

All India Aakash Test Series for NEET - 2025

TEST - 5 (Code - E)**Click here for
Code-F Sol.**

Test Date : 09/02/2025

ANSWERS

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

Medical III

$$\text{Sol.: } U_{\text{net}} = \frac{-kq^2}{b} + \frac{kq^2}{b} - \frac{kq^2}{2b} \Rightarrow U_{\text{net}} = \frac{-kq^2}{2b}$$

12. Answer (1)

Hint: Electrostatic potential

$$= \frac{\text{Electrostatic potential energy}}{\text{Charge}}$$

$$\text{Sol.: } V = \frac{U}{q}$$

$$\Rightarrow [V] = \frac{[ML^2T^{-2}]}{[AT]} = [ML^2T^{-3}A^{-1}]$$

13. Answer (1)

Hint and Sol.

The potential due to an electric dipole on its axis

$$\text{is } \frac{p}{4\pi\epsilon_0 r^2}.$$

14. Answer (1)

Hint & Sol.: The electrostatic force is perpendicular to circumference. Therefore, work done by electrostatic force is zero.

15. Answer (2)

Hint: Potential due to a point charge q is $\frac{kq}{r}$ **Sol.:** $W = q\Delta V$ where ΔV represents change in electric potential

$$\Rightarrow V_s = \frac{kq_1}{40} + \frac{kq_2}{10} \Rightarrow V_s = \frac{kq_1}{0.4} + 10kq_2$$

$$V_R = \frac{kq_1}{0.4} + \frac{kq_2}{50} \Rightarrow V_R = \frac{kq_1}{0.4} + 2kq_2$$

$$\Rightarrow \Delta V = V_s - V_R = 8kq_2 \Rightarrow W = 8kq_2 = \frac{8q_2}{4\pi\epsilon_0} = \frac{2q_2}{\pi\epsilon_0}$$

16. Answer (3)

Hint: According to Gauss's law, $\phi = \frac{q_{\text{enc}}}{\epsilon_0}$.**Sol.:** Since the net charge enclosed by the gaussian surface is same, hence the net electric flux remains same.

17. Answer (2)

Hint: Current density, $|\vec{\lambda}| = \frac{i}{A}$ **Sol.:** For steady current flowing through conductors, $\lambda \propto \frac{1}{A}$

$$\Rightarrow \lambda_P A_P = \lambda_Q A_Q$$

$$\Rightarrow \frac{\lambda_P}{\lambda_Q} = \frac{A_Q}{A_P} \text{ as } A_Q > A_P$$

$$\Rightarrow \lambda_P > \lambda_Q$$

18. Answer (2)

Hint: Use the concept of parallel combination of resistors.**Sol.:** The current will be equally divided among the three resistors.

$$P = I^2 R$$

$$= 3^2 \times 2 = 18 \text{ W}$$

19. Answer (3)

Hint: When resistors are connected in series,

$$R_{\text{eq}} = R_1 + R_2 + \dots$$

When resistors are connected in parallel,

$$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$\text{Sol.: } \frac{1}{R_{\text{eq}}} = \frac{1}{R} + \frac{1}{R} + \dots$$

$$\Rightarrow \frac{1}{R_{\text{eq}}} = \frac{n}{R}$$

$$\Rightarrow R_{\text{eq}} = \frac{R}{n}$$

$$\Rightarrow \alpha = \frac{R}{n}$$

$$\Rightarrow R = n\alpha$$

When connected in series, $R'_{\text{eq}} = nR$

$$\Rightarrow R'_{\text{eq}} = n(n\alpha) = n^2\alpha$$

20. Answer (4)

Hint: Resistance of a wire is given by, $R = \frac{\rho\ell}{A}$ **Sol.:** Since the wire is drawn out, the volume is going to remain conserved.

$$\Rightarrow R = \frac{\rho\ell \times \ell}{A \times \ell}$$

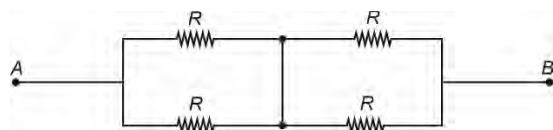
$$\Rightarrow R = \frac{\rho\ell^2}{V}$$

$$\Rightarrow R \propto \ell^2$$

$$\Rightarrow \frac{R_0}{20} = \frac{\ell^2}{4\ell^2}$$

$$\Rightarrow R_0 = 5 \Omega$$

21. Answer (1)

Hint: Use the concept of series and parallel combination of resistors.**Sol.:** The circuit can be redrawn in the following manner

$$\Rightarrow R_{eq} = \frac{R}{2} + \frac{R}{2} = R$$

22. Answer (3)

Hint: Use, Power = VI and Potential difference, $V = IR$

$$\text{Sol.: } 50 = \frac{V^2}{R} \Rightarrow R = \frac{100 \times 100}{50} \Rightarrow R = 200 \, \Omega$$

$$\text{Power consumed} = \frac{V^2}{R} = \frac{25 \times 25}{200} = 3.125 \, \text{W}$$

23. Answer (1)

Hint: During discharging of cell, terminal potential difference, $V = E - Ir$.**Sol.:** The negative slope of graph between V and I should give internal resistance.

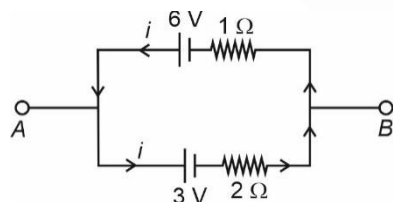
$$\Rightarrow r = \frac{4}{10} = 0.4 \, \Omega$$

24. Answer (3)

Hint: Resistance, $R = \frac{\rho l}{A}$

$$\text{Sol.: Resistance, } R = \frac{\rho \times a}{a \times t} \Rightarrow R = \frac{\rho}{t}$$

25. Answer (2)

Hint: Use Kirchhoff's loop rule.**Sol.:**Applying the loop rule, $3 + 2i + i - 6 = 0$

$$\Rightarrow 3i - 3 = 0 \Rightarrow i = 1 \, \text{A}$$

$$(\text{P.D.})_{AB} = 6 - (1)(1) = 5 \, \text{V}$$

26. Answer (4)

Hint: Use Kirchhoff's loop rule**Sol.:** If potential at point A is zero, then $V_C = 2 \, \text{V}$

$$V_D - V_C = 2 \times 1 \Rightarrow V_D = V_C + 2 = 4 \, \text{V}$$

If $V_D = 4 \, \text{V}$, then $V_B = 8 \, \text{V}$

27. Answer (1)

Hint: Use, $j = \sigma E$ and $i = neAv_d$ **Sol.:** We know that, $i = neAv_d \Rightarrow j = nev_d$

$$\text{and } j = \frac{E}{\rho}$$

$$\Rightarrow \frac{E}{\rho} = nev_d \text{ and } E = \frac{V_0}{L}$$

$$\Rightarrow \rho = \frac{V_0}{neLv_d}$$

28. Answer (4)

Hint: Mobility, $\mu = \frac{v_d}{E}$ **Sol.:** The S.I. Unit of mobility is $\frac{\text{m}^2}{\text{Vs}}$

29. Answer (2)

Hint: Instantaneous current (i) = $\frac{dq}{dt}$

$$\text{Sol.: } i = \frac{dq}{dt} = \frac{d}{dt}(t^3 + 2t) = 3t^2 + 2$$

$$\Rightarrow (i)_{\text{at } t=1} = 3(1) + 2 = 5 \, \text{A}$$

30. Answer (2)

$$\text{Hint \& Sol : } U = \frac{kq_1q_2}{r}$$

If q_1 and q_2 have same sign so, on decreasing r , potential energy will increase.

Potential is defined only for conservative fields.

31. Answer (1)

Hint: The force experienced by a test charge in an electric field is directly proportional to the magnitude of electric field.

$$\text{Sol.: } E_A > E_B > E_C \Rightarrow F_A > F_B > F_C$$

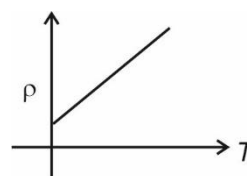
32. Answer (1)

Hint: Use Kirchhoff's law

$$\text{Sol.: } V_A - (3 \times 3) + 3 - (3 \times 2) = V_B$$

$$\Rightarrow V_A - 9 + 3 - 6 = V_B \Rightarrow V_A - V_B = 12 \, \text{V}$$

33. Answer (4)

Hint & Sol : Nichrome exhibits a very weak dependence of resistivity with temperature. Hence, the correct variation is

34. Answer (2)

Hint: Use the concept of series and parallel grouping of resistors.**Sol.:** When S_1 is closed, $i = \frac{E}{4R}$,

$$\Rightarrow V_1 = \frac{E}{4R} \times 3R = \frac{3E}{4}$$

When S_2 is closed, $i = \frac{E}{7R}$,

$$\Rightarrow V_2 = \frac{E}{7R} \times 6R = \frac{6E}{7} \Rightarrow V_2 > V_1$$

35. Answer (3)

Hint: In steady state, the branch at which capacitor is connected will behave as open switch.**Sol.:** Since the capacitor behaves as an open switch $\Rightarrow i = \frac{E}{R_1 + R_3}$

$$\text{P.D. across capacitor} = \frac{ER_1}{R_1 + R_3}$$

$$\Rightarrow \text{Charge on capacitor} = \frac{CER_1}{R_1 + R_3}$$

SECTION-B

36. Answer (1)

Hint & Sol: Initial charge = CV Let the common potential be V_0

$$\Rightarrow CV = CV_0 + 3CV_0 \Rightarrow CV = 4CV_0$$

$$\Rightarrow V_0 = \frac{V}{4}$$

Energy stored in C , after closing switch

$$= \frac{1}{2} \times C \times \frac{V^2}{16} = \frac{CV^2}{32}$$

Energy stored in $3C$, after closing switch

$$= \frac{1}{2} \times 3C \times \frac{V^2}{16} = \frac{3CV^2}{32}$$

$$\text{Total energy stored} = \frac{1}{2} \times 4C \times \frac{V^2}{16} = \frac{CV^2}{8}$$

 $\Rightarrow$ Energy lost in redistribution

$$= \frac{1}{2} \times C \times V^2 - \frac{1}{8} CV^2$$

$$= \frac{CV^2}{2} \left[1 - \frac{1}{4} \right] = \frac{3CV^2}{8}$$

37. Answer (2)

Hint: Use the concept of potential due to hollow sphere.**Sol.:** Let us assume that charge q appears at inner sphere.

