PACE-IIT & MEDICAL

ANSWER KEY FOR MAJOR TEST- 04 (FOR 2024 ASPIRANTS) 25th June 2023

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

Solutions

1. (1)

$\vec{R} = \vec{A} + \vec{B} = 3\hat{i} + 6\hat{j} - 2\hat{k}$

$\hat{R} = \frac{1}{7}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right)$

2. (1)

$\frac{\Delta x}{x} \times 100\% = \pm\left(\frac{\Delta a}{a} \times 100\% + 2\frac{\Delta b}{b} \times 100\% + 3\frac{\Delta c}{c} \times 100\%\right)$

$= \pm(1\% + 2 \times 3\% + 3 \times 2\%) = \pm 13\%$

3. (2)

$V_{avg} = \frac{\text{area of } (v - t) \text{ curve}}{\text{time interval}} = \frac{350}{25} = 14 m/s$

4. (3)

$y = 16x - \frac{x^2}{4} \Rightarrow y = 16x\left(1 - \frac{x}{64}\right)$

Compare with $y = x\tan\theta\left(1 - \frac{x}{R}\right)$

$R = 64m$

5. (2)

$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$

$\& A_1 V_1 = A_2 V_2$

$P_2 = 2.6 \times 10^5 Pa$

6. (4)

$h \propto \frac{T}{\rho} \Rightarrow \frac{h_1}{h_2} = \frac{60 \times 0.6}{50 \times 0.8} = \frac{9}{10}$

7. (1)

$mg = F_B + F_B \Rightarrow AL\sigma g = A\frac{L}{4}2dg + A\frac{3L}{4}dg$

$\Rightarrow \sigma = \frac{5d}{4}$

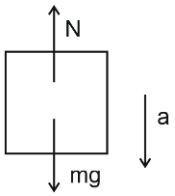
8. (3)

(a) $a = \frac{(2m - m)g}{2m + m} = g/3$ (b) $a = \frac{2mg}{m} = 2g$

9. (2)

$f = -\frac{dU}{dx} = 16x - 4 = 0 \Rightarrow x = 0.25m$

10. (2)



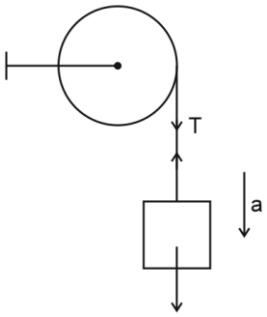
$N = mg - ma = 4N$

11. (4)

12. (2)

$$2gh = 5gR \Rightarrow R = \frac{2h}{5} = 2cm$$

13. (4)



$mg - T = ma - (1)$

$$TR = \frac{MR^2}{2}\alpha - (2)$$

$$a = \alpha R - (3)$$

From (1), (2), (3)

$$a = \frac{mg}{\left(m + \frac{M}{2}\right)} = \frac{1.2g}{\left(1.2 + \frac{2.4}{2}\right)}$$

$$\Rightarrow a = \frac{10}{2} = 5m/s^2$$

$$T = \frac{Ma}{2} = \frac{2.4 \times 5}{2} = 6N$$

14. (1)

$$K_i + Ui = K_f + U_f$$

$$\frac{1}{2}MV^2 - \frac{GM_1M}{d/2} - \frac{GM_2M}{d/2} = O$$

$$V = \sqrt{\frac{4G}{d}\left(M_1 + M_2\right)}$$

15. (3)

$$V_{p_{max}} = A\omega = 10 \times 20 = 200m/s$$

16. (3)

$$\frac{V_1}{V_2} = \frac{\sigma_1 - \rho}{\sigma_2 - \rho} \Rightarrow V_2 = 0.1m/s$$

17. (1)

$$x = A\sin\omega t \Rightarrow \frac{\sqrt{3}}{2}A = \frac{A}{2}\sin\left(\frac{2\pi}{T} \times 3\right) \Rightarrow \frac{\pi}{3} = \frac{6\pi}{T} \Rightarrow T = 18s$$

18. (3)

$$A = \frac{F_o}{\omega_d b} \qquad \&\left(\omega = \omega_d\right) = \sqrt{\frac{k}{m}} = \sqrt{\frac{100}{0.6}} \approx 12.9$$

Hence A = 7.75m

19. (4)

20. (1)

$$12 = \frac{k(2)(6)}{r^2} \,\&\, F = \frac{K(-2)(2)}{r^2} = -4(\text{attractive})$$

21. (3)

$$f_1 = \sqrt{\frac{\frac{k.k}{k+k}}{m}} = \sqrt{\frac{k}{2m}} \,\&\, f_2 = \sqrt{\frac{\frac{2k\times k}{2k+k}}{m}} = \sqrt{\frac{2k}{3m}} \Rightarrow \frac{f_1}{f_2} = \frac{\sqrt{\frac{1}{2}}}{\sqrt{\frac{2}{3}}} = \frac{\sqrt{3}}{2}$$

22. (3)

23. (3)

24. (3)

$$K = E.X^3 = \frac{Nm^3}{C} \Rightarrow \left[M^1L^4T^{-3}A^{-1}\right]$$

25. (2)

$$\vec{E} = -\left(\frac{\partial V}{\partial x}\hat{i} + \frac{\partial V}{\partial y}\hat{j} + \frac{\partial V}{\partial z}\hat{k}\right) = \left(2xy + z^3\right)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$$

