

All India Aakash Test Series for NEET - 2020

TEST - 4 (Code-A)

Test Date : 08/12/2019

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint and Sol. : Light of all wavelengths in vacuum travel with same speed, so

$$c \propto \lambda^0$$

2. Answer (3)

Hint : Momentum of photon $p = \frac{E}{c}$

Sol. : Energy of photon = 3 MeV
 $= 3 \times 1.6 \times 10^{-13}$ joule

$$p = \frac{E}{c} = \frac{3 \times 1.6 \times 10^{-13}}{3 \times 10^8}$$

$$p = 1.6 \times 10^{-21} \text{ kg m/s}$$

3. Answer (4)

Hint : Energy of photon = $\phi_0 + eV_0$

Sol. : Work function of surface = 5.1 eV
 Energy of incident photons = (5.1 + 6) eV
 $= 11.1$ eV

$$\text{Wavelength of photons} = \frac{12400}{11.1} \text{ \AA}$$

$$\approx 1117 \text{ \AA}$$

Wavelength 1117 Å lies in ultraviolet region.

4. Answer (1)

Hint : Maximum kinetic energy of photo electron
 $= eV_c$

Sol. : Work function of surface = $h\nu_0$
 $= \frac{6.6 \times 10^{-34} \times 5 \times 10^{14}}{1.6 \times 10^{-19}}$
 $= 2.06$ eV

Wavelength of incident radiation = 4000 Å

$$\text{Energy of incident radiation} = \frac{12400}{4000} = 3.1 \text{ eV}$$

Energy of photon = $+ eV_c$

$$3.1 = 2.06 + eV_c$$

$$eV_c = 1.04 \text{ eV}$$

$$V_c = 1.0 \text{ V}$$

5. Answer (3)

Hint : $h\nu = \frac{1}{2}mv^2 + \phi$

Sol. :

$$\text{Case - I : } h\nu = \frac{1}{2}mv_1^2 + \phi \quad \dots(i)$$

$$\text{Case - II : } 4h\nu = \frac{1}{2}mv_2^2 + \phi \quad \dots(ii)$$

Divide (i) by (ii)

$$\frac{h\nu}{4h\nu} = \frac{mv_1^2 + 2\phi}{mv_2^2 + 2\phi}$$

$$4mv_1^2 + 8\phi = mv_2^2 + 2\phi$$

$$v_2^2 = 4v_1^2 + \frac{6\phi}{m}$$

$$v_2 > 2v_1$$

6. Answer (2)

Hint : Kinetic energy of charged particle = qV

$$\text{Sol. : de-Broglie wavelength } \lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$$

$$\text{For deuteron } ({}_1\text{H}^2) \lambda_D = \frac{h}{\sqrt{2qV(2m)}}$$

$$\text{For } \alpha\text{-particle } ({}_2\text{He}^4) \lambda_\alpha = \frac{h}{\sqrt{2(2q)V(4m)}}$$

$$\frac{\lambda_D}{\lambda_\alpha} = \frac{2}{1}$$

7. Answer (1)

Hint and Sol. : Point source is placed at focus of convex lens, so after refraction light rays become parallel. Hence on changing the distance, there is no change in number of photons striking on photocell. So saturated current and cut-off potential remains same.

8. Answer (2)

Hint and Sol. : Stopping potential is greater for b than a it means $v_b > v_a$. Saturation photo current is same for a and b it means $I_a = I_b$

9. Answer (4)

Hint and Sol. : One of the electrons enters in magnetic field, so there is no change in magnitude of linear momentum. Hence λ_1 remains same. While second electron enters in electric field, and it will accelerate, so its magnitude of momentum may increase, decrease or at some instant may be equal to the first electron. Hence λ_1 may be greater than equal or less than λ_2 .

10. Answer (3)

Hint : In electric fields particle will accelerate so its momentum will change.**Sol. :** Electric force on charge $\vec{F} = qE\hat{i}$ Acceleration of charge $\vec{a} = \frac{qE}{m}\hat{i}$ Velocity along x-axis v_x (as a function of time)

$$= \frac{qE}{m}t$$

$$\frac{h}{3mv_0} = \frac{h}{\sqrt{(mv_0)^2 + (qEt)^2}}$$

$$9m^2v_0^2 = m^2v_0^2 + q^2E^2t^2$$

$$8m^2v_0^2 = q^2E^2t^2$$

$$t = \frac{2\sqrt{2}mv_0}{qE}$$

11. Answer (1)

Hint : Einstein's equation of photoelectric effect.

$$\text{Sol. : } eV_0 = \frac{hc}{\lambda} - w$$

$$\text{Case - I : } 3eV_0 = \frac{hc}{\lambda} - w \quad \dots(i)$$

$$\text{Case - II : } eV_0 = \frac{hc}{2\lambda} - w \quad \dots(ii)$$

Multiply equation (ii) with 3 and subtract equation (i)

$$\frac{hc}{2\lambda} - 2w = 0 \Rightarrow 2w = \frac{hc}{2\lambda}$$

$$\Rightarrow 2\frac{hc}{\lambda_0} = \frac{hc}{2\lambda}$$

$$\Rightarrow \lambda_0 = 4\lambda$$

12. Answer (3)

Hint : Total energy of electron in any orbit is half of potential energy.

$$\text{Sol. : Total energy of electron } E_{\text{Tot}} = -\frac{1}{4\pi\epsilon_0} \frac{Ze^2}{2r_n}$$

$$\text{Potential energy of electron } E_{\text{Pot}} = -\frac{1}{4\pi\epsilon_0} \frac{Ze^2}{r_n}$$

$$E_{\text{Pot}} : E_{\text{Tot}} = 2 : 1$$

13. Answer (2)

Hint and Sol. : Absorption of energy is possible only from ground state $n = 1$. So in absorption spectrum possible spectral lines are 3.

14. Answer (1)

Hint and Sol. : Intensity of x-rays depends on number of photons, which depends on number of electrons striking at target. The number of electrons can be increased by increasing current in filament.

15. Answer (3)

Hint : The radius of Bohr orbit of hydrogen like

$$\text{element is } r_n = 0.529 \frac{n^2}{Z} \text{ \AA}$$

Sol. : Radius of first orbit of hydrogen

$$r_1 = 0.529 \text{ \AA}$$

Radius of second orbit of helium ion

$$r_2 = \frac{0.529 \times 4}{2} \text{ \AA}$$

$$= 1.058 \text{ \AA}$$

$$= 10.58 \times 10^{-11} \text{ m}$$

16. Answer (1)

Hint : Speed of electron in any orbit $v_n \propto \frac{Z}{n}$

$$\text{Radius of Bohr orbit } r_n \propto \frac{n^2}{Z}$$

$$\text{Sol. : } v_n = r_n \omega_n$$

$$\frac{\omega_n}{v_n} = \frac{1}{r_n}$$

$$\frac{\omega_n}{v_n} \propto \frac{1}{n^2}$$

17. Answer (4)

Hint and Sol. : Wavelength of first line of Balmer series.

$$\frac{1}{\lambda_B} = R \left[\frac{1}{2^2} - \frac{1}{3^2} \right]$$

$$= R \left[\frac{1}{4} - \frac{1}{9} \right] = \frac{5R}{36}$$

Wavelength of second line of Lyman series.

$$\frac{1}{\lambda_L} = R \left[\frac{1}{1^2} - \frac{1}{9} \right] = \frac{8R}{9}$$

$$\frac{\lambda_B}{\lambda_L} = \frac{32}{5}$$

18. Answer (3)

Hint and Sol. : Average mass density

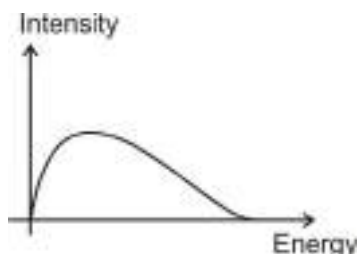
$$d = \frac{M}{V} = \frac{Am_P}{\frac{4}{3}\pi R^3}$$

$$R = R_0 A^{\frac{1}{3}}$$

$$d = \frac{3Am_P}{4\pi R_0^3 A}$$

$$d \propto A^0$$

19. Answer (3)

Hint and Sol. :

β -particle of all the energies from 0 to a certain maximum value emitted from same element. So spectrum is continuous spectrum.

20. Answer (2)

Hint and Sol. : Nuclear forces between two nucleons having like spin is different than those having unlike spin, so nuclear forces are spin dependent.

21. Answer (3)

Hint and Sol. : 1 atomic mass unit = $\frac{1}{12}$ [mass of one ${}^6\text{C}^{12}$ carbon atom].

22. Answer (1)

Hint : In this process momentum remains constant.

Sol. : According to law of conservation of momentum

$$0 = m_1 \vec{v}_1 + m_2 \vec{v}_2$$

$$0 = m_1 v - m_2 (27v)$$

$$\frac{m_1}{m_2} = \frac{27}{1}$$

$$\frac{\frac{4}{3}\pi R_1^3}{\frac{4}{3}\pi R_2^3} = \frac{27}{1}$$

$$R_1 : R_2 = 3 : 1$$

23. Answer (2)

Hint : Energy will be released in nuclear reaction, when energy of product nuclei is greater than the energy of reactant nuclei

Sol. : Energy of product nuclei = $4c$

Energy of reactant nuclei = $(a + 3b)$

$$\begin{aligned} \text{Energy released} &= 4c - (a + 3b) \\ &= 4c - a - 3b \end{aligned}$$

24. Answer (3)

Hint and Sol. : As the mass of radioactive sample is increased, then number of nuclei will also increase, so activity will increase. Decay constant is the property of element, so it remains same.

25. Answer (1)

Hint : Mean life $\tau = 1.44 T_{1/2}$

$$\text{Sol. : Initial value} = 50\% N_0 = \frac{50}{100} N_0 = \frac{N_0}{2}$$

$$\text{Remaining value} = 3.125\% N_0 = \frac{3.125}{100} N_0 = \frac{N_0}{32}$$

$$N = N_0 \left(\frac{1}{2}\right)^n$$

$$\frac{N_0}{32} = \frac{N_0}{2} \left(\frac{1}{2}\right)^n$$

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

$$\text{Half life of element} = \frac{40}{4} = 10 \text{ s}$$

$$\text{Mean life} = 10 \times 1.44 = 14.4 \text{ s}$$

26. Answer (2)

Hint and Sol. : Concentration of holes is greater than number of free electrons, so it is a P-type semiconductor.

27. Answer (3)

Hint and Sol. : As doping concentration increased width of depletion layer decreases.

28. Answer (4)

Hint and Sol. : A zener diode is highly doped and used in reverse biased.

29. Answer (4)

Hint and Sol. : Extrinsic semiconductors are also electrically neutral because they contain equal number of acceptors and donors.

30. Answer (3)

Hint and Sol. : In reverse bias the barrier potential ($V_0 + V_r$) becomes large. Therefore, the diffusion current is usually negligible for reverse bias.

31. Answer (4)

Hint and Sol. : In forward biases P-type is at high potential and n-type at low potential so diode in option (4) is forward biased.

32. Answer (4)

Hint and Sol. : Truth table of given circuit

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

The given truth table is for NAND gate.

33. Answer (3)

Hint : Power gain $P = \beta^2 \frac{R_L}{R_{in}}$

Sol. : $P = (5)^2 \left[\frac{2000}{10} \right] = 5000$

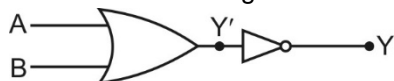
34. Answer (1)

Hint : When amplifiers are connected in series then resultant voltage gain $A = A_1 \times A_2$.**Sol. :** Net voltage gain $A = 20 \times 20 = 400$

35. Answer (1)

Hint and Sol. :

Truth table of NOR gate.



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

36. Answer (3)

Hint : The rate of disintegration of x_1 is more than x_2 .