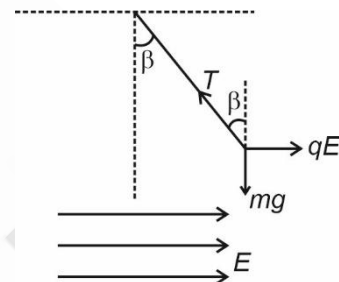
$$\Rightarrow V_{\text{inner sphere}} = \frac{K \cdot q}{a} + \frac{K(-Q)}{b} = 0$$

$$\Rightarrow \frac{1}{4\pi\epsilon_0} \left[\frac{q}{a} - \frac{Q}{b} \right] = 0$$

$$\Rightarrow \frac{q}{a} = \frac{Q}{b}$$

$$\Rightarrow q = \frac{Qa}{b}$$

38. Answer (3)

Hint: Use the condition of equilibrium and concept of free body diagram**Sol.:**

From the free body diagram, we can write that

$$T \cos \beta = mg \text{ and } T \sin \beta = qE$$

$$\Rightarrow T = \frac{mg}{\cos \beta} \text{ or } T = \frac{qE}{\sin \beta}$$

39. Answer (4)

Hint: Use concept of series and parallel combination.**Sol.:** Charge across $4 \mu\text{F}$ capacitor is

$$= 4 \times 6 = 24 \mu\text{C}$$

For upper branch

$$C_{\text{eq}} = 2 \mu\text{F}$$

$$\text{Charge across } 3\mu\text{F} = 2 \times 6 = 12 \mu\text{C}$$

$$\Rightarrow \text{Ratio} = \frac{12}{24} = \frac{1}{2}$$

40. Answer (2)

Hint: Use the property of conductor to determine charge on capacitor.**Sol.:** Final charge on inside plate of capacitor

$$= \frac{Q}{2} + CV$$

We also know that, $Q' = CV'$

$$\Rightarrow \frac{Q}{2} + CV = C(V') \Rightarrow V' = V + \frac{Q}{2C}$$

41. Answer (1)

Hint & Sol : When a capacitor is charged with a battery, then energy stored in it is 50% of the work done by battery and remaining is lost in the form of heat.

If the charges are same, then the potential difference across them would be divided in inverse ratio of their capacities.

42. Answer (1)

Hint & Sol.: The resistivity of a semiconductor decreases with increase in temperature as electron density increases while the average time of collision decreases with increase in temperature.

Resistance of a conductor depends on its dimensions.

43. Answer (3)

Hint: Use the concept of parallel combination of resistors.

Sol.: As the resistors are connected in parallel combination

$$\Rightarrow 20 \times i = 10 \times i_1$$

$$\Rightarrow i_1 = 2i$$

$$\text{Also, } i = 1 - i - i_1 \Rightarrow i = 1 - i - 2i \Rightarrow i = 1 - 3i$$

$$\Rightarrow 4i = 1 \Rightarrow i = \frac{1}{4} \text{ A}$$

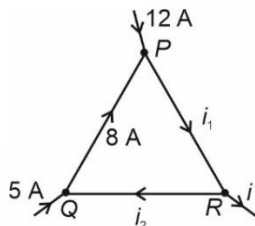
44. Answer (4)

Hint & Sol.: Resistivity is the property of material and it is independent of dimensions of wire.

45. Answer (1)

Hint: Use Kirchhoff's junction rule

Sol.:



At junction P, $i_1 = 20 \text{ A}$

At junction Q, $i_2 = 3 \text{ A}$

$$\Rightarrow i = 17 \text{ A}$$

46. Answer (3)

Hint: When N cells are connected in series then, $E' = NE$ and $R' = Nr$

Sol.: Since current of 4 A is required through 5Ω resistor then,

$$4 = \frac{N \times 3}{5 + N \times 0.5}$$

$$\Rightarrow 20 + 2N = 3N$$

$$\Rightarrow N = 20$$

47. Answer (4)

Hint: Current (i) = $\frac{dq}{dt}$

$$\text{Sol.} \quad i = \frac{dq}{dt} = 2 + 3t$$

$$\Rightarrow dq = 2dt + 3tdt$$

$$\Rightarrow q = \int dq = \int_0^2 2dt + \int_0^2 3tdt$$

$$\Rightarrow q = 2[2 - 0] + \frac{3}{2}[4 - 0] = 4 + \frac{3}{2} \times 4$$

$$= 4 + 6 = 10 \text{ C}$$

48. Answer (1)

Hint: Drift velocity, $v_d = \frac{eE\tau}{m}$

Sol.: $v_d = \frac{eE\tau}{m}$ and $V = Ed$, thus for the same conductor, $v_d \propto (\text{Potential difference})$

$$\Rightarrow \frac{v_1}{v'} = \frac{V}{2V} \Rightarrow v' = 2v_1$$

49. Answer (4)

Hint & Sol.: The electrostatic force on q_2 due to q_1 will remain unaffected by the presence of other charges.

50. Answer (2)

Hint & Sol.: The dielectric constant for a metal is infinite.

[CHEMISTRY]

SECTION-A

51. Answer (3)

Hint: The boiling point of straight chain alkanes increases with increase in carbon atoms while boiling point of isomeric alkanes, decreases with increasing branching due to less van der Waals forces.

Sol.:

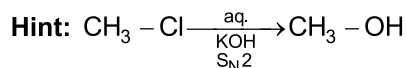
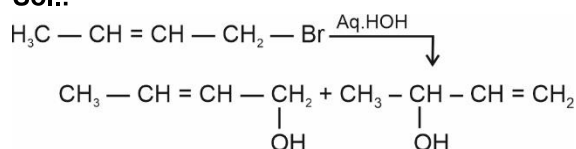
$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ n-Hexane	341.9 K
$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ n-pentane	309.1 K

$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_3 \\ \text{2-methylbutane} \end{array}$	300.9 K
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ \\ \text{CH}_3 \\ \text{2, 2-dimethylpropane} \end{array}$	282.5 K

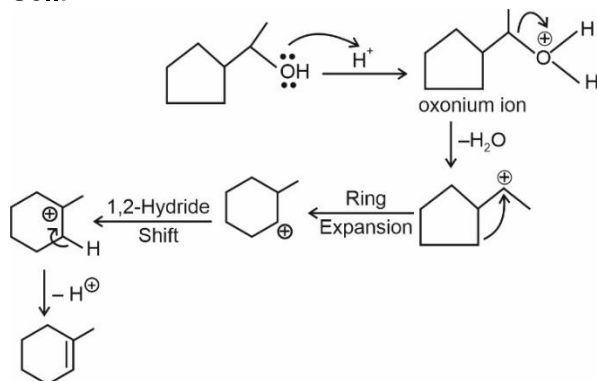
52. Answer (4)

Hint & Sol.: Kolbe's electrolysis method is used to prepare alkanes containing even number of atoms.

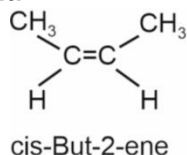
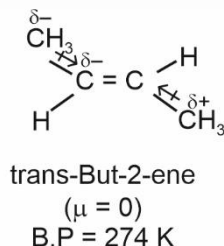
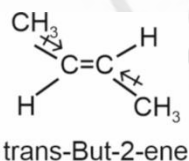
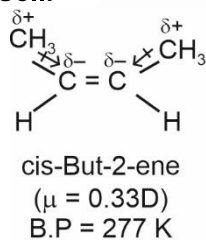
53. Answer (1)

**Sol.:**

54. Answer (2)

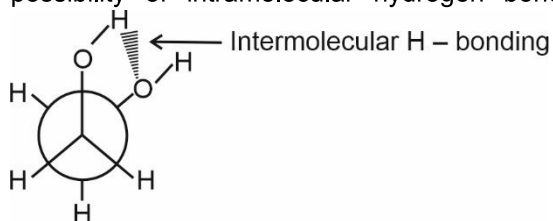
Hint: Hot and conc. H_2SO_4 is a dehydrating agent.**Sol.:**

55. Answer (3)

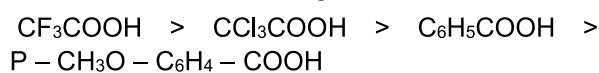
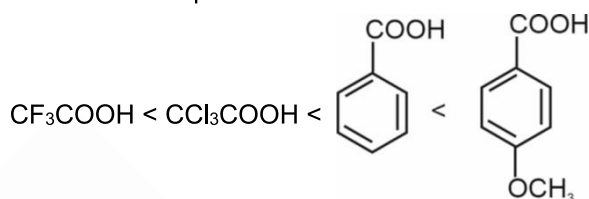
Hint:**Sol.:**

Due to more symmetry, trans isomer has higher melting point in solid state.

56. Answer (4)

Hint: A conformer will be more stable if it has a possibility of intramolecular hydrogen bonding.**Sol.:** In Gauche form of ethane-1,2-diol, there is a possibility of intramolecular hydrogen bonding

57. Answer (4)

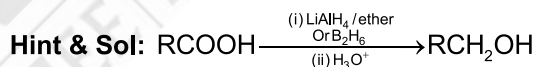
Hint: More the acidic nature, less will be the pK_a value of acid.**Sol.:** Order of acidic strength:So the order of pK_a value :

58. Answer (3)

Hint: Cold dilute and alkaline KMnO_4 is known as Baeyer's reagent.**Sol.:**

$\text{CrO}_3 - \text{H}_2\text{SO}_4$	Jones Reagent
Cold dilute Alkaline KMnO_4	Baeyer's Reagent
$[\text{Ag}(\text{NH}_3)_2]\text{NO}_3$	Tollen's Reagent
Aq. CuSO_4 and Rochelle salt (aq) in equal amount	Fehling solution A

59. Answer (2)



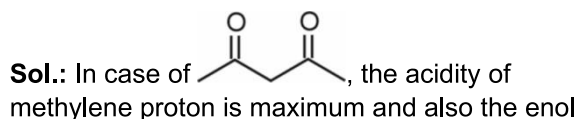
Sodium borohydride does not reduce the carboxyl acid.

60. Answer (1)

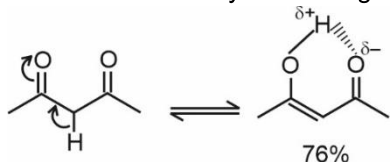
Hint: AlCl_3 is a Lewis acid and it is used as catalyst in Friedel – Crafts reactions.

Sol.: In $\text{C}_6\text{H}_5\text{COOH}$, $-\text{COOH}$ group is deactivating group and carboxylic group gets bonded with Lewis acid AlCl_3 in Friedel – Crafts reaction.

