

All India Aakash Test Series for NEET-2023

TEST - 7 (Code-E)

Test Date : 02/04/2023

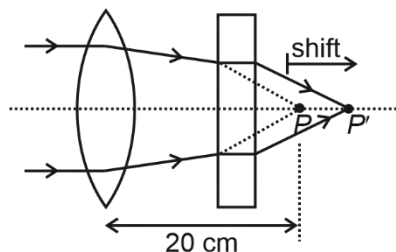
ANSWERS

1. (3)	41. (1)	81. (1)	121. (2)	161. (1)
2. (4)	42. (3)	82. (1)	122. (4)	162. (4)
3. (1)	43. (2)	83. (1)	123. (2)	163. (2)
4. (1)	44. (2)	84. (2)	124. (1)	164. (2)
5. (1)	45. (4)	85. (2)	125. (2)	165. (3)
6. (2)	46. (1)	86. (1)	126. (3)	166. (4)
7. (4)	47. (2)	87. (1)	127. (2)	167. (4)
8. (2)	48. (3)	88. (1)	128. (3)	168. (3)
9. (2)	49. (2)	89. (4)	129. (2)	169. (3)
10. (3)	50. (1)	90. (3)	130. (3)	170. (4)
11. (1)	51. (1)	91. (4)	131. (2)	171. (1)
12. (3)	52. (1)	92. (1)	132. (3)	172. (3)
13. (3)	53. (2)	93. (4)	133. (4)	173. (4)
14. (4)	54. (4)	94. (4)	134. (4)	174. (4)
15. (3)	55. (3)	95. (2)	135. (2)	175. (3)
16. (2)	56. (4)	96. (1)	136. (1)	176. (4)
17. (1)	57. (3)	97. (4)	137. (3)	177. (4)
18. (1)	58. (4)	98. (2)	138. (2)	178. (4)
19. (1)	59. (3)	99. (4)	139. (3)	179. (1)
20. (1)	60. (3)	100. (2)	140. (3)	180. (2)
21. (4)	61. (1)	101. (3)	141. (2)	181. (1)
22. (2)	62. (1)	102. (2)	142. (4)	182. (4)
23. (2)	63. (4)	103. (3)	143. (3)	183. (4)
24. (4)	64. (4)	104. (3)	144. (3)	184. (3)
25. (4)	65. (3)	105. (4)	145. (2)	185. (4)
26. (1)	66. (3)	106. (1)	146. (1)	186. (1)
27. (2)	67. (4)	107. (2)	147. (1)	187. (4)
28. (2)	68. (4)	108. (3)	148. (3)	188. (4)
29. (3)	69. (1)	109. (2)	149. (3)	189. (4)
30. (1)	70. (4)	110. (1)	150. (1)	190. (3)
31. (2)	71. (2)	111. (4)	151. (3)	191. (2)
32. (3)	72. (3)	112. (2)	152. (3)	192. (4)
33. (1)	73. (3)	113. (4)	153. (2)	193. (4)
34. (2)	74. (4)	114. (2)	154. (2)	194. (4)
35. (2)	75. (3)	115. (1)	155. (4)	195. (2)
36. (1)	76. (1)	116. (3)	156. (1)	196. (3)
37. (2)	77. (4)	117. (2)	157. (4)	197. (3)
38. (4)	78. (4)	118. (4)	158. (2)	198. (2)
39. (4)	79. (2)	119. (4)	159. (2)	199. (3)
40. (1)	80. (4)	120. (2)	160. (2)	200. (4)

HINTS & SOLUTIONS**[PHYSICS]****SECTION-A**

1. Answer (3)

$$\text{Hint: Shift} = t \left(1 - \frac{1}{\mu} \right)$$

Sol.:

$$\text{Shift} = 6 \left(1 - \frac{1}{1.5} \right) = 2 \text{ cm}$$

Beam will be focused at a distance 22 cm from convex lens.

2. Answer (4)

$$\text{Hint: } \frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{Sol.: } \frac{1}{24} = (1.5 - 1) \left(\frac{1}{20} - \frac{1}{-R_2} \right)$$

$$\Rightarrow R_2 = 30 \text{ cm}$$

3. Answer (1)

$$\text{Hint: For equiconvex lens; } \frac{1}{f} = (\mu - 1) \left(\frac{2}{R} \right)$$

$$\text{Sol.: } \frac{1}{20} = (1.5 - 1) \left(\frac{2}{R} \right)$$

$$\Rightarrow R = 20 \text{ cm}$$

$$\text{Inside liquid, } \frac{1}{f} = \left(\frac{1.5}{1.2} - 1 \right) \left(\frac{2}{20} \right)$$

$$f = 40 \text{ cm}$$

$$\text{For combination } \frac{1}{f_c} = \frac{1}{40} + \frac{1}{40} \Rightarrow f_c = 20 \text{ cm}$$

4. Answer (1)

$$\text{Hint: } i + e = A + \delta \text{ and } \mu = \frac{\sin \left(\frac{A + \delta_m}{2} \right)}{\sin \left(\frac{A}{2} \right)}$$

$$\text{Sol.: } i + e = 60^\circ + 30^\circ$$

$$\Rightarrow i = 45^\circ$$

$$\text{also, } \mu = \frac{\sin 45^\circ}{\sin 30^\circ}$$

$$\mu = \sqrt{2}$$

5. Answer (1)

Hint: In normal adjustment, M.P. = f_o/f_e

$$\text{Sol.: } 50 = \frac{100}{f_e}$$

$$\Rightarrow f_e = 2 \text{ cm}$$

6. Answer (2)

Hint & Sol.: In primary rainbow, violet appears as innermost layer.

7. Answer (4)

Hint: For normal vision far point is at infinity.

$$\text{Sol.: } \frac{1}{-200} - \frac{1}{\infty} = \frac{1}{f}$$

$$\Rightarrow f = -200 \text{ cm}$$

8. Answer (2)

$$\text{Hint: } \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

Sol.: If f_1 is focal length of left half and f_2 be focal length of right half, then equivalent focal length is $(f_1 f_2 / f_1 + f_2)$.

9. Answer (2)

Hint: Wavelength λ in air, reduces to λ/μ in medium.

Sol.: Path difference at position of 1st minima = $\lambda'/2$ where $\lambda' = \lambda/\mu$

$$\therefore \text{Path difference for first minima} = \frac{\lambda}{2\mu}$$

10. Answer (3)

Hint: Use Malus law $I_t = I_0 \cos^2 \theta$

Sol.: After 1st polaroid intensity is $\frac{I_0}{2}$. Now,

$$I = \frac{I_0}{2} \cos^2 (30^\circ) = \frac{3I_0}{8}$$

11. Answer (1)

Hint: Brewster's law, $\mu = \tan i_p$.

And $i_c = \sin^{-1}\left(\frac{1}{\mu}\right)$

Sol.: $\mu = \tan(53^\circ) \Rightarrow \mu = \frac{4}{3}$

$i_c = \sin^{-1}\left(\frac{1}{\mu}\right) = \sin^{-1}\left(\frac{3}{4}\right)$

12. Answer (3)

Hint: $\beta = \frac{\lambda D}{d}$

Sol.: $\beta' = \frac{\lambda(2D)}{(d/2)} = 4\beta$

13. Answer (3)

Hint: For 1st minima, $a \sin \theta = \lambda$ and for 1st maxima, $a \sin \theta = \frac{3\lambda}{2}$

Sol.: $a \sin(37^\circ) = \lambda$ (1st minima)

$\Rightarrow a = \frac{5\lambda}{3}$

and, $a \sin \theta = \frac{3\lambda}{2}$ (1st secondary maxima)

$\frac{5\lambda}{3} \sin \theta = \frac{3\lambda}{2}$

$\Rightarrow \theta = \sin^{-1}\left(\frac{9}{10}\right)$

14. Answer (4)

Hint: For n^{th} bright fringe $\Delta x = n\lambda$ and for n^{th} dark fringe $\Delta x = (2n-1)\frac{\lambda}{2}$

Sol.: $(2 \times 4 - 1)\frac{\lambda_1}{2} = 6\lambda_2$

$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{12}{7}$

15. Answer (3)

Hint: $\phi = \frac{hc}{\lambda}$

Sol.: $\lambda_1 = \frac{hc}{\phi_1}$

$\lambda_2 = \frac{hc}{\phi_2}$

$\frac{\lambda_1}{\lambda_2} = \frac{4.6}{2.3} = \frac{2}{1}$

16. Answer (2)

Hint: $\lambda_0 = \frac{hc}{\phi}$

Sol.: $\lambda_0 \approx \frac{12400 \text{ eV } \text{\AA}}{2 \text{ eV}}$

$\Rightarrow \lambda_0 \approx 6200 \text{ \AA}$

17. Answer (1)

Hint: $h\nu = \phi + K$

Sol.: $E = \phi + K$... (1)

$3E = \phi + 4K$... (2)

From (1) and (2), $\phi = \frac{E}{3}$ and $K = \frac{2E}{3}$

Now, $4E = \phi + K'$

$\Rightarrow K' = \frac{11}{2}K$

18. Answer (1)

Hint: Intensity $\propto \frac{1}{r^2}$; Stopping potential depends on frequency.

Sol.: As source is moved away, the number of incident photons decrease but their frequency remains same.

19. Answer (1)

Hint: $\lambda_{\text{electron}} = \sqrt{\frac{150}{V}} \text{ \AA}$

Sol.: $\lambda = \sqrt{\frac{150}{600}} \text{ \AA}$

$= 0.5 \text{ \AA}$

20. Answer (1)

Hint: $\lambda = \frac{h}{\sqrt{2mqV}}$

Sol.: $\lambda \propto \frac{1}{\sqrt{V}}$ wavelength has inverse relationship with accelerating voltage.

21. Answer (4)

Hint: Lyman, Balmer and Paschen series lie in U.V., visible and infrared region respectively.

Sol.: $3 \rightarrow 1$ and $4 \rightarrow 1$ correspond to Lyman series and $4 \rightarrow 2$ corresponds to Balmer series and $4 \rightarrow 3$ corresponds to Paschen series.

22. Answer (2)

Hint & Sol.: $TE = \frac{PE}{2} = -KE$

23. Answer (2)

Hint: Conservation of linear momentum.

$$\text{Sol.: } \frac{1}{\lambda} = R \left(\frac{1}{1^2} - \frac{1}{3^2} \right)$$

$$\Rightarrow \lambda = \frac{9}{8R}$$

$$\therefore \text{Momentum of photon} = \frac{h}{\lambda} = \frac{8}{9} hR$$

Since atom was initially at rest, so momentum gained by atom is also $\frac{8}{9} hR$

24. Answer (4)

Hint: $Q = BE_{\text{product}} - BE_{\text{reactant}}$

$$\text{Sol.: } Q = E - 3e$$

25. Answer (4)

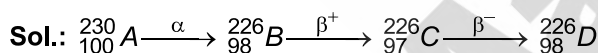
$$\text{Hint: Half-life} = \frac{\ln 2}{\lambda}; \text{ mean life} = \frac{1}{\lambda}$$

$$\text{Sol.: } t_1 = \frac{\ln 2}{\lambda}$$

$$t_2 = \frac{1}{\lambda}$$

$$\Rightarrow t_1 = t_2 \ln 2$$

26. Answer (1)

Hint: Mass number remains same in β^+ and β^- decay and decreases in α decay.

27. Answer (2)

$$\text{Hint: } A = \frac{A_0}{2^{t/T}}$$

$$\text{Sol.: } A = \frac{A_0}{2^{25/10}}$$

$$A = \frac{A_0}{4\sqrt{2}}$$

$$\Rightarrow \frac{A}{A_0} = \frac{1}{4\sqrt{2}}$$

28. Answer (2)

Hint & Sol.: For most semiconductors the band gap should be less than 3 eV.

29. Answer (3)

Hint & Sol.: For CE amplifier, output and input signal differs in phase by π rad.

30. Answer (1)

$$\text{Hint: Dynamic resistance} = \frac{\Delta V}{\Delta I}$$

$$\text{Sol.: } r_d = \frac{0.9 - 0.8}{(25 - 20) \times 10^{-3}} = 20 \, \Omega$$

31. Answer (2)

$$\text{Hint: } A_P = \beta A_V$$

$$\text{Sol.: } A_P = 90 \times 20 = 1800$$

32. Answer (3)

Hint: $A + B = Y$ represents OR Gate

$$\text{Sol.: } Y = A \cdot A + B \cdot B$$

$$Y = A + B$$

33. Answer (1)

Hint & Sol.: The current in reverse bias is majorly due to drift of charge carriers.

34. Answer (2)

Hint & Sol.: For PN junction to be forward biased, P side should be at higher potential.

35. Answer (2)

$$\text{Hint: } n_e n_h = n_i^2$$

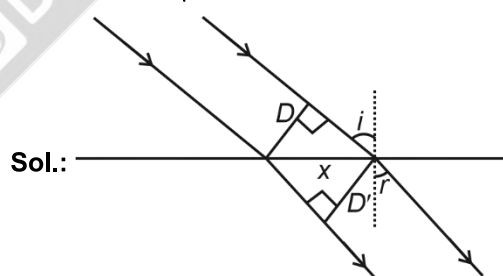
$$\text{Sol.: } n_e (10^{23}) = (10^{16})^2$$

$$\Rightarrow n_e = 10^9/\text{m}^3$$

SECTION-B

36. Answer (1)

$$\text{Hint: } \sin r = \frac{\sin i}{\mu}$$



Sol.:

$$x = \frac{D}{\cos i} = \frac{D'}{\cos r} \quad \dots(i)$$

$$\sin i = \frac{4}{5} \Rightarrow \cos i = \frac{3}{5}$$

$$\sin r = \frac{4/5}{5/3} = \frac{3}{5} \Rightarrow \cos r = \frac{4}{5}$$

$$\Rightarrow \frac{D}{(3/5)} = \frac{D'}{(4/5)}$$

$$\Rightarrow D' = \frac{4}{3} D$$

37. Answer (2)

Hint: $\sin i_{12} = \frac{1}{\mu_{21}}$

Sol.: $\sin 37^\circ = \frac{\mu_A}{\mu_B} \dots (1)$

$\sin 53^\circ = \frac{\mu_B}{\mu_C} \dots (2)$

Multiply equation (1) and (2)

$$\frac{3}{5} \times \frac{4}{5} = \frac{\mu_A}{\mu_C}$$

$$\Rightarrow \sin i_{AC} = \frac{12}{25}$$

$$i_{AC} = \sin^{-1}\left(\frac{12}{25}\right)$$

38. Answer (4)

Hint: For mirror, $v = \frac{uf}{u-f}$

Sol.: $v_1 = \frac{(-40)(-20)}{(-40)-(-20)} = -40 \text{ cm}$

and $v_2 = \frac{(-30)(-20)}{(-30)-(-20)} = -60 \text{ cm}$

 $\Rightarrow$ Image displace from -40 cm to -60 cm .