Sol. : $N_{x_1} = N_0 e^{-10\lambda t}$

$$N_{x_2} = N_0 e^{-\lambda t}$$

$$\frac{N_{x_1}}{N_{x_2}} = \frac{e^{-10\lambda t}}{e^{-\lambda t}}$$

$$\frac{1}{e^3} = e^{-9\lambda t}$$

$$\frac{1}{e^3} = \frac{1}{e^{9\lambda t}}$$

$$e^{9\lambda t} = e^3$$

$$9\lambda t = 3$$

$$t = \frac{1}{3\lambda}$$

37. Answer (1)

Hint and Sol. :Energy released per fission = 200 MeV
= 3.2×10^{-11} J

Total energy produced per day

$$= 100 \times 10^6 \times 86400$$

$$= 8.64 \times 10^{12} \text{ J}$$

Number of fission per day = n

Efficiency of reactor = 80%

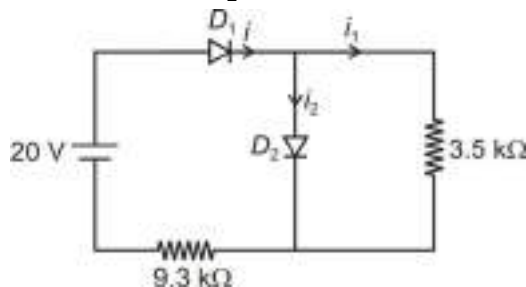
$$n \times 3.2 \times 10^{-11} \times \frac{80}{100} = 8.64 \times 10^{12}$$

$$n = \frac{8.64 \times 10^{12}}{3.2 \times 0.8 \times 10^{-11}} = 3.375 \times 10^{23}$$

$$\text{Mass of uranium} = \frac{235 \times 3.375 \times 10^{23}}{6.023 \times 10^{23}}$$

$$= 132 \text{ g (app.)}$$

38. Answer (1)

Hint and Sol. :Potential drop in $D_2 = 0.7$ V

$$\text{Current in } 3.5 \text{ k}\Omega = \frac{0.7}{3.5 \times 10^3} = 0.2 \text{ mA}$$

39. Answer (3)

Hint and Sol. : In common emitter amplifier input and output voltage are in opposite phase.

$$A = \frac{V_{out}}{V_{in}}$$

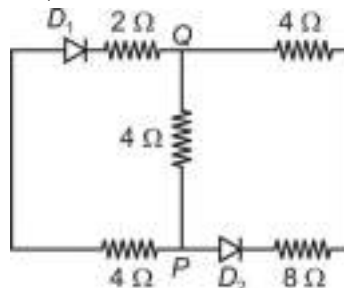
$$V_{out} = 0.04 \times 100 = 4 \text{ V}$$

$$V = (4 \text{ V}) \sin\left(\omega t + \frac{3\pi}{2}\right)$$

40. Answer (1)

Hint : Current will flow in junction diode when it is forward biased.**Sol. :** If P is at low potential and Q at high potential, then no diode will conduct, so

$$R_{PQ} = 4\Omega$$



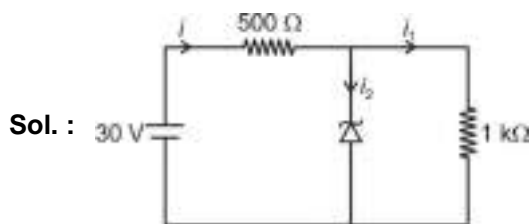
41. Answer (3)

Hint and Sol. : Diode is in forward bias, hence

$$I = \frac{(3-1)}{100} = 20 \text{ mA}$$

42. Answer (2)

Hint : Zener diode will conduct when potential difference across zener is more than break down voltage.



Sol. : Potential drop across dropping resistance = 20 V

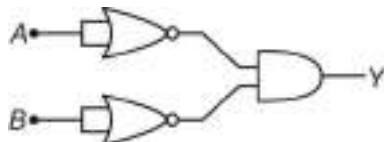
Current in dropping resistance $i = \frac{20}{500} = 40 \text{ mA}$

Current in 1 kΩ, $i_1 = \frac{10}{1000} = 10 \text{ mA}$

Current in zener diode = (40 – 10) mA
= 30 mA

43. Answer (2)

Hint and Sol. :



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

It is a NOR gate

44. Answer (1)

Hint : During α decay mass number decrease by 4 and no change in mass number during β decay.

Sol. : $4 \times n = 32$

$n = 8\alpha$

and 6β

45. Answer (2)

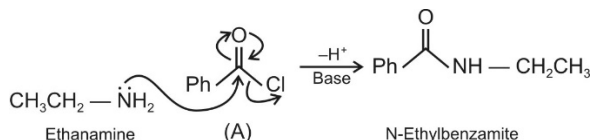
Hint and Sol. : Base in transistor is lightly doped and thin.

[CHEMISTRY]

46. Answer (4)

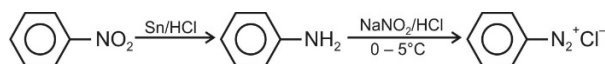
Hint : N-Ethylbenzamide is $\text{Ph}-\text{C}(=\text{O})\text{NH}-\text{CH}_2\text{CH}_3$

Sol. :

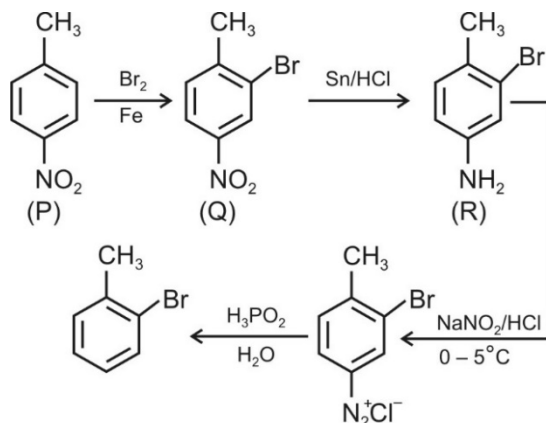


47. Answer (2)

Hint :



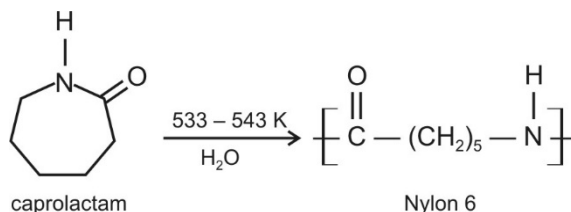
Sol. :



48. Answer (4)

Hint : Nylon 6 is a polyamide

Sol. :

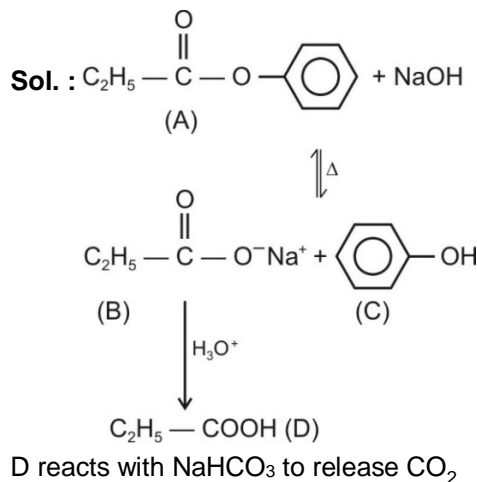


49. Answer (4)

Hint : $\text{CH}_3(\text{CH}_2)_{11}-\text{C}_6\text{H}_4-\text{SO}_3^+\text{Na}^-$
Sodium dodecylbenzenesulphonate

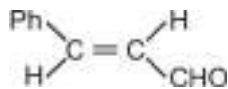
50. Answer (4)

Hint : Carboxylic acid is a stronger acid than carbonic acid.



51. Answer (4)

Hint : Cinnamaldehyde is an α, β unsaturated aromatic aldehyde.



52. Answer (1)

Hint : Homopolymers consist of only one type of monomeric species

Sol. :

Polymer	Monomer
PVC	Vinyl chloride
Teflon	Tetrafluoroethene
Neoprene	2-chloro-1,3-butadiene

53. Answer (4)

Hint : Polypropene is used in the manufacture of ropes.

Sol. : Polystyrene is used as insulator.

Urea-formaldehyde resin is used for making unbreakable cups and laminated sheets.

Bakelite (Polymer of phenol and formaldehyde) is used for making electrical switches)

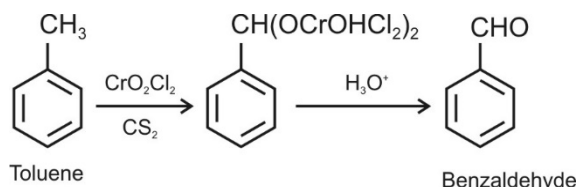
54. Answer (3)

Hint : Compounds in which carbonyl group is least hindered are found to be most reactive towards nucleophilic addition reaction.

Sol. : Carbonyl group in formaldehyde is least hindered.

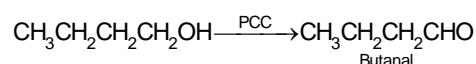
55. Answer (2)

Hint : CrO_2Cl_2 can be used to oxidise toluene to benzaldehyde.

Sol. :

56. Answer (2)

Hint : PCC is a mild oxidising agent.

Sol. :

57. Answer (2)

Hint :

Artificial sweetener	Sweetness value in Comparison to cane sugar
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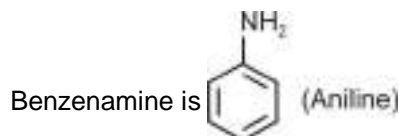
Aspartame	100
Saccharin	550
Sucralose	600
Alitame	2000

58. Answer (4)

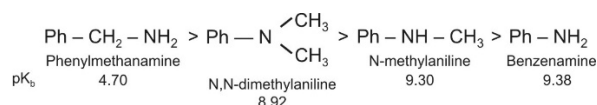
Hint : Xerophthalmia is the hardening of cornea of eye.

Sol. : This happens due to the deficiency of vitamin A.

59. Answer (2)

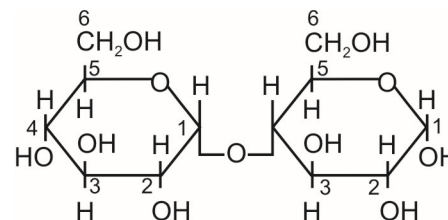
Hint :

Sol. : Order of basic character :



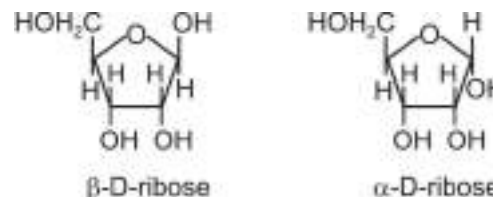
60. Answer (3)

Hint : In maltose, C-1 of one α -D-Glucopyranose is linked to C-4 of another α -D-Glucopyranose molecule by glycosidic linkage.

Sol. :

61. Answer (4)

Hint : D-ribose is in furanose form

Sol. :

62. Answer (4)

Hint : PHBV and Nylon-2-Nylon 6 are biodegradable polymer.

63. Answer (1)

Hint : Tranquilizers relieve or reduce the stress and anxiety.**Sol. :** Tranquilizers : Equanil, Phenelzine

64. Answer (4)

Hint : An elastomer involves weakest van der Waals interactions.**Sol. :** Buna-N is an elastomer

65. Answer (3)

Hint : $\text{H}_2\text{C}=\text{O}$ reacts with Br_2 water, NH_2OH , HCN **Sol. :** $\text{CH}_3\text{C}(\text{OH})_2\text{CH}_3$ reacts with acetic anhydride

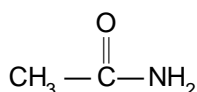
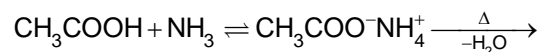
66. Answer (1)

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

67. Answer (3)

Hint : Albumin is a globular protein.**Sol. :** Globular proteins are usually soluble in water.

68. Answer (2)

Hint :Acetamide is $\text{CH}_3-\text{C}(=\text{O})-\text{NH}_2$ **Sol. :**

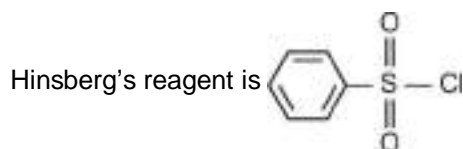
69. Answer (3)

Hint : Benzene diazonium chloride reacts with phenol and aniline in basic and acidic medium respectively.**Sol. :**

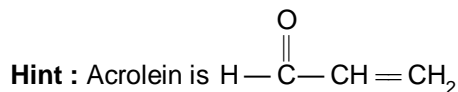
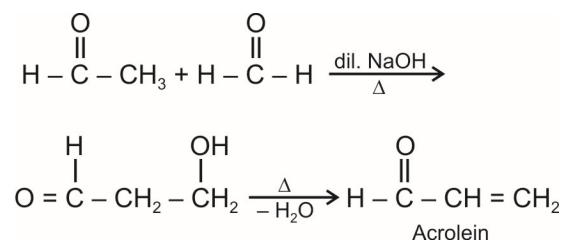
70. Answer (3)

Hint : Lower aliphatic amines are more soluble in water than higher aliphatic amines.**Sol. :** Solubility of amines in water decreases with increase in molar mass of amines due to increase in size of the hydrophobic alkyl part.

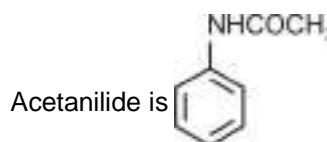
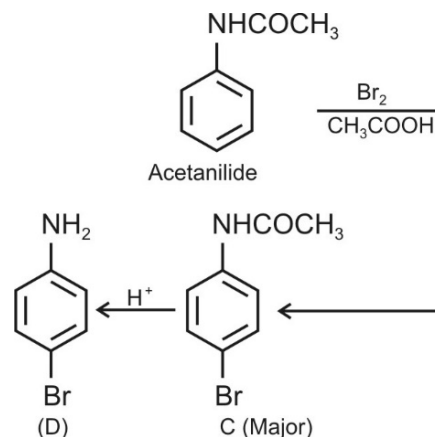
71. Answer (3)

Hint :**Sol. :** 2° -amine CH_3NHCH_3 reacts with Hinsberg's reagent (or, benzenesulphonyl chloride).