61. Answer (3)

Hint: Higher the acidity of methylene proton, more the enol content.

form is stabilised by H-bonding

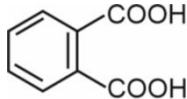


62. Answer (2)

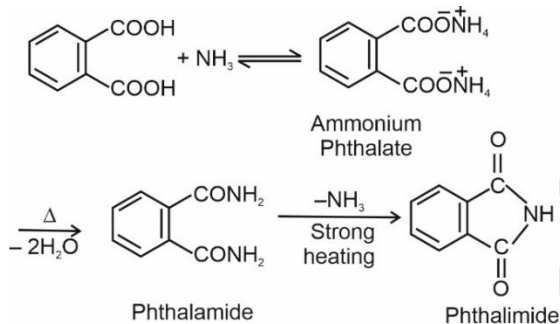
Hint and Sol: The reactivity order of halogens towards ethane is $F_2 > Cl_2 > Br_2 > I_2$

63. Answer (3)

Hint: Phthalic acid is a dicarboxylic acid



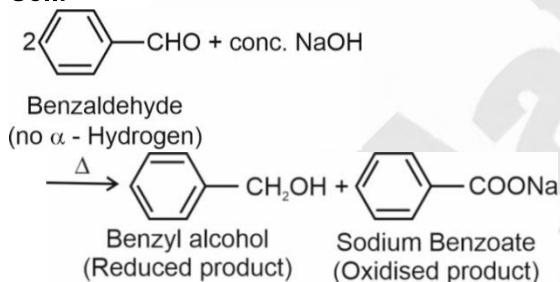
Sol.:



64. Answer (2)

Hint: In Cannizzaro reaction, one aldehyde molecule undergoes reduction while other undergoes oxidation.

Sol.:

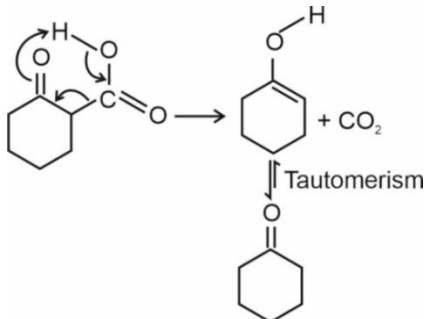


Disproportionation Reaction

65. Answer (3)

Hint: β -keto acids easily decarboxylate on heating.

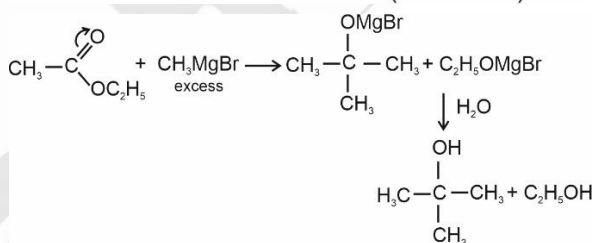
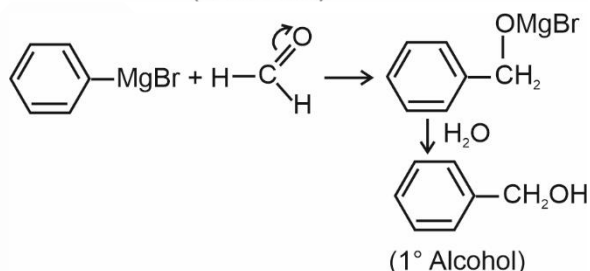
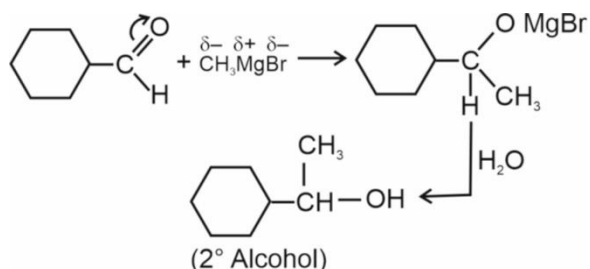
Sol.:



66. Answer (2)

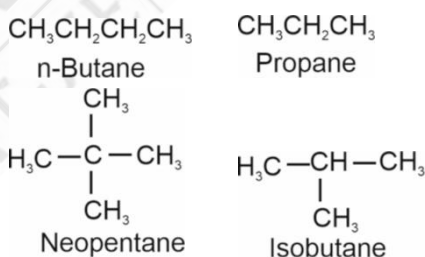
Hint: Reaction of Grignard reagent with an aldehyde is a nucleophilic addition.

Sol.:



67. Answer (1)

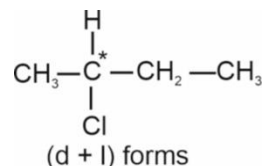
Hint:



Sol.: Monochlorination product of n-Butane



2-Chlorobutane has chiral carbon and it will show optical isomerism.



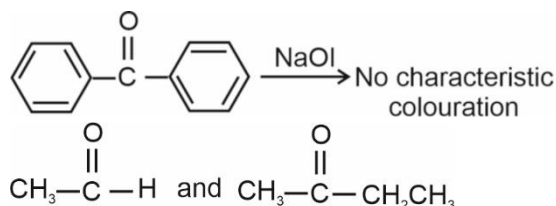
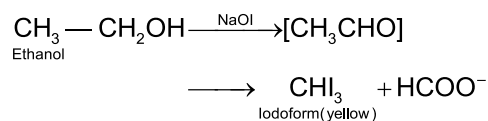
Hence, 3 monochlorination products are formed.

68. Answer (2)

Hint: Compounds containing $\text{CH}_3-\text{C}(=\text{O})-$ group

give positive iodoform test

Sol.:



(Ethanal) (Butanone)

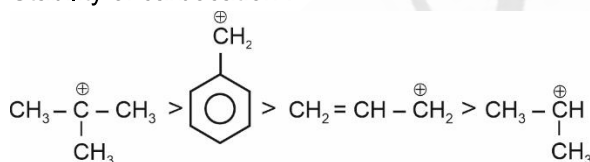
Both give positive iodoform test and can't be distinguished by iodoform test.

69. Answer (4)

Hint: Order to $\text{S}_{\text{N}}1$ depends upon stability of intermediate carbocation.

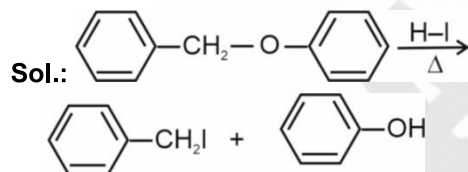
Sol.:

Stability of carbocation :



70. Answer (2)

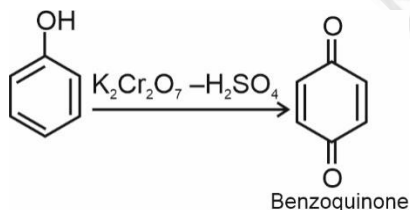
Hint: C – O bond in phenol has partial double bond character.



71. Answer (4)

Hint: Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ is as strong oxidising agent

Sol.:



72. Answer (3)

Hint: Cyclic planar species with $(4n + 2)\pi$ delocalised electrons is aromatic. (Where $n = 0, 1, 2, 3, \dots$)

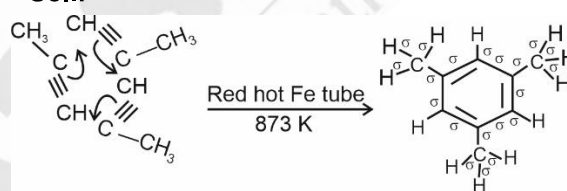
Sol.:

a.	 (Cyclobutenyl cation)	It is a cyclic planar species with 2π electrons so, $n = 0$. Hence, aromatic
b.	 (Cyclopenta-1,3-dienyl anion)	It is a cyclic, planar species with 6π electrons where $n = 1$ Hence, aromatic
c.	 Cyclooctatetraene	It is not a planar species. Hence, non-aromatic
d.	 Cyclopenta-1,3-dienyl cation	It is a cyclic planar species with $4n\pi$ electrons ($n = 1$). Hence, it is antiaromatic.

73. Answer (4)

Hint: Alkyne undergoes cyclic polymerisation to give aromatic hydrocarbon.

Sol.:



74. Answer (2)

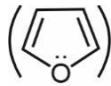
Hint: +R group increases the reactivity of benzene ring towards electrophilic substitution.

Sol.: OH group has +R effect and it increases reactivity towards electrophilic substitution.

–Cl is a +R group but it has –I effect too, hence it has less activating effect as compared to –OH towards electrophilic substitution. –NO₂ and –CHO groups have –R effect.

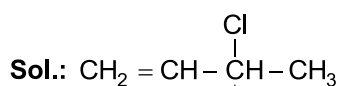
75. Answer (3)

Hint and Sol.:

In furan,  6π electrons are in conjugation.

76. Answer (3)

Hint : Optically active molecule has chiral carbon.



Above molecule has chiral carbon.

77. Answer (1)

Hint: Halogenation of toluene in the presence of sunlight leads to side chain substitution.

Sol.:

78. Answer (4)

Hint: Least stable conformer of ethane is its eclipsed form.

Sol.:

- Angle of rotation about C – C bond is termed as dihedral angle or torsional angle.
- Dihedral angle of least stable conformation of ethane is 0° .
- Conformers are interconvertible and non-separable.

79. Answer (1)

Hint: Electrophilic substitution will occur in the benzene ring which has more electron density.

Sol.:

80. Answer (3)

Hint and Sol:

Glycerol:

Propane –1, 2, 3 – triol.

81. Answer (3)

Hint: Aspirin is acetylsalicylic acid

Sol.:

$\text{ArOH} + \text{RCOCl}$

$\text{ArOCOR} + \text{HCl}$

Pyridine neutralises HCl formed to shift equilibrium to the right hand side.

82. Answer (4)

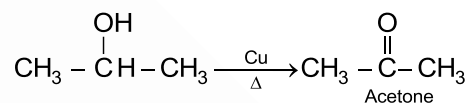
Hint: Lucas reagent is conc. HCl + ZnCl_2

Sol.: Tertiary alcohol reacts fastest with conc. HCl in the presence of ZnCl_2 to form alkyl halide and form turbidity immediately.

83. Answer (2)

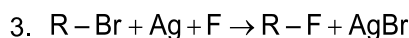
Hint: On heating alcohol with Cu, dehydrogenation takes place.

Sol.:

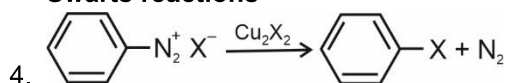


84. Answer (4)

Hint: In Hell-Volhard Zelinsky



Swarts reactions



Sandmeyer reaction

87. Answer (4)

Hint: AgCN is a covalent compound and nitrogen is free to donate electron pair.

