



Aakash

Medical | IIT-JEE | Foundations

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

FINAL TEST SERIES for NEET-2025

MM : 720

Test - 8

Time : 180 Mins.

Answers

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

Hints and Solutions

PHYSICS

- (1) **Answer :** (3)
Solution:
Al is trivalent
- (2) **Answer :** (2)
Solution:
Energy released = (BE) of products – (BE) of reactants
= $8.5 \times 200 - 7.5 \times 200$
= 200×1
= 200 MeV
- (3) **Answer :** (4)
Solution:
If incident photon increases then more electrons absorb the photon inside the metal and more electrons are ejecting from metal.
- (4) **Answer :** (4)
Solution:
Solar cell operates under no biasing and LED works under forward biasing.
- (5) **Answer :** (4)
Solution:
By basic definition of reverse biasing P-terminal should be at lower potential while N-terminal should be at higher potential.
- (6) **Answer :** (3)
Solution:
$$L.C. = \frac{\text{Pitch}}{\text{no. of circular scale divisions}}$$

$$\Rightarrow 0.1 = \frac{\text{Pitch}}{50}$$

$$\Rightarrow \text{Pitch} = 5 \text{ mm}$$
- (7) **Answer :** (4)
Solution:
In nuclear reaction, mass-energy, charge and momentum are conserved.
- (8) **Answer :** (1)
Solution:
Momentum of system remain conserved.
$$\therefore 0 = P_1 + P_2$$

$$\Rightarrow m_1 v_1 = m_2 v_2$$

$$\frac{v_1}{v_2} = \frac{m_2}{m_1} = \left(\frac{R_2}{R_1}\right)^3$$

$$= \left(\frac{4}{1}\right)^3$$

$$= 64$$
- (9) **Answer :** (4)
Solution:
de-Broglie wavelength of electron,
$$\lambda = \frac{12.27}{\sqrt{k(\text{in eV})}} \text{ \AA}$$

$$= \frac{12.27}{\sqrt{169}} \text{ \AA}$$

$$= 0.944 \text{ \AA}$$

$$= 944 \times 10^{-4} \text{ nm}$$
- (10) **Answer :** (1)
Solution:

For metals temperature coefficient of resistance is positive while for insulators and semiconductors, temperature coefficient of resistance is negative.

(11) Answer : (4)

Solution:

According to Bohr's model

$$\Rightarrow R \propto \frac{n^2}{Z}$$

$$\Rightarrow v \propto \frac{Z}{n}$$

$$\Rightarrow \text{Angular momentum } L \propto n$$

$$\Rightarrow \text{Linear momentum } P \propto v \propto \frac{Z}{n}$$

(12) Answer : (4)

Solution:

Energy of (K.E.) of emitted electron = Energy of incident photon – ϕ – Loss due to collision

(13) Answer : (4)

Solution:

$$I = neAVd$$

$$I = neA\mu E$$

$$I \propto \mu$$

$$\text{and } \mu_e > \mu_h$$

(14) Answer : (2)

Solution:

When both switch is closed then we get output.

\therefore AND gate

(15) Answer : (4)

Solution:

Threshold frequency is the minimum frequency at which photoelectric effect is possible.

\Rightarrow By Einstein's equation

$$eV_s = hf - hf_{th}$$

$$V_s = \frac{h}{e}f - \frac{h}{e}f_{th}$$

At x-intercept, $f = f_{th}$

(16) Answer : (1)

Hint:

$${}_Z X^A \xrightarrow{\alpha} {}_{Z-2} Y^{A-4} \text{ and } {}_Z X^A \xrightarrow{\beta^-} {}_{Z+1} Y^A$$

Solution:

$$A' = A - (n \times 4)$$

$$4n = 288 - 260 = 28$$

$$n = 7$$

$$Z' = Z - 2n + m$$

$$m = -90 + 80 + 14 = 4$$

(17) Answer : (3)

Solution:

$$\lambda = \frac{h}{P} \text{ and } r = \frac{P}{qB}$$

$$\lambda = \frac{h}{qBr}$$

(18) Answer : (4)

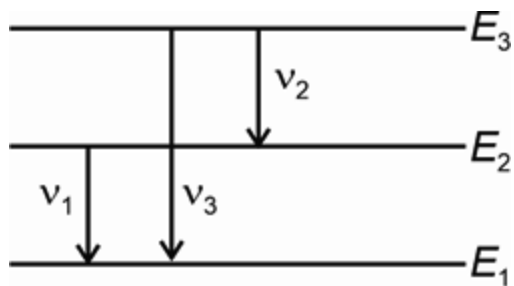
Solution:

Knee voltage for Si p-n junction is 0.7 V while for Ge p-n junction it is 0.3 V. Hence only Ge diode will be on and thus $V_A -$

$$V_B = 0.3 \text{ V.}$$

(19) Answer : (2)

Solution:



$$\nu_1 = \frac{E_2 - E_1}{h}$$

$$\nu_2 = \frac{E_3 - E_2}{h} \Rightarrow \nu_3 = \frac{E_3 - E_1}{h} = \nu_1 + \nu_2$$

(20) Answer : (2)

Hint:

$$R \propto A^{\frac{1}{3}}$$

Solution:

$$R_1 \propto (64)^{\frac{1}{3}} \quad \dots(i)$$

$$R_2 \propto (125)^{\frac{1}{3}} \quad \dots(ii)$$

Divide equation (ii) by (i)

$$\frac{R_2}{R_1} = \frac{5}{4}$$

$$R_2 = \frac{4.8 \times 5}{4}$$

$$\Rightarrow R_2 = 6 \text{ fermi}$$

(21) Answer : (1)

Solution:

$$\text{Energy} \times \text{radius} \propto \frac{1}{n^2} \times n^2$$

\therefore Constant

(22) Answer : (1)

Solution:

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

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

$$= A + B$$

(23) Answer : (3)

Solution:

The electrostatic force between nucleus and electron gives centripetal acceleration.