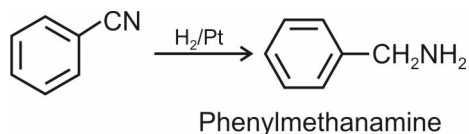
72. Answer (2)

**Sol. :**

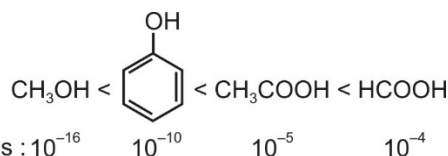
73. Answer (3)

Hint :**Sol. :**

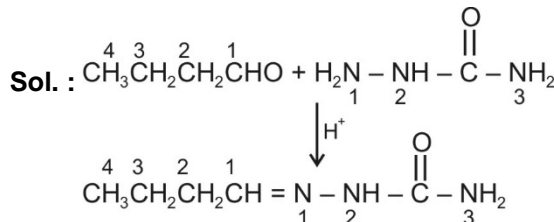
74. Answer (1)

Hint : Cyanide group (CN) is reduced into $-CH_2NH_2$ **Sol. :**

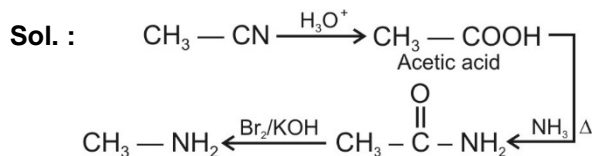
75. Answer (4)

Hint : Carboxylic acids are generally stronger acid than alcohols and phenols.**Sol. :**

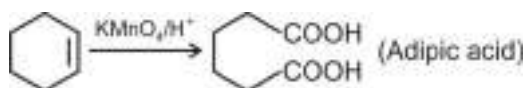
76. Answer (1)

Hint : Lone pairs of N2 and N3 are involve in resonance with keto group.

77. Answer (2)

Hint : Nitrile on complete hydrolysis, gives carboxylic acids.

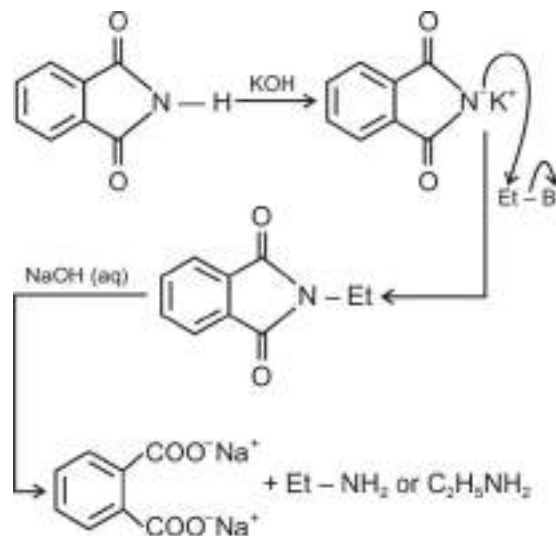
78. Answer (3)

Hint : Cleavage of $>C=C<$ take palce**Sol. :**

79. Answer (2)

Hint : B.P. of carboxylic acid is more than that of aldehydes with comparable molecular mass.**Sol. :** Formic acid exists as dimer in the vapour phase. Benzoic acid is nearly insoluble in cold water due to larger size of its hydrophobic ring. Acetic acid is miscible in water.

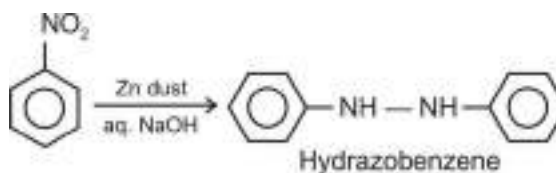
80. Answer (2)

Hint : Et-Br undergoes S_N2 reaction in Gabriel phthalimide synthesis of 1° amines.**Sol. :**

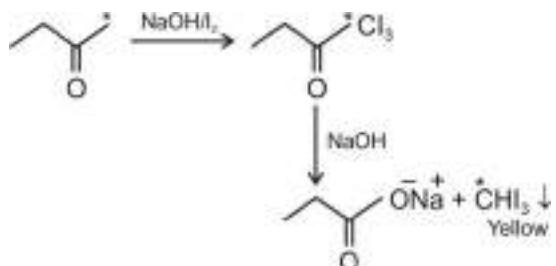
81. Answer (2)

Hint : During cannizzaro reaction, disproportionation of aldehydes takes place with conc. NaOH.**Sol. :** Aldehydes which do not have an α -hydrogen atom, undergo oxidation and reduction (disproportionation) reaction on heating with concentrated NaOH or KOH.**For example :** Formaldehyde, benzaldehyde.

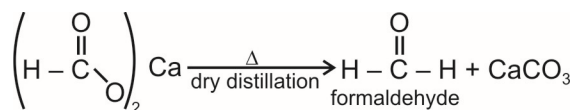
82. Answer (1)

Hint : Nitrobenzene gives different products in alkaline medium under different conditions.**Sol. :**

83. Answer (3)

Hint : This is an example of Iodoform test.**Sol. :**

84. Answer (1)

Hint :**Sol. :** Formaldehyde gives positive Tollens' test.

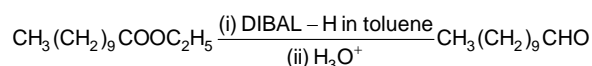
85. Answer (2)

Hint : Given carbohydrate is sucrose**Sol. :** Sucrose consists of α -D-glucose and β -D-fructose

86. Answer (1)

Hint : DNA contains four bases : A, G, C, T**Sol. :** DNA does not contain uracil (U)

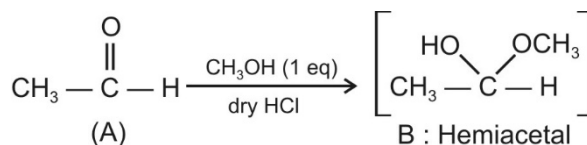
87. Answer (4)

Hint : Ester is reduced into aldehyde by using DIBAL – H

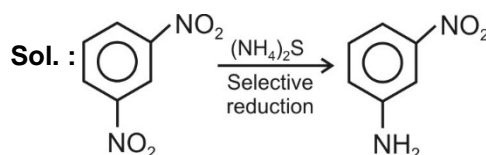
88. Answer (3)

Hint : Low density polythene is used in the insulation of electricity carrying wires.

89. Answer (3)

Hint : $\text{C}_2\text{H}_4\text{O}$ is an aldehyde.**Sol. :**

90. Answer (1)

Hint : Partial reduction take place

[BIOLOGY]

91. Answer (3)

Hint : Net primary productivity is the rate of organic matter build up or stored by producers in excess of respiratory utilization.**Sol. :** Net primary productivity (NPP) is the available biomass for the consumption of heterotrophs i.e. herbivores and decomposers. It depends upon various environmental factors. NPP of terrestrial ecosystems is generally higher than ocean.

92. Answer (2)

Hint : Decomposition process is slower when detritus contains complex and water-insoluble compounds.**Sol. :** Decomposition of detritus containing lignin, chitin and cellulose is slower. Process of decomposition requires aeration, activity of soil microbes, warm and moist soil.

93. Answer (1)

Hint : Stratification is vertical distribution of different species occupying different levels.**Sol. :** In a forest, vertical subdivision or strata are

- a. Trees – Top layer
- b. Shrubs – Second layer
- c. Grasses and herbs – Bottom layer

94. Answer (4)

Sol. : Detritus food chain begins with detritus or dead organic matter.

95. Answer (3)

Hint : In a food chain, transfer of energy at different trophic levels occur according to “10% law of energy transfer”.**Sol. :** If NPP is 2000 J then fixed energy in herbivores (primary consumer) is 200 J, secondary consumers 20 J, tertiary consumers 2 J.

96. Answer (2)

Hint : Plants capture approximately 1-5% of incident solar radiation for photosynthesis.**Sol. :** Plants capture 2-10% of PAR for synthesising their food.

97. Answer (2)

Sol. : Ecological pyramids accommodate a simple food chain not a food web. Saprophytes, decomposers and microbes are not given any place in ecological pyramid.

98. Answer (4)

Sol. : During succession, total biomass of the ecosystem increases.

99. Answer (3)

Sol. : For tree ecosystem, pyramid of number could be inverted or spindle shaped.

100. Answer (3)

Hint : Anthropogenic ecosystems are created and maintained by humans.

Sol. : Characteristics of anthropogenic ecosystem

- Low species diversity.
- High productivity.
- Presence of simple food chain.
- Absence of self regulatory mechanisms.
- Little cycling of nutrients.

101. Answer (4)

Hint : In secondary succession, pioneer community establishes with comparatively more ease.

Sol. : Secondary succession starts in areas that somehow lost all the living organisms that existed there. It has some soil or sediment existing at the site of succession. Here climax is also reached more quickly.

102. Answer (2)

Hint : In hydrarch succession, the successional series progress from hydric to mesic conditions.

Sol. : Transitional communities in hydrarch succession are –

Submerged plant stage → Submerged free-floating plant stage → Reed-swamp stage → Marsh-meadow stage → Scrub stage.

103. Answer (2)

Hint : Part of water soluble substances present in fragmented and decomposing detritus go down in soil horizon by percolating water is called leaching.

Sol. : During decomposition, fragmentation of detritus involves activity of detritivores while humification and mineralisation involve activity of saprophytic fungi and bacteria. Leaching process does not directly involve activity of living organisms.

104. Answer (4)

Sol. : Reservoir pool of a gaseous cycle is atmosphere or hydrosphere. Lithosphere or earth's crust is the reservoir pool for sedimentary cycle.

105. Answer (1)

Hint : Phosphorus cycle is a sedimentary cycle.

Sol. : There is no respiratory release of phosphorus into atmosphere by living organisms.

106. Answer (3)

Sol. : Humus is dark coloured, amorphous, more or less decomposed organic matter. It is slightly acidic and resistant to microbial action.

107. Answer (1)

Hint : India is on 8th rank among 12 megadiversity countries.

Sol. : India has only 2.4% of world's land area but it possesses 8.1% species diversity of the world.

108. Answer (3)

Sol. : Species area relationship of biodiversity was given by Alexander von Humboldt.

109. Answer (2)

Hint : Among the invertebrates, insects are the most species rich.

Sol. : In the given pie chart

A – Insects

B – Molluscs

C – Crustaceans

110. Answer (4)

Hint. : Biodiversity is important for ecosystem stability, productivity, resistance etc.

Sol. : Communities with more biodiversity are more stable and more resistant to natural disturbances, man-made disturbances and invasion by alien species. Rich biodiversity decreases year-to-year variations in productivity of an ecosystem.

111. Answer (3)

Sol. : Some examples of most recent extinctions are

Dodo – Mauritius

Quagga – Africa

Thylacine – Australia

Steller's sea cow – Russia

112. Answer (1)

Sol. : Cichlid fishes of Lake Victoria of East Africa are the native species of that area.

113. Answer (3)

Hint : Species with small population are more susceptible to extinction.

Sol. : Large body size, low reproductive rate, high trophic level in food chain, fixed habitat and migratory route are some characteristics of those species which are highly susceptible to extinction.

114. Answer (4)

Hint : *in-situ* conservation strategies are also called on-site conservation strategies.

Sol. : Hot-spots, national parks, sacred lakes and biosphere reserves are *in-situ* conservation strategies.

115. Answer (3)

Hint : Direct economic benefits derived from nature are called narrowly utilitarian benefits.

Sol. : Pollination, oxygen and aesthetic pleasure are broadly utilitarian benefits of ecosystem. Rest are narrow utilitarian benefits.

116. Answer (2)

Hint : Rivet popper hypothesis was given by Paul Ehrlich which explains relation between biodiversity and ecosystem health.

Sol. : According to Rivet popper hypothesis, loss of key species is major threat to ecosystem safety because key species drive major ecosystem functions.

117. Answer (4)

Sol. : Khasi and Jaintia hills are situated in Meghalaya.

118. Answer (2)

Sol. : Snow leopards are protected in Khangchendzonga National park of Gangtok, Sikkim.

119. Answer (3)

Hint : Trees such as Neem and Ashoka are planted under green muffler scheme to reduce noise pollution.

Sol. :

Removal of particulate matter – Electrostatic precipitator.

Controls SO_2 pollution – Scrubber

Hospital waste disposal – Incinerators

120. Answer (4)

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

121. Answer (2)

Hint : High sulphur content in petrol or diesel increases SO_2 pollution.

Sol. : One of the important measures taken by the government to reduce air pollution is, use of low-sulphur petrol or diesel.

122. Answer (1)

Hint : In the 3rd session of conference of parties a protocol was proposed for countries to take appropriate measure to reduce overall levels of greenhouse gas emission.

Sol. : 3rd session of conference of parties (COP) was held in Kyoto, Japan was an important initiative to take measures towards global climate change.

123. Answer (4)

Sol. : In Bhopal gas tragedy, the poisonous gas Methyl isocyanate (MIC) was leaked.