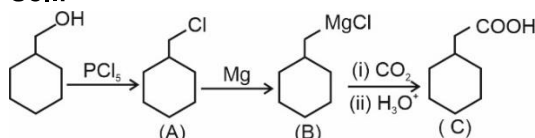
Sol.: In AgCN, nitrogen atom is free to donate electron pair forming isocyanide as the main product while reacting with alkyl halide



88. Answer (1)

Hint: Reaction of

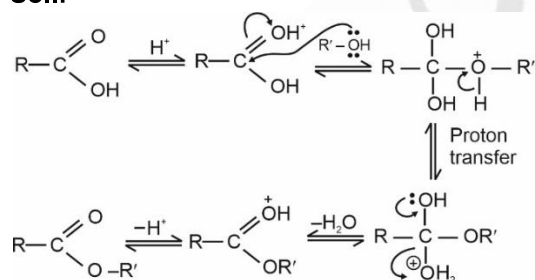
Sol.:



89. Answer (4)

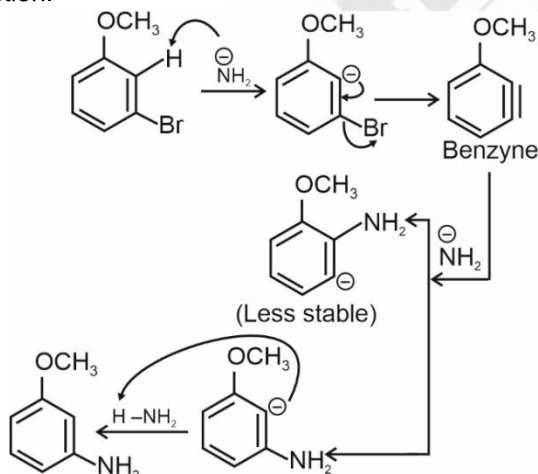
Hint: During esterification, tetrahedral intermediate is formed.

Sol.:



90. Answer (3)

Hint: $\bar{N}H_2$ is the attacking nucleophile in this reaction.

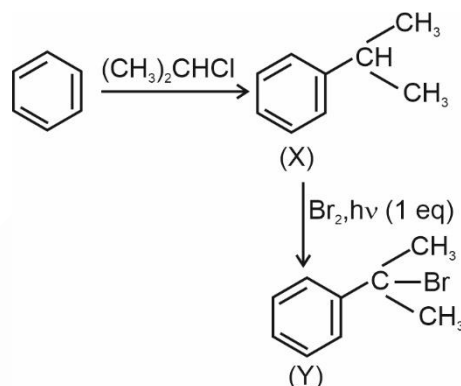


Sol.: m-methoxyaniline

91. Answer (4)

Hint: Reaction of alkyl halide with benzene ring in the presence of anhydrous $AlCl_3$ leads to Friedel-Crafts alkylation.

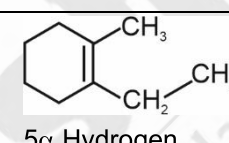
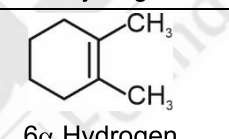
Sol.:

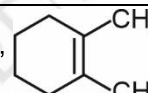


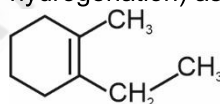
92. Answer (3)

Hint: Less the stability of alkene, more the heat of hydrogenation.

Sol.:

	5-hyperconjugative structures
	6-hyperconjugative structures

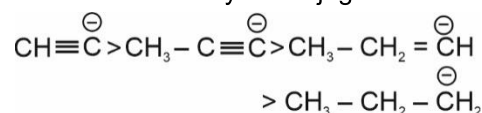
Hence,  is more stable (less heat of hydrogenation) as compared to



93. Answer (4)

Hint: More the stability of conjugate base will lead to more acidic nature of compound.

Sol.: Order of stability of conjugate bases.



94. Answer (3)

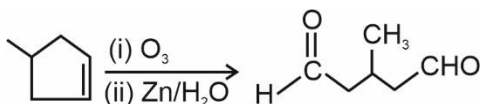
Hint: The C - O bond in methoxymethane is polar and hence ethers have net dipole moment.

Sol.: Ethers do not react with sodium metal due to absence of H-bonding in $CH_3 - O - CH_3$, it has less boiling point as compared to ethanol.

95. Answer (3)

Hint: Reductive ozonolysis of an alkene leads to the formation of aldehyde or ketone.

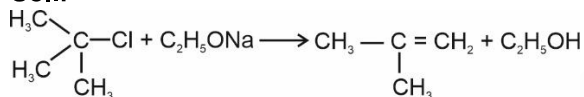
Sol.:



96. Answer (1)

Hint: Tertiary halide reacts with a strong base then elimination takes place.

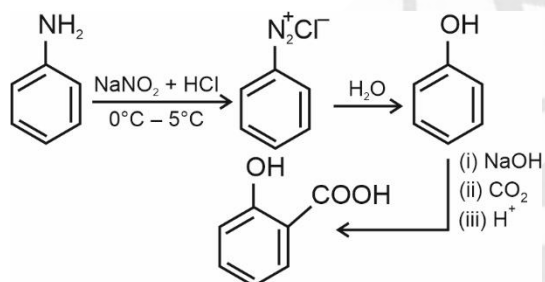
Sol.:



97. Answer (1)

Hint: Aniline undergoes diazotisation to form benzene diazonium chloride.

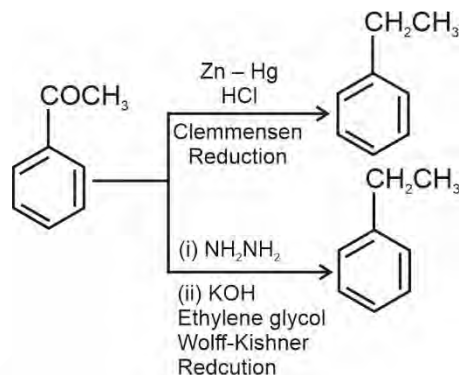
Sol.:



98. Answer (2)

Hint: Clemmensen reduction includes the reagent Zn-Hg/HCl and results in the conversion of carbonyl compound into alkane.

Sol.:



99. Answer (3)

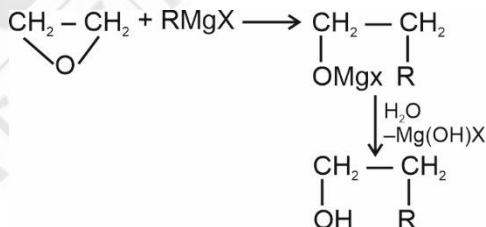
Hint: Double bond equivalent for $C_4H_{10}O$ is zero.

Sol.:

(1)	$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array}$
(2)	$\begin{array}{c} \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\ \\ \text{OH} \end{array}$
(3)	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2\text{OH} \\ \\ \text{CH}_3 \end{array}$
(4)	$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$

100. Answer (3)

Hint and Sol.:



[BOTANY]

SECTION-A

101. Answer (3)

Hint: The innermost layer of anther wall surrounds the sporogenous tissue.

Sol.: Cells of tapetum layer are polyploid and show increase in their DNA content.

102. Answer (2)

Hint: Long, sticky unwettable stigma is found in water pollinated plants.

Sol.:

<i>Zostera</i>	Marine plant showing hydrophily
Bamboo	Wind pollinated plant
<i>Yucca</i>	Insect pollinated plant showing presence of nectaries
Water lily	Pollinated by insects or wind

103. Answer (4)

Hint: Cleistogamous flowers do not open at all

Sol.: *Viola* and *Commelina* produce both chasmogamous and cleistogamous flowers. Cleistogamous flowers are invariably autogamous

as there is no chance of cross-pollen landing on stigma.

104. Answer (4)

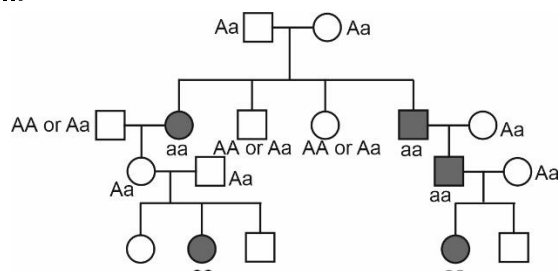
Hint: Law of independent assortment is based on the results obtained from dihybrid crosses.

Sol.: Morgan obtained 1.3% recombinant in F_2 generation when he crossed yellow bodied white eyed female with brown bodied red eyed male.

105. Answer (3)

Hint: Sex-linked trait like colour blindness shows criss-cross inheritance.

Sol.:



Trait will be expressed only in homozygous recessive condition.

106. Answer (4)

Hint: Test crosses are performed to know the genotype of a dominant phenotype.

Sol.: Test cross is carried between organism with dominant phenotype and the recessive one.

107. Answer (1)

Hint: Scutellum is a shield shaped cotyledon

Sol.: Coleorhiza encloses the root cap and radicle.

108. Answer (2)

Hint: In autogamy, pollination is achieved in the same flower.

Sol.: Geitonogamy is functionally cross-pollination involving a pollinating agent. Genetically, it is similar to autogamy.

109. Answer (4)

Hint: In heterozygous condition, pink coloured flowers are observed in snapdragon.

Sol.: In patients of Down's syndrome, big and wrinkled tongue is observed. In *Drosophila*, 4 pairs of chromosomes are present. Flower colour of snapdragon shows incomplete dominance.

110. Answer (4)

Hint & Sol.: Double fertilization and triple fusion are unique to flowering plants.

111. Answer (3)

Hint: In the grass only one cotyledone is found.

Sol.: Epiblast refers to the remains of second cotyledon.

112. Answer (4)

Hint: In a pedigree chart, the symbols for affected individuals are shaded completely.

Sol.:

- Mating between diseased individuals →
- Consanguineous mating →
- Sex unspecified →
- Parents with affected female child →

113. Answer (2)

Hint: In incomplete dominance, F_1 did not resemble either of the two parents and is in between the two.

Sol.:

	<u>Phenotypic ratio</u>
Test cross	— 1 : 1

Incomplete dominance — 1 : 2 : 1

114. Answer (1)

Hint: The genotype with all the dominant alleles will have the darkest skin colour.

Sol.: Human skin colour is an example of polygenic inheritance or quantitative inheritance.

115. Answer (2)

Hint: Chalaza represents the basal part of the ovule in a typical angiosperm.

Sol.: Enclosed within the integuments is a mass of cells called nucellus having abundant reserves food.

116. Answer (4)

Hint: Two anther lobes are attached to each other by a band of vascular sterile tissue known as connective.

Sol.: Synergids have special cellular thickenings at the micropylar tip called filiform apparatus.

117. Answer (2)

Hint: Mendel's results pointed to general rules of inheritance rather than being unsubstantiated ideas.

Sol.: Mendel used a large sampling size which gave credibility to his results.

118. Answer (3)

Hint: Fruit which develops from ovary is called a true fruit.

Sol.: Banana is a parthenocarpic fruit, developed without the process of fertilization whereas rest of them are false fruits.

119. Answer (3)

Hint: Haemophilia is also called as bleeder's disease**Sol.:** Sickle cell anaemia is a qualitative problem of synthesising incorrectly functioning globin molecules.

120. Answer (3)

Hint: Yellow colour and round seed shape of pea is dominant over green colour and wrinkled seed shape.**Sol.:** In a dihybrid cross, the genotypes obtained are:

2 Rr YY

2 RR Yy

4 RrYy

2 rrYy

2 Rryy

So, $\frac{12}{16} \times 1000 \Rightarrow 750$

121. Answer (2)

Hint: Mendelian disorders are mainly determined by alteration or mutation in a single gene.**Sol.:** Down's syndrome is not a Mendelian disorder rather a chromosomal disorder. Affected individual has an extra autosome.