26. (4)

$$F = \frac{n^2}{4\pi\varepsilon_o}\frac{e^2}{d^2} \Rightarrow n^2 = \frac{4\pi\varepsilon_o F d^2}{e^2} \Rightarrow n = \sqrt{\frac{4\pi\varepsilon_o F d^2}{e^2}}$$

27. (4)

28. (2)

$$I_1\omega_2 = I_2\omega_2 \Rightarrow MR^2\omega = \left(MR^2 + 4mR^2\right)\omega^1$$

$$\omega^1 = \frac{M\omega}{M+4m}$$

29. (1)

$$\Delta V = Ed \Rightarrow \Delta V = \left(\frac{2000}{5}\right)\times 0.02 = 8V$$

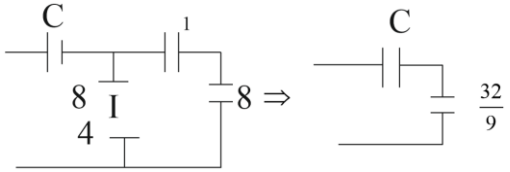
30. (2)

$$E = \frac{\sigma}{2\varepsilon_o}\left(1 - \frac{x}{\sqrt{R^2 + x^2}}\right) = \frac{10^{-8}}{2\times 8.85\times 10^{-12}}\left(1 - \frac{3}{\sqrt{3^2+4^2}}\right)$$

$$= \frac{10^4}{2\times 8.85}\times\frac{2}{5} = \frac{2\times 10^3}{8.85} = 0.22\times 10^3\,N/C$$

31. (1)

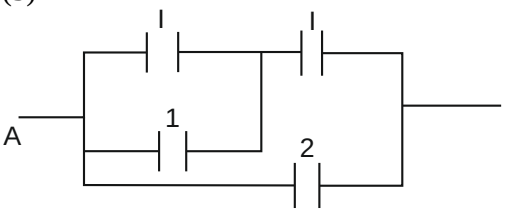
32. (2)



$$1=\frac{\frac{32}{9}\times C}{\frac{32}{9}+C}\Rightarrow C=\frac{32}{23}\mu F$$

33. (4)

34. (3)



$$C_{eq}=\frac{2}{3}+2=\frac{8}{3}\mu F$$

35. (4)

$$Q_1=2V\mu C$$

$$Q_1=Q_1^1+Q_2^1$$

$$2V=(2+8)V^1$$

$$V^1=V/5$$

$$U_i=\frac{1}{2}\times 2V^2=V^2$$

$$U_f=\frac{1}{2}(2+8)\left(\frac{V}{5}\right)^2=\frac{V^2}{5}$$

$$\frac{\Delta U}{U}=\frac{4}{5}=80\%$$

36. (1)

$$\Delta U=8\pi\left(r_2^2-r_1^2\right)T=24\pi r^2T$$

37. (2)

$$r_c=\frac{r_1r_2}{r_2-r_1}=\frac{5\times 4}{5-4}=20\text{cm.}$$

38. (1)

$$C=\frac{(K_1+K_2)\in\frac{A}{2}}{d}$$

39. (1)

$$\mu=\frac{\sin\left(\frac{\delta m+A}{2}\right)}{\text{Sin}\left(\frac{A}{2}\right)}=\frac{\text{Sin}\left(\frac{60^o+30^o}{2}\right)}{\text{Sin}\,30^o}=\frac{\frac{1}{\sqrt{2}}}{1/2}=\sqrt{2}$$

40. (1)

$$\theta_c = \sin^{-1}\left(\frac{1}{\mu}\right) \qquad \left(\mu \propto \frac{1}{\lambda}\right)$$

$$\mu_v > \mu_I > \mu_B > \mu_G > \mu_y > \mu_O > \mu_R$$

41. (1)

$$f' = \left(\frac{\mu_{gw} - 1}{\mu_g - 1}\right) f = 2\text{cm}$$

42. (1)

$$U = mgh \Rightarrow V = gh \Rightarrow 2 = g(20) \Rightarrow g = \frac{1}{10}$$

$$\therefore W = mV^1 = 5 \times \frac{1}{10} \times 4 = 2\text{J}$$

43. (4)

$$\left(Q_1 + Q_2 + Q_3\right) + Q_4 = 0$$

$$m_i \times s_i\left(0 - (-10)\right) + m_i \times L_i + m_i \times S_w \times T + M_w \times S_w\left(T - 30\right) = 0$$

$$T = 8.7^o\text{C}$$

44. (1)

$$F = AY \propto \Delta T = 10^4\,\text{N}$$

45. (4)

$$\frac{E}{E} = \frac{A_1 T_1^4}{A_2 T_2} = \frac{A(400)^4}{\frac{A}{4}(600)^4} = \frac{(4)^4 \times 4}{3^4} = \frac{64}{81}$$

$$E' = \frac{81}{64} E$$

46. (3)

$$PT = C \Rightarrow P(PV) = C \Rightarrow P^2 V = C$$

47. (1)

$$r = \frac{kA\Delta T}{\ell}, r_1 = r_2 \Rightarrow \frac{9K(100 - T)}{18} = \frac{K(T - 0)}{6}$$

$$\Rightarrow T = 75^o\text{C}$$

48. (4)

$$E = 0 \Rightarrow \frac{Gm}{X^2} = \frac{GM}{(d - x)^2} \Rightarrow \sqrt{m}(d - x) = \sqrt{M}x$$

$$x = \frac{\sqrt{m}d}{\sqrt{m} + \sqrt{M}}$$

$$V = \frac{-Gm}{x} - \frac{GM}{(d - x)} = \frac{-G}{d}\left(\sqrt{m} + \sqrt{M}\right)^2$$