124. Answer (3)

Hint : Biochemical oxygen demand (BOD) is a measure of oxygen required by aerobic decomposers for degradation of organic waste material in water.

Sol. : Increase in amount of biodegradable organic wastes in water increases BOD and leads to low amount of dissolve oxygen.

125. Answer (2)

Sol. : High concentration of DDT causes thinning of egg shells and their premature breaking by disturbing calcium metabolism.

126. Answer (1)

Hint : Ecosanitation uses dry composting toilets to recycle human excreta into natural fertilizers.

Sol. : EcoSan toilets are hygienic, cost-effective and efficient solution of human waste disposal.

127. Answer (3)

Hint : Global warming leads to melting of polar ice caps.

Sol. : Global warming causes melting of polar ice caps and rise in sea level.

128. Answer (3)

Hint : Ozone depletion can cause UV radiation mediated damages to humans.

Sol. : If ozone depletion occurs, UV radiation specially UV-B can cause DNA damage, mutations, skin cancer, ageing of skin, damage to cornea and snow blindness.

CO_2 fertilisation effect and cooling of troposphere are associated with greenhouse effect.

129. Answer (2)

Hint : Polyblend mixed with bitumen is used to lay roads.

Sol. : Polyblend is a fine powder of modified recycled plastic developed by Ahmed Khan.

130. Answer (4)

Sol. : Painful skeletal deformities or itai-itai is due to cadmium toxicity.

131. Answer (2)

Hint : This area is at the south pole of earth.

Sol. : Every year between late August and early October ozone hole is observed over the Antarctic region.

132. Answer (3)

Hint : Jhum cultivation is slash and burnt agricultural practice used in north-eastern states of India.

Sol. : Jhum cultivation leads to deforestation while Van Mahotsava, Chipko movement and Joint forest management are associated with maintenance and conservation of forests.

133. Answer (2)

Sol. : Ramesh Chandra Dagar is related to organic farming in Haryana, India.

134. Answer (4)

Hint : Water hyacinth (*Eichhornia crassipes*) is called terror of Bengal.

Sol. : Water hyacinth is an invasive problematic aquatic weed of eutrophic lakes.

135. Answer (3)

Hint : All the buses of Delhi were shifted to CNG by year 2002 by the government.

Sol. : CNG burns more efficiently than petrol and diesel. It cannot be adulterated like petrol and diesel.

136. Answer (3)

Hint : Stealing of patent.**Sol. :** Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned with compensatory payment.

137. Answer (4)

Hint : Identify a super bug.**Sol. :** Bioremediation is a strategy that uses naturally occurring organisms to breakdown pollutants, such as petroleum hydrocarbons into less toxic substances. Bioremediation by *Pseudomonas aeruginosa* is also well documented.

138. Answer (1)

Hint : It is considered as salt retaining hormone**Sol. :** The gene for human growth hormone (hGH) was isolated from human pituitary gland. *E. coli* is used in recombinant DNA technology for pharmaceutical manufacturing of insulin.

139. Answer (1)

Hint : It is produced by *Streptococcus*.**Sol. :** Myocardial infarction can now be treated by genetic engineering. Erythropoietin is synthesized from J.G. cells of kidney promoting erythropoiesis. Interleukins are lymphokines that activate immune system.

140. Answer (4)

Hint : Breaking dsDNA into ssDNA is DNA denaturation.**Sol. :** The temperature of melting (T_m) or denaturation is defined as the temperature at which 50% of double stranded DNA is changed to a single-stranded DNA. The process of breaking the hydrogen bonds between the nucleotide base pairs in double stranded DNA requires energy.

141. Answer (3)

Hint : They are called molecular glue.**Sol. :** DNA ligases form phosphodiester bonds between adjacent nucleotides and covalently link two individual fragments of double-stranded DNA by utilising energy from dNTPs. Endonucleases are restriction enzymes. DNA polymerase synthesizes a new strand of DNA complementary to an existing DNA template in 5' to 3' direction.

142. Answer (1)

Hint : An expensive technique for treatment of genetic disease.**Sol. :** Gene therapy is an expensive technique that uses genes to treat or prevent disease. In the future, this technique may allow doctors to treat a disorder by inserting a gene into a patient's cell instead of using drugs or surgery.

143. Answer (1)

Hint : pBR322 has unique restriction site for certain endonucleases.**Sol. :** Unique restriction site for *SaI* is present in tetra cycline resistance gene.

144. Answer (3)

Hint : Selectable marker helps in eliminating the non-transformants.**Sol. :** Purified DNA precipitates out after the addition of chilled ethanol. Plasmids are extrachromosomal double stranded circular DNA in bacteria.

145. Answer (4)

Hint : Origin of replication.**Sol. :** Plasmids are extra-chromosomal DNA. They replicate autonomously and are one of the most commonly used cloning vectors.

146. Answer (2)

Hint : Extraction of desired product utilizes downstream processing.**Sol. :** Downstream processing is the name given to the stage after fermentation when the desired product is recovered and purified.

147. Answer (1)

Hint : Bacterial cells must be made 'competent' to take up DNA.**Sol. :** Other methods for insertion of recombinant DNA into the host cell/organism include microinjection, biolistic etc.

148. Answer (2)

Hint : It is genetic material of *Reoviruses***Sol. :** In nature, RNA is used for the regulation of specific genes and is also applied as a defence against pathogens.

149. Answer (3)

Hint : Organisms belonging to largest phylum.**Sol. :** *Baculoviruses* are insect pathogenic viruses that are used for insect control and as tools to produce recombinant proteins. They are particularly valuable where traditional chemical insecticides have become ineffective.

150. Answer (3)

Hint : Transformed cell may turn into a tumor.**Sol. :** *Agrobacterium tumefaciens* invades plants at the site of wound and delivers T-DNA into normal plant cells eventually forming a tumor.

151. Answer (3)

Hint : Fluorescent tag used in staining nucleic acid.**Sol. :** Ethidium bromide is also called bromoethane. Aniline blue used as a biological dye to stain glycogen and cell organelles that appear yellow green under violet light. Bromophenol blue is a tracking dye.

152. Answer (4)

Hint : ELISA is protein based technique.

Sol. : PCR is a powerful technique used to identify many genetic disorders. ELISA can detect proteins like antigens or antibodies.

153. Answer (2)

Hint : PCR is replication on a grander scale.

Sol. : A single PCR involves three temperature dependent steps : Denaturation, Annealing and Primer extension (polymerisation). *Taq* polymerase cannot work on RNA samples.

154. Answer (3)

Hint : LacZ undergoes insertional inactivation

Sol. : Blue colonies represent non-recombinants. All transformants have intact Amp^R gene.

155. Answer (4)

Hint : Agitation is needed to mix nutrients and keep fermentation homogenous.

Sol. : A popular bioreactor for continuous fermentation is the sparged tank bioreactor through which sterile bubbles are sparged.

156. Answer (2)

Hint : Agarose gel is commonly used for this technique.

Sol. : The use of agarose gel electrophoresis revolutionized the separation of DNA fragments. The phosphate backbone of the DNA (and RNA) molecule is negatively charged, therefore when placed in an electric field, DNA fragments will migrate to the positively charged anode based on size.

157. Answer (3)

Hint : Select an anticoagulant.

Sol. : Synthetic hirudin gene is introduced into *Brassica napus*. The resulting transgenic plant yielded seeds in which hirudin accumulates. The hirudin is purified and used as medicine.

158. Answer (2)

Hint : *cry-IIAb* controls *Helicoverpa armigera*.

Sol. : *cry-IIAb* and *cry-IAC* are genes for controlling bollworm whereas *cryIAb* controls corn borer. Gene for synthesis of β -carotene has been taken from plant daffodil.

159. Answer (1)

Hint : Enzymes which act at palindromic sites.

Sol. : Restriction endonucleases are called molecular scissors as they cut the DNA strands at particular locations known as restriction sites.

160. Answer (2)

Hint : It was developed by Boliver and Rodriguez.

Sol. : pBR322 is a plasmid with 4361 base pairs. It has unique restriction sites for more than forty restriction enzymes. It is the most widely used vector in genetic engineering. YAC has maximum carrying capacity among given vectors.

161. Answer (1)

Hint : Monocot crop with yellow core.

Sol. : Biofortification increases the nutritional value in crops. Golden rice is genetically modified in order to produce enhanced amount of beta carotene, which is not normally produced in rice. Beta carotene is converted into vitamin A when metabolized by the human body.

162. Answer (1)

Hint : Identify covalent bonds.

Sol. : Insulin is a relatively small protein, comprising two polypeptides, one of 21 amino acids (the A chain) and the other 30 amino acids (the B chain) that are linked together by disulphide bonds/bridges.

163. Answer (4)

Hint : Choose a primate.

Sol. : Polly and Molly, two ewes, were the first mammals to have been successfully cloned from an adult somatic cell and to be transgenic at the same time.

164. Answer (4)

Hint : Mineral usage from soil is efficient in case of transgenic plants

Sol. : Transgenic plants prevent early exhaustion of fertility of soil.

165. Answer (2)

Hint : This enzyme assembles nucleotides.

Sol. : At high temperatures, *Taq* polymerase and Pfu are used as they link nucleotides to a DNA primer, thereby replicating the DNA template. Thermostable enzymes do not break down at high temperatures, necessary for copying DNA using a PCR.

166. Answer (2)

Hint : It is often labelled with a radioactive moiety.

Sol. : A probe is a fragment of DNA or RNA of variable length used to detect the presence of nucleotide sequences that are complementary to the sequence in the probe. Somatic hybridization involves fusion of plant cells of different varieties.

167. Answer (3)

Hint : 2^n where 'n' is number of cycles.

Sol. : PCR is a common and indispensable technique used in medical laboratory research for variety of applications including biomedical research and criminal forensics $2^{30} = 1$ billion.

168. Answer (2)

Hint : The DNA fragments separate or resolve according to their size.

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

169. Answer (2)

Hint : *Agrobacterium* is responsible for opportunistic infections in plants.

Sol. : *Agrobacterium tumefaciens* has been termed as "nature's genetic engineer". *Agrobacterium* causes tumors (crown gall disease) and usually infects plants through an open wound.

170. Answer (4)

Hint : Each restriction enzyme recognizes a specific nucleotide sequence in DNA.

Sol. : Restriction enzymes serve as chemical knives to cut genes into defined fragments.

171. Answer (4)

Hint : This bacteria is found in our large intestine as symbiont.

Sol. : Human insulin gene is spliced into a plasmid. *E. coli* bacteria is then "infected" with that plasmid. The bacteria take up the plasmid and incorporate the new gene and now a new strain of insulin producing *E. coli* bacteria can be cultured in bulk to create insulin inexpensively.

172. Answer (3)

Hint : Identify a cash crop

Sol. : First genetically modified crop, an antibiotic resistant tobacco plant was produced in 1982. Bt cotton produces an insecticide to combat bollworm.

173. Answer (1)

Hint : It makes use of enzyme reverse transcriptase.

Sol. : Retrovirus is commonly used to transfer a DNA fragment in human lymphocytes as they have a very high division potential. So after modification i.e., after inactivation of the oncogenic genes of that virus it would become a vector which can carry our desired gene and replicate it with itself.

174. Answer (3)

Hint : Aromatic amino acid.

Sol. : Roundup is trade name for herbicide glyphosate. This herbicide blocks synthesis of aromatic amino acid phenylalanine, tryptophan and tyrosine.

175. Answer (1)

Hint : Gene subtraction.

Sol. : Many proteins such as human insulin, human growth hormone and a wide range of pharmaceuticals are mass produced from genetically engineered bacteria and fungi.

176. Answer (3)

Hint : In Flavr Savr reduced production of polygalacturonase is seen.

Sol. : Flavr Savr tomatoes are the genetically modified tomatoes. They have longer and more flavourful shelf life than the normal tomatoes due to the presence of gene that reduces the production of polygalacturonase (cell wall degrading enzyme responsible for fruit ripening).

177. Answer (4)

Hint : This committee follows a case by case system of approvals.

Sol. : Genetic Engineering Appraisal Committee (GEAC) approves or denies genetically engineered organisms/cells from labs, hospitals etc. into environment.

178. Answer (4)

Hint : It is a nucleic acid based technique.

Sol. : PCR is used for amplification of DNA.

179. Answer (4)

Hint : First step of PCR renders a double stranded template DNA into two single strands.

Sol. : The three stages of PCR are denaturation, annealing, and primer extension. The denaturation occurs when the DNA is heated at 94°C to make it single stranded. Annealing occurs when the complementary strands are bonded.

180. Answer (3)

Hint : Protein present in milk.

Sol. : α_1 -antitrypsin was produced by first transgenic sheep named 'Tracy'. Streptokinase is a clot buster and hirudin is anticoagulant obtained from transgenic plant *Brassica nap*.



All India Aakash Test Series for NEET - 2020

TEST - 4 (Code-B)

Test Date : 08/12/2019

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (2)

Hint and Sol. : Base in transistor is lightly doped and thin.