39. Answer (4)

Hint: For dispersion without deviation

$$\frac{A_1}{A_2} = \frac{(\mu_2 - 1)}{(\mu_1 - 1)}$$

Sol.: $A_2 = \left(\frac{1.40-1}{1.36-1}\right) \times 3^\circ$ OR $A_2 = \left(\frac{1.36-1}{1.40-1}\right) 3^\circ$

$$\Rightarrow A_2 = 3.33^\circ \text{ or } 2.7^\circ.$$

40. Answer (1)

Hint: $\theta = \frac{1.22\lambda}{D}$

Sol.: $\theta = \frac{1.22 \times 5737 \times 10^{-10}}{70 \times 10^{-2}}$

$$= 10^{-6} \text{ rad}$$

41. Answer (1)

Hint & Sol.: Fringe shift

$$(\Delta y) = \frac{D(\mu-1)t}{d} = \frac{\beta}{\lambda}(\mu-1)t$$

42. Answer (3)

Hint: $I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2$ and $I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2$

Sol.: $\left(\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right)^2 = \frac{25}{1}$

$$\Rightarrow \sqrt{I_1} + \sqrt{I_2} = 5(\sqrt{I_1} - \sqrt{I_2})$$

$$\Rightarrow 6\sqrt{I_2} = 4\sqrt{I_1}$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{9}{4}$$

43. Answer (2)

Hint: $K = h\nu - h\nu_0$

Sol.: $\frac{1}{2}mv^2 = h(F - F_0)$

$$\Rightarrow v = \sqrt{\frac{2h}{m}(F - F_0)}$$

44. Answer (2)

Hint: Energy of photon = $\frac{hc}{\lambda}$

Sol.: $\frac{\text{Energy emitted}}{\text{Time}} = N \frac{hc}{\lambda}$

(Here N is number of photons ejected in unit time)

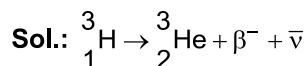
$$\Rightarrow P = N \frac{hc}{\lambda}$$

$$\Rightarrow N = \frac{P\lambda}{hc}$$

45. Answer (4)

Hint & Sol.: Photoelectric effect explains particle nature of light.

46. Answer (1)

Hint: Antineutrino is accompanied with β^- decay.

47. Answer (2)

Hint: $L = \frac{nh}{2\pi}$

Sol.: $L_1 = \frac{4h}{2\pi}$

and $L_2 = \frac{3h}{2\pi}$

$$L_1 : L_2 = 4 : 3$$

48. Answer (3)

Hint & Sol.: I - V characteristics of solar cell is drawn in fourth quadrant.

49. Answer (2)

Hint: For OR gate $Y = A + B$

Sol.: Truth table for given gate is

A	B	Y
1	1	1
0	1	1
1	0	1
0	0	0

⇒ The gate is OR gate.

50. Answer (1)

Hint: For potential difference greater than 0.3 V, germanium diode acts as short circuit.

Sol.: $V_R = 5 - 0.3$

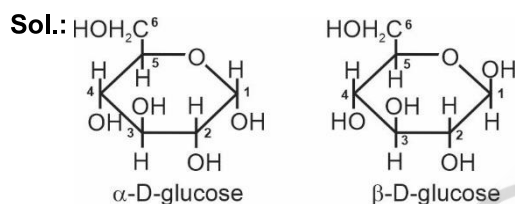
= 4.7 V (potential difference across resistor)

[CHEMISTRY]

SECTION-A

51. Answer (1)

Hint: Cyclic isomers of glucose having different configuration at C₁ carbon only are called anomers.



α -D-glucose and β -D-glucose are anomers of each other.

52. Answer (1)

Hint: Purine bases are bicyclic compounds.

Sol.:

- Guanine and Adenine are purine bases
- Cytosine, uracil and thymine are pyrimidine bases.

53. Answer (2)

Hint: Essential amino acids cannot be synthesised in the body.

Sol.:

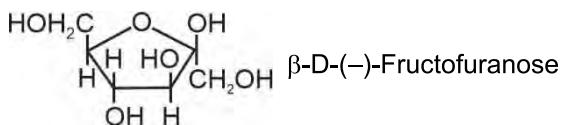
- Methionine is essential amino acid
- Tyrosine, glutamic acid and glutamine are non-essential amino acids.

54. Answer (4)

Hint & Sol : Vitamin B are water soluble vitamins and they are readily excreted in urine and cannot be stored (except vitamin B₁₂) in our body.

55. Answer (3)

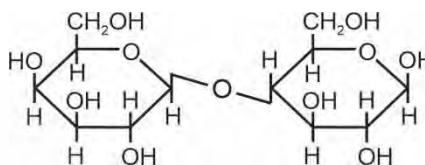
Hint:



Sol.: Number of chiral centres present in β -D-(-)-Fructofuranose is 4.

56. Answer (4)

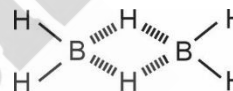
Hint: Lactose is a disaccharide, its structure is



Sol.: Lactose is composed of β -D-galactose and β -D-glucose

57. Answer (3)

Hint: Structure of diborane is



Sol.:

- Number of $3c - 2e^-$ bonds = 2
- Number of $3c - 4e^-$ bonds = 0

58. Answer (4)

Hint: Octet of boron in boric acid is incomplete.

Sol.:

- Boric acid is a weak monobasic acid
- It acts as a Lewis acid.
- Hybridisation of Boron is sp^2
- It is associated with each other by intermolecular H-bonding.

59. Answer (3)

Hint & Sol.: Borax bead consists of B_2O_3 and $NaBO_2$

60. Answer (3)

Hint: Due to presence of filled d -subshell, the size of gallium is relatively less.

Sol.: Order of atomic radius : $B < Ga < Al < In < Tl$

61. Answer (1)

Hint: Due to inert pair effect, stability order of +2 oxidation state is $Pb^{2+} > Sn^{2+} > Ge^{2+} > Si^{2+}$

Sol.: More is the stability of +2 oxidation state better is the oxidising nature of their dioxide

Oxidising nature : $PbO_2 > SnO_2 > GeO_2 > SiO_2$

62. Answer (1)

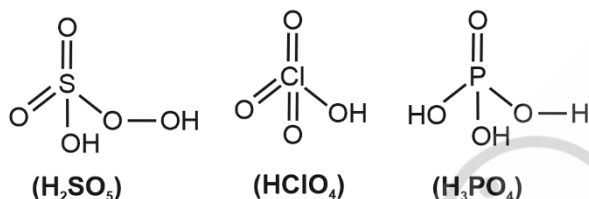
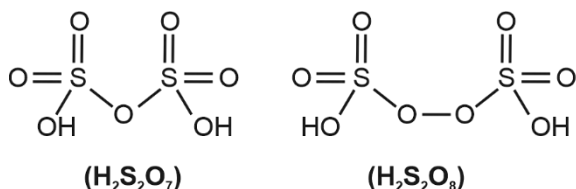
Hint: Central atom of the species having vacant orbital can participate in hydrolysis.

Sol.: In CCl_4 , carbon has no vacant orbital, so it does not go hydrolysis easily.

63. Answer (4)

Hint: Compounds having O – O bond are said to have peroxy linkage

Sol.:



64. Answer (4)

Hint: Chlorine on treatment with base disproportionates.

Sol.: $3\text{Cl}_2 + 6\text{NaOH}$ (Hot and Conc.) $\rightarrow$
 $5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$

$\text{Cl}_2 + 2\text{NaOH}$ (cold and dilute) $\rightarrow$
 $\text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$

65. Answer (3)

Hint: Down the group acidic strength of higher oxides decreases

Sol.:	Compound	Chemical Nature
	SnO , PbO_2	Amphoteric
	GeO_2	Acidic
	CO	Neutral

66. Answer (3)

Hint: Bond dissociation enthalpy of F – F is low because of lone pair-lone pair repulsion between two fluorine atoms.

Sol.:	Bond	Bond dissociation enthalpy (kJ mol^{-1})
	F–F	158.8
	Cl–Cl	242.6
	Br–Br	192.8
	I–I	151.1

67. Answer (4)

Hint:

Process	Used for formation of
Deacon's process	Cl_2
Contact process	H_2SO_4
Haber's process	NH_3
Ostwald's process	HNO_3

Sol.:

Process	Catalyst
Deacon's process	CuCl_2
Contact process	V_2O_5
Haber's process	Finely divided Iron
Ostwald's process	Pt/Rh

68. Answer (4)

Hint: • $2\text{XeF}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Xe} + 4\text{HF} + \text{O}_2$

Sol.: • $\text{Xe} + 2\text{F}_2 \rightarrow \text{XeF}_4$
 1 : 5

• $6\text{XeF}_4 + 12\text{H}_2\text{O} \rightarrow 4\text{Xe} + 2\text{XeO}_3 + 24\text{HF} + 3\text{O}_2$

• $\text{XeF}_6 + 3\text{H}_2\text{O} \xrightarrow{+6 \quad -1} \text{XeO}_3 + 6\text{HF}$

It is not a redox reaction.

69. Answer (1)

Hint: $[\text{Rh}(\text{PPh}_3)_3\text{Cl}]$ is Wilkinson catalyst

Sol.: $\text{Al}(\text{Et})_3 + \text{TiCl}_4$ together is called Ziegler-Natta catalyst

70. Answer (4)

Hint: Dacron is a polyester

Sol.: Ethylene glycol + Terephthalic acid



71. Answer (2)

Hint: Monomer of natural rubber is isoprene (2-methyl-1,3-butadiene)

Sol.: Natural rubber is also called cis-1,4-polyisoprene

72. Answer (3)

Hint: The polymers which undergo microbial degradation in the environment are called biodegradable polymers.

Sol.: PHBV (Poly β -hydroxybutyrate – co- β -hydroxy valerate) and Nylon 2-nylon 6 are biodegradable polymers

73. Answer (3)

Hint: Cationic detergents are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

Sol.: Cetyltrimethyl ammonium bromide is a cationic detergent.

74. Answer (4)

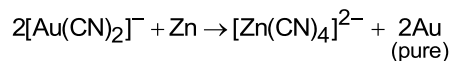
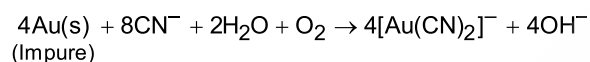
Hint: Antioxidants help in food preservation by retarding the action of oxygen on food.

Sol.: BHT (butylated hydroxyl toluene) and BHA (butylated hydroxyl anisole) are common antioxidants.

75. Answer (3)

Hint: The metal is leached with the reagent which can form complex with gold.

Sol.:



76. Answer (1)

Hint & Sol.: Normally rain water has a pH of 5.6.

77. Answer (4)

Hint: Photochemical smog is also known as oxidising smog

Sol.: Photochemical smog occurs in warm, dry and sunny climate

78. Answer (4)

Hint & Sol.: Excess nitrate in drinking water can cause 'blue baby' syndrome.

79. Answer (2)

Hint: $(\text{Molarity})_{\text{H}_2\text{O}_2} = \frac{\text{Volume strength}}{11.2}$

Sol.: $M_{\text{H}_2\text{O}_2} = \frac{5}{11.2}$

or, strength of $\text{H}_2\text{O}_2 = \frac{5}{11.2} \times 34 \text{ gL}^{-1}$
 $= 15.178$
 $\approx 15 \text{ gL}^{-1}$

80. Answer (4)

Hint: Hydrides having complete octet and lone pair present on central atom are electron rich.

Sol.: BH_3 electron deficient hydride
 CH_4 and SiH_4 electron precise hydrides
 $\text{H}_2\ddot{\text{O}}:$ electron rich hydride

81. Answer (1)

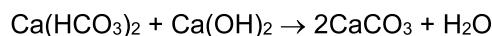
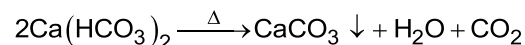
Hint: Molecular mass of D_2O is greater than H_2O

Sol.: Boiling point and enthalpy of vaporisation of D_2O is more than H_2O due to more molecular interaction between D_2O molecules.

82. Answer (1)

Hint: Temporary hardness consists of bicarbonates of magnesium and calcium.

Sol.: Temporary hardness is removed by boiling and by Clark's method



83. Answer (1)

Hint: Calamine is ore of zinc

Sol.:

Composition	Ore name
ZnCO_3	Calamine
CuFeS_2	Copper pyrite
Cu_2S	Copper glance
FeCO_3	Siderite

84. Answer (2)

Hint: One of the element present in German silver is zinc.

Sol.: German silver is composed of (Cu 25-30%, Zn 25-30% and Ni 40-50%)

85. Answer (2)

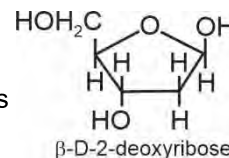
Hint & Sol.: Wrought iron is purest form of iron.

SECTION-B

86. Answer (1)

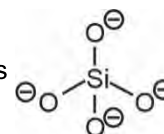
Hint: Sugar moiety in DNA molecule is β -D-2-deoxyribose

Sol.: Sugar moiety in DNA is



87. Answer (1)

Hint: Basic structure of silicate is



Sol.: • Basic structural unit of silicates is SiO_4^{4-}

• ZSM-5 is used to convert alcohols directly into gasoline.

88. Answer (1)

Hint: More is the electronegativity of central atom, more is the basic nature of compound.

Sol.: Basicity order $\rightarrow \text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3$

89. Answer (4)

Hint: Ammonia gas is evolved on reaction of NH_4Cl with base.

Sol.: $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \text{N}_2 + \text{Cr}_2\text{O}_3 + 4\text{H}_2\text{O}$

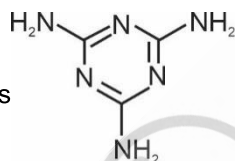
$\text{NH}_4\text{Cl} + \text{NaNO}_2 \longrightarrow \text{NaCl} + \text{N}_2 + \text{H}_2\text{O}$

$\text{Ba}(\text{N}_3)_2 \xrightarrow{\Delta} \text{Ba} + 3\text{N}_2$

$2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow 2\text{NH}_3 + 2\text{H}_2\text{O} + \text{CaCl}_2$

90. Answer (3)

Hint: Structure of melamine is



Sol.: Number of nitrogen atoms in melamine is 6.

91. Answer (4)

Hint & Sol.: • Veronal, Amytal and Luminal are derivatives of barbituric acid.
• Codeine is a narcotic analgesics.

92. Answer (1)

Hint: Saccharin is the sweetest compound.

Sol.:

Artificial Sweetener	Sweetness value in comparison to cane sugar
Aspartame	100
Saccharin	550
Sucralose	600
Alitame	2000

93. Answer (4)

Hint & Sol.: Greenhouse effect is shown by carbon dioxide, methane, ozone, CFCs and water vapour.

94. Answer (4)

Hint: Metal peroxide in presence of acidic medium gives hydrogen peroxide

Sol.: $2\text{H}_2\text{O}(\ell) \xrightarrow{\text{Electrolysis}} 2\text{H}_2 + \text{O}_2$

$\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$

$\text{Zn} + 2\text{NaOH} \longrightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$

$\text{BaO}_2 \cdot 8\text{H}_2\text{O}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4 + \text{H}_2\text{O}_2 + 8\text{H}_2\text{O}$

95. Answer (2)

Hint & Sol.: 2-ethylantraquinol on reaction with oxygen gives hydrogen peroxide and oxidised product.