(24) Answer : (1)

Solution:

$$\lambda = \frac{12400}{2 \text{ eV}} \text{ \AA}$$

$$\lambda = 6200 \text{ \AA} = 620 \text{ nm}$$

(25) Answer : (2)

Solution:

$$E_n \propto \frac{Z^2}{n^2}$$

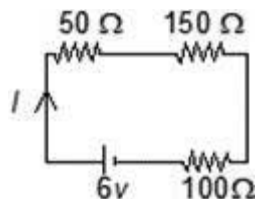
$$\left(\frac{Z_{\text{Li}}}{n_{\text{Li}}}\right)^2 = \left(\frac{Z_{\text{H}}}{n_{\text{H}}}\right)^2$$

$$n_{\text{Li}}^2 = \left(\frac{1}{3}\right) (3)^2$$

$$n_{\text{Li}} = 3$$

(26) Answer : (2)

Solution:



$$I = \frac{6}{50+150+100}$$

$$I = 0.02 \text{ A}$$

(27) Answer : (1)

Solution:

On changing the distance between target and source, number of photons hitting the target increases or decreases but frequency of photons remain same therefore, cut-off potential will be same.

(28) Answer : (4)

Solution:

By principle of moments, $4 \times 50 = m \times 20 \Rightarrow m = 10 \text{ kg}$

(29) Answer : (3)

Solution:

The output will be d.c with small ripples.

(30) Answer : (2)

Solution:

$$\text{Pitch} = \frac{4}{8} = 0.5 \text{ mm}$$

$$\text{Least count} = \frac{\text{Pitch}}{\text{No. of divisions on circular scale}}$$

$$= \frac{0.5 \text{ mm}}{50} = 0.01 \text{ mm}$$

(31) Answer : (3)

Solution:

Force of surface tension acting upwards will balance weight of water in tube.

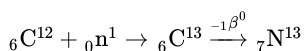
$$F_s = 2\pi r T \cos \theta = mg$$

$$m \propto r$$

$$\frac{m_2}{m_1} = \frac{r_2}{r_1} = 2$$

$$m_2 = 2 \times 6 = 12 \text{ g}$$

(32) Answer : (2)

Solution:

(33) Answer : (1)

Solution:

In p-type semiconductor, number of holes is more compared to intrinsic semiconductor. Therefore, rate of recombination of electrons will increase.

(34) Answer : (3)

Solution:

Number of protons = 80, Number of neutrons = $198 - 80 = 118$

$$Q = (80 m_p + 118 m_N - m_X) \times c^2$$

(35) Answer : (1)

Solution:

$$X + Z \rightarrow 2Y$$

$$Q = 2 \times 4 \times 6 - 3 \times 5 - 7 \times 5$$

$$= 48 - 15 - 35$$

$$Q = -2 \text{ MeV}$$

(36) Answer : (2)

Solution:

According to Bohr's model, for same atom

$$R \propto n^2$$

$$\frac{R_2}{r} = \left(\frac{3}{2}\right)^2$$

$$R_2 = \frac{9}{4}r$$

(37) Answer : (4)

Solution:

By Electromagnetic spectrum

VIBGYOR

Photon of violet light has more energy than blue light photon.

∴ It can eject photo-electron

Photon of red light has less energy than blue light

∴ it cannot photo-electron

(38) Answer : (2)

Solution:

$\Rightarrow_Z X^A \xrightarrow{\alpha} Z-2 Y^{A-4}$ both A and Z are changed.

$\Rightarrow_Z X^A \xrightarrow{\beta^-} Y_{Z+1}^A$, ${}_Z X^A \xrightarrow{\beta^+} Y_{Z-1}^A$,

${}_Z^A Y^* \xrightarrow{\gamma} {}_Z^A Y$

(39) Answer : (2)

Solution:

$$v = f\lambda \Rightarrow \lambda = \frac{v}{f} = \frac{320}{160} = 2 \text{ m}$$

$$\Rightarrow \text{first resonance } \frac{\lambda}{4} = \frac{2}{4} = 0.5 \text{ m} = 50 \text{ cm}$$

$$\Rightarrow \text{second resonance } \frac{3\lambda}{4} = 3 \times 50 = 150 \text{ cm}$$

∴ Minimum height of water required = 170 – 150
= 20 cm

(40) Answer : (2)

Solution:

According to Einstein's equation,

$$K = \frac{hc}{\lambda} - \phi$$

$$\text{So, } K_1 = \frac{hc}{\lambda_1} - \phi \Rightarrow K_1 \lambda_1 = hc - \phi \lambda_1 \dots (i)$$

$$\text{and } K_2 = \frac{hc}{\lambda_2} - \phi \Rightarrow K_2 \lambda_2 = hc - \phi \lambda_2 \dots (ii)$$

Subtract equation (ii) from (i)

$$K_2 \lambda_2 - K_1 \lambda_1 = \phi(\lambda_1 - \lambda_2)$$

$$\frac{K_2 \lambda_2 - K_1 \lambda_1}{\lambda_1 - \lambda_2} = \phi$$

(41) Answer : (4)

Solution:

Input of AND gate is \bar{A} and B, So $Y = \bar{A}B$

(42) Answer : (4)

Solution:

Photoelectric effect

Photocurrent \propto Intensity of incident light

$$K.E = \frac{hc}{\lambda} - \phi,$$

K.E does not depend on intensity of incident light.

(43) Answer : (3)

Solution:

$$v = \frac{v_0}{n} \Rightarrow \text{Speed decreases}$$

\Rightarrow K.E. decreases

$$P.E. = -2 \left[\frac{13.6}{n^2} \right] \Rightarrow P.E. \text{ increases with increase in } n.$$

(44) Answer : (2)

Solution:

'A' has more $\frac{BE}{A}$ than B.

(45) Answer : (1)

Solution:



$$\text{We know, } \mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{30^\circ + 60^\circ}{2}\right)}{\sin 30^\circ}$$

$$\mu = \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{1}{\sqrt{2}}(2) = \sqrt{2} = 1.414$$

CHEMISTRY

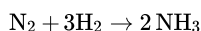
(46) Answer : (3)

Solution:

$$\text{No. of glucose molecules} = \frac{540}{180} = 3$$

$$\text{No. of carbon atoms} = 3 \times 6 = 18$$

(47) Answer : (3)

Solution:

$$\text{Mole of N}_2 = \frac{56}{28} = 2$$

$$\text{Mole of H}_2 = \frac{10}{2} = 5$$

$$\text{Mole of N}_2 \text{ required} = \frac{1}{3} \times 5 = \frac{5}{3}$$

H₂ is limiting reagent

$$\text{Mole of NH}_3 \text{ produced} = \frac{2}{3} \times 5 = \frac{10}{3}$$

$$\text{Mass of NH}_3 \text{ produced} = \frac{10}{3} \times 17 = 56.67 \text{ g}$$

(48) Answer : (3)

Solution:

$$\text{Molarity} = \frac{3.01 \times 10^{22} \times 1000}{6.02 \times 10^{23} \times 50} = 1 \text{ M}$$

(49) Answer : (3)

Solution:

Number of atoms in methane

Number of atoms in SO₂

$$= \frac{1 \times 5 \times 64}{16 \times 4 \times 3} = 5 : 3$$

(50) Answer : (1)

Solution:

$$\text{For } l = 1, m_l = -1, 0, +1$$

$$\text{For } l = 0, m_l = 0$$

(51) Answer : (3)

Solution:

$$E = -2.18 \times 10^{-18} \times \frac{Z^2}{n^2} \text{ J}$$

$$E = -2.18 \times 10^{-18} \times \frac{(3)^2}{(2)^2}$$

$$E = -4.9 \times 10^{-18} \text{ J}$$

(52) Answer : (2)

Solution:

$$\text{Element } (Z = 44) : [\text{Kr}] 4d^7 5s^1$$

(53) Answer : (4)

Solution:

Atomic number	Symbol
104	Unq
109	Une

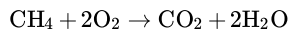
(54) Answer : (1)

Solution:

$$E = N_A h \frac{c}{\lambda}$$

$$E = \frac{6.02 \times 10^{23} \times 6.6 \times 10^{-34} \times 3 \times 10^8}{1200 \times 10^{-9}}$$

$$E = 9.9 \times 10^4 \text{ J}$$

(55) Answer : (3)**Solution:**

$$\text{Mole of CH}_4 = \frac{80}{16} = 5$$

$$\text{Mole of CO}_2 \text{ formed} = 5$$

$$\text{Volume of CO}_2 \text{ liberated at STP} = 5 \times 22.4 = 112 \text{ L}$$

(56) Answer : (3)**Solution:**

For isoelectronic species, lesser is the value of positive charge, larger is the size of carbon.

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

Behaviour of lithium and beryllium is more similar with second element of the following group i.e. magnesium and aluminium respectively. This sort of similarity is commonly referred to as diagonal relationship.

(58) Answer : (2)**Solution:**

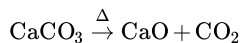
$$\text{Number of protons} = 93$$

$$\text{Number of electrons} = 93$$

$$\text{Number of neutrons} = 237 - 93 = 144$$

(59) Answer : (2)**Solution:**

Energy of 2s orbitals of hydrogen is greater than 2s orbital of lithium.

(60) Answer : (2)**Solution:**

$$\text{Mole of CaO} = \frac{5.6}{56} = 0.1$$

$$\text{Mass of CaCO}_3 = 100 \times 0.1 = 10$$

$$\text{Percentage purity} = \frac{10 \times 100}{12.5} = 80\%$$

(61) Answer : (2)**Solution:**

For minimum molar mass, the compound should contain one sulphur atom in it.