2. Answer (1)

Hint : During α decay mass number decrease by 4 and no change in mass number during β decay.

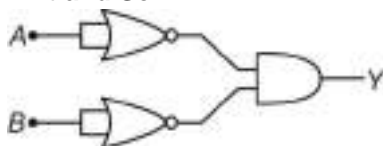
Sol. : $4 \times n = 32$

$$n = 8\alpha$$

$$\text{and } 6\beta$$

3. Answer (2)

Hint and Sol. :

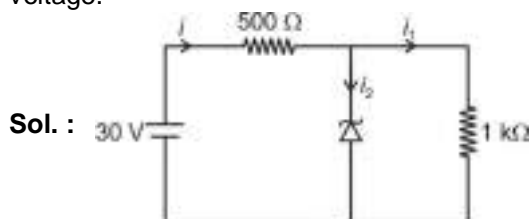


A	B	Y
0	0	1
1	0	0
0	1	0
1	1	0

It is a NOR gate

4. Answer (2)

Hint : Zener diode will conduct when potential difference across zener is more than break down voltage.



Sol. :

Potential drop across dropping resistance = 20 V

Current in dropping resistance $i = \frac{20}{500} = 40 \text{ mA}$

Current in 1 k Ω , $i_1 = \frac{10}{1000} = 10 \text{ mA}$

Current in zener diode = $(40 - 10) \text{ mA}$
= 30 mA

5. Answer (3)

Hint and Sol. : Diode is in forward bias, hence

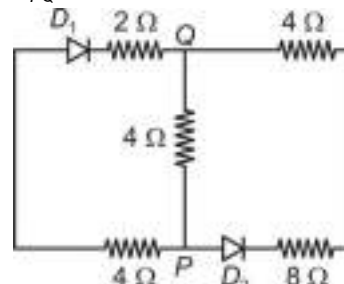
$$I = \frac{(3-1)}{100} = 20 \text{ mA}$$

6. Answer (1)

Hint : Current will flow in junction diode when it is forward biased.

Sol. : If P is at low potential and Q at high potential, then no diode will conduct, so

$$R_{PQ} = 4\Omega$$



7. Answer (3)

Hint and Sol. : In common emitter amplifier input and output voltage are in opposite phase.

$$A = \frac{V_{\text{out}}}{V_{\text{in}}}$$

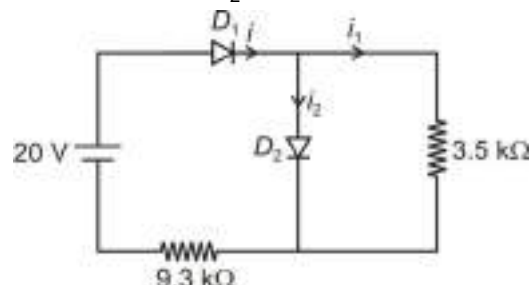
$$V_{\text{out}} = 0.04 \times 100 = 4 \text{ V}$$

$$V = (4 \text{ V}) \sin\left(\omega t + \frac{3\pi}{2}\right)$$

8. Answer (1)

Hint and Sol. :

Potential drop in $D_2 = 0.7 \text{ V}$



$$\text{Current in } 3.5 \text{ k}\Omega = \frac{0.7}{3.5 \times 10^3} = 0.2 \text{ mA}$$

9. Answer (1)

Hint and Sol. :

Energy released per fission = 200 MeV
= $3.2 \times 10^{-11} \text{ J}$

Total energy produced per day

$$= 100 \times 10^6 \times 86400 \\ = 8.64 \times 10^{12} \text{ J}$$

Number of fission per day = n

Efficiency of reactor = 80%

$$n \times 3.2 \times 10^{-11} \times \frac{80}{100} = 8.64 \times 10^{12}$$

$$n = \frac{8.64 \times 10^{12}}{3.2 \times 0.8 \times 10^{-11}} = 3.375 \times 10^{23}$$

$$\text{Mass of uranium} = \frac{235 \times 3.375 \times 10^{23}}{6.023 \times 10^{23}}$$

$$= 132 \text{ g (app.)}$$

10. Answer (3)

Hint : The rate of disintegration of x_1 is more than x_2 .

Sol. : $N_{x_1} = N_0 e^{-10\lambda t}$

$$N_{x_2} = N_0 e^{-\lambda t}$$

$$\frac{N_{x_1}}{N_{x_2}} = \frac{e^{-10\lambda t}}{e^{-\lambda t}}$$

$$\frac{1}{e^3} = e^{-9\lambda t}$$

$$\frac{1}{e^3} = \frac{1}{e^{9\lambda t}}$$

$$e^{9\lambda t} = e^3$$

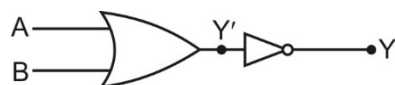
$$9\lambda t = 3$$

$$t = \frac{1}{3\lambda}$$

11. Answer (1)

Hint and Sol. :

Truth table of NOR gate.



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

12. Answer (1)

Hint : When amplifiers are connected in series then resultant voltage gain $A = A_1 \times A_2$.

Sol. : Net voltage gain $A = 20 \times 20 = 400$

13. Answer (3)

Hint : Power gain $P = \beta^2 \frac{R_L}{R_{in}}$

Sol. : $P = (5)^2 \left[\frac{2000}{10} \right] = 5000$

14. Answer (4)

Hint and Sol. : Truth table of given circuit

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

The given truth table is for NAND gate.

15. Answer (4)

Hint and Sol. : In forward biases P-type is at high potential and n-type at low potential so diode in option (4) is forward biased.

16. Answer (3)

Hint and Sol. : In reverse bias the barrier potential ($V_0 + V_r$) becomes large. Therefore, the diffusion current is usually negligible for reverse bias.

17. Answer (4)

Hint and Sol. : Extrinsic semiconductors are also electrically neutral because they contain equal number of acceptors and donors.

18. Answer (4)

Hint and Sol. : A zener diode is highly doped and used in reverse biased.

19. Answer (3)

Hint and Sol. : As doping concentration increased width of depletion layer decreases.

20. Answer (2)

Hint and Sol. : Concentration of holes is greater than number of free electrons, so it is a P-type semiconductor.

21. Answer (1)

Hint : Mean life $\tau = 1.44 T_{1/2}$

Sol. : Initial value = 50% $N_0 = \frac{50}{100} N_0 = \frac{N_0}{2}$

Remaining value = 3.125% $N_0 = \frac{3.125}{100} N_0 = \frac{N_0}{32}$

$$N = N_0 \left(\frac{1}{2} \right)^n$$

$$\frac{N_0}{32} = \frac{N_0}{2} \left(\frac{1}{2} \right)^n$$

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

Half life of element = $\frac{40}{4} = 10 \text{ s}$

Mean life = $10 \times 1.44 = 14.4 \text{ s}$

22. Answer (3)

Hint and Sol. : As the mass of radioactive sample is increased, then number of nuclei will also increase, so activity will increase. Decay constant is the property of element, so it remains same.

23. Answer (2)

Hint : Energy will be released in nuclear reaction, when energy of product nuclei is greater than the energy of reactant nuclei

Sol. : Energy of product nuclei = $4c$

Energy of reactant nuclei = $(a + 3b)$

Energy released = $4c - (a + 3b)$
 $= 4c - a - 3b$

24. Answer (1)

Hint : In this process momentum remains constant.

Sol. : According to law of conservation of momentum

$$0 = m_1 \vec{v}_1 + m_2 \vec{v}_2$$

$$0 = m_1 v - m_2 (27v)$$

$$\frac{m_1}{m_2} = \frac{27}{1}$$

$$\frac{\frac{4}{3}\pi R_1^3}{\frac{4}{3}\pi R_2^3} = \frac{27}{1}$$

$$R_1 : R_2 = 3 : 1$$

25. Answer (3)

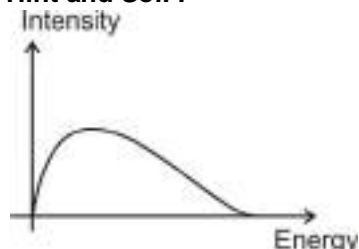
Hint and Sol. : 1 atomic mass unit = $\frac{1}{12}$ [mass of one ${}^{12}_6\text{C}$ carbon atom].

26. Answer (2)

Hint and Sol. : Nuclear forces between two nucleons having like spin is different than those having unlike spin, so nuclear forces are spin dependent.

27. Answer (3)

Hint and Sol. :



β -particle of all the energies from 0 to a certain maximum value emitted from same element. So spectrum is continuous spectrum.

28. Answer (3)

Hint and Sol. : Average mass density

$$d = \frac{M}{V} = \frac{Am_p}{\frac{4}{3}\pi R^3}$$

$$R = R_0 A^{\frac{1}{3}}$$

$$d = \frac{3Am_p}{4\pi R_0^3 A}$$

$$d \propto A^0$$

29. Answer (4)

Hint and Sol. : Wavelength of first line of Balmer series.

$$\frac{1}{\lambda_B} = R \left[\frac{1}{2^2} - \frac{1}{3^2} \right]$$

$$= R \left[\frac{1}{4} - \frac{1}{9} \right] = \frac{5R}{36}$$

Wavelength of second line of Lyman series.

$$\frac{1}{\lambda_L} = R \left[\frac{1}{1^2} - \frac{1}{9} \right] = \frac{8R}{9}$$

$$\frac{\lambda_B}{\lambda_L} = \frac{32}{5}$$

30. Answer (1)

Hint : Speed of electron in any orbit $v_n \propto \frac{Z}{n}$

Radius of Bohr orbit $r_n \propto \frac{n^2}{Z}$

Sol. : $v_n = r_n \omega_n$

$$\frac{\omega_n}{v_n} = \frac{1}{r_n}$$

$$\frac{\omega_n}{v_n} \propto \frac{1}{n^2}$$

31. Answer (3)

Hint : The radius of Bohr orbit of hydrogen like element is $r_n = 0.529 \frac{n^2}{Z} \text{ \AA}$

Sol. : Radius of first orbit of hydrogen

$$r_1 = 0.529 \text{ \AA}$$

Radius of second orbit of helium ion

$$r_2 = \frac{0.529 \times 4}{2} \text{ \AA}$$

$$= 1.058 \text{ \AA}$$

$$= 10.58 \times 10^{-11} \text{ m}$$

32. Answer (1)

Hint and Sol. : Intensity of x-rays depends on number of photons, which depends on number of electrons striking at target. The number of electrons can be increased by increasing current in filament.

33. Answer (2)

Hint and Sol. : Absorption of energy is possible only from ground state $n = 1$. So in absorption spectrum possible spectral lines are 3.

34. Answer (3)

Hint : Total energy of electron in any orbit is half of potential energy.

Sol. : Total energy of electron $E_{\text{Tot}} = -\frac{1}{4\pi\epsilon_0} \frac{Ze^2}{2r_n}$

Potential energy of electron $E_{\text{Pot}} = -\frac{1}{4\pi\epsilon_0} \frac{Ze^2}{r_n}$

$$E_{\text{Pot}} : E_{\text{Tot}} = 2 : 1$$

35. Answer (1)

Hint : Einstein's equation of photoelectric effect.

$$\text{Sol. : } eV_0 = \frac{hc}{\lambda} - w$$

$$\text{Case - I : } 3eV_0 = \frac{hc}{\lambda} - w \quad \dots(i)$$

$$\text{Case - II : } eV_0 = \frac{hc}{2\lambda} - w \quad \dots(ii)$$

Multiply equation (ii) with 3 and subtract equation (i)

$$\frac{hc}{2\lambda} - 2w = 0 \Rightarrow 2w = \frac{hc}{2\lambda}$$

$$\Rightarrow 2 \frac{hc}{\lambda_0} = \frac{hc}{2\lambda}$$

$$\Rightarrow \lambda_0 = 4\lambda$$

36. Answer (3)

Hint : In electric fields particle will accelerate so its momentum will change.

Sol. : Electric force on charge $\vec{F} = qE\hat{i}$

$$\text{Acceleration of charge } \vec{a} = \frac{qE}{m}\hat{i}$$

Velocity along x-axis v_x (as a function of time)

$$= \frac{qE}{m}t$$

$$\frac{h}{3mv_0} = \frac{h}{\sqrt{(mv_0)^2 + (qEt)^2}}$$

$$9m^2v_0^2 = m^2v_0^2 + q^2E^2t^2$$

$$8m^2v_0^2 = q^2E^2t^2$$

$$t = \frac{2\sqrt{2}mv_0}{qE}$$

37. Answer (4)

Hint and Sol. : One of the electrons enters in magnetic field, so there is no change in magnitude of linear momentum. Hence λ_1 remains same. While second electron enters in electric field, and it will accelerate, so its magnitude of momentum may increase, decrease or at some instant may be equal to the first electron. Hence λ_1 may be greater than equal or less than λ_2 .

38. Answer (2)

Hint and Sol. : Stopping potential is greater for b than a it means $v_b > v_a$. Saturation photo current is same for a and b it means $I_a = I_b$

39. Answer (1)

Hint and Sol. : Point source is placed at focus of convex lens, so after refraction light rays become parallel. Hence on changing the distance, there is no change in number of photons striking on photocell. So saturated current and cut-off potential remains same.