96. Answer (1)

Hint: More is the polarising power of cation, lesser will be ionic character.

Sol.: Smaller is the size of cation, more is the polarising power.

Order of ionic character $\rightarrow \text{CsH} > \text{NaH} > \text{LiH}$

97. Answer (4)

Hint & Sol.: Vapour phase refining is the method in which metal is converted into its volatile compound which is collected and decomposed to give pure metal.

98. Answer (2)

Hint: In Hall-Heroult process, electrolysis of alumina takes place.

Sol.: In Hall-Heroult the reaction taking place at electrodes are

Cathode $\rightarrow \text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$

Anode $\rightarrow \text{C}(\text{s}) + \text{O}^{2-}(\text{melt}) \rightarrow \text{CO}(\text{g}) + 2\text{e}^-$

$\text{C}(\text{s}) + 2\text{O}^{2-}(\text{melt}) \rightarrow \text{CO}_2(\text{g}) + 4\text{e}^-$

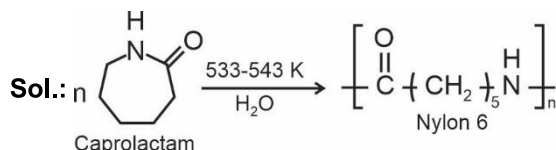
Overall reaction $\rightarrow 2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$

99. Answer (4)

Hint & Sol.: Copper matte consists of Cu_2S and FeS

100. Answer (2)

Hint: The polymers obtained by repetitive condensation reaction between two bi-functional or trifunctional monomeric units which results in the loss of some simple molecules as water, alcohol, hydrogen chloride etc. are called condensation polymers.



[BOTANY]**SECTION-A**

101. Answer (3)

Hint: Some organisms might avoid the stress by escaping in time for example, bear shows hibernation (winter sleep).

Sol.: Under unfavourable conditions, many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

102. Answer (2)

Hint: Maximum sunlight is received by the equator of earth.

Sol.: The average temperature on land decreases progressively from the equator towards the poles.

103. Answer (3)

Hint: The logistic growth model is represented by a sigmoid curve.

Sol.: The exponential growth pattern of a population results in a J-shaped curve when we plot population growth (N) in relation to time(t).

104. Answer (3)

Hint: Verhulst Pearl Logistic growth curve shows initially a lag phase, followed by a phase of acceleration then deceleration and finally asymptote.

Sol.: Since resources for growth for most animal populations are finite and become limiting sooner or later.

The logistic growth model is considered a more realistic one.

A population growing in a habitat with limited resources shows initially a lag phase.

105. Answer (4)

Hint: Natality refers to the number of births during a given period. Mortality is the number of deaths in a population.

Sol.: Mortality and emigration contribute to a decrease in population density in a given habitat during a given period.

106. Answer (1)

Hint: Desert plants have cuticle to minimise water loss through transpiration.

Sol.: Many deserts plants have a thick cuticle on their leaf surfaces to minimise water loss.

107. Answer (2)

Hint: In amensalism, one species is harmed whereas the other remains unaffected.

Sol.: In predation, only one species benefits and the interaction is detrimental to the other species.

Both the species are benefited in mutualism and both loses in competition with each other.

108. Answer (3)

Hint: The interaction in which both species benefits is called mutualism.

Sol.: The cattle egret and grazing cattle in close association is a classic example of commensalism.

109. Answer (2)

Sol.: Pond, lake, wetland, river and estuary are some examples of aquatic ecosystems.

110. Answer (1)

Hint: Net primary productivity is the available biomass for the consumption to heterotrophs.

Sol.: Gross primary productivity minus respiration losses (R) is the net primary productivity. NPP is the available biomass for the consumption to heterotrophs.

111. Answer (4)

Hint: The annual Net Primary Productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter.

Sol.: The annual NPP of the oceans are only 55 billion tons.

112. Answer (2)

Hint: Light penetration is difficult in deep sea.

Sol.: Sun is the only source of energy for all ecosystems on earth except for the deep sea hydro-thermal ecosystem.

113. Answer (4)

Hint: Lignin is resistant to degradation by most microbes.

Sol.: Decomposition rate is quicker if detritus is rich in nitrogen and water-soluble substances like sugars.

114. Answer (2)

Hint: Plants capture only 2-10 percent of the PAR

Sol.: The producers in an aquatic ecosystem are various species like phytoplanktons, algae and higher plants.

115. Answer (1)

Hint: In upright pyramid, producers are more in number and biomass than the herbivores, and herbivores are more in number and biomass than the carnivores.

Sol.: Upright pyramid of biomass shows a sharp decrease in biomass at higher trophic levels.

116. Answer (3)

Hint: There is no respiratory release of phosphorus into atmosphere.

Sol.: The gaseous exchange of phosphorus between organism and environment are negligible.

117. Answer (2)

Hint: Quagga became extinct from South Africa.

Sol.: Bali, Javan and Caspian are the subspecies of tiger.

118. Answer (4)

Hint: 32 percent of all amphibian species and 31 percent of all gymnosperms species in the world face the threat of extinction.

Sol.: 12 percent of all bird species and 23 percent of all mammal species in the world face the threat of extinction.

119. Answer (4)

Hint: Ecosystem with more species shows less year to year variation in total biomass.

Sol.: A stable community should not show too much variation in productivity from year to year.

120. Answer (2)

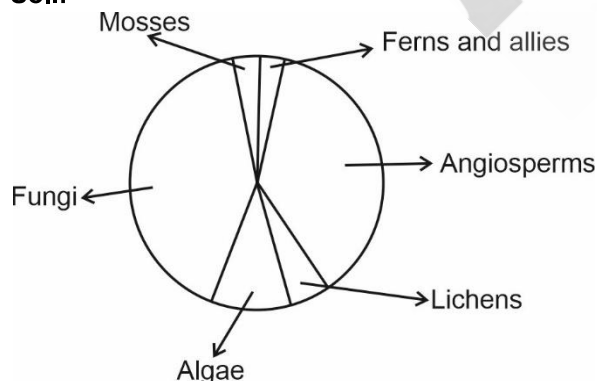
Hint: Tropical environments are relatively more constant and predictable.

Sol.: Tropical environments unlike temperate ones, are less seasonal.

121. Answer (2)

Hint: Fungi and angiosperms are most in number among plant global biodiversity.

Sol.:



122. Answer (4)

Hint: Aravalli hills are found in Rajasthan.

Sol.: The sacred groves are found in Khasi and Jaintia hills in Meghalaya and Aravalli hills of Rajasthan.

123. Answer (2)

Hint: Noise causes sleeplessness and stress.

Sol.: Noise causes sleeplessness, increased heart beat, altered breathing pattern, thus considerably stressing humans.

124. Answer (1)

Hint: Lead in the petrol inactivates the expensive metals used in catalytic converter.

Sol.: Steps taken in Delhi for reducing vehicular pollution include phasing out of old vehicles, use of unleaded petrol, use of low-sulphur petrol and diesel, use of catalytic converters in vehicles.

125. Answer (2)

Hint: Increase in concentration of the toxicant at successive trophic levels is called biomagnification.

Sol.: Pollutants from man's activities like effluents from the industries and homes can radically accelerate the aging process of lake. This phenomenon has been called Cultural or Accelerated Eutrophication.

126. Answer (3)

Hint: In an aquatic food chain, the concentration of DDT is increased at successive trophic levels.

Sol.: DDT concentration starts at 0.003 ppb (ppb = parts per billion) in water, it can ultimately reach 25 ppm (ppm = parts per million) in fish-eating birds, through biomagnification.

In large fish the concentration of DDT is 2 ppm.

127. Answer (2)

Hint: Bharat stage II is equivalent Euro-II norms.

Sol.: Euro III norms stipulate that sulphur be controlled at 350 parts-per-million (ppm) in diesel and 150 ppm in petrol.

128. Answer (3)

Hint: Presence of large amounts of nutrients in water causes excessive growth of planktonic (free-floating) algae is called an algal bloom.

Sol.: Algal bloom cause deterioration of the water quality and fish mortality.

129. Answer (2)

Hint: In India, the Air (Prevention and Control of Pollution) Act came into force in 1981.

Sol.: Water (Prevention and control of pollution) Act → 1974.

Environment (protection) Act → 1986.

130. Answer (3)

Hint: Garbage generated can be sorted on the basis of their degradability and whether they can be recycled or not.

Sol.: The biodegradable materials can be put into deep pits in the ground and be left for natural breakdown, that leaves only the non-biodegradable to be disposed off.

131. Answer (2)

Hint: Over half of the e-wastes generated in the developed countries are exported to developing countries.

Sol.: Incineration is crucial to dispose hospital waste.

132. Answer (3)

Hint: In integrated organic farming waste products from one process are cycled in as nutrients for other processes.

Sol.: Integrated organic farming allows the maximum utilisation of resources and increases the efficiency of production.

133. Answer (4)

Hint: The core zone of biosphere reserve is legally protected and no human activity is allowed.

Sol.: The buffer zone surrounds the core area, and is managed to accommodate a greater research and educational activities.

134. Answer (4)

Hint: Secondary pollutants are formed by the reactions of primary pollutants in the environment.

Sol.: Ozone (O_3) is a secondary pollutant.

135. Answer (2)

Hint: The historic Convention on Biological Diversity ('The Earth Summit') was held in Rio de Janeiro in 1992.

Sol.: The World Summit on Sustainable Development was held in 2002 in Johannesburg, South Africa.

SECTION-B

136. Answer (1)

Hint: Parasites are adapted in various way to increase infection in host.

Sol.: Multiple hosts increases parasitisation.

137. Answer (3)

Hint: In both the interactions one species benefits and the other is neither harmed nor benefited.

Sol.: Examples of commensalism are

- The interaction between sea anemone that has stinging tentacles and the clown fish that lives among them.
- An orchid growing as an epiphyte on a mango branch.

138. Answer (2)

Hint: In both parasitism and predation, only one species benefits and the interaction is detrimental to the other species.

Sol.: The interaction where one species is harmed and the other is neither benefitted nor harmed is called amensalism.

139. Answer (3)

Hint: Scrub stage precedes climax community.

Sol.: Rooted-floating plants are followed by free-floating plants, then Reed-Swamp, Marsh-Meadow, Scrub and finally the trees. The climax would be a forest.

140. Answer (3)

Hint: During succession, some species colonise an area and their population become more numerous whereas populations of other species decline and even disappear.

Sol.: The gradual and fairly predictable change in the species composition of a given area is called ecological succession.

141. Answer (2)

Hint: Decomposers meet their energy and nutrient requirements by degrading dead organic matter or detritus.

Sol.: DFC is made up of decomposers which are heterotrophic organisms, mainly fungi.

142. Answer (4)

Hint: Based on the source of their nutrition or food, organisms occupy a specific place in the food chain that is known as their trophic level.

Sol.: Producers belong to the first trophic level, herbivores (primary consumer) to the second and carnivores (secondary consumer) to the third. Tertiary consumer belongs to fourth trophic level.

143. Answer (3)

Hint: The number of trophic level in the grazing food chain is restricted as the transfer of energy follows 10 percent law.

Sol.: Only 10 percent of the energy is transferred to each trophic level from the lower trophic level.

144. Answer (3)

Hint: Hotspots biodiversity is conserved and protected at all levels.

Sol.: Conservationists identified for maximum protection certain 'biodiversity hotspots' regions with very high levels of species richness and high degree of endemism. It constitutes the *in-situ* conservation approach.

Hotspots are regions of accelerated habitat loss.

145. Answer (2)

Hint: A single species might show high diversity at the genetic level over its distributional range.

Sol.: India has more than 50,000 genetically different strains of rice and 1,000 varieties of mango.

146. Answer (1)

Hint: World Earth Day – 22nd April.

World Environment Day – 5th June

Sol.: World Ozone Day – 16th September

Nagasaki Day – 9th August

147. Answer (1)

Hint: It disturbs balance between production and degradation of ozone in the stratosphere.

Sol.: CFCs are widely used as refrigerants.

148. Answer (3)

Hint: One of the major effects of deforestation is enhanced carbon dioxide concentration in the atmosphere.

Sol.: Deforestation also causes loss of biodiversity due to habitat destruction, disturbs hydrologic cycle, causes soil erosion, and may lead to desertification in extreme cases.

149. Answer (3)

Hint: Carbon dioxide and methane are commonly known as greenhouse gases.

Sol.: The relative contribution of various greenhouse gases to total global warming is

CO₂ – 60%, CH₄ – 20%

CFCs – 14%, N₂O – 6%

150. Answer (1)

Hint: Zoological parks, botanical gardens and wildlife safari parks are *ex-situ* conservation approach of biodiversity.

Sol.: Biosphere reserves, national parks and wildlife sanctuaries are *in-situ* conservation approach of biodiversity.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: In case of drugs, clinical trials are carried out

Sol.: • After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product. The processes include separation and purification, which are collectively referred to as downstream processing. The product has to be formulated with suitable preservatives.

152. Answer (3)

Hint: Ultimate aim of recombinant DNA technology

Sol.: Selectable marker is one of the feature of vector, which helps in identifying and eliminating non-transformants and selectively permitting the growth of transformants.

153. Answer (2)

Hint: 1 dsDNA $\xrightarrow{1 \text{ PCR cycle}}$ 2 dsDNA

Sol.: **ELISA** $\rightarrow$

Enzyme Linked Immuno-Sorbent Assay is based on the principle of antigen-antibody interaction. It is a widely used diagnostic test for AIDS.

PCR $\rightarrow$

Polymerase Chain Reaction is a technique which is used for DNA amplification. It was developed by Kary Mullis.

1ds DNA $\xrightarrow{'n' \text{ PCR cycles}}$ $(2)^n$ ds DNA

Probe $\rightarrow$

A single stranded DNA/RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography.

Magnetic resonance imaging (uses non-ionising radiations) is used to diagnose cancer of internal organs.

154. Answer (2)

Hint: Months in a year

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

Hence, 5 litres of Rosie cow's milk contain 5×2.4 grams i.e., 12 grams of human α -lactalbumin protein.

155. Answer (4)

Hint: The year in which transgenic cow was created.

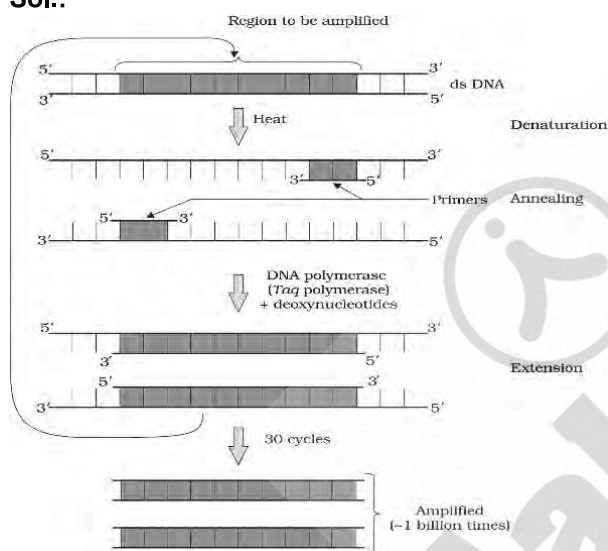
Sol.: In 1997, an American company got patent rights on Basmati rice through the US patent and Trademark Office. This allowed the company to sell a 'new' variety of Basmati, in the US and abroad.