5 g sulphur is present in 100 g of compound

$$32 \text{ g sulphur is present in } \frac{100 \times 32}{5} = 640$$

$$\text{Minimum molar mass} = 640 \text{ g mol}^{-1}$$

(62) Answer : (2)**Solution:**

For any sub-shell (l), $(2l + 1)$ values of m_l are possible.

(63) Answer : (4)**Solution:**

$$\bar{\nu} = \frac{1}{\lambda} = R_H \cdot \frac{1}{n_1^2} - \frac{1}{n_2^2}$$

$$\frac{1}{\lambda} = R_H \left(\frac{1}{3^2} - \frac{1}{4^2} \right)$$

$$\frac{1}{\lambda} = R_H \left(\frac{16-9}{144} \right) = \frac{7}{144} R_H$$

(64) Answer : (1)**Solution:**

$$\lambda = \frac{h}{mV} = \frac{6.6 \times 10^{-34}}{0.1 \times 10^{-6} \times 2000}$$

$$\lambda = 3.3 \times 10^{-30} \text{ m}$$

(65) Answer : (3)**Solution:**

$$\text{Volume of N}_2 \text{ at STP} = \frac{78 \times 25}{100} = 19.5 \text{ L}$$

$$\text{Number of nitrogen atoms} = \frac{19.5 \times 2}{22.4} N_A$$

$$= 1.74 N_A$$

(66) Answer : (3)**Solution:**

$$\text{Mass of HNO}_3 = 900 \times 4 \times 10^{-3} \times 63 \text{ g} = 226.8 \text{ g}$$

Mass of concentrated HNO₃ required

$$= \frac{100 \times 226.8}{70} = 324 \text{ g}$$

(67) Answer : (2)**Solution:**

n 1	n 2		Series
1	2, 3...	→	Lyman
4	5, 6...	→	Brackett
3	4, 5...	→	Paschen
5	6, 7...	→	Pfund

(68) Answer : (4)**Solution:**

$$\text{Number of radial nodes} = (n - l - 1)$$

$$= (5 - 3 - 1) = 1$$

(69) Answer : (2)**Solution:**NO₂ and NO are formed from same elements, hence they follow law of multiple proportions**(70) Answer :** (2)**Solution:**

Average atomic mass of X

$$= \frac{45 \times 20 + 47 \times 50 + 48 \times 30}{100}$$

$$= \frac{900 + 2350 + 1440}{100} = 46.9 \text{ u}$$

(71) Answer : (4)**Hint:**Number of atoms = Moles \times N_A \times atomicity**Solution:**

$$7 \text{ g of nitrogen gas} = \frac{7}{28} \times N_A \times 2$$

$$\Rightarrow 0.5 N_A$$

$$34 \text{ g of ammonia gas} = \frac{34}{17} \times N_A \times 4$$

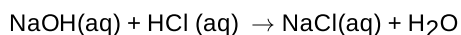
$$= 8 N_A$$

$$1.6 \text{ g of oxygen gas} = \frac{1.6}{32} \times N_A \times 2$$

$$\Rightarrow 0.1 N_A$$

$$2 \text{ g of hydrogen gas} = \frac{2}{2} \times N_A \times 2$$

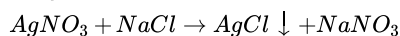
$$= 2 N_A$$

(72) Answer : (2)**Solution:**

$$\text{Moles of HCl} = \text{Moles of NaOH} = 3 \times 10 \times 10^{-3}$$

$$\text{Mass of NaOH} = 30 \times 10^{-3} \times 40 = 1.2 \text{ g}$$

(73) Answer : (3)

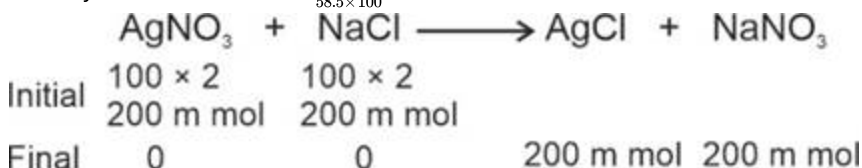
Hint:

Precipitate formed is of AgCl

Solution:Molarity of AgNO_3 solution

$$= \frac{34 \times 1000}{170 \times 100} = 2 \text{ M}$$

$$\text{Molarity of NaCl solution} = \frac{11.7 \times 1000}{58.5 \times 100} = 2 \text{ M}$$



$$\text{Mass of AgCl precipitated} = 200 \times 143.5 \times 10^{-3} = 28.7 \text{ g}$$

(74) Answer : (4)**Solution:**

Energy difference order

$$E_7 - E_6 < E_6 - E_5 < E_5 - E_4 < E_4 - E_3$$

(75) Answer : (4)**Hint:**

For H atom, energy depends only on principal quantum number n.

Solution:For 3rd excited state n = 4number of orbitals = n²

$$= 4^2 = 16$$

(76) Answer : (3)**Hint:**Balmer series \Rightarrow visible region**Solution:**Lyman series \Rightarrow U.V. regionPaschen series \Rightarrow I.R. regionBrackett series \Rightarrow I.R. region**(77) Answer :** (2)**Hint:**

Calculate the molar ratio of elements.