122. Answer (3)

Hint: In rice and wheat, pollen grains lose viability within 30 minutes of their release.**Sol.:** In *Michelia*, gynoecium is multicarpellary apocarpous. In Rosaceae, Leguminosae and Solanaceae, pollen grains maintain viability for months.

123. Answer (1)

Hint: In some seeds, remnants of nucellus are also persistent.**Sol.:** The residual, persistent nucellus is perisperm, e.g. beet, black pepper.

124. Answer (2)

Hint: Megaspороgenesis is the process of formation of megaspores from megaspore mother cell through meiosis.**Sol.:** Ovule (megasporangium) is diploid

125. Answer (3)

Hint: In honey bees, male produce sperms by mitosis**Sol.:** In honey bees, an unfertilised egg develops as a male (drone) by parthenogenesis. Males do not have father and thus cannot have sons, but have a grandfather and can have grandsons.

126. Answer (4)

Hint: AB human blood group shows co-dominance.**Sol.:**

	I^O	I^A
I^O	$I^O I^O$	$I^A I^O$
I^B	$I^O I^B$	$I^A I^B$

In a cross of $I^O A^A$ and $I^O A^B$, 'O' blood group can be obtained in the progeny.

127. Answer (3)

Hint: Number of heterozygous loci decides the number of gametes formed.**Sol.:** Types of gametes = 2^n Here, $n = 3$ $\therefore 2^3 \Rightarrow 8$

128. Answer (3)

Hint: Mendel worked for 7 years on *Pisum sativum*.**Sol.:** Mendel conducted hybridisation experiments on garden peas for 7 years (1856-1863).

129. Answer (4)

Hint: The trait that expresses itself in homozygous condition is called as recessive trait.**Sol.:** Constricted pod shape of pea is a recessive trait.

130. Answer (3)

Hint: All the events from pollen deposition on stigma until the pollen tube enters the ovule are together referred as pollen-pistil interaction.**Sol.:** Chemical components mediate pollen-pistil interaction. Embryo development occurs in the sequence of:Proembryo $\rightarrow$ Globular embryo $\rightarrow$ Heart shaped embryo $\rightarrow$ Mature embryo

131. Answer (3)

Hint: Gene for cystic fibrosis is found on autosome.**Sol.:** Cystic fibrosis is an autosomal recessive disorder.

132. Answer (3)

Hint: Mendel proposed two general rules to consolidate his understanding of inheritance in monohybrid crosses.**Sol.:** Law of segregation is based on the fact that alleles do not show blending.

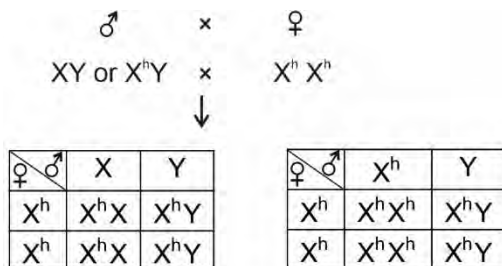
133. Answer (2)

Hint: *Zostera* (Sea-grass) is a marine plant.**Sol.:** *Vallisneria* is a fresh water plant in which pollination occurs on the surface of water.

134. Answer (2)

Hint: Haemophilia is an X-linked recessive disorder.

Sol.:



All male children will be haemophilic.

135. Answer (4)

Hint: 'X-body' term was given by Henking.

Sol.: Starch synthesis gene in pea (different grain sizes) shows incomplete dominance.

SECTION-B

136. Answer (2)

Hint: Turner's syndrome is caused due to the absence of one of the X chromosomes.

Sol.: An individual suffering from Turner's syndrome has rudimentary ovaries and lacks other secondary sexual characters.

137. Answer (1)

Hint: Morgan coined the terms linkage and recombination.

Sol.: T. H. Morgan and his colleagues verified the chromosomal theory of inheritance experimentally.

138. Answer (1)

Hint: Cryopreservation is done in liquid N₂ at the temperature of -196°C

Sol.: Pollen grains are formed from microsporogenesis and have taxonomic significance.

139. Answer (3)

Hint: Sex-determination in honey bees is based on the number of sets of chromosomes an individual receives.

Sol.: Birds: ZW type of sex determination.

Honey bee : Haplo-diploid sex determination

Grasshopper : XO type of sex determination

Butterflies : ZO type of sex determination

140. Answer (3)

Hint: In monoecious plants, male and female flowers are produced on the same plant.

Sol.: Castor prevents autogamy but not geitonogamy.

141. Answer (4)

Hint: Colour blindness is an X-linked recessive disease.

Sol.: Colour blindness occurs in about 8 percent of males and only about 0.4 percent of female. This is because the genes that lead to red-green colour blindness are on the X-chromosome.

142. Answer (4)

Hint: *Hydrilla* is a fresh water plant

Sol.: *Hydrilla* is a water pollinated plant, having light, unwettable pollen grains. Presence of single non-sticky pollen is a characteristic of wind pollinated plants.

143. Answer (1)

Sol.: Human genome project utilised genetic maps.

144. Answer (2)

Hint: Fruit fly is a tiny fly of about 2 mm size and a life cycle of about 2 weeks

Sol.: Fruit fly has a life cycle of about 2 weeks. Female body is larger in size as compared to males and hereditary variation can be seen with a low power microscope.

145. Answer (4)

Hint: In some plants, pollination is done by Gecko lizard.

Sol.: In over 60 percent of angiosperms, pollen grains are shed at 2-celled stage.

146. Answer (2)

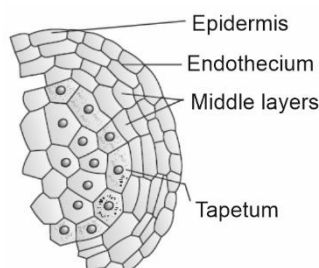
Hint: In a dihybrid cross, the phenotypic ratio obtained is 9 : 3 : 3 : 1

Sol.: Law of dominance is not universally applicable

147. Answer (3)

Hint: Outer three anther wall layers perform the function of protection and help in dehiscence of anther to release pollen.

Sol.: Tapetum nourish the developing pollen grains.



148. Answer (4)

Hint: Haemophilia is a X-linked recessive disorder.

Sol.: Sickle cell anaemia is caused by substitution of glutamic acid by valine at the sixth position. α -thalassemia is controlled by two closely linked genes HBA1 and HBA2 on chromosome 16 of each parent.

149. Answer (2)

Hint: Pollens can be preserved as fossils due to the presence of sporopollenin in exine.

Sol.: Vegetative cell is bigger in size, having abundant food reserve and a large irregularly

shaped nucleus. Sporopollenin can withstand high temperature, strong acids and alkali.

150. Answer (4)

Hint: In phenylketonuria, the affected individual lacks an enzyme called phenylalanine hydroxylase.

Sol.: In affected individuals of phenylketonuria there is a reduction in hair and skin pigmentation. It is an autosomal recessive disorder. Phenylalanine is accumulated in the brain of patients.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: Year of second republic day in India.

Sol.: To attain total reproductive health as a social goal, some programmes called 'family planning' were initiated in India in 1951 and were periodically assessed over the past decades.

152. Answer (2)

Hint: During intrauterine life

Sol.: Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary. First menstruation begins at the puberty. Menstrual cycle ceases around 50 years of age; that is termed as menopause.

153. Answer (4)

Hint: Location of Leydig cells

Sol.: Leydig cells synthesise and secrete testicular hormones called androgens and are located in interstitial spaces of testis.

Rete testis is sex accessory duct in human males. Seminiferous tubules are lined on its inside by male germ cells and Sertoli cells.

154. Answer (3)

Hint: It is located along the posterior surface of each testis.

Sol.: Sperms released from the seminiferous tubules follow the pathway as mentioned below:

Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra

An extra-testicular duct system consists of tubes which conduct sperms from the testes to the outside.

Epididymis is an extra-testicular duct which stores the sperms temporarily and leads to vas deferens.

155. Answer (3)

Hint: It lies at the base of the bladder and surrounds the first part of the urethra.

Sol.: In humans, the male reproductive accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands (Cowper's gland). Penis is not a gland.

156. Answer (3)

Hint: The structure to lodge testes.

Sol.: Extra abdominal testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes ($2 - 2.5^{\circ}\text{C}$ lower than the normal internal body temperature), which is necessary for spermatogenesis.

157. Answer (4)

Hint: Contractions occur in the middle layer during parturition.

Sol.: In human females, the wall of uterus has three layers of tissues. They are:

1. Perimetrium → External thin membranous layer
2. Myometrium → Middle thick layer of smooth muscle; undergoes contractions
3. Endometrium → Inner glandular layer; undergoes cyclical changes during the menstrual cycle

158. Answer (2)

Hint : Can be removed by a procedure called circumcision.

Sol.: The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination. The enlarged end of penis called glans penis is covered by a loose fold of skin called foreskin.

Hymen is a membrane which partially covers the opening of vagina.

The urethra originates from urinary bladder and extends through the penis to its external opening called urethral meatus.

159. Answer (4)

Hint: Oogenesis starts since foetal stage.

Sol.: The oogonial cells start division and enter into prophase-I of the meiotic division, and get temporarily arrested at this stage called primary oocytes. Each primary oocyte gets surrounded by a layer of granulosa cells and then called primary follicle.

Primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles. The secondary follicle soon transforms into tertiary follicle which is characterised by antrum. The tertiary follicle further matures into Graafian follicle.

160. Answer (3)

Hint: Secreted by a temporary endocrine gland

Sol.: In the absence of fertilisation, the corpus luteum degenerates; the level of progesterone hormone fall in the blood. This causes disintegration of the endometrium, leading to menstruation, marking a new cycle.

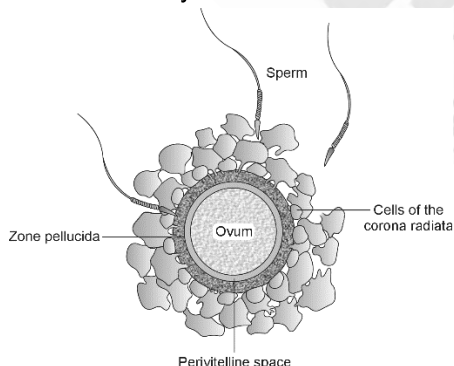
Progesterone – estrogen combinations or progestogens alone, prevent ovulation as well as alter the quality for cervical mucus.

Relaxin is a proteinaceous hormone which is released in the later part of pregnancy from ovaries.

161. Answer (1)

Hint: An acellular layer

Sol.:



During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms.

Thus, it ensures that only one sperm can fertilise an ovum.

Zona pellucida is a non-cellular and glycoprotein layer that surrounds the mammalian oocytes. It is present between the plasma membrane of oocyte and the corona radiata.

In the Graafian follicle, the secondary oocyte forms a new membrane surrounding it, called zona pellucida.

162. Answer (3)

Hint: A yellow-coloured temporary gland develops during this phase.