Indian government has set up organisations such as GEAC, which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

156. Answer (1)

Hint: Sample is heated to 72°C

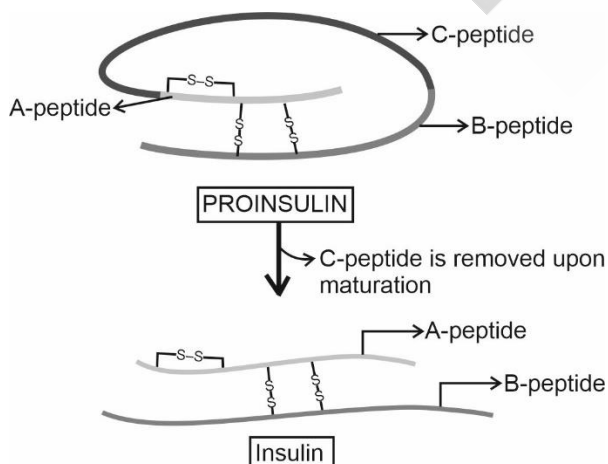
Sol.:



157. Answer (4)

Hint: Number of ear ossicles in each ear

Sol.:



158. Answer (2)

Hint: Sticky ends

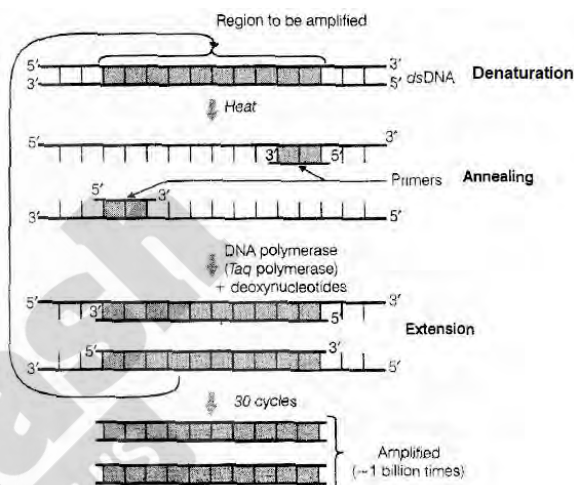
Sol.:

Enzyme	Microbial origin	Recognition site	Type of ends after restriction enzyme digestion
Bam HI	<i>Bacillus amyloliquefaciens</i>	5'-G-G-A-T-C-C-3' 3'-C-C-T-A-G-G-5'	Sticky ends
Eco RI	<i>Escherichia coli</i>	5'-G-A-A-T-T-C-3' 3'-C-T-T-A-A-G-5'	Sticky ends
Hind III	<i>Haemophilus influenzae</i>	5'-A-A-G-C-T-T-3' 3'-T-T-C-G-A-A-5'	Sticky ends
Pst I	<i>Providencia stuartii</i>	5'-C-T-G-C-A-G-3' 3'-G-A-C-G-T-C-5'	Sticky ends
Sal I	<i>Streptomyces albus</i>	5'-G-T-C-G-A-C-3' 3'-C-A-G-C-T-G-5'	Sticky ends
Sma I	<i>Serratia marcescens</i>	5'-C-C-C-G-G-G-3' 3'-G-G-G-C-C-C-5'	Blunt ends

159. Answer (2)

Hint: The first step involves breaking of H-bonds

Sol.:



160. Answer (2)

Hint: Intercalating agent

Sol.: The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).

161. Answer (1)

Hint: Mosquitoes belong to the same category

Sol.: Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes).

162. Answer (4)

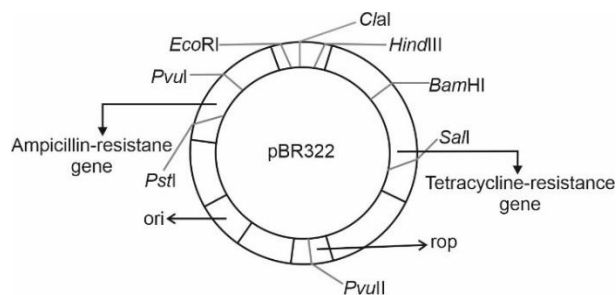
Hint: Two carbon compound

Sol.: To obtain purified DNA, specific cells are treated with specific enzymes.

After the activity of enzymes, all other molecules can be removed by appropriate treatments.

The purified DNA is then precipitated out after addition of chilled ethanol.

163. Answer (2)

Hint: Replication starts from this sequence**Sol.:**

- *ori* is responsible for controlling the copy number of the linked DNA.

164. Answer (2)

Hint: Multiple of 3**Sol.:** Basmati rice is distinct for its unique aroma and flavour and 27 documented varieties of Basmati are grown in India.

165. Answer (3)

Hint: Exclude downstream processing**Sol.:** A stirred-tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitate even mixing and oxygen availability throughout the bioreactor.

Downstream processing include separation and purification.

166. Answer (4)

Hint: Pest resistant crop**Sol.:** The proteins encoded by the genes *cryIAc* and *cryIIAb* control the cotton bollworms, that of *cryIAb* controls corn borer.

RNAi is used as method of cellular defence in eukaryotes. PCR stands for Polymerase Chain Reaction.

167. Answer (4)

Hint: Common carp belongs to the same category**Sol.:** Marine water fishes : Sardines, Mackerel, Pomfrets and *Hilsa*.Fresh water fishes : *Rohu*, *Catla* and common carp.

168. Answer (3)

Hint: Between two different species**Sol.:** Inbreeding: Mating of more closely related animals within the same breed for 4-6 generations.

Out-crossing : Mating of animals within the same breed, but having no common ancestors on either side of their pedigree for upto 4-6 generations.

Cross-breeding : Superior males of one breed are mated with superior females of another breed.

Interspecific hybridisation : Mating of male and female animals of two different related species e.g., Mule.

169. Answer (3)

Hint: Follicular maturation**Sol.:** **Multiple Ovulation Embryo Transfer Technology** (MOET) is one such programme for herd improvement. In this method, a cow is administered hormones, with FSH-like activity, to induce follicular maturation and super ovulation – instead of one egg, which they normally yield per cycle, they produce 6-8 eggs. The animal is either mated with an elite bull or artificially inseminated. The fertilised eggs at 8–32 cells stages, are recovered non-surgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

170. Answer (4)

Hint: Also beneficial for crop yield production**Sol.:** Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the crop yield and honey yield.

171. Answer (1)

Hint: Overhanging stretches**Sol.:** The recognition sequence of *EcoRI* is 5' GAATTC3'.*EcoRI* cuts the DNA between bases G and A only where the sequence GAATTC is present. It produces sticky ends.

172. Answer (3)

Hint: pBR322 is isolated from this.**Sol.:** 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. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin.

173. Answer (4)

Hint: Same as that of head of lipids**Sol.:** DNA is a hydrophilic molecule whereas cell membrane is lipophilic. So, DNA molecule cannot pass through cell membranes.

174. Answer (4)

Hint: Present in prokaryotes**Sol.:** Plasmid is an autonomously replicating double-stranded circular extra-chromosomal DNA.

175. Answer (3)

Hint: HIV belongs to this category

- Sol.:**
- Microinjection – rDNA is directly injected into nucleus of an animal cell
 - Biolistic or gene gun – suitable for plants

176. Answer (4)

Hint: Pathogen of dicot plants

- Sol.:**
- Using *Agrobacterium* vectors, nematode specific genes were introduced into the tobacco plants.
 - Retroviruses are used to deliver desirable genes into animal cells.

177. Answer (4)

Hint: Does not induce unwanted immunological responses**Sol.:** Insulin was earlier extracted from pancreas of slaughtered pigs and cattles. Insulin is used to treat diabetes mellitus.

In ELISA, infection by pathogen can be detected either by the presence of antigens or by detecting antibodies synthesised against the pathogen.

About 30 recombinant therapeutics have been approved for human-use the world over. In India, 12 of these are presently being marketed.

178. Answer (4)

Hint: Bee-keeping

- Sol.:**
- Pisciculture refers to production of fishes only.
 - Sericulture is the breeding and management of silkworm for production of silk.
 - Aquaculture is breeding, raising and harvesting of aquatic plants and aquatic animals.

179. Answer (1)

Hint: Factor of 4**Sol.:**

$$1 \text{ dsDNA} \xrightarrow{\text{PCR Cycle}} (2)^n \text{ dsDNA} = (2)^1 = 2 \text{ dsDNA}$$

$$\therefore 1 \text{ dsDNA} \xrightarrow{3 \text{ PCR Cycle}} (2)^n \text{ dsDNA} = (2)^3 = 8 \text{ dsDNA}$$

$$\text{and } 2 \text{ dsDNA} \xrightarrow{3 \text{ (PCR) Cycle}} 2 \times 8 \text{ dsDNA} = 16 \text{ dsDNA molecules}$$

180. Answer (2)

Hint: Synonym of sequence

Sol.: The convention for naming restriction enzymes is the first letter of the name comes from the genus and the second two letters come from the species of the prokaryotic cell from which they were isolated, e.g., *EcoRI* comes from *Escherichia coli* RY 13. In *EcoRI*, the letter 'R' is derived from the name of strain. Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria.

181. Answer (1)

Hint: Causative agent of typhoid**Sol.:** Stanley Cohen and Herbert Boyer accomplished the construction of first rDNA by linking a gene encoding antibiotic resistance with a native plasmid (autonomously replicating circular extra-chromosomal DNA) of *Salmonella typhimurium*.

182. Answer (4)

Hint: Belongs to class VI of enzymes**Sol.:** DNA ligase is a specific type of enzyme, that facilitates the joining of DNA strands together by catalysing the formation of phosphodiester bond.

Alkaline phosphatase removes the phosphate group from the 5' end of the DNA hence, prevents self-ligation.

DNA polymerases are a group of enzymes used to make copies of DNA templates, essentially used in DNA replication mechanism.

183. Answer (4)

Hint: pBR322 is self replicating.**Sol.:** Plasmids and bacteriophages have the ability to replicate within bacterial cells independent of the control of chromosomal DNA.Normal *E.coli* cells do not carry resistance against antibiotics.

184. Answer (3)

Hint: Protoxins are inactive**Sol.:** The Bt toxin proteins exist as inactive protoxins, but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to alkaline pH of the gut which solubilise the crystals.

GM has been used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

185. Answer (4)

Hint: Present in pancreatic juice.

- Sol.:**
- (a) Plant cell wall – Cellulase
 - (b) Bacterial cell wall – Lysozyme
 - (c) Fungal cell wall – Chitinase
 - (d) RNA – Ribonuclease

SECTION-B

186. Answer (1)

Hint: In bacteriophage lambda, insert size is 9-23 kb.

Sol.: Plasmids and bacteriophages have the ability to replicate within bacterial cells.

Bacteriophages because of their high number per cell, have very high copy numbers of their genome within the bacterial cells.

187. Answer (4)

Hint: GM crops can be made tolerant to cold.

Sol.: Genetic modifications in the plants have made the crops more tolerant to abiotic stresses and also increased the efficiency of mineral usage by plants.

188. Answer (4)

Hint: Evolve a pureline

Sol.: When breeding is between animals of the same breed for upto 4-6 generations it is called inbreeding. Inbreeding increases homozygosity.

A single outcross can overcome the inbreeding depression.

189. Answer (4)

Hint: Culture followed by extraction

Sol.: Recombinant DNA technology involves several steps in 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 recombinant DNA into the host, culturing the host cells in a medium at large scale and extraction of the desired product.

190. Answer (3)

Hint: Discovery of Alexander Fleming

Sol.: With fed-batch culture more control of the process is involved than with batch culture. The process is commonly used to produce penicillin and in baking industry.

191. Answer (2)

Hint: Direct method of transformation

Sol.: In micro-injection, rDNA is directly injected into the nucleus of an animal cell.

In gene gun/biolistics, suitable for plants, cell are bombarded with high velocity micro-particles of gold or tungsten coated with DNA.

192. Answer (4)

Hint: *cryI*Ac controls the cotton bollworms.

Sol.: The proteins encoded by the genes *cryI*Ac and *cryII*Ab control the cotton bollworms, that of *cryI*Ab control corn borer.

193. Answer (4)

Hint: Ethidium bromide is used

Sol.: The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique called gel electrophoresis.

The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation.

194. Answer (4)

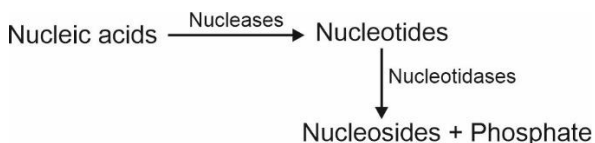
Hint: *Bam*HI and *Sal*I are present on same gene.

Sol.: If a foreign DNA is ligated at *Bam*HI site of tetracycline resistance gene in the vector pBR322, the recombinant plasmids will lose the tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on tetracycline containing medium. In this case, one antibiotic resistance gene (ampicillin) helps in selecting the transformants whereas the other antibiotic resistance gene (tetracycline) gets 'inactivated due to insertion' of alien DNA, and helps in selection of recombinants.

195. Answer (2)

Hint: Present in saliva

Sol.: Chitinase is used to degrade the cell wall of fungus which is composed of chitin.



Lysozyme is used to degrade the cell wall of bacteria which is composed of peptidoglycans.

196. Answer (3)

Hint: Delivers the T-DNA into plant cells

Sol.: *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.

It is called natural genetic engineer of plants.

Rice is a monocot plant.

197. Answer (3)

Hint: Involved in water absorption

Sol.: A nematode, *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield.

198. Answer (2)

Hint: Obtained from transgenic sheep

Sol.:

- Human protein (α -1-antitrypsin) is used to treat emphysema.
- In 1997, the first transgenic cow, Rosie, produced human protein-enriched (alpha-lactalbumin) milk.

- Globulins are present in blood plasma and participate in immune system.
- Casein is a milk protein

199. Answer (3)

Hint: Prevent translation

Sol.: A nematode, *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield.

RNAi takes place in all eukaryotic organisms as a method of cellular defense.

The source of complementary RNA could be from an infection by viruses having RNA genomes.

200. Answer (4)

Hint: Electrophoresis

Sol.:

- Restriction enzymes (molecular scissors) belongs to a larger class of enzymes called nucleases.
- The separated bands of DNA via gel electrophoresis are cut out from the agarose gel and extracted from the gel piece. This step is known as elution.