Solution:

Elements	%	Mole	Ratio
C	40	$\frac{40}{12} = 3.33$	1
H	6.67	$\frac{6.67}{1} = 6.67$	2
O	53.33	$\frac{53.33}{16} = 3.33$	1

Empirical formula = CH_2O **(78) Answer :** (3)**Hint:**

For multielectronic species, higher is the value of (n + l), higher is the energy of orbital.

Solution:

For same value of (n + l), higher is the value of n, higher is the energy of orbital.

Correct order of energy of orbital $4f > 5p > 4d > 5s$ **(79) Answer :** (2)**Hint:**

In chlorine, the incoming electron adds to 3p subshell whereas in fluorine, the incoming electron adds to 2p subshell.

Solution:

Generally, the negative electron gain enthalpy decreases down the group in the modern periodic table.

However, electron gain enthalpy of O or F is less negative than that of the succeeding element. This is because when an electron is added to O or F, the added electron goes to the smaller n = 2 quantum level and suffers significant repulsion from

the other electrons present in this level.

For $n = 3$ quantum level, the added electron occupies a larger region of space and the electron-electron repulsion is much lesser.

(80) Answer : (3)

Hint:

In a period the electronegativity generally increases as we move from left to right

Solution:

Correct order of electronegativity value of the third period elements

$\text{Cl} > \text{S} > \text{P} > \text{Si} > \text{Al} > \text{Mg} > \text{Na}$

(81) Answer : (2)

Solution:

- Unnilennium : Meitnerium
- Ununbium : Copernicium
- Unnilquadium : Rutherfordium
- Unnilunium : Mendeleevium

(82) Answer : (2)

Solution:

Lower is the value of electronegativity more is the electropositivity of the metal.

(83) Answer : (4)

Solution:

Half filled and completely filled subshells have extra stability.

(84) Answer : (2)

Solution:

Orbital angular momentum (L) = $\sqrt{l(l+1)} \cdot \hbar$

$$L = \sqrt{2(2+1)} \cdot \hbar = \sqrt{6} \cdot \hbar$$

(85) Answer : (4)

Solution:

In $3d_{xy}$, electron density lobes are in between axis.

(86) Answer : (2)

Solution:

Work function of group I metals decreases down the group hence Na will have lesser work function than Li.

(87) Answer : (4)

Solution:

Canal rays are produced as a result of knock out of the electrons from the gaseous atoms by the bombardment of high speed stream of electrons from cathode.

(88) Answer : (1)

Solution:

Power of bulb = 60 Watt = 60 J s^{-1}

$$\text{Energy} = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \text{ Js} \times 3 \times 10^8 \text{ ms}^{-1}}{600 \times 10^{-9} \text{ m}} = 0.033 \times 10^{-17} \text{ J}$$

$$\text{No. of photons} = \frac{\text{Power}}{\text{Energy}} = \frac{60 \times 10^{17}}{0.033} = 1.8 \times 10^{20}$$

(89) Answer : (1)

Solution:

$$\text{Molality} \cdot m \cdot = \frac{n_{\text{Glucose}}}{W(\text{kg})} = \frac{\frac{18}{180}}{82 \times 10^{-3}} = 1.22 \text{ m}$$

(90) Answer : (3)

Solution:

$\Delta x \cdot \Delta p \geq \frac{\hbar}{4\pi}$ (Heisenberg's uncertainty principle)

$$\Delta p = m\Delta v$$

$$\Delta x = 2m\Delta v$$

$$2m\Delta v \cdot m\Delta v = \frac{\hbar}{4\pi}$$

$$\Delta v^2 = \frac{\hbar}{2m^2 \times 4\pi}$$

$$\Delta v = \frac{1}{2\sqrt{2}m} \sqrt{\frac{h}{\pi}}$$

BOTANY

(91) Answer : (2)

Solution:

Sapindales is an order of mango.

(92) Answer : (2)

Solution:

Lower the taxa, more are the characteristics that the members within the taxon share.

(93) Answer : (2)

Solution:

Prion is an agent consisting of abnormally folded protein and it causes Bovine spongiform encephalopathy.

(94) Answer : (3)

Solution:



This organism belongs to dinoflagellates. Its cell wall has stiff cellulose plates on the outer surface.

(95) Answer : (4)

Solution:

The morphology of the mycelium, mode of spore formation and fruiting bodies form the basis for the division of the kingdom fungi into various classes.

(96) Answer : (4)

Solution:

Wheat rust – *Puccinia*

Bread mould – *Rhizopus*

Parasitic fungus on mustard – *Albugo*

Smut fungus – *Ustilago*

(97) Answer : (2)

Solution:

Nostoc can fix atmospheric nitrogen in specialised cells called heterocysts.

(98) Answer : (2)

Solution:

Mucor belongs to Phycomycetes and its mycelium is aseptate and coenocytic.