49. (3)

$$\Delta E = -TE = \frac{+GMm}{(R + h)} = \frac{+GMm}{5R.} = \frac{mgR}{5}$$

50. (1)

$r_1 = 2R \;\&\; r_2 = 8r$

$T.E. \propto \frac{1}{r} \Rightarrow \frac{TE_1}{TE_2} = \frac{8}{2} = 4$

$KE \propto \frac{1}{r} \Rightarrow \frac{KE_1}{KE_2} = 4. \qquad PE \propto \frac{1}{4} \Rightarrow \frac{PE_1}{PE_2} = 4$

51. (3)

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

16gm $\qquad$ 2mole

$= 1$mole $\qquad$ $= 36$gm

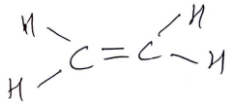
52. (4)

Size: Cation < Atom < Anion

53. (3)

Electron acts as wave

54. (3)



55. (2)

	O_2	O_2^-	O_2^+
b.o.	2	1.5	2.5

$O_2^+ > O_2 > O_2^-$

56. (1)

$\ell.p - \ell.p$ repulsion > $\ell.p. -$ b.p.rtpulsion

57. (1)

On increasing temperature, molecular speed increases. Above critical temp this speed is so high that molecules escape from liquid.

58. (2)

$C(s) + 2H_2(g) \rightarrow CH_4(g) \qquad \Delta ng = 1 - 2 = -1$

$\Delta H = \Delta U + \Delta ngRT$

$\Delta H = \Delta U - RT$

$\Delta U = \Delta H + RT \Rightarrow \Delta U > \Delta H$

59. (4)

$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$

$\Delta ng = 2 - 0 = 2$

60. (2)

$\Delta G = \Delta H - T\Delta S$

$\Delta H = -VE$ favours spontaneity

61. (3)

Buffer solution is formed in titration of weak base and strong acid when strong acid is limiting reagent.

62. (1)

$(NH_4)_2CO_3$

$NH_4^+ + CO_3^{2-} + H_2O \rightleftharpoons NH_4OH + HCO_3^-$

pH depends upon Ka of HCO_3^-
& k_b of NH_4OH

63. (4)
No effect of addition of inert gas at constant volume.

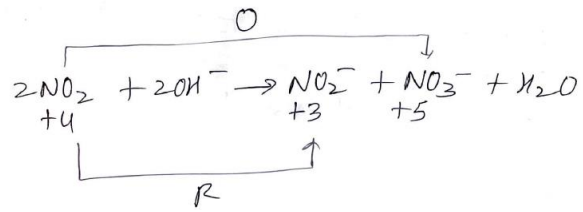
64. (4)
For spmtaneous reaction, $\Delta G^o < O \& E^o > O$

$Ag + Fe^{3+} \rightarrow Fe^{2+} + Ag^+$

$E^o = 0.77 - 0.80$

$= -0.03V$

65. (4)



66. (3)
He doesn't react with Cl_2

67. (2)

$$\underset{t=O}{A(g)} \rightarrow \underset{Pi}{B(g)} + \underset{O}{C(g)} \quad \underset{O}{}$$

$t = t \quad pi - x \quad x \quad x$

$pi - x + x + x = p_t$

$pi + x = p_t$

$x = p_t - p_i$

$p_i - x = p_i - (p_t - p_i)$

$= 2p_i - p_t$

$$K = \frac{2.303}{t}\log\frac{P_i}{P_i - x} = \frac{2.303}{t}\log\frac{p_i}{2p_i - p_t}$$

68. (4)
1st order reaction takes infinite time for completion

69. (2)
on increasing [B] 2 times, rate increases
4 times

$\text{rate} \propto [B]^2$

On increasing [A] 2 times, rate is doubled

$\text{Rate} \propto [A]$

$\text{Rate} \propto [A][B]^2$

70. (2)
Order of reaction is determined experimentally

71. (2)
Lower the value of SRP, substance is easily oxidized and can act as reducing agent

72. (4)

$CuSO_4 + Zn \longrightarrow Cu + ZnSO_4$

Zn can displace Cu from $CuSO_4$

73. (2)

Order of reactivity Hl > HBr > HCl as bond energy is Hl < HBr < HCl

74. (4)

Methyl ethanoate $CH_3-\overset{\overset{O}{\|}}{C}-O-CH_3$;

Molecular formula = $C_3H_6O_2$

Options (a), (b), (c) have same molecular formula.

Functional group in (a) is 'carboxylic acid'. Functional group in (b) are 'aldehyde' and 'alcohol'. Functional group in (c) are aldehyde and 'ether'.

75. (2)

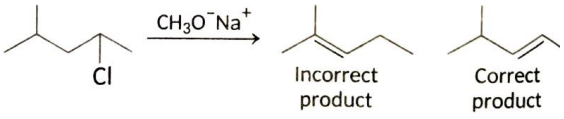
Primary alkyl halide undergoes fastest S_N2 reaction

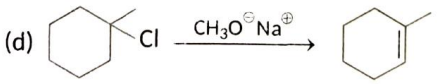
76. (3)

(a) –F is a bad leaving group. E1Cb reaction takes place forming Hofmann as the major product.

(b) With bulky base, less alkylated Hofmann is major product.