□ □ □

All India Aakash Test Series for NEET-2023

TEST - 7 (Code-F)

Test Date : 02/04/2023

ANSWERS

1. (2)	41. (4)	81. (3)	121. (1)	161. (3)
2. (2)	42. (2)	82. (4)	122. (2)	162. (4)
3. (1)	43. (2)	83. (2)	123. (4)	163. (4)
4. (3)	44. (3)	84. (1)	124. (2)	164. (3)
5. (2)	45. (1)	85. (1)	125. (4)	165. (1)
6. (1)	46. (1)	86. (2)	126. (1)	166. (4)
7. (3)	47. (4)	87. (4)	127. (2)	167. (3)
8. (2)	48. (4)	88. (2)	128. (3)	168. (3)
9. (2)	49. (2)	89. (4)	129. (2)	169. (4)
10. (1)	50. (1)	90. (1)	130. (1)	170. (4)
11. (4)	51. (2)	91. (2)	131. (4)	171. (3)
12. (4)	52. (2)	92. (4)	132. (3)	172. (2)
13. (2)	53. (1)	93. (4)	133. (3)	173. (2)
14. (2)	54. (1)	94. (1)	134. (2)	174. (4)
15. (4)	55. (1)	95. (4)	135. (3)	175. (1)
16. (1)	56. (4)	96. (3)	136. (1)	176. (2)
17. (1)	57. (2)	97. (4)	137. (3)	177. (2)
18. (1)	58. (4)	98. (1)	138. (3)	178. (2)
19. (1)	59. (4)	99. (1)	139. (1)	179. (4)
20. (2)	60. (1)	100. (1)	140. (1)	180. (1)
21. (3)	61. (3)	101. (2)	141. (2)	181. (4)
22. (4)	62. (4)	102. (4)	142. (3)	182. (2)
23. (3)	63. (3)	103. (4)	143. (3)	183. (2)
24. (3)	64. (3)	104. (3)	144. (4)	184. (3)
25. (1)	65. (2)	105. (2)	145. (2)	185. (3)
26. (3)	66. (4)	106. (3)	146. (3)	186. (4)
27. (2)	67. (1)	107. (2)	147. (3)	187. (3)
28. (2)	68. (4)	108. (3)	148. (2)	188. (2)
29. (4)	69. (4)	109. (2)	149. (3)	189. (3)
30. (2)	70. (3)	110. (3)	150. (1)	190. (3)
31. (1)	71. (3)	111. (2)	151. (4)	191. (2)
32. (1)	72. (4)	112. (1)	152. (3)	192. (4)
33. (1)	73. (4)	113. (2)	153. (4)	193. (4)
34. (4)	74. (1)	114. (4)	154. (4)	194. (4)
35. (3)	75. (1)	115. (2)	155. (1)	195. (2)
36. (1)	76. (3)	116. (2)	156. (2)	196. (3)
37. (2)	77. (3)	117. (4)	157. (1)	197. (4)
38. (3)	78. (4)	118. (4)	158. (4)	198. (4)
39. (2)	79. (3)	119. (2)	159. (4)	199. (4)
40. (1)	80. (4)	120. (3)	160. (4)	200. (1)

HINTS & SOLUTIONS**[PHYSICS]****SECTION-A**

1. Answer (2)

Hint: $n_e n_h = n_i^2$ **Sol.:** $n_e (10^{23}) = (10^{16})^2$

$$\Rightarrow n_e = 10^9/\text{m}^3$$

2. Answer (2)

Hint & Sol.: For PN junction to be forward biased, P side should be at higher potential.

3. Answer (1)

Hint & Sol.: The current in reverse bias is majorly due to drift of charge carriers.

4. Answer (3)

Hint: $A + B = Y$ represents OR Gate**Sol.:** $Y = A \cdot A + B \cdot B$

$$Y = A + B$$

5. Answer (2)

Hint: $A_P = \beta A_V$ **Sol.:** $A_P = 90 \times 20$
 $= 1800$

6. Answer (1)

Hint: Dynamic resistance = $\frac{\Delta V}{\Delta I}$

$$\text{Sol.} \quad r_d = \frac{0.9 - 0.8}{(25 - 20) \times 10^{-3}} = 20 \, \Omega$$

7. Answer (3)

Hint & Sol.: For CE amplifier, output and input signal differs in phase by π rad.

8. Answer (2)

Hint & Sol.: For most semiconductors the band gap should be less than 3 eV.

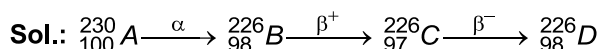
9. Answer (2)

Hint: $A = \frac{A_0}{2^{t/T}}$ **Sol.:** $A = \frac{A_0}{2^{25/10}}$

$$A = \frac{A_0}{4\sqrt{2}}$$

$$\Rightarrow \frac{A}{A_0} = \frac{1}{4\sqrt{2}}$$

10. Answer (1)

Hint: Mass number remains same in β^+ and β^- decay and decreases in α decay.

11. Answer (4)

Hint: Half-life = $\frac{\ln 2}{\lambda}$; mean life = $\frac{1}{\lambda}$

$$\text{Sol.} \quad t_1 = \frac{\ln 2}{\lambda}$$

$$t_2 = \frac{1}{\lambda}$$

$$\Rightarrow t_1 = t_2 \ln 2$$

12. Answer (4)

Hint: $Q = BE_{\text{product}} - BE_{\text{reactant}}$ **Sol.:** $Q = E - 3e$

13. Answer (2)

Hint: Conservation of linear momentum.

$$\text{Sol.} \quad \frac{1}{\lambda} = R \left(\frac{1}{1^2} - \frac{1}{3^2} \right)$$

$$\Rightarrow \lambda = \frac{9}{8R}$$

$$\therefore \text{Momentum of photon} = \frac{h}{\lambda} = \frac{8}{9} hR$$

Since atom was initially at rest, so momentum gained by atom is also $\frac{8}{9} hR$

14. Answer (2)

Hint & Sol.: $TE = \frac{PE}{2} = -KE$

15. Answer (4)

Hint: Lyman, Balmer and Paschen series lie in U.V., visible and infrared region respectively.**Sol.:** $3 \rightarrow 1$ and $4 \rightarrow 1$ correspond to Lyman series and $4 \rightarrow 2$ corresponds to Balmer series and $4 \rightarrow 3$ corresponds to Paschen series.

16. Answer (1)

$$\text{Hint: } \lambda = \frac{h}{\sqrt{2mqV}}$$

Sol.: $\lambda \propto \frac{1}{\sqrt{V}}$ wavelength has inverse relationship with accelerating voltage.

17. Answer (1)

$$\text{Hint: } \lambda_{\text{electron}} = \sqrt{\frac{150}{V}} \text{ \AA}$$

$$\text{Sol.: } \lambda = \sqrt{\frac{150}{600}} \text{ \AA} \\ = 0.5 \text{ \AA}$$

18. Answer (1)

Hint: Intensity $\propto \frac{1}{r^2}$; Stopping potential depends on frequency.

Sol.: As source is moved away, the number of incident photons decrease but their frequency remains same.

19. Answer (1)

$$\text{Hint: } h\nu = \phi + K$$

$$\text{Sol.: } E = \phi + K \quad \dots(1)$$

$$3E = \phi + 4K \quad \dots(2)$$

$$\text{From (1) and (2), } \phi = \frac{E}{3} \text{ and } K = \frac{2E}{3}$$

$$\text{Now, } 4E = \phi + K'$$

$$\Rightarrow K' = \frac{11}{2}K$$

20. Answer (2)

$$\text{Hint: } \lambda_0 = \frac{hc}{\phi}$$

$$\text{Sol.: } \lambda_0 \approx \frac{12400 \text{ eV \AA}}{2 \text{ eV}}$$

$$\Rightarrow \lambda_0 \approx 6200 \text{ \AA}$$

21. Answer (3)

$$\text{Hint: } \phi = \frac{hc}{\lambda}$$

$$\text{Sol.: } \lambda_1 = \frac{hc}{\phi_1}$$

$$\lambda_2 = \frac{hc}{\phi_2}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{4.6}{2.3} = \frac{2}{1}$$

22. Answer (4)

Hint: For n^{th} bright fringe $\Delta x = n\lambda$ and for n^{th} dark fringe $\Delta x = (2n-1)\frac{\lambda}{2}$

$$\text{Sol.: } (2 \times 4 - 1)\frac{\lambda_1}{2} = 6\lambda_2$$

$$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{12}{7}$$

23. Answer (3)

Hint: For 1st minima, $a \sin \theta = \lambda$ and for 1st maxima, $a \sin \theta = \frac{3\lambda}{2}$

$$\text{Sol.: } a \sin (37^\circ) = \lambda \quad (1^{\text{st}} \text{ minima})$$

$$\Rightarrow a = \frac{5\lambda}{3}$$

$$\text{and, } a \sin \theta = \frac{3\lambda}{2} \quad (1^{\text{st}} \text{ secondary maxima})$$

$$\frac{5\lambda}{3} \sin \theta = \frac{3\lambda}{2}$$

$$\Rightarrow \theta = \sin^{-1} \left(\frac{9}{10} \right)$$

24. Answer (3)

$$\text{Hint: } \beta = \frac{\lambda D}{d}$$

$$\text{Sol.: } \beta' = \frac{\lambda(2D)}{(d/2)} = 4\beta$$

25. Answer (1)

Hint: Brewster's law, $\mu = \tan i_p$.

$$\text{And } i_c = \sin^{-1} \left(\frac{1}{\mu} \right)$$

$$\text{Sol.: } \mu = \tan(53^\circ) \Rightarrow \mu = \frac{4}{3}$$

$$i_c = \sin^{-1} \left(\frac{1}{\mu} \right) = \sin^{-1} \left(\frac{3}{4} \right)$$

26. Answer (3)

Hint: Use Malus law $I_t = I_0 \cos^2 \theta$ **Sol.:** After 1st polaroid intensity is $\frac{I_0}{2}$. Now,

$$I = \frac{I_0}{2} \cos^2 (30^\circ) = \frac{3I_0}{8}$$

27. Answer (2)

Hint: Wavelength λ in air, reduces to λ/μ in medium.**Sol.:** Path difference at position of 1st minima = $\lambda'/2$ where $\lambda' = \lambda/\mu$

$$\therefore \text{Path difference for first minima} = \frac{\lambda}{2\mu}$$

28. Answer (2)

$$\text{Hint: } \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

Sol.: If f_1 is focal length of left half and f_2 be focal length of right half, then equivalent focal length is $(f_1 f_2 / f_1 + f_2)$.

29. Answer (4)

Hint: For normal vision far point is at infinity.

$$\text{Sol.: } \frac{1}{-200} - \frac{1}{\infty} = \frac{1}{f}$$

$$\Rightarrow f = -200 \text{ cm}$$

30. Answer (2)

Hint & Sol.: In primary rainbow, violet appears as innermost layer.

31. Answer (1)

Hint: In normal adjustment, M.P. = f_o/f_e

$$\text{Sol.: } 50 = \frac{100}{f_e}$$

$$\Rightarrow f_e = 2 \text{ cm}$$

32. Answer (1)

$$\text{Hint: } i + e = A + \delta \text{ and } \mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\text{Sol.: } i + e = 60^\circ + 30^\circ$$

$$\Rightarrow i = 45^\circ$$

$$\text{also, } \mu = \frac{\sin 45^\circ}{\sin 30^\circ}$$

$$\mu = \sqrt{2}$$

33. Answer (1)

$$\text{Hint: For equiconvex lens; } \frac{1}{f} = (\mu - 1) \left(\frac{2}{R} \right)$$

$$\text{Sol.: } \frac{1}{20} = (1.5 - 1) \left(\frac{2}{R} \right)$$

$$\Rightarrow R = 20 \text{ cm}$$

$$\text{Inside liquid, } \frac{1}{f} = \left(\frac{1.5}{1.2} - 1 \right) \left(\frac{2}{20} \right)$$

$$f = 40 \text{ cm}$$

$$\text{For combination } \frac{1}{f_c} = \frac{1}{40} + \frac{1}{40} \Rightarrow f_c = 20 \text{ cm}$$

34. Answer (4)

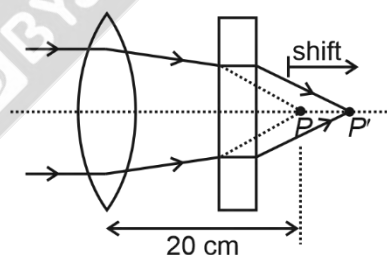
$$\text{Hint: } \frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{Sol.: } \frac{1}{24} = (1.5 - 1) \left(\frac{1}{20} - \frac{1}{R_2} \right)$$

$$\Rightarrow R_2 = 30 \text{ cm}$$

35. Answer (3)

$$\text{Hint: Shift} = t \left(1 - \frac{1}{\mu} \right)$$

Sol.:

$$\text{Shift} = 6 \left(1 - \frac{1}{1.5} \right) = 2 \text{ cm}$$

Beam will be focused at a distance 22 cm from convex lens.

SECTION-B

36. Answer (1)

Hint: For potential difference greater than 0.3 V, germanium diode acts as short circuit.

$$\text{Sol.: } V_R = 5 - 0.3$$

$$= 4.7 \text{ V (potential difference across resistor)}$$

37. Answer (2)

Hint: For OR gate $Y = A + B$ **Sol.:** Truth table for given gate is

A	B	Y
1	1	1
0	1	1
1	0	1
0	0	0

 $\Rightarrow$ The gate is OR gate.

38. Answer (3)

Hint & Sol.: I - V characteristics of solar cell is drawn in fourth quadrant.

39. Answer (2)

Hint: $L = \frac{nh}{2\pi}$ **Sol.:** $L_1 = \frac{4h}{2\pi}$ and $L_2 = \frac{3h}{2\pi}$ $L_1 : L_2 = 4 : 3$

40. Answer (1)

Hint: Antineutrino is accompanied with β^- decay.**Sol.:** ${}^3_1\text{H} \rightarrow {}^3_2\text{He} + \beta^- + \bar{\nu}$

41. Answer (4)

Hint & Sol.: Photoelectric effect explains particle nature of light.