(99) Answer : (2)

Solution:

Pteropsida – *Adiantum*, *Dryopteris*

Lycopsida – *Selaginella*

Psilopsida – *Psilotum*

(100) Answer : (2)

Solution:

The most notable disease caused by prions are bovine spongiform encephalopathy, commonly called mad cow disease in cattle and its analogous variant Cr-Jacob disease in humans.

(101) Answer : (3)

Solution:

Scientific name of wheat is *Triticum aestivum*.

(102) Answer : (3)

Solution:

Taxonomic categories showing hierarchical arrangement in ascending order is
Muscidae → Diptera → Insecta → Arthropoda

(103) Answer : (2)

Solution:

Convolvulaceae and Solanaceae are included in the order Polymoniales, mainly based on the floral characters.

(104) Answer : (3)

Solution:

Carolus Linnaeus used *Systema Naturae* as the title of his publication.

(105) Answer : (1)

Solution:

A family has maximum common characters as compared to class, order and division.

(106) Answer : (2)

Solution:

Dictyota belongs to brown algae and its stored food is mannitol and laminarin.

(107) Answer : (3)

Solution:

Algin is obtained from brown algae. *Gracilaria* is a red alga.

(108) Answer : (3)

Solution:

Bryophytes are also called amphibians of the plant kingdom. They are homosporous.

(109) Answer : (4)

Solution:

Anisogamous type of sexual reproduction is seen in *Eudorina*.

(110) Answer : (2)

Solution:

The gymnosperms are plants in which the ovules are not enclosed by any ovary wall and remain exposed.

(111) Answer : (3)

Solution:

Consciousness is a defining feature of a living organism.

Prokaryotes are truly living organisms; they can also sense and respond to environmental cues.

(112) Answer : (4)

Hint:

Spores of slime moulds are extremely resistant and survive for many years.

Solution:

Majority of slime moulds are saprophytic protists.

(113) Answer : (1)

Solution:

TMV has ssRNA as a genetic material.

(114) Answer : (2)

Solution:

The diagram shows a male thallus of *Marchantia*.

A – Antheridiophore

B – Gemma cup

C – Rhizoids

Gemma cup bears asexual buds called gemmae.

(115) Answer : (2)

Solution:

ICBN stands for International Code for Botanical Nomenclature.

(116) Answer : (3)

Solution:

The abbreviated form of author is not printed in italics and specific epithet starts with a small letter.

(117) Answer : (3)

Solution:

Monkey, gorilla and gibbon are placed under the order, Primata.

(118) Answer : (4)

Solution:

Puccinia is a parasitic fungus and causes wheat rust.

(119) Answer : (2)

Hint:

Archaeobacteria differ from other bacteria in having a different cell wall structure.

Solution:

Cell membrane of Archaeobacteria contains branched chain lipids.

(120) Answer : (3)

Solution:

Fossils play important role in phylogenetic classification system.

(121) Answer : (4)

Solution:

The plant body of liverworts is thalloid and dorsiventral whereas mosses have upright, slender axis bearing spirally arranged leaves.

(122) Answer : (3)

Solution:

Mangifera, Solanum, Panthera all are genus.

(123) Answer : (2)

Solution:

Methanogens are chemoautotrophic and are found in guts of ruminants.

Halophiles are heterotrophic and are found in extreme saline environment. Thermoacidophiles are found in hot water springs.

Cyanobacteria are photoautotrophic.

(124) Answer : (4)

Solution:

The stems are unbranched in *Cycas* and branched in *Cedrus*.

(125) Answer : (3)

Solution:

The given diagram is of *Selaginella* and it belongs to Lycopsidea.

(126) Answer : (4)

Solution:

Volvox produce motile male and non motile female gamete.

(127) Answer : (4)

Solution:

Metabolism is the defining feature of the living organisms and metabolic reactions *in vitro* are said to be living reactions.

(128) Answer : (1)

Solution:

Kingdom has maximum number of organisms.

(129) Answer : (1)

Solution:

Monera includes unicellular prokaryotic organisms.

Members of kingdom Protista are eukaryotic.

Fungi includes eukaryotes with loose tissue type multicellular body organisation.

(130) Answer : (3)

Solution:

Zygosporangium is sexual spore.

(131) Answer : (4)

Solution:

Cuscuta is a parasitic plant with heterotrophic mode of nutrition.

(132) Answer : (4)

Solution:

Lichen is a mutualistic relationship between algae and fungi, where algae are autotrophs while, fungi are heterotrophs.

(133) Answer : (2)**Solution:**

Bentham and Hooker's classification system was a natural classification system. Artificial classification system was given by Linnaeus.

(134) Answer : (2)**Hint:**

In mosses, spore germinates to form protonema.

Solution:

Protonema is a gametophytic stage.

(135) Answer : (1)**Hint:**

Red algae lack motile stages in its life.

Solution:

	Red algae	Brown algae
Zoospore	Absent	2 flagella in zoospore
Inner cell wall	Cellulosic	Cellulosic
Stored food	Floridean Starch	Laminarin
Vegetative reproduction	Fragmentation	Fragmentation

ZOOLOGY

(136) Answer : (3)**Solution:**

For the multiplication of any alien piece of DNA in an organism, it needs to be a part of a chromosome which has a specific sequence known as 'origin of replication'. Thus, an alien piece of DNA is linked with the origin of replication, so that, this alien piece of DNA can replicate and multiply itself in the host organism.