40. Answer (2)

Hint : Kinetic energy of charged particle = qV

$$\text{Sol. : } \text{de-Broglie wavelength } \lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$$

$$\text{For deuteron } ({}_1\text{H}^2) \lambda_D = \frac{h}{\sqrt{2qV(2m)}}$$

$$\text{For } \alpha\text{-particle } ({}_2\text{He}^4) \lambda_\alpha = \frac{h}{\sqrt{2(2q)V(4m)}}$$

$$\frac{\lambda_D}{\lambda_\alpha} = \frac{2}{1}$$

41. Answer (3)

$$\text{Hint : } h\nu = \frac{1}{2}mv^2 + \phi$$

Sol. :

$$\text{Case - I : } h\nu = \frac{1}{2}mv_1^2 + \phi \quad \dots(i)$$

$$\text{Case - II : } 4h\nu = \frac{1}{2}mv_2^2 + \phi \quad \dots(ii)$$

Divide (i) by (ii)

$$\frac{h\nu}{4h\nu} = \frac{mv_1^2 + 2\phi}{mv_2^2 + 2\phi}$$

$$4mv_1^2 + 8\phi = mv_2^2 + 2\phi$$

$$v_2^2 = 4v_1^2 + \frac{6\phi}{m}$$

$$v_2 > 2v_1$$

42. Answer (1)

Hint : Maximum kinetic energy of photo electron
 $= eV_c$

Sol. : Work function of surface $= h\nu_0$

$$= \frac{6.6 \times 10^{-34} \times 5 \times 10^{14}}{1.6 \times 10^{-19}}$$

$$= 2.06 \text{ eV}$$

Wavelength of incident radiation $= 4000 \text{ \AA}$

Energy of incident radiation $= \frac{12400}{4000} = 3.1 \text{ eV}$

Energy of photon $= + eV_c$

$$3.1 = 2.06 + eV_c$$

$$eV_c = 1.04 \text{ eV}$$

$$V_c = 1.0 \text{ V}$$

43. Answer (4)

Hint : Energy of photon $= \phi_0 + eV_0$

Sol. : Work function of surface $= 5.1 \text{ eV}$

Energy of incident photons $= (5.1 + 6) \text{ eV}$

$$= 11.1 \text{ eV}$$

Wavelength of photons $= \frac{12400}{11.1} \text{ \AA}$

$$\approx 1117 \text{ \AA}$$

Wavelength 1117 \AA lies in ultraviolet region.

44. Answer (3)

Hint : Momentum of photon $p = \frac{E}{c}$

Sol. : Energy of photon $= 3 \text{ MeV}$
 $= 3 \times 1.6 \times 10^{-13} \text{ joule}$

$$p = \frac{E}{c} = \frac{3 \times 1.6 \times 10^{-13}}{3 \times 10^8}$$

$$p = 1.6 \times 10^{-21} \text{ kg m/s}$$

45. Answer (2)

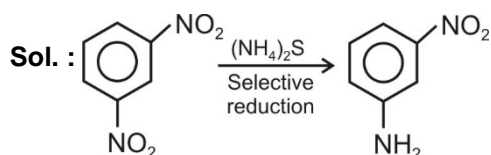
Hint and Sol. : Light of all wavelengths in vacuum travel with same speed, so

$$c \propto \lambda^0$$

[CHEMISTRY]

46. Answer (1)

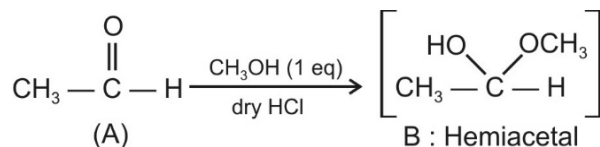
Hint : Partial reduction take place



47. Answer (3)

Hint : C_2H_4O is an aldehyde.

Sol. :

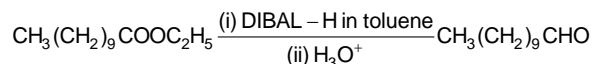


48. Answer (3)

Hint : Low density polythene is used in the insulation of electricity carrying wires.

49. Answer (4)

Hint : Ester is reduced into aldehyde by using DIBAL - H



50. Answer (1)

Hint : DNA contains four bases : A, G, C, T

Sol. : DNA does not contain uracil (U)

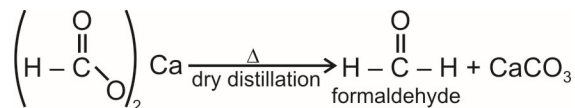
51. Answer (2)

Hint : Given carbohydrate is sucrose

Sol. : Sucrose consists of α -D-glucose and β -D-fructose

52. Answer (1)

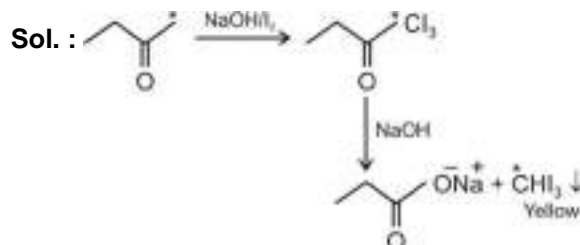
Hint :



Sol. : Formaldehyde gives positive Tollens' test.

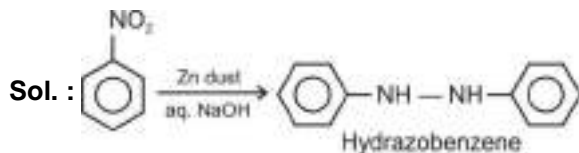
53. Answer (3)

Hint : This is an example of Iodoform test.



54. Answer (1)

Hint : Nitrobenzene gives different products in alkaline medium under different conditions.



55. Answer (2)

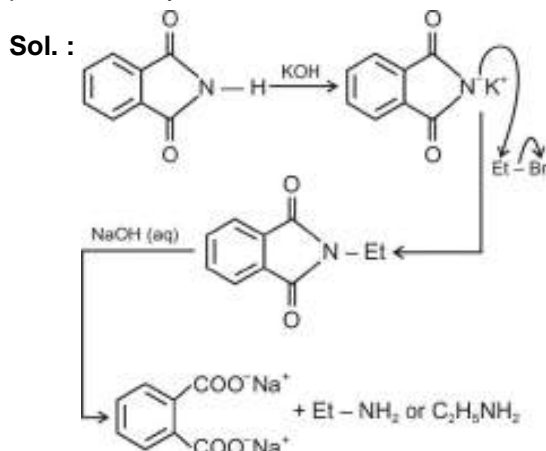
Hint : During cannizzaro reaction, disproportionation of aldehydes takes place with conc. NaOH.

Sol. : Aldehydes which do not have an α -hydrogen atom, undergo oxidation and reduction (disproportionation) reaction on heating with concentrated NaOH or KOH.

For example : Formaldehyde, benzaldehyde.

56. Answer (2)

Hint : Et-Br undergoes S_N2 reaction in Gabriel phthalimide synthesis of 1° amines.



57. Answer (2)

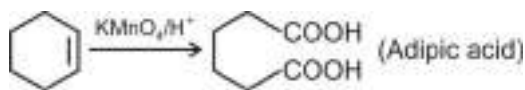
Hint : B.P. of carboxylic acid is more than that of aldehydes with comparable molecular mass.

Sol. : Formic acid exists as dimer in the vapour phase. Benzoic acid is nearly insoluble in cold water due to larger size of its hydrophobic ring. Acetic acid is miscible in water.

58. Answer (3)

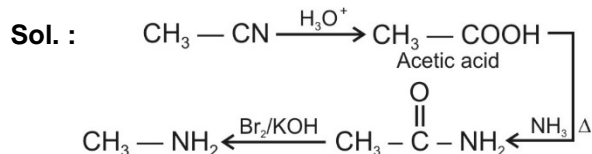
Hint : Cleavage of $>C=C<$ take place

Sol. :



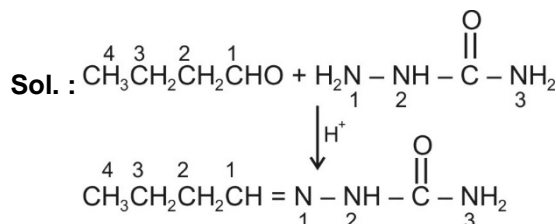
59. Answer (2)

Hint : Nitrile on complete hydrolysis, gives carboxylic acids.



60. Answer (1)

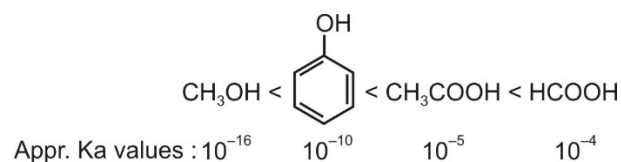
Hint : Lone pairs of N₂ and N₃ are involve in resonance with keto group.



61. Answer (4)

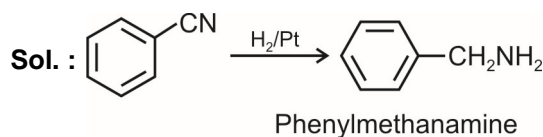
Hint : Carboxylic acids are generally stronger acid than alcohols and phenols.

Sol. :

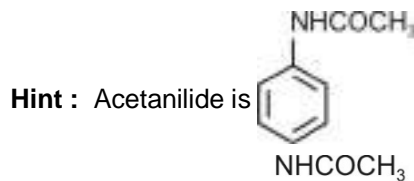


62. Answer (1)

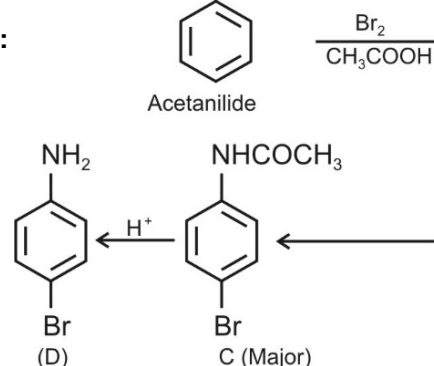
Hint : Cyanide group (CN) is reduced into -CH₂NH₂



63. Answer (3)

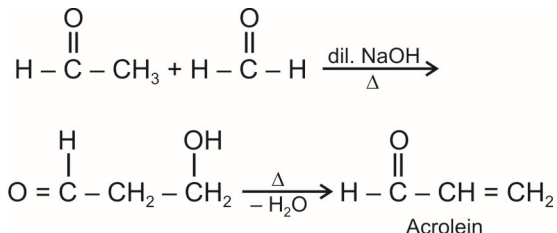


Sol. :

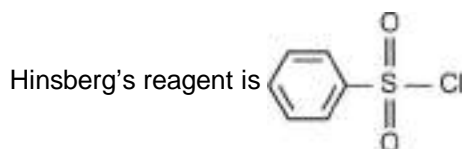


64. Answer (2)

Hint : Acrolein is $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}=\text{CH}_2$

Sol. :

65. Answer (3)

Hint :**Sol. :**

2°-amine CH_3NHCH_3 reacts with Hinsberg's reagent (or, benzenesulphonyl chloride).

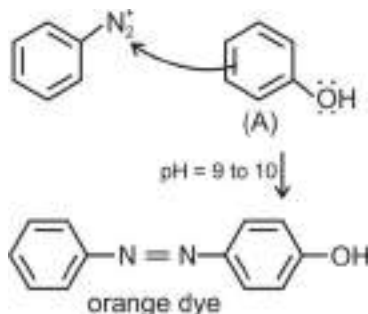
66. Answer (3)

Hint : Lower aliphatic amines are more soluble in water than higher aliphatic amines.

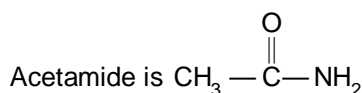
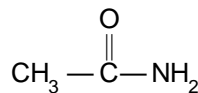
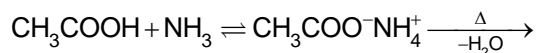
Sol. : Solubility of amines in water decreases with increase in molar mass of amines due to increase in size of the hydrophobic alkyl part.

67. Answer (3)

Hint : Benzene diazonium chloride reacts with phenol and aniline in basic and acidic medium respectively.

Sol. :

68. Answer (2)

Hint :**Sol. :**

69. Answer (3)

Hint : Albumin is a globular protein.

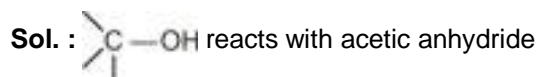
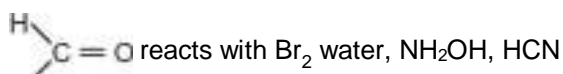
Sol. : Globular proteins are usually soluble in water.

70. Answer (1)

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

Sol. : Essential amino acids : Histidine

71. Answer (3)

Hint :

72. Answer (4)

Hint : An elastomer involves weakest van der Waals interactions.

Sol. : Buna-N is an elastomer

73. Answer (1)

Hint : Tranquilizers relieve or reduce the stress and anxiety.