42. Answer (2)

Hint: Energy of photon = $\frac{hc}{\lambda}$ **Sol.:** $\frac{\text{Energy emitted}}{\text{Time}} = N \frac{hc}{\lambda}$ (Here N is number of photons ejected in unit time)

$$\Rightarrow P = N \frac{hc}{\lambda}$$

$$\Rightarrow N = \frac{P\lambda}{hc}$$

43. Answer (2)

Hint: $K = h\nu - h\nu_0$ **Sol.:** $\frac{1}{2}mv^2 = h(F - F_0)$

$$\Rightarrow v = \sqrt{\frac{2h}{m}(F - F_0)}$$

44. Answer (3)

Hint: $I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2$ and $I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2$ **Sol.:** $\left(\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right)^2 = \frac{25}{1}$

$$\Rightarrow \sqrt{I_1} + \sqrt{I_2} = 5(\sqrt{I_1} - \sqrt{I_2})$$

$$\Rightarrow 6\sqrt{I_2} = 4\sqrt{I_1}$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{9}{4}$$

45. Answer (1)

Hint & Sol.: Fringe shift

$$(\Delta y) = \frac{D(\mu - 1)t}{d} = \frac{\beta}{\lambda}(\mu - 1)t$$

46. Answer (1)

Hint: $\theta = \frac{1.22\lambda}{D}$

$$\text{Sol.} \quad \theta = \frac{1.22 \times 5737 \times 10^{-10}}{70 \times 10^{-2}} = 10^{-6} \text{ rad}$$

47. Answer (4)

Hint: For dispersion without deviation

$$\frac{A_1}{A_2} = \frac{(\mu_2 - 1)}{(\mu_1 - 1)}$$

$$\text{Sol.} \quad A_2 = \left(\frac{1.40 - 1}{1.36 - 1}\right) \times 3^\circ \text{ OR } A_2 = \left(\frac{1.36 - 1}{1.40 - 1}\right) 3^\circ$$

$$\Rightarrow A_2 = 3.33^\circ \text{ or } 2.7^\circ.$$

48. Answer (4)

Hint: For mirror, $v = \frac{uf}{u - f}$

$$\text{Sol.} \quad v_1 = \frac{(-40)(-20)}{(-40) - (-20)} = -40 \text{ cm}$$

$$\text{and } v_2 = \frac{(-30)(-20)}{(-30) - (-20)} = -60 \text{ cm}$$

$\Rightarrow$ Image displace from -40 cm to -60 cm .

49. Answer (2)

$$\text{Hint: } \sin i_{12} = \frac{1}{\mu_{21}}$$

$$\text{Sol.: } \sin 37^\circ = \frac{\mu_A}{\mu_B} \quad \dots(1)$$

$$\sin 53^\circ = \frac{\mu_B}{\mu_C} \quad \dots(2)$$

Multiply equation (1) and (2)

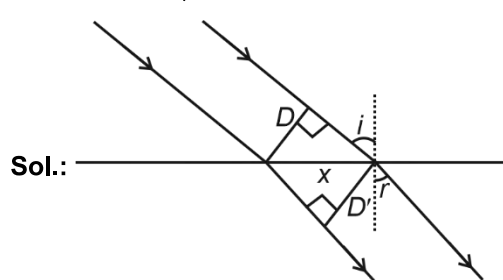
$$\frac{3}{5} \times \frac{4}{5} = \frac{\mu_A}{\mu_C}$$

$$\Rightarrow \sin i_{AC} = \frac{12}{25}$$

$$i_{AC} = \sin^{-1}\left(\frac{12}{25}\right)$$

50. Answer (1)

$$\text{Hint: } \sin r = \frac{\sin i}{\mu}$$



Sol.:

$$x = \frac{D}{\cos i} = \frac{D'}{\cos r} \quad \dots(i)$$

$$\sin i = \frac{4}{5} \Rightarrow \cos i = \frac{3}{5}$$

$$\sin r = \frac{4/5}{5/3} = \frac{3}{5} \Rightarrow \cos r = \frac{4}{5}$$

$$\Rightarrow \frac{D}{(3/5)} = \frac{D'}{(4/5)}$$

$$\Rightarrow D' = \frac{4}{3}D$$

[CHEMISTRY]

SECTION-A

51. Answer (2)

Hint & Sol.: Wrought iron is purest form of iron.

52. Answer (2)

Hint: One of the element present in German silver is zinc.

Sol.: German silver is composed of (Cu 25-30%, Zn 25-30% and Ni 40-50%)

53. Answer (1)

Hint: Calamine is ore of zinc

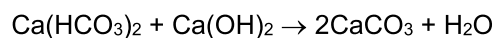
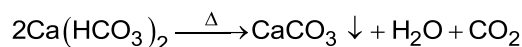
Sol.:

Composition	Ore name
ZnCO ₃	Calamine
CuFeS ₂	Copper pyrite
Cu ₂ S	Copper glance
FeCO ₃	Siderite

54. Answer (1)

Hint: Temporary hardness consists of bicarbonates of magnesium and calcium.

Sol.: Temporary hardness is removed by boiling and by Clark's method



55. Answer (1)

Hint: Molecular mass of D₂O is greater than H₂O

Sol.: Boiling point and enthalpy of vaporisation of D₂O is more than H₂O due to more molecular interaction between D₂O molecules.

56. Answer (4)

Hint: Hydrides having complete octet and lone pair present on central atom are electron rich.

Sol.: BH₃ electron deficient hydride

CH₄ and SiH₄ electron precise hydrides

H₂O: electron rich hydride

57. Answer (2)

$$\text{Hint: (Molarity)}_{\text{H}_2\text{O}_2} = \frac{\text{Volume strength}}{11.2}$$

$$\text{Sol.: } M_{\text{H}_2\text{O}_2} = \frac{5}{11.2}$$

$$\begin{aligned}\text{or, strength of H}_2\text{O}_2 &= \frac{5}{11.2} \times 34 \text{ gL}^{-1} \\ &= 15.178 \\ &\approx 15 \text{ gL}^{-1}\end{aligned}$$

58. Answer (4)

Hint & Sol.: Excess nitrate in drinking water can cause 'blue baby' syndrome.

59. Answer (4)

Hint: Photochemical smog is also known as oxidising smog

Sol.: Photochemical smog occurs in warm, dry and sunny climate

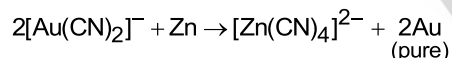
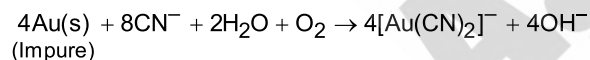
60. Answer (1)

Hint & Sol.: Normally rain water has a pH of 5.6.

61. Answer (3)

Hint: The metal is leached with the reagent which can form complex with gold.

Sol.:



62. Answer (4)

Hint: Antioxidants help in food preservation by retarding the action of oxygen on food.

Sol.: BHT (butylated hydroxyl toluene) and BHA (butylated hydroxyl anisole) are common antioxidants.

63. Answer (3)

Hint: Cationic detergents are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

Sol.: Cetyltrimethyl ammonium bromide is a cationic detergent.

64. Answer (3)

Hint: The polymers which undergo microbial degradation in the environment are called biodegradable polymers.

Sol.: PHBV (Poly β -hydroxybutyrate – co- β -hydroxy valerate) and Nylon 2-nylon 6 are biodegradable polymers

65. Answer (2)

Hint: Monomer of natural rubber is isoprene (2-methyl-1,3-butadiene)

Sol.: Natural rubber is also called cis-1,4-polyisoprene

66. Answer (4)

Hint: Dacron is a polyester

Sol.: Ethylene glycol + Terephthalic acid

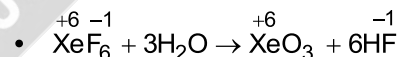
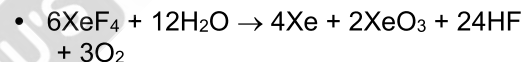
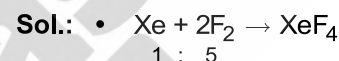
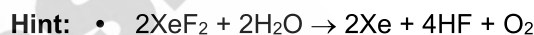


67. Answer (1)

Hint: $[\text{Rh}(\text{PPh}_3)_3\text{Cl}]$ is Wilkinson catalyst

Sol.: $\text{Al}(\text{Et})_3 + \text{TiCl}_4$ together is called Ziegler-Natta catalyst

68. Answer (4)



It is not a redox reaction.

69. Answer (4)

Hint:

Process	Used for formation of
Deacon's process	Cl_2
Contact process	H_2SO_4
Haber's process	NH_3
Ostwald's process	HNO_3

Sol.:

Process	Catalyst
Deacon's process	CuCl_2
Contact process	V_2O_5
Haber's process	Finely divided Iron
Ostwald's process	Pt/Rh

70. Answer (3)

Hint: Bond dissociation enthalpy of F – F is low because of lone pair-lone pair repulsion between two fluorine atoms.

Sol.: Bond	Bond dissociation enthalpy (kJ mol ⁻¹)
F–F	158.8
Cl–Cl	242.6
Br–Br	192.8
I–I	151.1

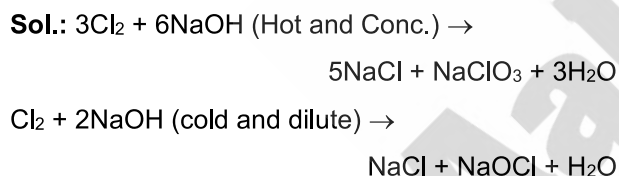
71. Answer (3)

Hint: Down the group acidic strength of higher oxides decreases

Sol.: Compound	Chemical Nature
SnO, PbO ₂	Amphoteric
GeO ₂	Acidic
CO	Neutral

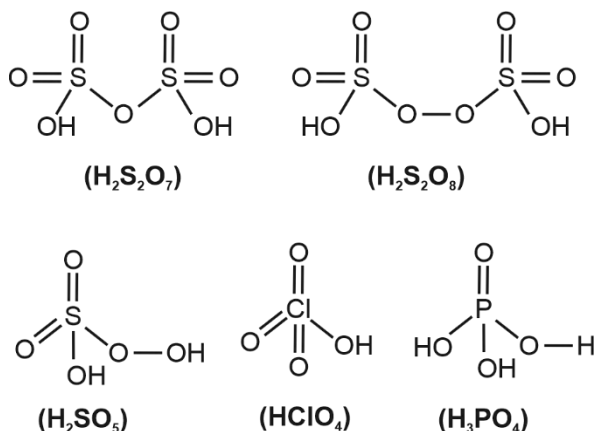
72. Answer (4)

Hint: Chlorine on treatment with base disproportionates.



73. Answer (4)

Hint: Compounds having O – O bond are said to have peroxy linkage

Sol.:

74. Answer (1)

Hint: Central atom of the species having vacant orbital can participate in hydrolysis.

Sol.: In CCl₄, carbon has no vacant orbital, so it does not go hydrolysis easily.

75. Answer (1)

Hint: Due to inert pair effect, stability order of +2 oxidation state is Pb²⁺ > Sn²⁺ > Ge²⁺ > Si²⁺

Sol.: More is the stability of +2 oxidation state better is the oxidising nature of their dioxide

Oxidising nature : PbO₂ > SnO₂ > GeO₂ > SiO₂

76. Answer (3)

Hint: Due to presence of filled *d*-subshell, the size of gallium is relatively less.

Sol.: Order of atomic radius : B < Ga < Al < In < Tl

77. Answer (3)

Hint & Sol.: Borax bead consists of B₂O₃ and NaBO₂

78. Answer (4)

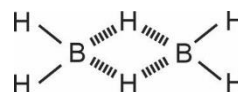
Hint: Octet of boron in boric acid is incomplete.

Sol.:

- Boric acid is a weak monobasic acid
- It acts as a Lewis acid.
- Hybridisation of Boron is sp²
- It is associated with each other by intermolecular H-bonding.

79. Answer (3)

Hint: Structure of diborane is

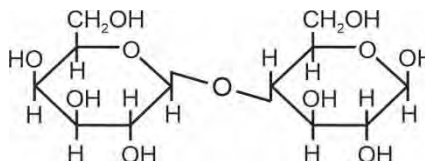


Sol.:

- Number of 3c – 2e⁻ bonds = 2
- Number of 3c – 4e⁻ bonds = 0

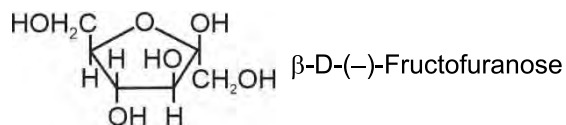
80. Answer (4)

Hint: Lactose is a disaccharide, its structure is



Sol.: Lactose is composed of β-D-galactose and β-D-glucose

81. Answer (3)

Hint:

Sol.: Number of chiral centres present in β -D-(-)-Fructofuranose is 4.

82. Answer (4)

Hint & Sol : Vitamin B are water soluble vitamins and they are readily excreted in urine and cannot be stored (except vitamin B₁₂) in our body.

83. Answer (2)

Hint: Essential amino acids cannot be synthesised in the body.

Sol.: • Methionine is essential amino acid
• Tyrosine, glutamic acid and glutamine are non-essential amino acids.

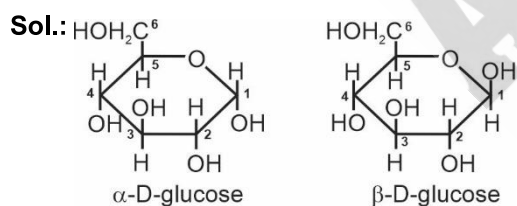
84. Answer (1)

Hint: Purine bases are bicyclic compounds.

Sol.: • Guanine and Adenine are purine bases
• Cytosine, uracil and thymine are pyrimidine bases.

85. Answer (1)

Hint: Cyclic isomers of glucose having different configuration at C₁ carbon only are called anomers.

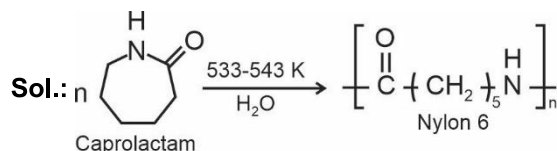


α -D-glucose and β -D-glucose are anomers of each other.

SECTION-B

86. Answer (2)

Hint: The polymers obtained by repetitive condensation reaction between two bi-functional or trifunctional monomeric units which results in the loss of some simple molecules as water, alcohol, hydrogen chloride etc. are called condensation polymers.



87. Answer (4)

Hint & Sol.: Copper matte consists of Cu₂S and FeS

88. Answer (2)

Hint: In Hall-Heroult process, electrolysis of alumina takes place.

Sol.: In Hall-Heroult the reaction taking place at electrodes are

Cathode $\rightarrow \text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$

Anode $\rightarrow \text{C(s)} + \text{O}^{2-}(\text{melt}) \rightarrow \text{CO(g)} + 2\text{e}^-$

$\text{C(s)} + 2\text{O}^{2-}(\text{melt}) \rightarrow \text{CO}_2(\text{g}) + 4\text{e}^-$

Overall reaction $\rightarrow 2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$

89. Answer (4)

Hint & Sol.: Vapour phase refining is the method in which metal is converted into its volatile compound which is collected and decomposed to give pure metal.

90. Answer (1)

Hint: More is the polarising power of cation, lesser will be ionic character.

Sol.: Smaller is the size of cation, more is the polarising power.

Order of ionic character $\rightarrow \text{CsH} > \text{NaH} > \text{LiH}$

91. Answer (2)

Hint & Sol.: 2-ethylantraquinol on reaction with oxygen gives hydrogen peroxide and oxidised product.

92. Answer (4)

Hint: Metal peroxide in presence of acidic medium gives hydrogen peroxide

Sol.: $2\text{H}_2\text{O}(\ell) \xrightarrow{\text{Electrolysis}} 2\text{H}_2 + \text{O}_2$

$\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$

$\text{Zn} + 2\text{NaOH} \longrightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$

$\text{BaO}_2 \cdot 8\text{H}_2\text{O(s)} + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4 + \text{H}_2\text{O}_2 + 8\text{H}_2\text{O}$

93. Answer (4)

Hint & Sol.: Greenhouse effect is shown by carbon dioxide, methane, ozone, CFCs and water vapour.