Sol.: Uterine events of menstrual cycle include:

- (1) Menstrual phase
- (2) Proliferative phase
- (3) Secretory phase

* Ovarian events of menstrual cycle include:

- (1) Follicular phase
- (2) Ovulatory phase
- (3) Luteal phase

163. Answer (2)

Hint: Fertilisation and pregnancy are chance events.

Sol.: Fertilisation can only occur, if the ovum and the sperms are transported simultaneously to the ampullary region. Thus, it is the reason why not all copulations lead to fertilisation and pregnancy.

Sperms show rapid whiplash movements of the tail part and reach the ampullary-isthmic junction.

Ovum reaches ampulla region of oviduct, the site of fertilization, by the ciliary action of ciliated columnar epithelial lining of oviduct.

164. Answer (3)

Hint: It is one of the female accessory ducts.

Sol.: During *in vitro* fertilisation, the zygote or early embryo (with upto 8 blastomeres) is transferred into the fallopian tube (ZIFT – Zygote Intra Fallopian Transfer). Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus.

- Labia majora → Fleshy folds of tissue which extend down from the mons pubis and surround the vaginal opening.
- Uterus → It is an inverted pear shaped structure and is supported by ligaments attached to the pelvic wall.
- Clitoris → A tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.
Embryos with more than 8 blastomeres are transferred into the uterus.

165. Answer (4)

Hint: Urinogenital ducts carry urine and sperms.

Sol.: In human males, urethra acts as the urinogenital duct. Urinogenital duct refers to the duct that transports both urine and sperms.

- Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells.
- The hymen is often torn during the first coitus (intercourse). However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horse back riding, cycling, etc.

Thus, it is not a reliable indicator of sexual experience.

166. Answer (3)

Hint: Closest to the number of bones in a limb of humans.

Sol.: In spermatogenesis, each primary spermatocytes undergoes two meiotic divisions. The first meiotic division produces 2 secondary spermatocytes from each primary spermatocyte. Each secondary spermatocyte then undergoes the second meiotic division to form two spermatids.

Thus, 16 primary spermatocytes

↓

Will form 32 secondary spermatocytes

32 meiotic divisions ↓

Will form 64 spermatids

167. Answer (1)

Hint: This hormone plays a role in thickening of endometrium.

Sol.: In the luteal phase, the endometrium is thickened due to estrogen hormone secreted by the corpus luteum.

Secretions of gonadotropins (LH and FSH) increase gradually during the follicular phase and stimulate the follicular development and secretion of estrogen by the growing follicles.

Relaxin is secreted in the later stages of pregnancy.

168. Answer (1)

Hint: Observed during end of second month of pregnancy.

Sol.: In human beings, after one month of pregnancy (almost 4 weeks), the embryo's heart is formed. The first sign of growing foetus may be noticed by listening to the heart sounds through the stethoscope. By the end of the second month

of pregnancy (almost 8 weeks), the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well developed. The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month.

169. Answer (3)

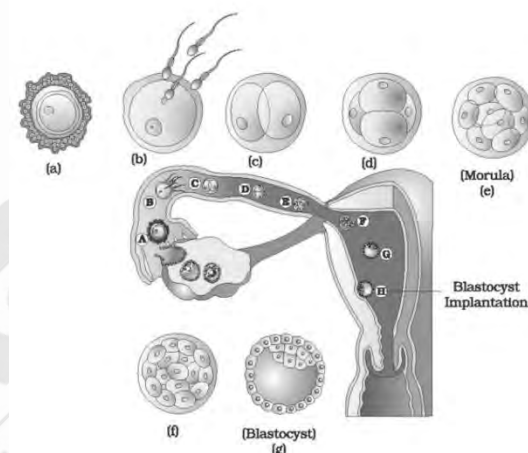
Hint: Sertoli cells are nurse cells.

Sol.: After spermiogenesis, sperm head becomes embedded in the Sertoli cell, and are finally released from the seminiferous tubules by the process called spermiation.

170. Answer (3)

Hint: Cleavage division starts as the zygote moves through the isthmus.

Sol.:



The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The embryo with 8 to 16 blastomeres is called a morula (Represented by 'e'). The morula continues to divide and transforms into blastocyst (Represented by 'g') as it moves further into the uterus. The trophoblast layer then gets attached to the endometrium (Represented by 'H') called implantation.

171. Answer (4)

Hint: Reason why sterilisation method is not opted to space children.

Sol.: An ideal contraceptive should be user-friendly, easily available, effective and reversible with no or least side-effects. It also should in no way interfere with the sexual drive, desire or the sexual act of the user.

172. Answer (2)

Hint: Ovulation occurs prior to luteal phase**Sol.:** Periodic abstinence is a natural method of contraception in which the couple should avoid coitus from day 10 to 17 of the 28 days menstrual cycle. So, in case of menstrual cycle of 30 days, coitus should be avoided from day 12 – 19

173. Answer (4)

Hint: Good health services have increased the longevity.**Sol.:** Increased health facilities along with better living conditions have an explosive impact on the growth of population. A rapid decline in death rate, maternal mortality rate (MMR) and infant mortality rate (IMR) as well as an increase in number of people in reproductive age are probable reasons for population explosion.

174. Answer (4)

Hint: Isthmus joins uterus**Sol.:** In human females, last part of oviduct, isthmus has a narrow lumen and it joins the uterus. The uterus opens into vagina through a narrow cervix.

175. Answer (2)

Hint: There can be various reasons for infertility.**Sol.:** The reason for infertility can be many-physical, congenital, diseases, drugs, immunological or even psychological.

- MTP are considered relatively safe during the first trimester, *i.e.*, up to 12 weeks of pregnancy.
- Nirodh is a popular brand of condom used by males.

176. Answer (2)

Hint: Helps in fertilization of ovum**Sol.:** Acrosome is a cap-like structure, present in the anterior portion of sperm head. Head also contains an elongated haploid nucleus. Middle piece possesses numerous mitochondria which help in sperm motility.

177. Answer (1)

Hint: Opposite effect of Cu^{2+} ions**Sol.:** IUDs increase phagocytosis of sperms within the uterus and the Cu^{2+} ions releasing IUDs suppress sperm motility and the fertilising capacity of sperms. The hormone releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms.

178. Answer (3)

Hint: Same chemical composition**Sol.:** Progestogens alone or in combination with estrogen can be used by females as injections or implants under the skin. Their mode of action is similar to that of pills but their effective periods are much longer.

They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

Diaphragm, cervical caps and vaults are barriers made of rubber that are inserted into female reproductive tract to cover the cervix during coitus.

179. Answer (3)

Hint: Body fluid should get exchanged for transmission.**Sol.:** Some of the STIs can be transmitted by sharing of injection needles, surgical instruments, *etc.*, with the infected person, transfusion of blood, or from an infected mother to the foetus too.

180. Answer (3)

Hint: Paired accessory gland**Sol.:** The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of penis.

181. Answer (2)

Hint: Prevents ovulation**Sol.:** Pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle. After a gap of 7 days (during which menstruation occurs) it has to be repeated in the same pattern till the female desires to prevent conception. They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

182. Answer (1)

Hint : Micropipette is used to inject sperm into the center of the egg.**Sol.:** In ICSI (Intra Cytoplasmic Sperm Injection), a sperm is directly injected into the ovum to form an embryo in the laboratory.

In AI (Artificial insemination), the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – Intra-uterine insemination) of the female.

GIFT is gamete intra fallopian transfer.

183. Answer (1)

Hint: Less than 2 per cent**Sol.:** According to the 2011 census report, the population growth rate was less than 2 per cent, i.e., 20/1000/year.

Administration of progestogens or progestogen-estrogen combinations or IUDs within 72 hours of coitus have been found to be very effective as emergency contraceptives as they could be used to avoid possible pregnancy due to rape or casual unprotected intercourse.

Spermicidal creams, jellies and foams are used along with barriers (condoms, etc) to increase their contraceptive efficiency.

184. Answer (3)

Hint: Gamete is transferred

Sol.: GIFT - (Gamete Intra Fallopian Transfer) - Transfer of an ovum collected from a donor into the fallopian tube of another female cannot produce one, but can provide suitable environment for fertilisation and further development.

ZIFT is Zygote Intra Fallopian Transfer.

ICSI is Intra Cytoplasmic Sperm Injection.

IUI is Intra Uterine Insemination.

185. Answer (3)

Hint: Promotes well-being of individuals in reproduction related aspects

Sol.: Improved programmes covering wider reproduction related areas are currently in operation under the popular name 'Reproductive and Child Health Care (RCH) programmes'. Creating awareness among people about various reproduction related aspects and providing facilities and support for building up a reproductively healthy society are the major tasks under these programmes.

Awareness of problems due to uncontrolled population growth, social evils like sex-abuse and sex related crimes need to be created.

SECTION-B

186. Answer (4)

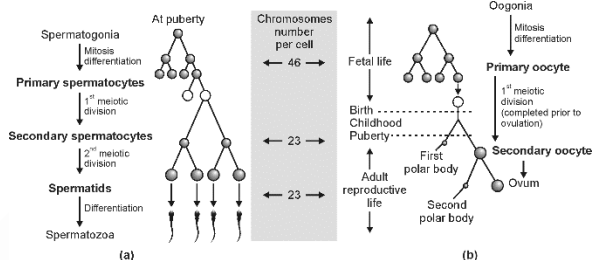
Hint: Estrogen receptors are present at the site of implantation.

Sol.: 'Saheli' is an oral contraceptive that contains a non-steroidal preparation. It is a 'once a week' pill with very few side effects and high contraceptive value.

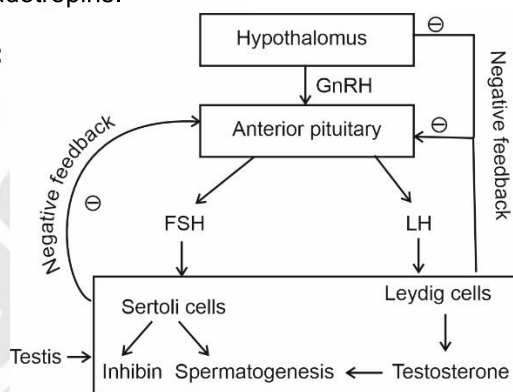
It blocks the estrogen receptors in the uterus and prevents eggs from getting implanted. Thus, it prevents implantation, not ovulation. It was

developed by scientists at Central Drug Research Institute (CDRI) in Lucknow, India.

187. Answer (2)

Hint: Primary oocyte and primary spermatocyte undergo meiosis.**Sol.:**

188. Answer (3)

Hint: Spermatogenesis starts at the age of puberty due to the significant increase in secretion of gonadotropins.**Sol.:**

189. Answer (4)

Hint: The hormone which is only released in a pregnant female.

Sol.: Pregnancy tests work by detecting the human chorionic gonadotropin (hCG) in the body of human females.