(c) E2 reaction takes place with methoxide ion. So rearrangement is possible.

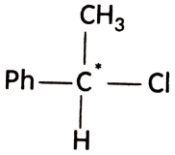


(d) 

E2 reaction takes place with methoxide ion.

77. (2)

S_N1 reaction at chiral centre generates two enantiomeric products d and l.



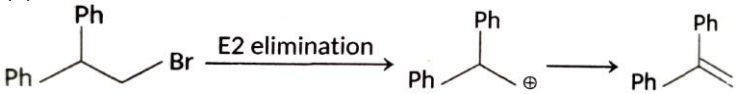
78. (2)

Rate of dehydrohalogenation (elimination)

$= 3^o > 2^o > 1^o$

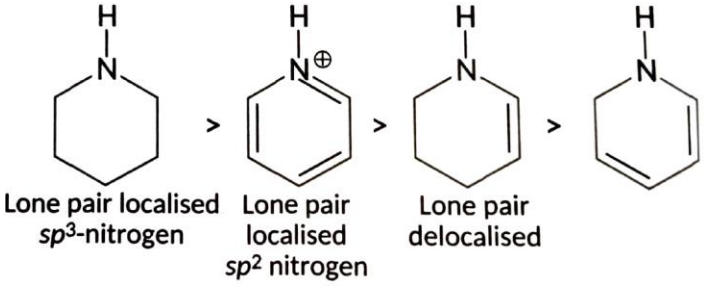
So, rate of reaction I > II > III

79. (2)



Here, there is possibility of elimination from one position.

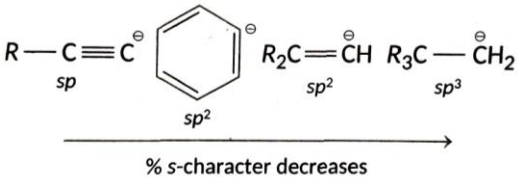
80. (4)



81. (2)

(i) > (ii) > (iii) > (iv)

More the electronegativity, more will be stability of carbanion. More the *s*-character, higher will be electronegativity.



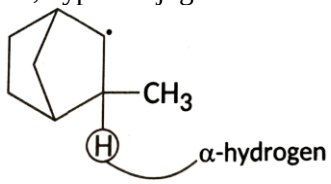
∴ Stability of carbanions decrease.

82. (3)

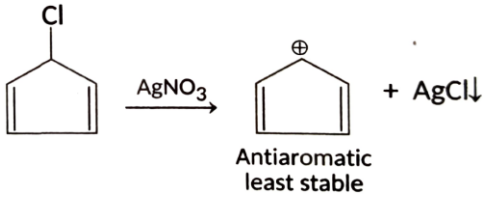
Hyperconjugation occurs through the H-atoms present on the carbon atom next to the double bond, i.e. α -hydrogen atoms.

There is no a-H in the structures I and I.

So, hyperconjugation occurs in structure III only, i.e.



83. (4)



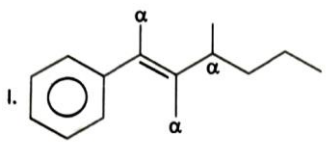
84. (1) II > III > I > IV (2) II > III > IV > I (3) IV > III > I > II (4) I > II > III > IV

(3)

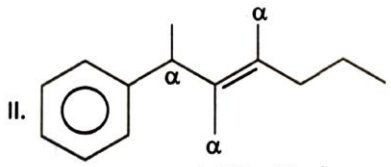
Heat of hydrogenation ∝ number of π-bond

If number of π-bonds are same.

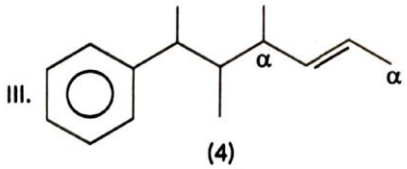
$$\Delta H_{Hydrogenation} \propto \frac{1}{Stability}$$



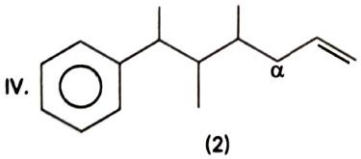
(7) Hyperconjugation resonance stabilised

II. 

No resonance stabilised by hyperconjugation

III. 

(4)

IV. 

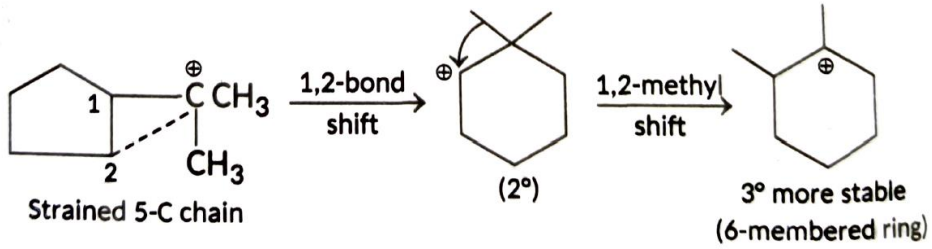
(2)

More the number of α-hydrogens, more will its hyperconjugative structures and higher will be the stability.