94. Answer (1)

Hint: Saccharin is the sweetest compound.

Sol.:

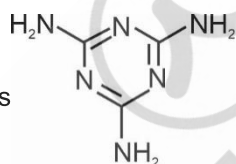
Artificial Sweetener	Sweetness value in comparison to cane sugar
Aspartame	100
Saccharin	550
Sucralose	600
Alitame	2000

95. Answer (4)

Hint & Sol.: • Veronal, Amytal and Luminal are derivatives of barbituric acid.
• Codeine is a narcotic analgesics.

96. Answer (3)

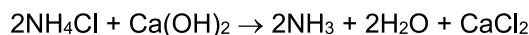
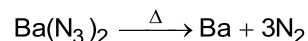
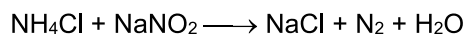
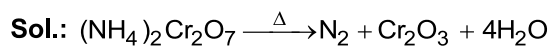
Hint: Structure of melamine is



Sol.: Number of nitrogen atoms in melamine is 6.

97. Answer (4)

Hint: Ammonia gas is evolved on reaction of NH_4Cl with base.



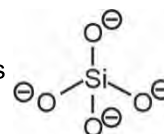
98. Answer (1)

Hint: More is the electronegativity of central atom, more is the basic nature of compound.

Sol.: Basicity order $\rightarrow \text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3$

99. Answer (1)

Hint: Basic structure of silicate is



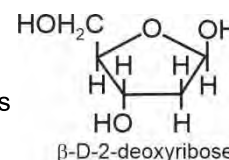
Sol.: • Basic structural unit of silicates is SiO_4^{4-}

• ZSM-5 is used to convert alcohols directly into gasoline.

100. Answer (1)

Hint: Sugar moiety in DNA molecule is β -D-2-deoxyribose

Sol.: Sugar moiety in DNA is



[BOTANY]

SECTION-A

101. Answer (2)

Hint: The historic Convention on Biological Diversity ('The Earth Summit') was held in Rio de Janeiro in 1992.

Sol.: The World Summit on Sustainable Development was held in 2002 in Johannesburg, South Africa.

102. Answer (4)

Hint: Secondary pollutants are formed by the reactions of primary pollutants in the environment.

Sol.: Ozone (O_3) is a secondary pollutant.

103. Answer (4)

Hint: The core zone of biosphere reserve is legally protected and no human activity is allowed.

Sol.: The buffer zone surrounds the core area, and is managed to accommodate a greater research and educational activities.

104. Answer (3)

Hint: In integrated organic farming waste products from one process are cycled in as nutrients for other processes.

Sol.: Integrated organic farming allows the maximum utilisation of resources and increases the efficiency of production.

105. Answer (2)

Hint: Over half of the e-wastes generated in the developed countries are exported to developing countries.

Sol.: Incineration is crucial to dispose hospital waste.

106. Answer (3)

Hint: Garbage generated can be sorted on the basis of their degradability and whether they can be recycled or not.

Sol.: The biodegradable materials can be put into deep pits in the ground and be left for natural breakdown, that leaves only the non-biodegradable to be disposed off.

107. Answer (2)

Hint: In India, the Air (Prevention and Control of Pollution) Act came into force in 1981.

Sol.: Water (Prevention and control of pollution) Act → 1974.

Environment (protection) Act → 1986.

108. Answer (3)

Hint: Presence of large amounts of nutrients in water causes excessive growth of planktonic (free-floating) algae is called an algal bloom.

Sol.: Algal bloom cause deterioration of the water quality and fish mortality.

109. Answer (2)

Hint: Bharat stage II is equivalent Euro-II norms.

Sol.: Euro III norms stipulate that sulphur be controlled at 350 parts-per-million (ppm) in diesel and 150 ppm in petrol.

110. Answer (3)

Hint: In an aquatic food chain, the concentration of DDT is increased at successive trophic levels.

Sol.: DDT concentration starts at 0.003 ppb (ppb = parts per billion) in water, it can ultimately reach 25 ppm (ppm = parts per million) in fish-eating birds, through biomagnification.

In large fish the concentration of DDT is 2 ppm.

111. Answer (2)

Hint: Increase in concentration of the toxicant at successive trophic levels is called biomagnification.

Sol.: Pollutants from man's activities like effluents from the industries and homes can radically accelerate the aging process of lake. This phenomenon has been called Cultural or Accelerated Eutrophication.

112. Answer (1)

Hint: Lead in the petrol inactivates the expensive metals used in catalytic converter.

Sol.: Steps taken in Delhi for reducing vehicular pollution include phasing out of old vehicles, use of unleaded petrol, use of low-sulphur petrol and diesel, use of catalytic converters in vehicles.

113. Answer (2)

Hint: Noise causes sleeplessness and stress.

Sol.: Noise causes sleeplessness, increased heart beat, altered breathing pattern, thus considerably stressing humans.

114. Answer (4)

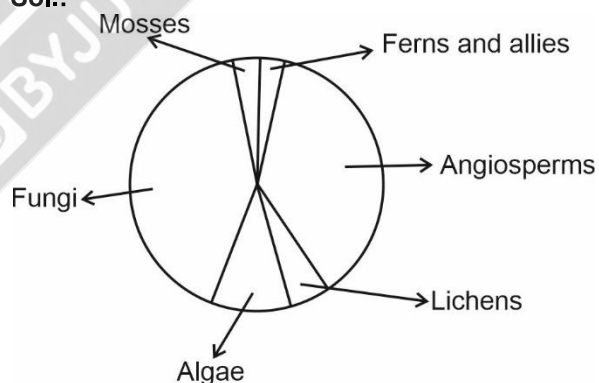
Hint: Aravalli hills are found in Rajasthan.

Sol.: The sacred groves are found in Khasi and Jaintia hills in Meghalaya and Aravalli hills of Rajasthan.

115. Answer (2)

Hint: Fungi and angiosperms are most in number among plant global biodiversity.

Sol.:



116. Answer (2)

Hint: Tropical environments are relatively more constant and predictable.

Sol.: Tropical environments unlike temperate ones, are less seasonal.

117. Answer (4)

Hint: Ecosystem with more species shows less year to year variation in total biomass.

Sol.: A stable community should not show too much variation in productivity from year to year.

118. Answer (4)

Hint: 32 percent of all amphibian species and 31 percent of all gymnosperms species in the world face the threat of extinction.

Sol.: 12 percent of all bird species and 23 percent of all mammal species in the world face the threat of extinction.

119. Answer (2)

Hint: Quagga became extinct from South Africa.

Sol.: Bali, Javan and Caspian are the subspecies of tiger.

120. Answer (3)

Hint: There is no respiratory release of phosphorus into atmosphere.

Sol.: The gaseous exchange of phosphorus between organism and environment are negligible.

121. Answer (1)

Hint: In upright pyramid, producers are more in number and biomass than the herbivores, and herbivores are more in number and biomass than the carnivores.

Sol.: Upright pyramid of biomass shows a sharp decrease in biomass at higher trophic levels.

122. Answer (2)

Hint: Plants capture only 2-10 percent of the PAR

Sol.: The producers in an aquatic ecosystem are various species like phytoplanktons, algae and higher plants.

123. Answer (4)

Hint: Lignin is resistant to degradation by most microbes.

Sol.: Decomposition rate is quicker if detritus is rich in nitrogen and water-soluble substances like sugars.

124. Answer (2)

Hint: Light penetration is difficult in deep sea.

Sol.: Sun is the only source of energy for all ecosystems on earth except for the deep sea hydro-thermal ecosystem.

125. Answer (4)

Hint: The annual Net Primary Productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter.

Sol.: The annual NPP of the oceans are only 55 billion tons.

126. Answer (1)

Hint: Net primary productivity is the available biomass for the consumption to heterotrophs.

Sol.: Gross primary productivity minus respiration losses (R) is the net primary productivity. NPP is the available biomass for the consumption to heterotrophs.

127. Answer (2)

Sol.: Pond, lake, wetland, river and estuary are some examples of aquatic ecosystems.

128. Answer (3)

Hint: The interaction in which both species benefits is called mutualism.

Sol.: The cattle egret and grazing cattle in close association is a classic example of commensalism.

129. Answer (2)

Hint: In amensalism, one species is harmed whereas the other remains unaffected.

Sol.: In predation, only one species benefits and the interaction is detrimental to the other species.

Both the species are benefited in mutualism and both loses in competition with each other.

130. Answer (1)

Hint: Desert plants have cuticle to minimise water loss through transpiration.

Sol.: Many deserts plants have a thick cuticle on their leaf surfaces to minimise water loss.

131. Answer (4)

Hint: Natality refers to the number of births during a given period. Mortality is the number of deaths in a population.

Sol.: Mortality and emigration contribute to a decrease in population density in a given habitat during a given period.

132. Answer (3)

Hint: Verhulst Pearl Logistic growth curve shows initially a lag phase, followed by a phase of acceleration then deceleration and finally asymptote.

Sol.: Since resources for growth for most animal populations are finite and become limiting sooner or later.

The logistic growth model is considered a more realistic one.

A population growing in a habitat with limited resources shows initially a lag phase.

133. Answer (3)

Hint: The logistic growth model is represented by a sigmoid curve.

Sol.: The exponential growth pattern of a population results in a J-shaped curve when we plot population growth (N) in relation to time (t).

134. Answer (2)

Hint: Maximum sunlight is received by the equator of earth.

Sol.: The average temperature on land decreases progressively from the equator towards the poles.

135. Answer (3)

Hint: Some organisms might avoid the stress by escaping in time for example, bear shows hibernation (winter sleep).

Sol.: Under unfavourable conditions, many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

SECTION-B

136. Answer (1)

Hint: Zoological parks, botanical gardens and wildlife safari parks are *ex-situ* conservation approach of biodiversity.

Sol.: Biosphere reserves, national parks and wildlife sanctuaries are *in-situ* conservation approach of biodiversity.

137. Answer (3)

Hint: Carbon dioxide and methane are commonly known as greenhouse gases.

Sol.: The relative contribution of various greenhouse gases to total global warming is

CO₂ – 60%, CH₄ – 20%
CFCs – 14%, N₂O – 6%

138. Answer (3)

Hint: One of the major effects of deforestation is enhanced carbon dioxide concentration in the atmosphere.

Sol.: Deforestation also causes loss of biodiversity due to habitat destruction, disturbs hydrologic cycle, causes soil erosion, and may lead to desertification in extreme cases.

139. Answer (1)

Hint: It disturbs balance between production and degradation of ozone in the stratosphere.

Sol.: CFCs are widely used as refrigerants.

140. Answer (1)

Hint: World Earth Day – 22nd April.

World Environment Day – 5th June

Sol.: World Ozone Day – 16th September

Nagasaki Day – 9th August

141. Answer (2)

Hint: A single species might show high diversity at the genetic level over its distributional range.

Sol.: India has more than 50,000 genetically different strains of rice and 1,000 varieties of mango.

142. Answer (3)

Hint: Hotspots biodiversity is conserved and protected at all levels.

Sol.: Conservationists identified for maximum protection certain 'biodiversity hotspots' regions with very high levels of species richness and high degree of endemism. It constitutes the *in-situ* conservation approach.

Hotspots are regions of accelerated habitat loss.

143. Answer (3)

Hint: The number of trophic level in the grazing food chain is restricted as the transfer of energy follows 10 percent law.

Sol.: Only 10 percent of the energy is transferred to each trophic level from the lower trophic level.

144. Answer (4)

Hint: Based on the source of their nutrition or food, organisms occupy a specific place in the food chain that is known as their trophic level.

Sol.: Producers belong to the first trophic level, herbivores (primary consumer) to the second and carnivores (secondary consumer) to the third. Tertiary consumer belongs to fourth trophic level.

145. Answer (2)

Hint: Decomposers meet their energy and nutrient requirements by degrading dead organic matter or detritus.

Sol.: DFC is made up of decomposers which are heterotrophic organisms, mainly fungi.

146. Answer (3)

Hint: During succession, some species colonise an area and their population become more numerous whereas populations of other species decline and even disappear.

Sol.: The gradual and fairly predictable change in the species composition of a given area is called ecological succession.

147. Answer (3)

Hint: Scrub stage precedes climax community.

Sol.: Rooted-floating plants are followed by free-floating plants, then Reed-Swamp, Marsh-

Meadow, Scrub and finally the trees. The climax would be a forest.

148. Answer (2)

Hint: In both parasitism and predation, only one species benefits and the interaction is detrimental to the other species.

Sol.: The interaction where one species is harmed and the other is neither benefitted nor harmed is called amensalism.

149. Answer (3)

Hint: In both the interactions one species benefits and the other is neither harmed nor benefitted.

Sol.: Examples of commensalism are

- The interaction between sea anemone that has stinging tentacles and the clown fish that lives among them.
- An orchid growing as an epiphyte on a mango branch.

150. Answer (1)

Hint: Parasites are adapted in various way to increase infection in host.

Sol.: Multiple hosts increases parasitisation.

[ZOOLOGY]

SECTION-A

151. Answer (4)

Hint: Present in pancreatic juice.

Sol.: (a) Plant cell wall – Cellulase

(b) Bacterial cell wall – Lysozyme

(c) Fungal cell wall – Chitinase

(d) RNA – Ribonuclease

152. Answer (3)

Hint: Protoxins are inactive

Sol.: The Bt toxin proteins exist as inactive protoxins, but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to alkaline pH of the gut which solubilise the crystals.

GM has been used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

153. Answer (4)

Hint: pBR322 is self replicating.

Sol.: Plasmids and bacteriophages have the ability to replicate within bacterial cells independent of the control of chromosomal DNA.

Normal *E.coli* cells do not carry resistance against antibiotics.

154. Answer (4)

Hint: Belongs to class VI of enzymes

Sol.: DNA ligase is a specific type of enzyme, that facilitates the joining of DNA strands together by catalysing the formation of phosphodiester bond.

Alkaline phosphatase removes the phosphate group from the 5' end of the DNA hence, prevents self-ligation.

DNA polymerases are a group of enzymes used to make copies of DNA templates, essentially used in DNA replication mechanism.

155. Answer (1)

Hint: Causative agent of typhoid

Sol.: Stanley Cohen and Herbert Boyer accomplished the construction of first rDNA by linking a gene encoding antibiotic resistance with a native plasmid (autonomously replicating circular extra-chromosomal DNA) of *Salmonella typhimurium*.

156. Answer (2)

Hint: Synonym of sequence

Sol.: The convention for naming restriction enzymes is the first letter of the name comes from the genus and the second two letters come from the species of the prokaryotic cell from which they were isolated, e.g., *EcoRI* comes from *Escherichia coli* RY 13. In *EcoRI*, the letter 'R' is derived from the name of strain. Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria.