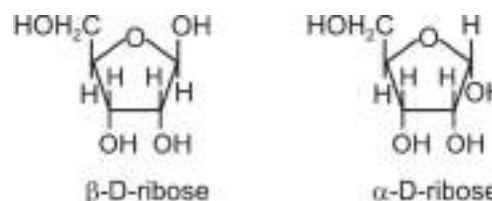
Sol. : Tranquilizers : Equanil, Phenelzine

74. Answer (4)

Hint : PHBV and Nylon-2-Nylon 6 are biodegradable polymer.

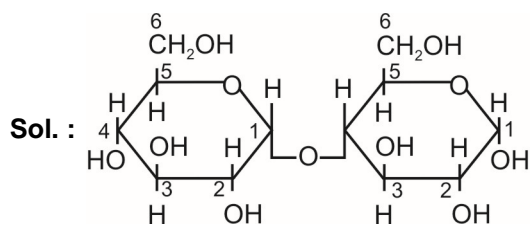
75. Answer (4)

Hint : D-ribose is in furanose form

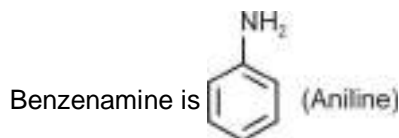
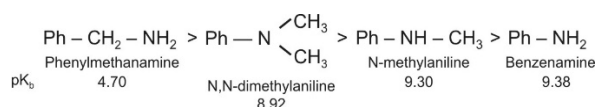
Sol. :

76. Answer (3)

Hint : In maltose, C-1 of one α -D-Glucopyranose is linked to C-4 of another α -D-Glucopyranose molecule by glycosidic linkage.



77. Answer (2)

Hint :**Sol. :** Order of basic character :

78. Answer (4)

Hint : Xerophthalmia is the hardening of cornea of eye.**Sol. :** This happens due to the deficiency of vitamin A.

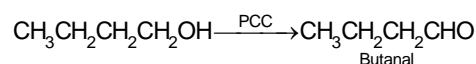
79. Answer (2)

Hint :

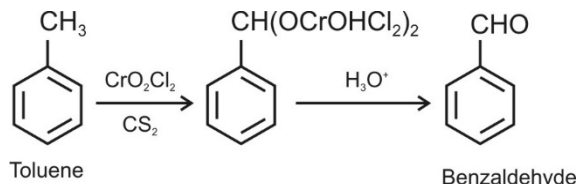
Artificial sweetener **Sweetness value in Comparison to cane sugar**

Aspartame	100
Saccharin	550
Sucralose	600
Alitame	2000

80. Answer (2)

Hint : PCC is a mild oxidising agent.**Sol. :**

81. Answer (2)

Hint : CrO_2Cl_2 can be used to oxidise toluene to benzaldehyde.**Sol. :**

82. Answer (3)

Hint : Compounds in which carbonyl group is least hindered are found to be most reactive towards nucleophilic addition reaction.**Sol. :** Carbonyl group in formaldehyde is least hindered.

83. Answer (4)

Hint : Polypropene is used in the manufacture of ropes.**Sol. :** Polystyrene is used as insulator.

Urea-formaldehyde resin is used for making unbreakable cups and laminated sheets.

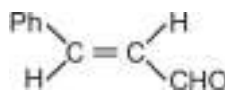
Bakelite (Polymer of phenol and formaldehyde) is used for making electrical switches)

84. Answer (1)

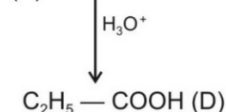
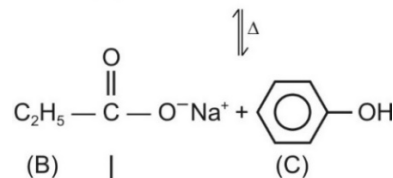
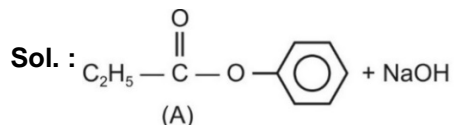
Hint : Homopolymers consist of only one type of monomeric species**Sol. :**

Polymer	Monomer
PVC	Vinyl chloride
Teflon	Tetrafluoroethene
Neoprene	2-chloro-1,3-butadiene

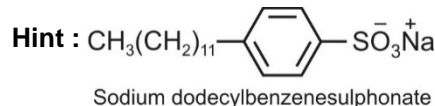
85. Answer (4)

Hint : Cinnamaldehyde is an α, β unsaturated aromatic aldehyde.

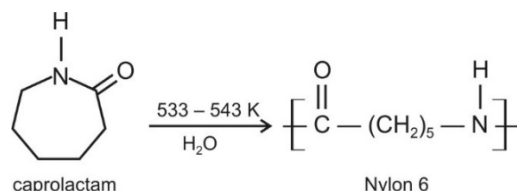
86. Answer (4)

Hint : Carboxylic acid is a stronger acid than carbonic acid.D reacts with NaHCO_3 to release CO_2

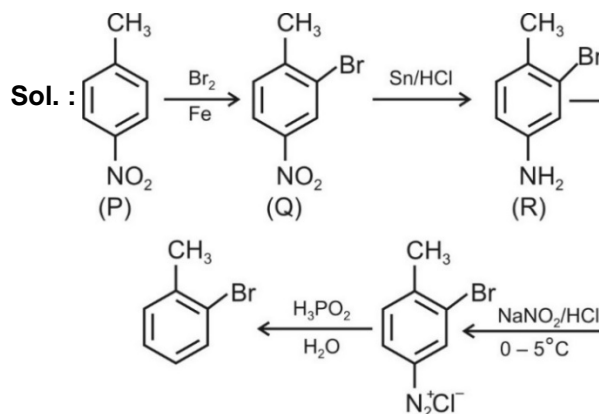
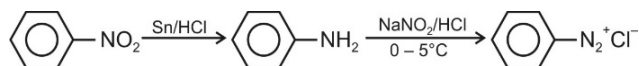
87. Answer (4)



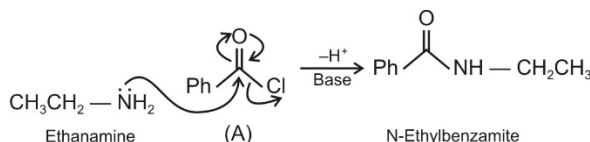
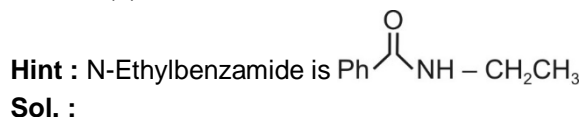
88. Answer (4)

Hint : Nylon 6 is a polyamide**Sol. :**

89. Answer (2)

Hint :

90. Answer (4)



[BIOLOGY]

91. Answer (3)

Hint : All the buses of Delhi were shifted to CNG by year 2002 by the government.**Sol. :** CNG burns more efficiently than petrol and diesel. It cannot be adulterated like petrol and diesel.

92. Answer (4)

Hint : Water hyacinth (*Eichhornia crassipes*) is called terror of Bengal.**Sol. :** Water hyacinth is an invasive problematic aquatic weed of eutrophic lakes.

93. Answer (2)

Sol. : Ramesh Chandra Dagar is related to organic farming in Haryana, India.

94. Answer (3)

Hint : Jhum cultivation is slash and burnt agricultural practice used in north-eastern states of India.**Sol. :** Jhum cultivation leads to deforestation while Van Mahotsava, Chipko movement and Joint forest management are associated with maintenance and conservation of forests.

95. Answer (2)

Hint : This area is at the south pole of earth.**Sol. :** Every year between late August and early October ozone hole is observed over the Antarctic region.

96. Answer (4)

Sol. : Painful skeletal deformities or itai-itai is due to cadmium toxicity.

97. Answer (2)

Hint : Polyblend mixed with bitumen is used to lay roads.**Sol. :** Polyblend is a fine powder of modified recycled plastic developed by Ahmed Khan.

98. Answer (3)

Hint : Ozone depletion can cause UV radiation mediated damages to humans.**Sol. :** If ozone depletion occurs, UV radiation specially UV-B can cause DNA damage, mutations, skin cancer, ageing of skin, damage to cornea and snow blindness. CO_2 fertilisation effect and cooling of troposphere are associated with greenhouse effect.

99. Answer (3)

Hint : Global warming leads to melting of polar ice caps.**Sol. :** Global warming causes melting of polar ice caps and rise in sea level.

100. Answer (1)

Hint : Ecosanitation uses dry composting toilets to recycle human excreta into natural fertilizers.**Sol. :** EcoSan toilets are hygienic, cost-effective and efficient solution of human waste disposal.

101. Answer (2)

Sol. : High concentration of DDT causes thinning of egg shells and their premature breaking by disturbing calcium metabolism.

102. Answer (3)

Hint : Biochemical oxygen demand (BOD) is a measure of oxygen required by aerobic decomposers for degradation of organic waste material in water.

Sol. : Increase in amount of biodegradable organic wastes in water increases BOD and leads to low amount of dissolve oxygen.

103. Answer (4)

Sol. : In Bhopal gas tragedy, the poisonous gas Methyl isocyanate (MIC) was leaked.

104. Answer (1)

Hint : In the 3rd session of conference of parties a protocol was proposed for countries to take appropriate measure to reduce overall levels of greenhouse gas emission.

Sol. : 3rd session of conference of parties (COP) was held in Kyoto, Japan was an important initiative to take measures towards global climate change.

105. Answer (2)

Hint : High sulphur content in petrol or diesel increases SO₂ pollution.

Sol. : One of the important measures taken by the government to reduce air pollution is, use of low-sulphur petrol or diesel.

106. Answer (4)

Sol. : Ozone (O₃) is a secondary air pollutant.

107. Answer (3)

Hint : Trees such as Neem and Ashoka are planted under green muffler scheme to reduce noise pollution.

Sol. :

Removal of particulate matter – Electrostatic precipitator.

Controls SO₂ pollution – Scrubber

Hospital waste disposal – Incinerators

108. Answer (2)

Sol. : Snow leopards are protected in Khangchendzonga National park of Gangtok, Sikkim.

109. Answer (4)

Sol. : Khasi and Jaintia hills are situated in Meghalaya.

110. Answer (2)

Hint : Rivet popper hypothesis was given by Paul Ehrlich which explains relation between biodiversity and ecosystem health.

Sol. : According to Rivet popper hypothesis, loss of key species is major threat to ecosystem safety because key species drive major ecosystem functions.

111. Answer (3)

Hint : Direct economic benefits derived from nature are called narrowly utilitarian benefits.

Sol. : Pollination, oxygen and aesthetic pleasure are broadly utilitarian benefits of ecosystem. Rest are narrow utilitarian benefits.

112. Answer (4)

Hint : *in-situ* conservation strategies are also called on-site conservation strategies.

Sol. : Hot-spots, national parks, sacred lakes and biosphere reserves are *in-situ* conservation strategies.

113. Answer (3)

Hint : Species with small population are more susceptible to extinction.

Sol. : Large body size, low reproductive rate, high trophic level in food chain, fixed habitat and migratory route are some characteristics of those species which are highly susceptible to extinction.

114. Answer (1)

Sol. : Cichlid fishes of Lake Victoria of East Africa are the native species of that area.

115. Answer (3)

Sol. : Some examples of most recent extinctions are

Dodo – Mauritius

Quagga – Africa

Thylacine – Australia

Steller's sea cow – Russia

116. Answer (4)

Hint : Biodiversity is important for ecosystem stability, productivity, resistance etc.

Sol. : Communities with more biodiversity are more stable and more resistant to natural disturbances, man-made disturbances and invasion by alien species. Rich biodiversity decreases year-to-year variations in productivity of an ecosystem.

117. Answer (2)

Hint : Among the invertebrates, insects are the most species rich.

Sol. : In the given pie chart

A – Insects

B – Molluscs

C – Crustaceans

118. Answer (3)

Sol. : Species area relationship of biodiversity was given by Alexander von Humboldt.

119. Answer (1)

Hint : India is on 8th rank among 12 megadiversity countries.

Sol. : India has only 2.4% of world's land area but it possesses 8.1% species diversity of the world.

120. Answer (3)

Sol. : Humus is dark coloured, amorphous, more or less decomposed organic matter. It is slightly acidic and resistant to microbial action.

121. Answer (1)

Hint : Phosphorus cycle is a sedimentary cycle.

Sol. : There is no respiratory release of phosphorus into atmosphere by living organisms.

122. Answer (4)

Sol. : Reservoir pool of a gaseous cycle is atmosphere or hydrosphere. Lithosphere or earth's crust is the reservoir pool for sedimentary cycle.

123. Answer (2)

Hint : Part of water soluble substances present in fragmented and decomposing detritus go down in soil horizon by percolating water is called leaching.

Sol. : During decomposition, fragmentation of detritus involves activity of detritivores while humification and mineralisation involve activity of saprophytic fungi and bacteria. Leaching process does not directly involve activity of living organisms.

124. Answer (2)

Hint : In hydrarch succession, the successional series progress from hydric to mesic conditions.

