubbles are sparged in sparged stirred-tank bioreactor, which dramatically increase the oxygen transfer area. The stirrer in stirred tank bioreactor facilitates even mixing and oxygen availability throughout the bioreactor.

(147) Answer : (1)
Solution:
The parturition is induced by a complex neuroendocrine mechanism. Signals for parturition originate from the fully developed foetus and placenta which induces mild uterine contractions called foetal ejection reflex. This reflex trigger release of oxytocin from maternal pituitary. Oxytocin acts on myometrium of uterus. Due to feedback stimulation, it increases uterine contractions stronger and stronger resulting in expulsion of baby through birth canal called parturition.

(148) Answer : (3)
Solution:
High H^+ concentration, high temperature, high BPG, high pCO_2 and low pH is favourable for dissociation of oxyhaemoglobin to release O_2 for tissues.

(149) Answer : (3)
Solution:
Crop and gizzard are two additional chambers present in alimentary canal of insects and birds. In annelids, *Nereis* is unisexual with external fertilisation.

(150) Answer : (2)

Solution:
Barrier methods of contraception prevent physical meeting of male and female gametes. IUDs increase phagocytosis of sperms within uterus. Oral steroidal contraceptive pills prevent ovulation as well as implantation. Sterilisation is the effective method of contraception.

(151) Answer : (3)
Solution:
Many collecting ducts converge and open into renal pelvis through medullary pyramids in the calyces.

(152) Answer : (3)
Solution:
The first step in the formation of a recombinant DNA is cutting of both foreign DNA and vector DNA by same restriction enzyme e.g. *Eco*RI. In 2^{nd} step both vector DNA and foreign DNA are joined with the help of DNA ligase. *Eco*RI always cuts both strands of DNA between guanine and adenine bases which are substituted purines.

(153) Answer : (4)
Solution:

Chelone	– Turtle
Columba	– Pigeon
Testudo	– Tortoise
Aptenodytes	– Penguin

(154) Answer : (3)
Solution:

Between frontal and parietal bones	– Fibrous joint, a suture is present between bones
Between atlas and axis vertebrae	– Pivot joint which provides sidewise rotational movement of skull
Between carpal and metacarpal of thumb	– Saddle joint which is responsible for oppositional movement of thumb
Between femur and tibia	– Knee joint placed in category of hinge joint

(155) Answer : (2)
Solution:
The opening of vagina is often covered partially by hymen. It is often torn during first coitus. However, it can also be broken by a sudden fall or jolt, insertion of vaginal tampon, active participation in some sports like horseback riding, cycling, *etc.*

(156) Answer : (1)
Solution:
Rose has half-inferior ovary. In pea, marginal placentation is found. China rose exhibits twisted aestivation. Strawberry has aggregate fruit.

(157) Answer : (4)
Solution:
The DNA dependent DNA polymerase catalyses the polymerisation only in one direction, that is 5′ → 3′. Deoxyribonucleoside triphosphate acts as substrate and provides energy for polymerisation reaction. Both strands of DNA act as template for polymerisation.

(158) Answer : (1)
Solution:
The given figure is of water pollinated plant *Vallisneria*. In *Vallisneria*, the female flower reaches the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water. They are carried passively by water currents, some of them eventually reach the female flowers and the stigma.

(159) Answer : (3)
Solution:
In the members of Rhodophyceae, sexual reproduction is oogamous and accompanied by complex post fertilisation developments.

(160) Answer : (3)
Solution:

I^{st} *trophic level* →	II^{nd} *trophic level* →	III^{rd} *trophic level*
GPP = 100x	*GPP = 10x*	*GPP = x*
NPP = 10x	*NPP = x*	*NPP = x/10*

(161) Answer : (3)
Solution:
Conversion of fumaric acid to malic acid does not yield NADH + H^+.

(162) Answer : (3)
Solution:
In C_4 plants, photorespiration does not occur and thus phosphoglycolate formation also does not occur.

(163) Answer : (1)
Solution:
Diadelphous condition can be found in *Pisum sativum*
Polyadelphous condition can be found in citrus
Epipetalous condition can be found in *Solanum nigrum*
Epitepalous condition can be found in *Allium cepa*

(164) Answer : (2)
Solution:
Ethylene promotes female flowers in cucumbers, thereby increasing the yield.

(165) Answer : (3)
Solution:
Thalassemia could be due to either mutation or deletion which ultimately results in reduced rate of synthesis of one of the globin chains. The individual affected with phenylketonuria lacks an enzyme that converts the amino acid phenylalanine into tyrosine. Sickle-cell anaemia is caused by the substitution of glutamic acid by valine at the sixth position of the beta globin chain of the haemoglobin molecule. In haemophilia, a single protein that is a part of the cascade of proteins involved in the clotting of blood is affected.