∴ Heat of hydrogenation value order will be

IV > III > I > II

85. (4)



Strained 5-C chain

(2°)

3° more stable (6-membered ring)

86. (2)

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

$m \uparrow \lambda \downarrow$

87. (4)

$$\text{Molality} = \frac{18.25 \times 1000}{36.5 \times 500} = 1\text{m}$$

88. (2)

From left to right, Zeff ↑ I.E. ↑

89. (3)

$$X_{O_2} = \frac{4}{5}$$

$$P_{O_2} = \frac{4}{5} \times 1\text{atm} = 0.8\text{atm}$$

$$= 0.8 \times 10^5\ \text{Nm}^{-2}$$

$$= 8 \times 10^4\ \text{Nm}^{-2}$$

90. (3)

$1\text{X C(graphite)} + O_2(g) \rightarrow CO_2(g)\ \Delta H = x$

$-1\text{X C(graphite)} + \frac{1}{2}O_2(g) \rightarrow CO(g)\ \Delta H = y$

$$CO(g)+\frac{1}{2}O_2(g)\rightarrow CO_2(g)\ \Delta H=z$$

$x - y = z$

$x = y + z$

91. (3)

$T\uparrow \quad Kw\uparrow \quad pKw\downarrow \quad \frac{pkw}{2}\downarrow$

pH of neutral solution $\downarrow$

92. (3)

$MnO_4^- \longrightarrow Mn^{2+}$

$+7 \qquad +2$

93. (3)

Conditions:

$\rightarrow$molecule should collide with sufficient threshold energy

$\rightarrow$Orientation must be proper

$\rightarrow$Collision must be effective

94. (1)

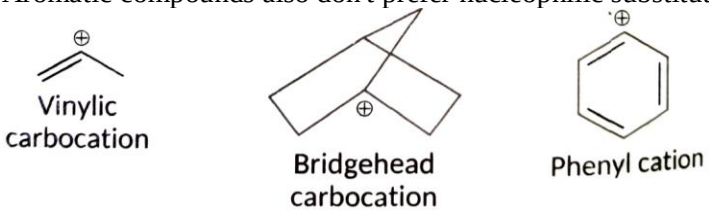
Catalyst lowers Ea, it doesn't change ΔH

95. (3)

Catalyst forms new activated complex of lower activation energy.

96. (4)

Bridgehead and vinylic halide don't undergo S_N1 as carbocation formed is highly unstable.
Aromatic compounds also don't prefer nucleophilic substitution.

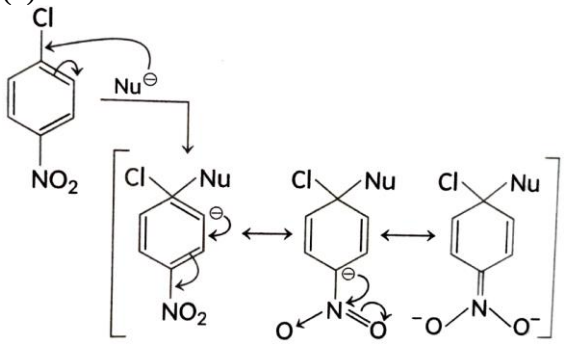


97. (4)

Down the group as size increases, leaving group ability increases as electrons are uniformly distributed.

$F^- < Cl^- < Br^- < I^-$

98. (4)



Intermediate is a carbanion which is resonance stabilised.

99. (3)

Sulphonic acid is stronger than carboxylic acid, Formic acid in more acidic than benzoic acid.
$PhSO_3H$ > HCOOH> PhCOOH> CH_3COOH

100. (3)

$$\text{Hybridisation} = \frac{\text{Number of } \sigma\text{-electrons}}{2}$$

$$= \frac{2 + 2\,(\text{negative ion})}{2} = 2 = sp$$

Hence, in the carbanion, $CH_3C \equiv C^{\ominus}$, pair of electron as (–)ve charge is present in *sp*-hybridised orbital.

101. (1)

Sexual reproduction in flowering plants

The given figure shows the stages in embryogenesis in a typical dicot (*Capsella*). The structure marked as A, B, C and D is respectively suspensor, radicle, plumule and cotyledon. Suspensor is a suspending part or structure as a group or chain of cells that is produced from the zygote of a seed plant and serves to push the developing embryo into the endosperm. Radicle is the part of a plant embryo that develops into the primary root. Plumule is the young shoot of a plant embryo above the cotyledons, consisting of the epicotyl and often of immature leaves. Cotyledon is an embryonic leaf in seed-bearing plants, one or more of which are the first leaves to appear from a germinating seed.

102. (4)

Respiration in plants

103. (2)

Sexual reproduction in flowering plants

Fig(2) is a wind pollinated plant showing compact inflorescence and well exposed stamens. Pollination by wind is more common amongst abiotic pollinations. Wind pollination also requires that the pollen grains are light, small, dry and non-sticky so that they can be transported in wind currents. Both the stigmas and anthers are exserted. Anthers are versatile, stigma is hairy, feathery or branched to catch the wind borne pollen grains.

104. (1)

Reproduction in organism

Onion - Bulb (Underground stem), Ginger - Rhizome, *Chlamydomonas* - Zoospore, Yeast - Ascospores

105. (3)

Morphology

Liliaceae is the characteristics of monocotyledonous plants. Floral characters of this family are: tricarpellary, actinomorphic, polyandrous, superior ovary, axile placentation.

106. (1)

Cell

Meiosis II maintains the haploid number of chromosomes obtained after meiosis I while changing 2n DNA content to nDNA during anaphase II will remain same *i.e.* 8.

107. (1)

Transport in plants

Water molecules posses kinetic energy water molecules are in random motion. In liquid and gaseous form the greater the concentration of water in a system, greater is its kinetic energy or water potential. Pure water has greatest water potential i.e., zero. When a solute is added to pure water, it decreases the free energy of water and thus decreases the water potential ψ_w .