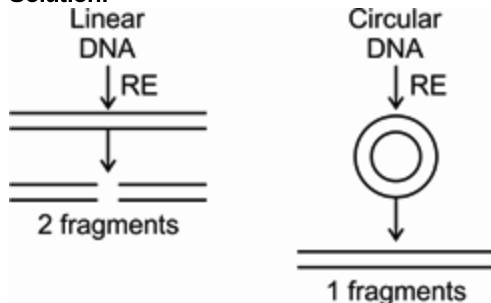
(137) Answer : (2)**Solution:**

Restriction enzymes belong to a larger class of enzymes called nucleases. These are of two kinds; exonucleases and endonucleases. Exonucleases remove nucleotides from the ends of the DNA whereas, endonucleases make cuts at specific positions within the DNA.

DNA ligase is used to link the adjacent nucleotides by phosphodiester bond. DNA polymerase is used for the polymerisation of DNA.

(138) Answer : (2)**Hint:**

Circle will open.

Solution:**(139) Answer :** (2)**Solution:**

512 molecules of DNA will be obtained at the end of 9 PCR cycles. To calculate the number of target molecules produced in a PCR, the formula 2^n is used, where n is number of PCR cycles.

(140) Answer : (3)

Solution:

Conventional methods like urine and serum analysis are not helpful in early detection of a disease.

(141) Answer : (4)

Solution:

A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen).

Bioreactors can be thought of as vessels in which raw materials are biologically converted into specific products, individual enzymes, etc. using microbial plant, animal or human cells.

(142) Answer : (4)

Solution:

The cells having rDNA can be multiplied in a continuous culture system wherein the used medium is drained out from one side while the fresh medium is added from the other to maintain the cells in their physiologically most active log/exponential phase. This type of culturing method produces a larger biomass leading to higher yields of desired protein.

(143) Answer : (2)

Solution:

The palindromes in DNA are base pair sequences that are the same when read forward (left to right) or backward (right to left) on the two strands in 5' → 3' direction or 3' → 5' direction.

(144) Answer : (4)

Solution:

In vitro fertilisation leading to a 'test-tube' baby, synthesizing a gene and using it, developing a DNA vaccine or correcting a defective gene, all are the parts of biotechnology.

(145) Answer : (2)

Solution:

Plasmids are double stranded circular DNA which are transferable and can perform independent replication.

(146) Answer : (1)

Solution:

In the year 1963, the two enzymes responsible for restricting the growth of bacteriophage in *E.coli* were isolated. One of these added methyl groups to DNA, while the other cuts DNA. The latter was called restriction endonuclease.

(147) Answer : (1)

Solution:

To take up the foreign DNA, bacterial cells must first be made competent. 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.

(148) Answer : (1)

Solution:

A nematode *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield. A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi). Using *Agrobacterium* vectors, nematode specific genes were introduced into the host plant.

(149) Answer : (2)

Solution:

Bacillus thuringiensis forms protein crystals during a particular phase of its growth. These crystals contain a toxic insecticidal protein. This *Bt* toxin protein exists as an inactive protoxin but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the insects gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

(150) Answer : (2)

Solution:

As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

(151) Answer : (2)

Solution:

RDT involves several steps in a specific sequence such as isolation of DNA, fragmentation of DNA by restriction endonucleases, isolation of a desired DNA fragment, ligation of the DNA fragment into a vector, transferring the DNA into the host, culturing the host cell in a medium at a large scale and extraction of the desired product.

(152) Answer : (1)

Solution:

Isolated protoplasts from two different varieties of plants – each having a desirable character can be fused to get hybrid protoplast, which can be further grown to form a new plant. These hybrids are called somatic hybrids while the process is called somatic hybridisation.

(153) Answer : (4)

Solution:

Plasmid is a self-replicating circular, extra chromosomal DNA which does not carry genetic information of bacteria.

(154) Answer : (4)

Solution:

Isolation and introduction of only one or a set of desirable genes without introducing undesirable genes into the target organism is an advantage of RDT over traditional hybridisation procedures.

(155) Answer : (2)

Solution:

GEAC (Genetic Engineering Approval Committee) takes decision regarding the validity of GM research and introducing GM organisms for public services.

(156) Answer : (2)

Solution:

The C-peptide is not present in the mature insulin and is removed during maturation of proinsulin into insulin.

(157) Answer : (1)

Solution:

In PCR, the step annealing and extension occurs at temperatures nearby 56°C and 72°C respectively.

(158) Answer : (4)

Solution:

Golden rice is a transgenic variety of rice which contains good quantities of β -carotene, a principal source of vitamin A. Vitamin K helps in blood clotting and vitamin D helps in calcium deposition in bone.

(159) Answer : (2)

Solution:

Orange coloured bands of DNA in an EtBr stained gel can be seen, when the gel is exposed to UV light.

(160) Answer : (4)

Solution:

RNAi involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevent translation of the mRNA.

(161) Answer : (3)

Solution:

Use of better management practices and use of agrochemicals are not included in the critical research area of biotechnology.