190. Answer (1)

Hint: Its causative agent is *Human papilloma virus*.

Sol.: Genital warts is a common sexually transmitted infection caused by the *Human papilloma virus* (HPV).

Chlamydia, syphilis and the gonorrhoea are bacterial STIs.

191. Answer (1)

Hint: Exclude the hormone secreted by anterior pituitary.

Sol.: Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental

lactogen (hPL), estrogen, progestogens, etc. Prolactin is secreted by anterior pituitary.

192. Answer (4)

Hint: Several mammary ducts join to form a wider mammary ampulla

Sol.: Several mammary ducts join to form a wider mammary ampulla, which is connected to lactiferous duct through which milk is sucked out.

193. Answer (4)

Hint : Formation of secondary oocyte

Sol.: The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles.

The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The theca layer is organised into an inner theca interna and an outer theca externa. At this stage, the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division.

Spermatids are differentiated into spermatozoa, this is called spermiogenesis.

194. Answer (4)

Hint: Estrogen peaks twice during the menstrual cycle

Sol.: Estrogen peaks during the first half of the menstrual cycle, during mid-follicular phase and then drops after ovulation.

The second rise in estrogen levels is observed during the mid-luteal phase with a decrease at the end of the menstrual cycle.

The menstrual phase is followed by the follicular phase.

New follicles are formed during the follicular phase.

Progesterone level peaks only once during luteal phase.

195. Answer (3)

Hint: $\frac{2}{5}$ th part

Sol.: In a normal ejaculate, 60% of sperms must have normal shape and size and 40% of them must show vigorous motility.

196. Answer (1)

Hint: Used by females exclusively

Sol.: Diaphragms, cervical caps and vaults are barriers made of rubber that are inserted into the female reproductive tract to cover the cervix during coitus. They prevent conception by blocking the entry of sperms through the cervix.

But, they do not protect the users from STIs.

Male condoms protect the users from STIs.

197. Answer (1)

Hint: To get pregnant

Sol.: Absence or less significant symptoms in the early stages of infection and the social stigma attached to the STIs, deter the infected individual from going for timely detection and proper treatment. This could lead to complications later, which include pelvic inflammatory diseases (PID), abortions, still births, ectopic pregnancies, infertility or even cancer of the reproductive tract.

198. Answer (2)

Hint: Exclude the method that involves *in vivo* fertilization.

Sol.: In ZIFT, the zygote or early embryos (with upto 8 blastomeres) are transferred into the fallopian tube of the female.

AI is artificial insemination. IUI is intra uterine insemination. GIFT is gamete intra fallopian transfer.

199. Answer (4)

Hint: Gamete transport will be blocked.

Sol.: Ejaculation will not get affected if vasectomy is performed. Hormone levels will also not get affected due to vasectomy. But the semen produced will not contain any sperm as gamete transport will be inhibited.

200. Answer (3)

Hint: Leads to formation of second polar body

Sol.: Entry of sperm within ovum induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum.



All India Aakash Test Series for NEET - 2025

TEST - 5 (Code - F)**Click here for
Code-E Sol.**

Test Date : 09/02/2025

ANSWERS

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

HINTS & SOLUTIONS

[PHYSICS]

SECTION - A

1. Answer (3)

Hint: In steady state, the branch at which capacitor is connected will behave as open switch.

Sol.: Since the capacitor behaves as an open switch $\Rightarrow i = \frac{E}{R_1 + R_3}$

$$\text{P.D. across capacitor} = \frac{ER_1}{R_1 + R_3}$$

$$\Rightarrow \text{Charge on capacitor} = \frac{CER_1}{R_1 + R_3}$$

2. Answer (2)

Hint: Use the concept of series and parallel grouping of resistors.

Sol.: When S_1 is closed, $i = \frac{E}{4R}$,

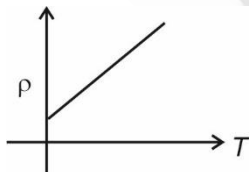
$$\Rightarrow V_1 = \frac{E}{4R} \times 3R = \frac{3E}{4}$$

When S_2 is closed, $i = \frac{E}{7R}$,

$$\Rightarrow V_2 = \frac{E}{7R} \times 6R = \frac{6E}{7} \Rightarrow V_2 > V_1$$

3. Answer (4)

Hint & Sol : Nichrome exhibits a very weak dependence of resistivity with temperature. Hence, the correct variation is



4. Answer (1)

Hint: Use Kirchhoff's law

$$\text{Sol.} : V_A - (3 \times 3) + 3 - (3 \times 2) = V_B$$

$$\Rightarrow V_A - 9 + 3 - 6 = V_B \Rightarrow V_A - V_B = 12 \text{ V}$$

5. Answer (1)

Hint: The force experienced by a test charge in an electric field is directly proportional to the magnitude of electric field.

$$\text{Sol.} : E_A > E_B > E_C \Rightarrow F_A > F_B > F_C$$

6. Answer (2)

$$\text{Hint & Sol : } U = \frac{kq_1q_2}{r}$$

If q_1 and q_2 have same sign so, on decreasing r , potential energy will increase.

Potential is defined only for conservative fields.

7. Answer (2)

Hint: Instantaneous current (i) = $\frac{dq}{dt}$

$$\text{Sol.} : i = \frac{dq}{dt} = \frac{d}{dt}(t^3 + 2t) = 3t^2 + 2$$

$$\Rightarrow (i)_{\text{at } t=1} = 3(1) + 2 = 5 \text{ A}$$

8. Answer (4)

Hint: Mobility, $\mu = \frac{v_d}{E}$

Sol.: The S.I. Unit of mobility is $\frac{\text{m}^2}{\text{Vs}}$

9. Answer (1)

Hint: Use, $j = \sigma E$ and $i = neAv_d$

Sol.: We know that, $i = neAv_d \Rightarrow j = nev_d$

$$\text{and } j = \frac{E}{\rho}$$

$$\Rightarrow \frac{E}{\rho} = nev_d \text{ and } E = \frac{V_0}{L}$$

$$\Rightarrow \rho = \frac{V_0}{neLv_d}$$

10. Answer (4)

Hint: Use Kirchhoff's loop rule

Sol.: If potential at point A is zero, then $V_C = 2 \text{ V}$

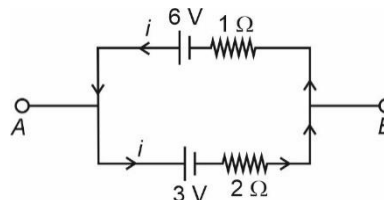
$$V_D - V_C = 2 \times 1 \Rightarrow V_D = V_C + 2 = 4 \text{ V}$$

$$\text{If } V_D = 4 \text{ V, then } V_B = 8 \text{ V}$$

11. Answer (2)

Hint: Use Kirchhoff's loop rule.

Sol.:



Applying the loop rule, $3 + 2i + i - 6 = 0$

$$\Rightarrow 3i - 3 = 0 \Rightarrow i = 1 \text{ A}$$

$$(\text{P.D.})_{AB} = 6 - (1)(1) = 5 \text{ V}$$

12. Answer (3)

Hint: Resistance, $R = \frac{\rho l}{A}$

$$\text{Sol.: Resistance, } R = \frac{\rho \times a}{a \times t} \Rightarrow R = \frac{\rho}{t}$$

13. Answer (1)

Hint: During discharging of cell, terminal potential difference, $V = E - Ir$.

Sol.: The negative slope of graph between V and I should give internal resistance.

$$\Rightarrow r = \frac{4}{10} = 0.4 \Omega$$

14. Answer (3)

Hint: Use, Power = VI and Potential difference, $V = IR$

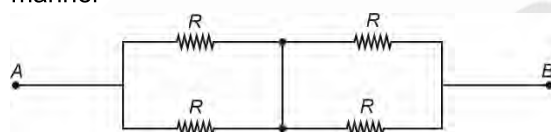
$$\text{Sol.: } 50 = \frac{V^2}{R} \Rightarrow R = \frac{100 \times 100}{50} \Rightarrow R = 200 \Omega$$

$$\text{Power consumed} = \frac{V^2}{R} = \frac{25 \times 25}{200} = 3.125 \text{ W}$$

15. Answer (1)

Hint: Use the concept of series and parallel combination of resistors.

Sol.: The circuit can be redrawn in the following manner



$$\Rightarrow R_{eq} = \frac{R}{2} + \frac{R}{2} = R$$

16. Answer (4)

Hint: Resistance of a wire is given by, $R = \frac{\rho l}{A}$

Sol.: Since the wire is drawn out, the volume is going to remain conserved.

$$\Rightarrow R = \frac{\rho l \times l}{A \times l}$$

$$\Rightarrow R = \frac{\rho l^2}{V}$$

$$\Rightarrow R \propto l^2$$

$$\Rightarrow \frac{R_0}{20} = \frac{l^2}{4l^2}$$

$$\Rightarrow R_0 = 5 \Omega$$

17. Answer (3)

Hint: When resistors are connected in series, $R_{eq} = R_1 + R_2 + \dots$

When resistors are connected in parallel,

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$\text{Sol.: } \frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{R} + \dots$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{n}{R}$$

$$\Rightarrow R_{eq} = \frac{R}{n}$$

$$\Rightarrow \alpha = \frac{R}{n}$$

$$\Rightarrow R = n\alpha$$

When connected in series, $R'_{eq} = nR$

$$\Rightarrow R'_{eq} = n(n\alpha) = n^2\alpha$$

18. Answer (2)

Hint: Use the concept of parallel combination of resistors.

Sol.: The current will be equally divided among the three resistors.

$$P = I^2 R$$

$$= 3^2 \times 2 = 18 \text{ W}$$

19. Answer (2)

Hint: Current density, $|\vec{\lambda}| = \frac{i}{A}$

Sol.: For steady current flowing through conductors, $\lambda \propto \frac{1}{A}$

$$\Rightarrow \lambda_P A_P = \lambda_Q A_Q$$

$$\Rightarrow \frac{\lambda_P}{\lambda_Q} = \frac{A_Q}{A_P} \text{ as } A_Q > A_P$$

$$\Rightarrow \lambda_P > \lambda_Q$$

20. Answer (3)

Hint: According to Gauss's law, $\phi = \frac{q_{enc}}{\epsilon_0}$.

Sol.: Since the net charge enclosed by the gaussian surface is same, hence the net electric flux remains same.

21. Answer (2)

Hint: Potential due to a point charge q is $\frac{kq}{r}$ **Sol.:** $W = q\Delta V$ where ΔV represents change in electric potential

$$\Rightarrow V_S = \frac{kq_1}{40} + \frac{kq_2}{10} \Rightarrow V_S = \frac{kq_1}{0.4} + 10kq_2$$

$$V_R = \frac{kq_1}{0.4} + \frac{kq_2}{50} \Rightarrow V_R = \frac{kq_1}{0.4} + 2kq_2$$

$$\Rightarrow \Delta V = V_S - V_R = 8kq_2 \Rightarrow W = 8kq_2 = \frac{8q_2}{4\pi\epsilon_0} = \frac{2q_2}{\pi\epsilon_0}$$

22. Answer (1)

Hint & Sol.: The electrostatic force is perpendicular to circumference. Therefore, work done by electrostatic force is zero.