108. (2)

Mineral nutrition

109. (1)

Sexual reproduction in flowering plants

Megaspore mother cell (MMC) undergoes meiosis to form four haploid cells (called megaspores) and the process of formation is known as megasporogenesis. The MMC undergoes meiotic division results in the production of four megaspores 100 functional megaspores are produced by 100 MMC, since three out of four megaspores degenerate in each case.

110. (4)

Mineral nutrition

Copper is absorbed on the clay particles as divalent cations, from where it can be absorbed by the plants by exchange mechanism. It is constituent of plastocyanin which takes part in electron transport during photosynthetic phosphorylation. Manganese is absorbed by the plants when it is in the bivalent form. Manganese participates in the photolysis of water in pigment system II during photosynthesis and thus it helps in the electron transport from water to chlorophyll. Iron is mainly available in the ferrous form and it is absorbed in the ferric form, also. It is a part of catalases, peroxidases, cytochromes etc. and plays a role in electron transport system in photosynthesis.

111. (1)

Photosynthesis

During light reaction, as electrons move through the photosystems, protons are transported across the membrane because of the primary acceptor of e^- (located towards the outer surface of the membrane) transfers its electrons not to an e^- carrier but to H carrier.

112. (1)

Morphology

Aestivation is the arrangement of petals and sepals with respect to one another in a floral bud before it opens. The given figure shows different types of aestivation. Figures A, B, C and D show valvate,twisted, imbricate and vexillary aestivation. In valvate aestivation, sepals or petals or tepals just touch one another without overlapping, e.g. *Calotropis*. In twisted aestivation, one margin of each petal overlaps the margin of an adjacent petal and the other margin is overlapped by margin of another adjacent petal, e.g. China rose, cotton. If the margin of sepals or petals overlap one another but not in any particular direction as in Cassia and Gulmohar, the aestivation is called imbricate. Vexillary is the characteristics aestivation of corolla of pea when posterior petal is outermost.

113. (3)

Photosynthesis

One molecule of RuBP and one molecule of CO_2 are required to produce two molecules of 3-PGA. Therefore, for the production of 6 molecules of 3- PGA, 3 molecules of RuBP and 3 molecules of CO_2 are required.

114. (4)

Respiration in plants

During glycolysis, dehydration occurs in the presence of enzyme enolase and cofactor Mg^{2+}. 2-phosphoglycerate loses a molecule of water and is changed into phosphoenol pyruvate (PEP).

115. (2)

Mineral nutrition

Rhizobium can fix nitrogen for plants like clover and beans. Rhizobia are soil bacteria that induce the formation of special structures, called nodules, on the roots of their host plants. Inside these nodules, the rhizobia fix nitrogen by converting dinitrogen (the nitrogen gas that makes up 80% of the air one breathe) into ammonia. Ammonia is toxic, so it is rapidly assimilated into organic compounds, most of which the bacteria pass to the plant to fulfill its nutritional need for nitrogen.

116. (4)

Respiration in plants

Oxidation of molecule of NADH gives rise to 3 molecules of ATP, while that of one molecule of $FADH_2$ produces 2 molecules of ATP.

Therefore $2\ NADH_2 = 6$ ATP molecules

$3\ FADH_2 = 6$ ATP molecules

Total = 12 ATP molecules

117. (2)

Plant growth and development

Relative growth rate is the measure of the ability of the plant to produce new plant material.
Growth = 19 – 5 = 14 cm
Period = 7 days
Growth rate = 14/7 = 2 cm/day
Relative growth rate = 2/5 × 100 = 40%

118. (3)

Reproduction in organism

Both X and Y are diploid in the given figure of transverse section of pea plant.

119. (3)

Transport in plants

Chemical potential of water is water potential. Water always move from higher water potential to lower water potential.
Water potential = Osmotic potential + Pressure potential

$\psi_w = \psi_s + \psi_p$

For cell A

$\psi_{W_{(A)}} = -20 + 8$

$= 12 \text{bars}$

For cell B

$\psi_{W_{(B)}} = 12 + 2$

$= -10 \text{bars}$

$\psi_B > \psi_A$

i.e., $-10 > -12$

Thus, movement of water will occur from cell B to cell A.

120. (4)

Reproduction in organism

Vegetative propagation or reproduction is the formation of new plants from vegetative units (= vegetative parts of the plant) such as buds, tubers, rhizomes, etc. These vegetative units are called vegetative propagules. In the given figures of members of angiosperms (A- Potato; B - Ginger; C - Agave and D - *Bryophyllum*), the correct vegetative propagules present are respectively tuber, rhizome, bulbil and leaf buds. Tubers: These have buds over their nodes or eyes which produce new plantlets when a stem tuber or a part of it having an eye is placed in the soil, e.g., Artichoke, Potato (also called eyes on tuber). Rhizomes are main underground stems which store food during unfavourable conditions. These have buds for formation of new aerial shoots during favourable conditions. Examples are banana, ginger, turmeric, *Aspidium*, and *Adiantum*. Bulbils are multicellular fleshy buds that take part in vegetative propagation, e.g., *Oxalis*, *Agave*, Pineapple (Ananas), Dioscorea (Yam), Lily, *Chlorophytum*. In Agave, bulbils are modified floral uds that develop on the flowering axis. Leaf buds: These leaf buds (adventitious) arise from the notches present at the margin of leaves in *Bryophyllum*.