(162) Answer : (2)

Solution:

Hint: Allergic response

Sol.: Bovine insulin may cause allergic response in some users whereas humulin does not cause allergic reaction when administered to humans. Humulin contains two polypeptide chains A and B which are joined to each other with the help of disulfide bonds.

(163) Answer : (2)

Solution:

Animals that had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals. They are used to study the normal physiology and development of an organism, to study the disease, to obtain certain biological products, for testing safety of vaccine and chemicals.

(164) Answer : (1)

Solution:

For chemical safety testing, transgenic animals are made to carry genes which make them more sensitive to toxic substances than non-transgenic animals.

Toxicity testing in such animals will allow scientists to obtain results in less time.

(165) Answer : (2)

Solution:

α -1-antitrypsin is used to treat emphysema. This enzyme is obtained from a transgenic sheep, Tracy.

(166) Answer : (3)

Solution:

In a method known as micro-injection, recombinant DNA is directly injected into the nucleus of an animal cell (human cell is also an animal cell). In another method, suitable for plants, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as biolistics or gene gun. Also, the 'disarmed pathogen' vectors like *Agrobacterium*, when allowed to infect the cell, transfer the recombinant DNA into the host.

(167) Answer : (3)**Solution:**

ELISA is an extremely sensitive test that is used to detect antibodies or specific antigens. Southern blotting is used to identify specific gene sequences and in DNA fingerprinting. Northern blotting is used in gene expression analysis.

(168) Answer : (2)**Solution:**

If the gene of interest is successfully inserted at *Sa*I site of pBR322, then the recombinants become tetracycline sensitive as the gene for tetracycline gets disrupted. Non-recombinants would take plasmid pBR322 but the gene of interest would be absent in the plasmid and hence these would be ampicillin and tetracycline resistant. Transformants could be recombinants or non-recombinants. Non-transformants are those which didn't take pBR322.

(169) Answer : (4)**Solution:**

Yeast has DNA as its genetic material. So, deoxyribonuclease must not be used, as it will digest DNA. The RNA can be removed by the treatment with ribonuclease whereas proteins can be removed by treatment with protease. Chitinase digests chitin (present in the cell wall of fungi).

(170) Answer : (2)**Solution:**

Bacteriophages because of their high number per cell, have very high copy numbers of their genome within the bacterial cells. Some plasmids may have only one or two copies per cell whereas others may have 15-100 copies per cell. Their numbers can go even higher. If one is able to link an alien piece of DNA with bacteriophage or plasmid DNA, one can multiply its numbers equal to the copy number of the plasmid or bacteriophage.

(171) Answer : (2)**Solution:**

Bt toxin is produced by a bacterium called *Bacillus thuringiensis*. Bt toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance in insects without the need for insecticides, in effect creating a bio-pesticide.

(172) Answer : (2)**Solution:**

Tobacco budworm and armyworm are lepidopterans; beetles are coleopterans; flies and mosquitoes are dipterans. *Meloidogyne incognita* is a nematode.

(173) Answer : (3)**Solution:**

Bio piracy is the term used to refer to the use of bioresources by multinational companies or other organisations without proper authorisation from the countries and people concerned without compensatory payment.

Bioremediation means using genetically modified organisms to break down environmental pollutants. Biofortification enhances nutritional value of food crops.

(174) Answer : (1)**Solution:**

Restriction endonuclease 1 has two recognition sites in DNA present in sample A, therefore three fragments will be obtained. Restriction endonuclease 2 has one recognition sites in DNA present in sample B, therefore two fragments will be obtained. One DNA fragment in each lane A and B has equal size. One of the fragment in lane B is larger than that of in lane A.

The total length of two fragments of DNA in lane B and that of three fragments of DNA in lane A is equal to size of DNA fragment present in lane C.

(175) Answer : (3)**Solution:**

Primers always attach to 3' end of the template DNA and *Taq* polymerase extends primers in 5' to 3' direction.

Sequence of nitrogen bases in primers and the corresponding DNA template are complementary to each other, if read in the same orientation.

Forward and reverse primers are used in the annealing step of PCR.

(176) Answer : (4)**Solution:**

Upstream processing includes all the steps from sterilisation of the bioreactor, preparation of the medium, till the completion of the biosynthetic pathway. Downstream processing includes all the steps after completion of biosynthetic pathway *i.e.* the isolation and purification of product.

(177) Answer : (4)

Solution:

A popular bioreactor for continuous fermentation is the sparged tank bioreactor through which sterile bubbles are sparged. A stirred-tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor.

(178) Answer : (2)

Solution:

In denaturation, the high temperature breaks the hydrogen bonds present between the two strands of the template DNA. During annealing, the primers bind to their complementary sequences on the single stranded template. During extension, the DNA polymerase adds nucleotides to the primer, synthesizing a new DNA strand.

(179) Answer : (3)

Solution:

Removal of C chain from proinsulin is required to form mature insulin. In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B chains of human insulin, introduced them in plasmid pBR322 and then transformed *E.coli* to produce humulin. Disulfide bonds are formed between cysteine residues on chain A and B in correct orientation.

(180) Answer : (1)

Solution:

Genetically modified crops are used to minimise the use of fertilizers and chemicals so that their harmful effects on the environment are reduced. Genetic modification has been used to create tailor made plants.

SECTION-A

SECTION-B