(166) Answer : (3)
Solution:
Zygotene – Synapsis between homologous chromosomes
Pachytene – Exchange of genetic material between homologous chromosomes
Diplotene – Dissolution of synaptonemal complex
Diakinesis – Disappearance of nucleolus

(167) Answer : (3)
Solution:
In *Amoeba*, the contractile vacuole is important for osmoregulation and excretion. In many cells, as in protists, food vacuoles are formed by engulfing the food particles. Sap vacuoles contain water, sap, excretory products and other materials not useful for the cell. Gas vacuole provides buoyancy in few prokaryotes.

(168) Answer : (4)
Solution:
If two species compete for the same resource, they could avoid competition by choosing different times for feeding or different foraging patterns.

(169) Answer : (4)
Solution:
RNA polymerase II catalyses the transcription of hnRNA. σ-factor facilitates the initiation of transcription in prokaryotes. Release factor facilitates the termination of translation. 2D structure of tRNA is clover leaf-like.

(170) Answer : (1)
Solution:
Genotype of the father with blood group AB is I^AI^B
Genotype of the mother with blood group A is I^Ai
Genotype of the child with blood group B is I^Bi

(171) Answer : (4)
Solution:
In nervous system of cockroach, segmentally arranged ganglia are joined by paired longitudinal connectives on the ventral side. The brain is represented in head region by supra-oesophageal ganglion. One pair of compound eyes are situated on dorsal side of the head. Each eye consists of about 2000 hexagonal units called ommatidia.

(172) Answer : (3)
Solution:
Perforated gill slits is characteristic feature of chordates which persists usually in fishes from embryonic to adult stages. In urochordates, cyclostomes and cartilaginous fishes, notochord is not completely replaced by vertebral column. The four chambered heart found in birds and mammals is associated with pulmonary and systemic circulation.

(173) Answer : (1)
Solution:

Vasa recta is either reduced or absent in cortical nephrons. Cortical nephrons (80%) are much more in number than juxta medullary nephrons (20%). In cortical nephrons, loop of Henle is present but it is too short in comparison to juxtamedullary nephrons.

(174) Answer : (3)

Solution:

A deep cleft divides cerebrum into right and left cerebral hemispheres. Brain stem is made of the pons, midbrain and medulla oblongata.

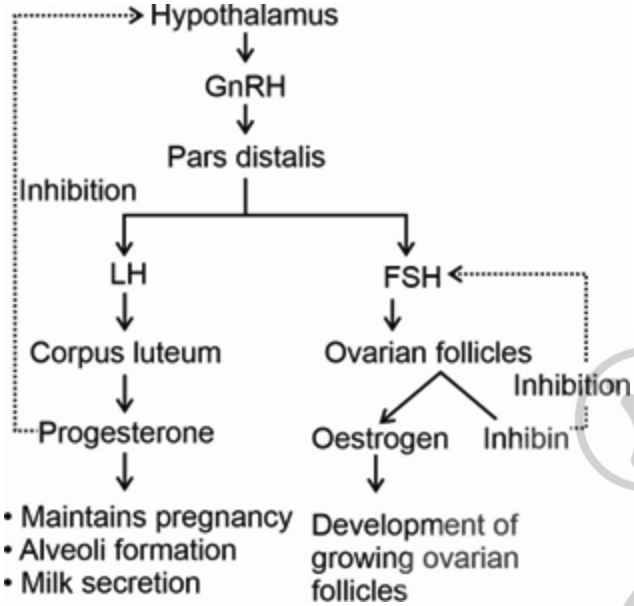
(175) Answer : (1)

Solution:

Bone marrow and thymus are primary lymphoid organs where immature lymphocytes differentiate into antigen sensitive lymphocytes. Antigens are trapped in lymph nodes, which are secondary lymphoid organ and also participate in immune response of the body.

(176) Answer : (2)

Solution:



(177) Answer : (3)

Solution:

In Devonian period, origin of Progymnosperms occured.

(178) Answer : (2)

Solution:

Brush border epithelium	– Intestine and PCT
Ciliated epithelium	– Bronchioles and oviducts
Compound epithelium	– Moist surface of buccal cavity and pharynx
Endocrine glandular epithelium	– Endocrine glands *i.e*. pancreas, thyroid, *etc*.

(179) Answer : (1)

Solution:

Ventricular systole	– Contraction of ventricles which starts just after Q-wave
End of T-wave	– End of ventricular contraction
Heart beat rate	– Number of QRS complexes per second
P-wave	– Represents atrial depolarisation

(180) Answer : (3)

Solution:

Gigantism	– Hypersecretion of growth hormone during childhood
Diabetes insipidus	– Hyposecretion of ADH
Addison's disease	– Underproduction of hormones by adrenal cortex
Graves' disease	– Weight loss due to hyperthyroidism.