Sol. : Transitional communities in hydrarch succession are –

Submerged plant stage → Submerged free-floating plant stage → Reed-swamp stage → Marsh-meadow stage → Scrub stage.

125. Answer (4)

Hint : In secondary succession, pioneer community establishes with comparatively more ease.

Sol. : Secondary succession starts in areas that somehow lost all the living organisms that existed there. It has some soil or sediment existing at the site of succession. Here climax is also reached more quickly.

126. Answer (3)

Hint : Anthropogenic ecosystems are created and maintained by humans.

Sol. : Characteristics of anthropogenic ecosystem

- Low species diversity.
- High productivity.
- Presence of simple food chain.
- Absence of self regulatory mechanisms.
- Little cycling of nutrients.

127. Answer (3)

Sol. : For tree ecosystem, pyramid of number could be inverted or spindle shaped.

128. Answer (4)

Sol. : During succession, total biomass of the ecosystem increases.

129. Answer (2)

Sol. : Ecological pyramids accommodate a simple food chain not a food web. Saprophytes, decomposers and microbes are not given any place in ecological pyramid.

130. Answer (2)

Hint : Plants capture approximately 1-5% of incident solar radiation for photosynthesis.

Sol. : Plants capture 2-10% of PAR for synthesising their food.

131. Answer (3)

Hint : In a food chain, transfer of energy at different trophic levels occur according to "10% law of energy transfer".

Sol. : If NPP is 2000 J then fixed energy in herbivores (primary consumer) is 200 J, secondary consumers 20 J, tertiary consumers 2 J.

132. Answer (4)

Sol. : Detritus food chain begins with detritus or dead organic matter.

133. Answer (1)

Hint : Stratification is vertical distribution of different species occupying different levels.

Sol. : In a forest, vertical subdivision or strata are

- Trees – Top layer
- Shrubs – Second layer
- Grasses and herbs – Bottom layer

134. Answer (2)

Hint : Decomposition process is slower when detritus contains complex and water-insoluble compounds.

Sol. : Decomposition of detritus containing lignin, chitin and cellulose is slower. Process of decomposition requires aeration, activity of soil microbes, warm and moist soil.

135. Answer (3)

Hint : Net primary productivity is the rate of organic matter build up or stored by producers in excess of respiratory utilization.

Sol. : Net primary productivity (NPP) is the available biomass for the consumption of heterotrophs i.e. herbivores and decomposers. It depends upon various environmental factors. NPP of terrestrial ecosystems is generally higher than ocean.

136. Answer (3)

Hint : Protein present in milk.**Sol. :** α_1 -antitrypsin was produced by first transgenic sheep named 'Tracy'. Streptokinase is a clot buster and hirudin is anticoagulant obtained from transgenic plant *Brassica napa*.

137. Answer (4)

Hint : First step of PCR renders a double stranded template DNA into two single strands.**Sol. :** The three stages of PCR are denaturation, annealing, and primer extension. The denaturation occurs when the DNA is heated at 94°C to make it single stranded. Annealing occurs when the complementary strands are bonded.

138. Answer (4)

Hint : It is a nucleic acid based technique.**Sol. :** PCR is used for amplification of DNA.

139. Answer (4)

Hint : This committee follows a case by case system of approvals.**Sol. :** Genetic Engineering Appraisal Committee (GEAC) approves or denies genetically engineered organisms/cells from labs, hospitals etc. into environment.

140. Answer (3)

Hint : In Flavr Savr reduced production of polygalacturonase is seen.**Sol. :** Flavr Savr tomatoes are the genetically modified tomatoes. They have longer and more flavourful shelf life than the normal tomatoes due to the presence of gene that reduces the production of polygalacturonase (cell wall degrading enzyme responsible for fruit ripening).

141. Answer (1)

Hint : Gene subtraction.**Sol. :** Many proteins such as human insulin, human growth hormone and a wide range of pharmaceuticals are mass produced from genetically engineered bacteria and fungi.

142. Answer (3)

Hint : Aromatic amino acid.**Sol. :** Roundup is trade name for herbicide glyphosate. This herbicide blocks synthesis of aromatic amino acid phenylalanine, tryptophan and tyrosine.

143. Answer (1)

Hint : It makes use of enzyme reverse transcriptase.**Sol. :** Retrovirus is commonly used to transfer a DNA fragment in human lymphocytes as they have a very high division potential. So after modification i.e., after inactivation of the oncogenic genes of that virus it would become a vector which can carry our desired gene and replicate it with itself.

144. Answer (3)

Hint : Identify a cash crop**Sol. :** First genetically modified crop, an antibiotic resistant tobacco plant was produced in 1982. Bt cotton produces an insecticide to combat bollworm.

145. Answer (4)

Hint : This bacteria is found in our large intestine as symbiont.**Sol. :** Human insulin gene is spliced into a plasmid. *E. coli* bacteria is then "infected" with that plasmid. The bacteria take up the plasmid and incorporate the new gene and now a new strain of insulin producing *E. coli* bacteria can be cultured in bulk to create insulin inexpensively.

146. Answer (4)

Hint : Each restriction enzyme recognizes a specific nucleotide sequence in DNA.**Sol. :** Restriction enzymes serve as chemical knives to cut genes into defined fragments.

147. Answer (2)

Hint : *Agrobacterium* is responsible for opportunistic infections in plants.**Sol. :** *Agrobacterium tumefaciens* has been termed as "nature's genetic engineer". *Agrobacterium* causes tumors (crown gall disease) and usually infects plants through an open wound.

148. Answer (2)

Hint : The DNA fragments separate or resolve according to their size.**Sol. :** The separated DNA can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation

149. Answer (3)

Hint : 2^n where 'n' is number of cycles.**Sol. :** PCR is a common and indispensable technique used in medical laboratory research for variety of applications including biomedical research and criminal forensics $2^{30} = 1$ billion.

150. Answer (2)

Hint : It is often labelled with a radioactive moiety.**Sol. :** A probe is a fragment of DNA or RNA of variable length used to detect the presence of nucleotide sequences that are complementary to the sequence in the probe. Somatic hybridization involves fusion of plant cells of different varieties.

151. Answer (2)

Hint : This enzyme assembles nucleotides.

Sol. : At high temperatures, *Taq* polymerase and Pfu are used as they link nucleotides to a DNA primer, thereby replicating the DNA template. Thermostable enzymes do not break down at high temperatures, necessary for copying DNA using a PCR.

152. Answer (4)

Hint : Mineral usage from soil is efficient in case of transgenic plants

Sol. : Transgenic plants prevent early exhaustion of fertility of soil.

153. Answer (4)

Hint : Choose a primate.

Sol. : Polly and Molly, two ewes, were the first mammals to have been successfully cloned from an adult somatic cell and to be transgenic at the same time.

154. Answer (1)

Hint : Identify covalent bonds.

Sol. : Insulin is a relatively small protein, comprising two polypeptides, one of 21 amino acids (the A chain) and the other 30 amino acids (the B chain) that are linked together by disulphide bonds/bridges.

155. Answer (1)

Hint : Monocot crop with yellow core.

Sol. : Biofortification increases the nutritional value in crops. Golden rice is genetically modified in order to produce enhanced amount of beta carotene, which is not normally produced in rice. Beta carotene is converted into vitamin A when metabolized by the human body.

156. Answer (2)

Hint : It was developed by Boliver and Rodriguez.

Sol. : pBR322 is a plasmid with 4361 base pairs. It has unique restriction sites for more than forty restriction enzymes. It is the most widely used vector in genetic engineering. YAC has maximum carrying capacity among given vectors.

157. Answer (1)

Hint : Enzymes which act at palindromic sites.

Sol. : Restriction endonucleases are called molecular scissors as they cut the DNA strands at particular locations known as restriction sites.

158. Answer (2)

Hint : *cry-IIAb* controls *Helicoverpa armigera*.

Sol. : *cry-IIAb* and *cry-IAC* are genes for controlling bollworm whereas *cryIAb* controls corn borer. Gene for synthesis of β -carotene has been taken from plant daffodil.

159. Answer (3)

Hint : Select an anticoagulant.

Sol. : Synthetic hirudin gene is introduced into *Brassica napus*. The resulting transgenic plant yielded seeds in which hirudin accumulates. The hirudin is purified and used as medicine.

160. Answer (2)

Hint : Agarose gel is commonly used for this technique.

Sol. : The use of agarose gel electrophoresis revolutionized the separation of DNA fragments. The phosphate backbone of the DNA (and RNA) molecule is negatively charged, therefore when placed in an electric field, DNA fragments will migrate to the positively charged anode based on size.

161. Answer (4)

Hint : Agitation is needed to mix nutrients and keep fermentation homogenous.

Sol. : A popular bioreactor for continuous fermentation is the sparged tank bioreactor through which sterile bubbles are sparged.

162. Answer (3)

Hint : LacZ undergoes insertional inactivation

Sol. : Blue colonies represent non-recombinants. All transformants have intact Amp^R gene.

163. Answer (2)

Hint : PCR is replication on a grander scale.

Sol. : A single PCR involves three temperature dependent steps : Denaturation, Annealing and Primer extension (polymerisation). *Taq* polymerase cannot work on RNA samples.

164. Answer (4)

Hint : ELISA is protein based technique.

Sol. : PCR is a powerful technique used to identify many genetic disorders. ELISA can detect proteins like antigens or antibodies.

165. Answer (3)

Hint : Fluorescent tag used in staining nucleic acid.

Sol. : Ethidium bromide is also called bromoethane. Aniline blue used as a biological dye to stain glycogen and cell organelles that appear yellow green under violet light. Bromophenol blue is a tracking dye.

166. Answer (3)

Hint : Transformed cell may turn into a tumor.

Sol. : *Agrobacterium tumefaciens* invades plants at the site of wound and delivers T-DNA into normal plant cells eventually forming a tumor.

167. Answer (3)

Hint : Organisms belonging to largest phylum.

Sol. : *Baculoviruses* are insect pathogenic viruses that are used for insect control and as tools to produce recombinant proteins. They are particularly valuable where traditional chemical insecticides have become ineffective.

168. Answer (2)

Hint : It is genetic material of *Reoviruses*

Sol. : In nature, RNA is used for the regulation of specific genes and is also applied as a defence against pathogens.

169. Answer (1)

Hint : Bacterial cells must be made 'competent' to take up DNA.

Sol. : Other methods for insertion of recombinant DNA into the host cell/organism include microinjection, biolistic etc.

170. Answer (2)

Hint : Extraction of desired product utilizes downstream processing.

Sol. : Downstream processing is the name given to the stage after fermentation when the desired product is recovered and purified.

171. Answer (4)

Hint : Origin of replication.

Sol. : Plasmids are extra-chromosomal DNA. They replicate autonomously and are one of the most commonly used cloning vectors.

172. Answer (3)

Hint : Selectable marker helps in eliminating the non-transformants.

Sol. : Purified DNA precipitates out after the addition of chilled ethanol. Plasmids are extrachromosomal double stranded circular DNA in bacteria.

173. Answer (1)

Hint : pBR322 has unique restriction site for certain endonucleases.

Sol. : Unique restriction site for *Sa*I is present in tetra cycline resistance gene.

174. Answer (1)

Hint : An expensive technique for treatment of genetic disease.

Sol. : Gene therapy is an expensive technique that uses genes to treat or prevent disease. In the future, this technique may allow doctors to treat a disorder

by inserting a gene into a patient's cell instead of using drugs or surgery.

175. Answer (3)

Hint : They are called molecular glue.

Sol. : DNA ligases form phosphodiester bonds between adjacent nucleotides and covalently link two individual fragments of double-stranded DNA by utilising energy from dNTPs. Endonucleases are restriction enzymes. DNA polymerase synthesizes a new strand of DNA complementary to an existing DNA template in 5' to 3' direction.

176. Answer (4)

Hint : Breaking dsDNA into ssDNA is DNA denaturation.

Sol. : The temperature of melting (T_m) or denaturation is defined as the temperature at which 50% of double stranded DNA is changed to a single-stranded DNA. The process of breaking the hydrogen bonds between the nucleotide base pairs in double stranded DNA requires energy.

177. Answer (1)

Hint : It is produced by *Streptococcus*.

Sol. : Myocardial infarction can now be treated by genetic engineering. Erythropoietin is synthesized from J.G. cells of kidney promoting erythropoiesis. Interleukins are lymphokines that activate immune system.

178. Answer (1)

Hint : It is considered as salt retaining hormone

Sol. : The gene for human growth hormone (hGH) was isolated from human pituitary gland. *E. coli* is used in recombinant DNA technology for pharmaceutical manufacturing of insulin.

179. Answer (4)

Hint : Identify a super bug.

Sol. : Bioremediation is a strategy that uses naturally occurring organisms to breakdown pollutants, such as petroleum hydrocarbons into less toxic substances. Bioremediation by *Pseudomonas aeruginosa* is also well documented.

180. Answer (3)

Hint : Stealing of patent.

Sol. : Biopiracy is the term used to refers to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned with compensatory payment.