157. Answer (1)

Hint: Factor of 4**Sol.:**

$$1 \text{ dsDNA} \xrightarrow{\text{PCR Cycle}} (2)^n \text{ dsDNA} = (2)^1 = 2 \text{ dsDNA}$$

$$\therefore 1 \text{ dsDNA} \xrightarrow{3 \text{ PCR Cycle}} (2)^n \text{ dsDNA} = (2)^3 = 8 \text{ dsDNA}$$

$$\text{and } 2 \text{ dsDNA} \xrightarrow{3 \text{ (PCR) Cycle}} 2 \times 8 \text{ dsDNA} = 16 \text{ dsDNA molecules}$$

158. Answer (4)

Hint: Bee-keeping

Sol.:

- Pisciculture refers to production of fishes only.
- Sericulture is the breeding and management of silkworm for production of silk.
- Aquaculture is breeding, raising and harvesting of aquatic plants and aquatic animals.

159. Answer (4)

Hint: Does not induce unwanted immunological responses

Sol.: Insulin was earlier extracted from pancreas of slaughtered pigs and cattles. Insulin is used to treat diabetes mellitus.

In ELISA, infection by pathogen can be detected either by the presence of antigens or by detecting antibodies synthesised against the pathogen.

About 30 recombinant therapeutics have been approved for human-use the world over. In India, 12 of these are presently being marketed.

160. Answer (4)

Hint: Pathogen of dicot plants

Sol.:

- Using *Agrobacterium* vectors, nematode specific genes were introduced into the tobacco plants.
- Retroviruses are used to deliver desirable genes into animal cells.

161. Answer (3)

Hint: HIV belongs to this category

Sol.:

- Microinjection – rDNA is directly injected into nucleus of an animal cell
- Biolistic or gene gun – suitable for plants

162. Answer (4)

Hint: Present in prokaryotes

Sol.: Plasmid is an autonomously replicating double-stranded circular extra-chromosomal DNA.

163. Answer (4)

Hint: Same as that of head of lipids

Sol.: DNA is a hydrophilic molecule whereas cell membrane is lipophilic. So, DNA molecule cannot pass through cell membranes.

164. Answer (3)

Hint: pBR322 is isolated from this.

Sol.: 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. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin.

165. Answer (1)

Hint: Overhanging stretches

Sol.: The recognition sequence of *EcoRI* is 5' GAATTC3'.

EcoRI cuts the DNA between bases G and A only where the sequence GAATTC is present. It produces sticky ends.

166. Answer (4)

Hint: Also beneficial for crop yield production

Sol.: Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the crop yield and honey yield.

167. Answer (3)

Hint: Follicular maturation

Sol.: **Multiple Ovulation Embryo Transfer Technology** (MOET) is one such programme for herd improvement. In this method, a cow is administered hormones, with FSH-like activity, to induce follicular maturation and super ovulation – instead of one egg, which they normally yield per cycle, they produce 6-8 eggs. The animal is either mated with an elite bull or artificially inseminated. The fertilised eggs at 8–32 cells stages, are recovered non-surgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

168. Answer (3)

Hint: Between two different species

Sol.: Inbreeding: Mating of more closely related animals within the same breed for 4-6 generations.

Out-crossing : Mating of animals within the same breed, but having no common ancestors on either side of their pedigree for upto 4-6 generations.

Cross-breeding : Superior males of one breed are mated with superior females of another breed.

Interspecific hybridisation : Mating of male and female animals of two different related species e.g., Mule.

169. Answer (4)

Hint: Common carp belongs to the same category

Sol.: Marine water fishes : Sardines, Mackerel, Pomfrets and *Hilsa*.

Fresh water fishes : *Rohu*, *Catla* and common carp.

170. Answer (4)

Hint: Pest resistant crop

Sol.: The proteins encoded by the genes *cryIAc* and *cryIIAb* control the cotton bollworms, that of *cryIAb* controls corn borer.

RNAi is used as method of cellular defence in eukaryotes. PCR stands for Polymerase Chain Reaction.

171. Answer (3)

Hint: Exclude downstream processing

Sol.: A stirred-tank reactor is usually cylindrical or with a curved base to facilitate the mixing of the reactor contents. The stirrer facilitate even mixing and oxygen availability throughout the bioreactor.

Downstream processing include separation and purification.

172. Answer (2)

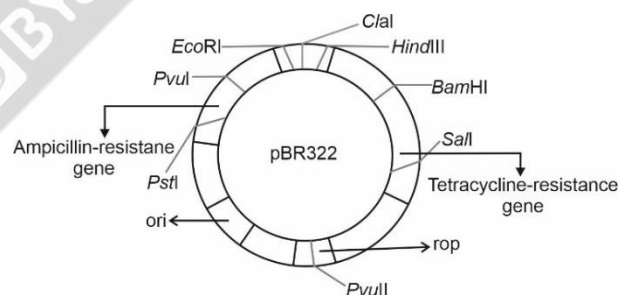
Hint: Multiple of 3

Sol.: Basmati rice is distinct for its unique aroma and flavour and 27 documented varieties of Basmati are grown in India.

173. Answer (2)

Hint: Replication starts from this sequence

Sol.:



- *ori* is responsible for controlling the copy number of the linked DNA.

174. Answer (4)

Hint: Two carbon compound

Sol.: To obtain purified DNA, specific cells are treated with specific enzymes.

After the activity of enzymes, all other molecules can be removed by appropriate treatments.

The purified DNA is then precipitated out after addition of chilled ethanol.

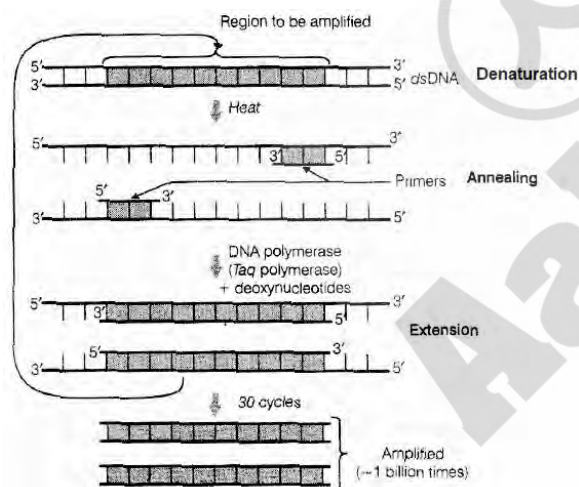
175. Answer (1)

Hint: Mosquitoes belong to the same category**Sol.:** Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes).

176. Answer (2)

Hint: Intercalating agent**Sol.:** The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).

177. Answer (2)

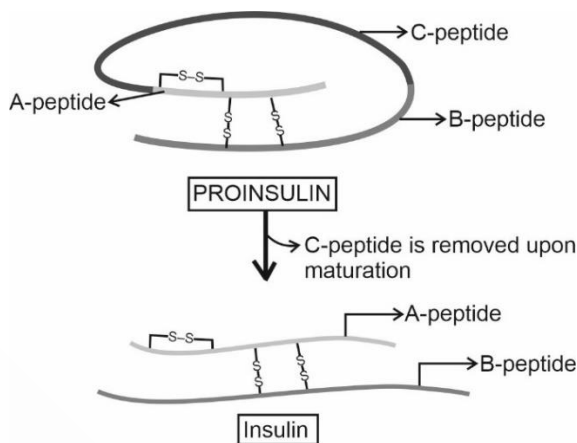
Hint: The first step involves breaking of H-bonds**Sol.:**

178. Answer (2)

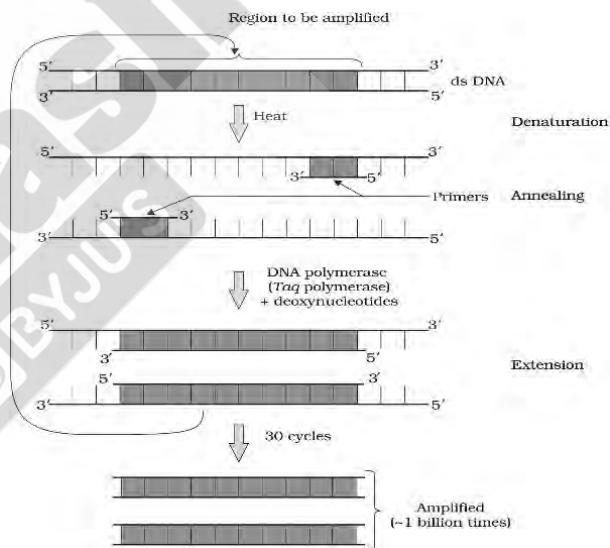
Hint: Sticky ends**Sol.:**

Enzyme	Microbial origin	Recognition site	Type of ends after restriction enzyme digestion
Bam HI	<i>Bacillus amyloliquefaciens</i>	5'-G↓G-A-T-C-C-3' 3'-C-C-T-A-G-G-5'	Sticky ends
Eco RI	<i>Escherichia coli</i>	5'-G-A-A-T-C-3' 3'-C-T-T-A-A-G-5'	Sticky ends
Hind III	<i>Haemophilus influenzae</i>	5'-A-A-G-C-T-T-3' 3'-T-T-C-G-A-A-5'	Sticky ends
Pst I	<i>Providencia stuartii</i>	5'-C-T-G-A-G-3' 3'-G-A-C-G-T-C-5'	Sticky ends
SaI I	<i>Streptomyces albus</i>	5'-G-T-C-A-A-C-3' 3'-C-A-G-C-T-G-5'	Sticky ends
Sma I	<i>Serratia marcescens</i>	5'-C-C-C-G-G-3' 3'-G-G-G-C-C-5'	Blunt ends

179. Answer (4)

Hint: Number of ear ossicles in each ear**Sol.:**

180. Answer (1)

Hint: Sample is heated to 72°C**Sol.:**

181. Answer (4)

Hint: The year in which transgenic cow was created.**Sol.:** In 1997, an American company got patent rights on Basmati rice through the US patent and Trademark Office. This allowed the company to sell a 'new' variety of Basmati, in the US and abroad.

Indian government has set up organisations such as GEAC, which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

182. Answer (2)

Hint: Months in a year**Sol.:** In 1997, the first transgenic cow, Rosie, produced human α -lactalbumin enriched milk (2.4 grams per litre).Hence, 5 litres of Rosie cow's milk contain 5×2.4 grams i.e., 12 grams of human α -lactalbumin protein.

183. Answer (2)

Hint: 1 dsDNA $\xrightarrow{1 \text{ PCR cycle}}$ 2 dsDNA**Sol.:** **ELISA** $\rightarrow$

Enzyme Linked Immuno-Sorbent Assay is based on the principle of antigen-antibody interaction. It is a widely used diagnostic test for AIDS.

PCR $\rightarrow$

Polymerase Chain Reaction is a technique which is used for DNA amplification. It was developed by Kary Mullis.

1 ds DNA $\xrightarrow{'n' \text{ PCR cycles}}$ $(2)^n$ ds DNA**Probe** $\rightarrow$

A single stranded DNA/RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography.

Magnetic resonance imaging (uses non-ionising radiations) is used to diagnose cancer of internal organs.

184. Answer (3)

Hint: Ultimate aim of recombinant DNA technology**Sol.:** Selectable marker is one of the feature of vector, which helps in identifying and eliminating non-transformants and selectively permitting the growth of transformants.

185. Answer (3)

Hint: In case of drugs, clinical trials are carried out**Sol.:** After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product. The processes include separation and purification, which are collectively referred to as downstream processing. The product has to be formulated with suitable preservatives.**SECTION-B**

186. Answer (4)

Hint: Electrophoresis

- Sol.:**
- Restriction enzymes (molecular scissors) belongs to a larger class of enzymes called nucleases.
 - The separated bands of DNA via gel electrophoresis are cut out from the agarose gel and extracted from the gel piece. This step is known as elution.

187. Answer (3)

Hint: Prevent translation**Sol.:** A nematode, *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield.

RNAi takes place in all eukaryotic organisms as a method of cellular defense.

The source of complementary RNA could be from an infection by viruses having RNA genomes.

188. Answer (2)

Hint: Obtained from transgenic sheep

- Sol.:**
- Human protein (α -1-antitrypsin) is used to treat emphysema.
 - In 1997, the first transgenic cow, Rosie, produced human protein-enriched (alpha-lactalbumin) milk.
 - Globulins are present in blood plasma and participate in immune system.
 - Casein is a milk protein

189. Answer (3)

Hint: Involved in water absorption**Sol.:** A nematode, *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield.

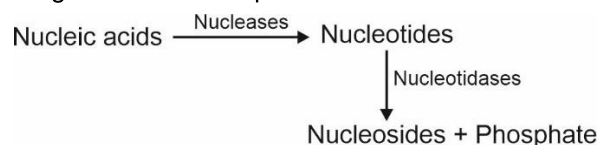
190. Answer (3)

Hint: Delivers the T-DNA into plant cells**Sol.:** *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.

It is called natural genetic engineer of plants.

Rice is a monocot plant.

191. Answer (2)

Hint: Present in saliva**Sol.:** Chitinase is used to degrade the cell wall of fungus which is composed of chitin.

Lysozyme is used to degrade the cell wall of bacteria which is composed of peptidoglycans.

192. Answer (4)

Hint: *Bam*HI and *Sal*I are present on same gene.**Sol.:** If a foreign DNA is ligated at *Bam*HI site of tetracycline resistance gene in the vector pBR322, the recombinant plasmids will lose the tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on tetracycline containing medium. In this case, one antibiotic resistance gene (ampicillin) helps in selecting the transformants whereas the other antibiotic resistance gene (tetracycline) gets 'inactivated due to insertion' of alien DNA, and helps in selection of recombinants.

193. Answer (4)

Hint: Ethidium bromide is used**Sol.:** The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique called gel electrophoresis.

The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation.

194. Answer (4)

Hint: *cry*I_{Ac} controls the cotton bollworms.**Sol.:** The proteins encoded by the genes *cry*I_{Ac} and *cry*II_{Ab} control the cotton bollworms, that of *cry*I_{Ab} control corn borer.

195. Answer (2)

Hint: Direct method of transformation**Sol.:** In micro-injection, rDNA is directly injected into the nucleus of an animal cell.

In gene gun/biolistics, suitable for plants, cell are bombarded with high velocity micro-particles of gold or tungsten coated with DNA.

196. Answer (3)

Hint: Discovery of Alexander Fleming**Sol.:** With fed-batch culture more control of the process is involved than with batch culture. The process is commonly used to produce penicillin and in baking industry.

197. Answer (4)

Hint: Culture followed by extraction**Sol.:** Recombinant DNA technology involves several steps in 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 recombinant DNA into the host, culturing the host cells in a medium at large scale and extraction of the desired product.

198. Answer (4)

Hint: Evolve a pureline**Sol.:** When breeding is between animals of the same breed for upto 4-6 generations it is called inbreeding. Inbreeding increases homozygosity.

A single outcross can overcome the inbreeding depression.

199. Answer (4)

Hint: GM crops can be made tolerant to cold.**Sol.:** Genetic modifications in the plants have made the crops more tolerant to abiotic stresses and also increased the efficiency of mineral usage by plants.

200. Answer (1)

Hint: In bacteriophage lambda, insert size is 9-23 kb.**Sol.:** Plasmids and bacteriophages have the ability to replicate within bacterial cells.

Bacteriophages because of their high number per cell, have very high copy numbers of their genome within the bacterial cells.