121. (4)

Sexual reproduction in flowering plants

Sequence of development during the formation of embryo sac is:
Archesporium $\rightarrow$ Megaspore mother cell $\rightarrow$ Megaspore $\rightarrow$ Embryo sac

122. (1)

Photosynthesis

In the given diagram of Calvin cycle, CO_2 is incorporated at stage P.

123. (2)

Plant kingdom

The female sex organ archegonium is formed in bryophytes (*Funaria)*, pteridophytes (*Dryopteris*) and gymnosperms (*Ginkgo*).

124. (1)

Sexual reproduction in flowering plants

Diploid female plant will have 2 polar nuclei (each haploid) with which one male gamete form tetraploid male plant (male gamete of tetraploid plant will be diploid) fuses, making endosperm. So endosperm will be tetraploid.

$$\underset{(2n)}{\text{Male gamete}} + \underset{(n)\ (n)}{\text{2 polar nuclei}} \longrightarrow \underset{(4n)}{\text{Endosperm}}$$

125. (3)

Photosynthesis

In C_4 (sugarcane plant) plant, $14CO_2$ is fixed in malic acid in which the enzymes that fixes CO_2 is phosphoenol pyruvic acid carboxylase. Phosphoenolpyruvate carboxylase catalyzes the addition of bicarbonate (HCO_3^-) to phosphoenolpyruvate (PEP) to form the four-carbon compound oxaloacetate and inorganic phosphate: PEP + HCO_3^- Oxaloacetate + P*i* This reaction is used for carbon fixation in CAM (Crassulacean acid metabolism) and C4 organisms, as well as to regulate flux through the citric acid cycle (also known as Krebs or TCA cycle) in bacteria and plants.

126. (4)

Biological classification

$$1 \xrightarrow{30\ min} 2 \xrightarrow{30\ min} 4 \xrightarrow{30\ min} 8 \xrightarrow{30\ min} 16 \xrightarrow{30\ min} 32 \xrightarrow{30\ min} 64 \xrightarrow{30\ min} 128 \xrightarrow{30\ min} 256$$

127. (3)

Sexual reproduction in flowering plants

Each microspore mother cell gives rise to 4 microspores which develop into pollen grains.

128. **Photosynthesis**

NCERT XI Pg no. 216,217

129. (4)

Sexual reproduction in flowering plants

Coleorhiza is the sheath that envelops the radicle in certain plants (grass or cereal grain) and that is penetrated by the root in germination. Food storing tissue is endosperm. Endosperm is the part of a seed which acts as a food store for the developing plant embryo. Parthenocarpic fruit produced without the formation of seeds due to lack of pollination, fertilization and embryo development. Examplebanana, pineapple, orange and grapefruit. Single seeded fruit developing from monocarpellary is mango. Membranous seed coat is present in maize.

130. (4)

Respiration in plants

In the presence of an enzyme complex, pyruvate dehydrogenase complex, sulphur containing CoA and NAD^+, pyruvate undergoes oxidative decarboxylation or both oxidation (removal of hydrogen) and decarboxylation (removal of CO_2). It produces a 2-carbon active acetate group or acetyl CoA, NADH + H^+ and CO_2.

$$\underset{(3-C)}{\text{Pyruvate}} + NAD^+ + CoA \xrightarrow[\text{Complex}]{\text{Pyruvate dehydrogenase}} \underset{(2-C)}{\text{Acetyl CoA}} + NADH + H^+ + CO_2\uparrow$$

131. (2)

Sexual reproduction in flowering plants

132. (2)

Respiration in plants

10 flowers

6 stamen/flower ∴ 60 stamen/anther
1 anther = 4 pollen sac
∴ 60 anther = 240 pollen sac
1 pollen sac = 30 PMC
1 PMC = 4 pollen grain
∴ 7200 PMC = 28,800 pollen grain
1 pollen grain = 2 male gametes
∴ 28,800 pollen grains = 57,600 male gametes

133. **Photosynthesis**

134. (2)
Sexual reproduction in flowering plants
Parthenocarpy is the development of fruit without the formation of seeds due to lack of pollination, fertilization and embryo development. Polyembryony is the formation of more than one embryo from a single fertilized ovum or in a single seed. Apomixis is the development of an embryo without the occurrence of fertilization. Parthenogenesis is one form of apomixis. Dormancy is a state of temporary metabolic inactivity or minimal activity therefore helps an organism to conserve energy.

135. **Respiration in plants**

136. (1)
Sexual reproduction in flowering plants
Pollen mother cells undergo meiosis and produce pollen grains. The pollen grains have haploid number of chromosomes.

137. **Plant kingdom**

138. (4)
Anatomy of flowering plants
Soft wood is non-porous, homoxylous gymnospermic wood rich in tracheids and xylem parenchyma, vessels and fibres are absent and resin canals are present, e.g., Deodar (*Cedrus*), Pine (*Pinus*)

139. **Sexual reproduction in flowering plants**
NCERT XII, Pg no. 24

140. (3)
Transport in plants
Statements (iii) and (iv) regarding translocation of mineral ions are correct.
(i) Mineral ions are frequently remobilised, particularly from older senescing parts.
(ii) Older drying leaves export much of their mineral contents to younger leaves.

141. (4)
Mineral nutrition
The kind of deficiency symptoms shown in plants includes chlorosis, necrosis, and stunted plant growth, premature fall of leaves and buds, and inhibition of cell division. Chlorosis is the loss of chlorophyll leading to yellowing in leaves. This symptom is caused by the deficiency of elements like N, K, Mg, S, Fe, Mn, Zn and Mo. Likewise, necrosis, or death of tissue, particularly leaf tissue, occurs due to the deficiency of Cu, K, Ca and Mg.

142. (1)
Photosynthesis
In C_4 plant, the first stable product is oxaloacetic acid (OAA), which is a 4 C-compound where PEP acts as the CO_2 acceptor. So, the radioactivity will first appear in OAA.

143. (4)
Sexual reproduction in flowering plants
Cleistogamy is a self-fertilization that occurs within a permanently closed flower. In cleistogamous flower, the anther and stigma lies close to each other. When anther dehisces in the flower buds, pollen grains

come in contact with the stigma to effect pollination. Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross – pollen landing on the stigma. Cleistogamous flowers produce assured seed set even in the absence of pollinators.

144. (3)
Respiration in plants

145. (2)
Plant growth and development
Ripening of citrus and apple fruits can be delayed with the help of gibberellins. The fruits can be left on the tree longer to extend market period. It is also useful for safe and prolonged storage of fruits.

146. (3)
Anatomy of flowering plants
Teak, mango and palm belong to angiosperms in which presence of vessels is a characteristic feature. Pine is a gymnosperm which lack vessels in their xylem.

147. **Sexual reproduction in flowering plants**
NCERT XII Pg no.23

148. **Reproduction in organism**
NCERT XII Pg no. 9

149. (3)
Sexual reproduction in flowering plants
Pollen grains can be stored in liquid nitrogen (–196°C) to retain their viability for longer duration of time. Such stored pollen can be used as pollen banks similar to seed banks, in crop breeding programmes

150. **Respiration in plants**
NCERT XII, Pg no. 212, 213

151. Endocrine and neural systems are for Co-ordination of all body functions .

152. (1)

153. XI NCERT pg 319

154. XII NCERT pg 11

155. XI NCERT pg 340

156. Zona pellucida is the primary non-cellular membrane and corona radiata is secondary cellular membrane.

157. White colour is due to myelin sheath.

158. Adrenal cortex-mesoderm and adrenal medulla –ectoderm, hence dual in origin. Thymus is not only endocrine but also lymphoid organ, hence dual in function.

159. XI NCERT pg 323,324

160. XI NCERT pg 335. Hormone produced in hypothalamus affects the uterine contraction . Hormone produced in adrenal medulla stimulates heart

161. Glycine is the simplest amino acid.

162. XII NCERT pg 48

163. (4)

164. XI NCERT pg 112

165. XI NCERT pg 321

166. XI NCERT pg 333,oxytocin

167. XII NCERT pg 49

168. XI NCERT pg 322

169. XI NCERT pg 317

170. Secretin is secreted by endocrine cells of small intestine that acts on liver, gastric glands and exocrine parts of pancreas.

171. XI NCERT pg 272

172. (4)

173. The blastomeres in the blastocyst are arranged as outer trophoblast and inner embryoblast

174. Adrenal cortex secrets sex corticoids.

175. XI NCERT pg 286

176. Pituitary hormones are always stimulatory for their target cell and hence called tropic hormones.

177. Medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions.

178. Sol. During parturition, the foetal ejection reflex triggers the release of oxytocin from maternal pituitary and cause uterine contraction form birth process.

179. Solution: The type of epithelial cells which line the inner surface of fallopian tubes, bronchioles and small bronchi are known as ciliated epithelium.

180. Sol. When head of sperm binds to zona pellucida of ovum the acrosome release its contents by exocytosis (hydrolytic enzymes like hyaluronidase, corona penetrating enzymes, etc). It helps the sperm to reach the plasma membrane of ovum, by dissolving corona radiata and zona pellucida.

181. Sol. Testes are located in scrotal sacs which maintains a lower (2 – 3 degree less) temperature then normal body temperature.

182. XI NCERT pg 333

183. Isthmus of the fallopian tube opens into the uterus. Vagina is not part of external genitilia.

184. Homeothermy is seen in aves too.

185. Iodine deficiency causes goitre is adults and mother suffering from such won't support proper development of foetus resulting in cretinism.

186. XI NCERT pg 259

187. Progestogens, oestrogens is secreted by even non pregnant females.

188. XI NCERT – PAGE NO. 148

189. (3)

The inner layer is the retina and it contains three layers of neural cells from inside to outside-ganglion cells, bipolar cells and photoreceptor cells. There are two types of photoreceptor cells, namely rods and cones. These cells contains the light-sensitive proteins called the photopigments.

190. The vagina along with cervix forms the birth canal.

191. Juxta medullary nephrons have long loop of Henle whereas, cortical nephrons have short loop of Henle.

192. First menstrual cycle begins at puberty and is called menarche.

193. Secretin inhibits gastric glands and gastrin stimulates gastric glands.

194. Meiosis occur during sexual reproduction during gametogenesis. Fertilisation can be external or internal in sexual reproduction.

195. XI NCERT pg 326

196. XI NCERT pg 312

197. The primary follicle get surrounded by more layers of granulosa cells and undifferentiated theca in secondary follicle, it is organised into inner theca interna and outer theca externa in tertiary follicle.

198. (3)
Ear ossicles amplify sound 15-20 times.

199. (2)

200. Oxytocin is milk ejaculatory hormone.