23. Answer (1)

Hint and Sol.

The potential due to an electric dipole on its axis

$$\text{is } \frac{p}{4\pi\epsilon_0 r^2}.$$

24. Answer (1)

Hint: Electrostatic potential

$$= \frac{\text{Electrostatic potential energy}}{\text{Charge}}$$

$$\text{Sol.: } V = \frac{U}{q}$$

$$\Rightarrow [V] = \frac{[ML^2T^{-2}]}{[AT]} = [ML^2T^{-3}A^{-1}]$$

25. Answer (1)

Hint: The electrostatic potential energy of two point charges separated by distance r is,

$$U = \frac{kq_1q_2}{r}$$

$$\text{Sol.: } U_{\text{net}} = \frac{-kq^2}{b} + \frac{kq^2}{b} - \frac{kq^2}{2b} \Rightarrow U_{\text{net}} = \frac{-kq^2}{2b}$$

26. Answer (4)

$$\text{Hint & Sol.: } V_T = V_S = \frac{kq}{R}$$

$$V_T - V_S = 0$$

27. Answer (3)

Hint: The potential energy of an electric dipole,

$$U = -\vec{P} \cdot \vec{E}$$

$$\text{Sol.: } U = -PE\cos\theta$$

$$U = U_{\min}$$

$$\cos\theta = 1$$

$$\theta = 0^\circ$$

28. Answer (4)

Hint: The relation between electric field and

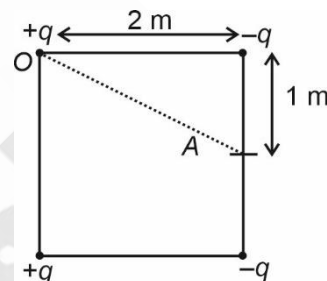
$$\text{potential is } E = -\frac{\delta V}{\delta r}$$

Sol.: Since, $E = -\frac{\delta V}{\delta r}$, hence the electric field in the region would be zero as $V = \text{constant}$.

29. Answer (2)

Hint: Electric potential due to point charge = $\frac{kq}{r}$

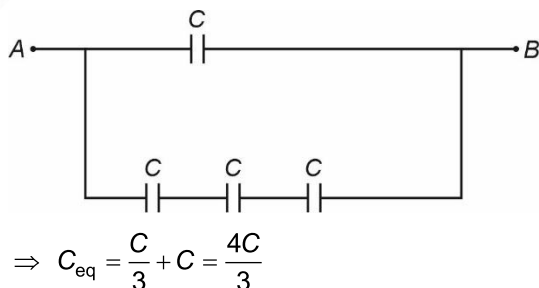
$$\text{Sol.: } OA = \sqrt{2^2 + 1^2} = \sqrt{5} \text{ m}$$



$$V_A = \left(\frac{-k \times q}{1} \right) \times 2 + \frac{2 \times k \times q}{\sqrt{5}}$$

$$\Rightarrow V_A = 2kq \left[-1 + \frac{1}{\sqrt{5}} \right]$$

30. Answer (3)

Hint: Use the concept of series and parallel combination**Sol.:** The above circuit can be rearranged as

31. Answer (1)

Hint & Sol.: The charge on alpha particle is equal to $2e$ i.e., charge = $2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19} \text{ C}$

32. Answer (2)

$$\text{Hint: Use, } \vec{E} = -\frac{\delta V}{\delta x} \hat{i} - \frac{\delta V}{\delta y} \hat{j} - \frac{\delta V}{\delta z} \hat{k}$$

Sol.:

$$\vec{E}_x = \frac{-dV}{dx} \hat{i} = -[2x + 10] \hat{i} \Rightarrow \vec{E}_x = -(2x + 10) \hat{i}$$

$$\text{at } x = 1, \vec{E} = -12 \hat{i} \Rightarrow |\vec{E}| = 12 \text{ V/m}$$

33. Answer (2)

Hint & Sol.: The electric field intensity will be zero nearer to the smaller magnitude charge. Therefore, to the left of charge +Q.

34. Answer (2)

Hint: Flux, $\phi = \vec{E} \cdot \vec{A}$

$$\text{Sol.} \quad \phi = (a\hat{i} + b\hat{j}) \cdot (\pi R^2 \hat{j}) = \pi b R^2$$

35. Answer (3)

Hint: Use principle of superposition

Sol.: The electric field due to four positive charges cancel each other and electric field due one positive charge and one single negative charge are in same direction and equal in magnitude.

$$|\vec{E}_{\text{net}}| = \frac{k \times q}{a^2} + \frac{k \times q}{a^2} = \frac{2kq}{a^2} = \frac{2 \times k \times q}{1} = \frac{2q}{4\pi\epsilon_0}$$

SECTION-B

36. Answer (2)

Hint & Sol.: The dielectric constant for a metal is infinite.

37. Answer (4)

Hint & Sol.: The electrostatic force on q_2 due to q_1 will remain unaffected by the presence of other charges.

38. Answer (1)

Hint: Drift velocity, $v_d = \frac{eE\tau}{m}$

Sol.: $v_d = \frac{eE\tau}{m}$ and $V = Ed$, thus for the same conductor, $v_d \propto (\text{Potential difference})$

$$\Rightarrow \frac{v_1}{v'} = \frac{V}{2V} \Rightarrow v' = 2v_1$$

39. Answer (4)

Hint: Current (i) = $\frac{dq}{dt}$

$$\text{Sol.} \quad i = \frac{dq}{dt} = 2 + 3t$$

$$\Rightarrow dq = 2dt + 3tdt$$

$$\Rightarrow q = \int dq = \int_0^2 2dt + \int_0^2 3tdt$$

$$\Rightarrow q = 2[2 - 0] + \frac{3}{2}[4 - 0] = 4 + \frac{3}{2} \times 4 = 4 + 6 = 10 \text{ C}$$

40. Answer (3)

Hint: When N cells are connected in series then, $E' = NE$ and $R' = Nr$

Sol.: Since current of 4 A is required through 5 Ω resistor then,

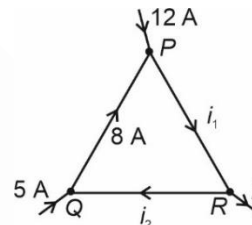
$$4 = \frac{N \times 3}{5 + N \times 0.5}$$

$$\Rightarrow 20 + 2N = 3N$$

$$\Rightarrow N = 20$$

41. Answer (1)

Hint: Use Kirchhoff's junction rule

Sol.:

At junction P, $i_1 = 20 \text{ A}$

At junction Q, $i_2 = 3 \text{ A}$

$$\Rightarrow i = 17 \text{ A}$$

42. Answer (4)

Hint & Sol.: Resistivity is the property of material and it is independent of dimensions of wire.

43. Answer (3)

Hint: Use the concept of parallel combination of resistors.

Sol.: As the resistors are connected in parallel combination

$$\Rightarrow 20 \times i = 10 \times i_1$$

$$\Rightarrow i_1 = 2i$$

$$\text{Also, } i = 1 - i - i_1 \Rightarrow i = 1 - i - 2i \Rightarrow i = 1 - 3i$$

$$\Rightarrow 4i = 1 \Rightarrow i = \frac{1}{4} \text{ A}$$

44. Answer (1)

Hint & Sol.: The resistivity of a semiconductor decreases with increase in temperature as electron density increases while the average time of collision decreases with increase in temperature.

Resistance of a conductor depends on its dimensions.

45. Answer (1)

Hint & Sol : When a capacitor is charged with a battery, then energy stored in it is 50% of the work done by battery and remaining is lost in the form of heat.

If the charges are same, then the potential difference across them would be divided in inverse ratio of their capacities.

46. Answer (2)

Hint: Use the property of conductor to determine charge on capacitor.

Sol.: Final charge on inside plate of capacitor

$$= \frac{Q}{2} + CV$$

We also know that, $Q' = CV'$

$$\Rightarrow \frac{Q}{2} + CV = C(V') \Rightarrow V' = V + \frac{Q}{2C}$$

47. Answer (4)

Hint: Use concept of series and parallel combination.

Sol.: Charge across 4 μF capacitor is

$$= 4 \times 6 = 24 \mu\text{C}$$

For upper branch

$$C_{\text{eq}} = 2 \mu\text{F}$$

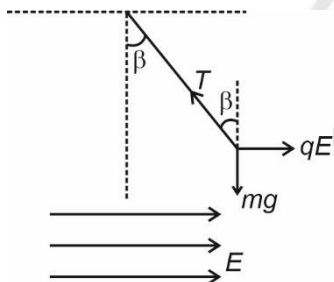
$$\text{Charge across } 3\mu\text{C} = 2 \times 6 = 12 \mu\text{C}$$

$$\Rightarrow \text{Ratio} = \frac{12}{24} = \frac{1}{2}$$

48. Answer (3)

Hint: Use the condition of equilibrium and concept of free body diagram

Sol.:



From the free body diagram, we can write that

$$T \cos \beta = mg \text{ and } T \sin \beta = qE$$

$$\Rightarrow T = \frac{mg}{\cos \beta} \text{ or } T = \frac{qE}{\sin \beta}$$

49. Answer (2)

Hint: Use the concept of potential due to hollow sphere.

Sol.: Let us assume that charge q appears at inner sphere.

$$\Rightarrow V_{\text{inner sphere}} = \frac{K \cdot q}{a} + \frac{K(-Q)}{b} = 0$$

$$\Rightarrow \frac{1}{4\pi\epsilon_0} \left[\frac{q}{a} - \frac{Q}{b} \right] = 0$$

$$\Rightarrow \frac{q}{a} = \frac{Q}{b}$$

$$\Rightarrow q = \frac{Qa}{b}$$

50. Answer (1)

Hint & Sol: Initial charge = CV

Let the common potential be V_0

$$\Rightarrow CV = CV_0 + 3CV_0 \Rightarrow CV = 4CV_0$$

$$\Rightarrow V_0 = \frac{V}{4}$$

Energy stored in C , after closing switch

$$= \frac{1}{2} \times C \times \frac{V^2}{16} = \frac{CV^2}{32}$$

Energy stored in $3C$, after closing switch

$$= \frac{1}{2} \times 3C \times \frac{V^2}{16} = \frac{3CV^2}{32}$$

$$\text{Total energy stored} = \frac{1}{2} \times 4C \times \frac{V^2}{16} = \frac{CV^2}{8}$$

$\Rightarrow$ Energy lost in redistribution

$$= \frac{1}{2} \times C \times V^2 - \frac{1}{8} CV^2$$

$$= \frac{CV^2}{2} \left[1 - \frac{1}{4} \right] = \frac{3CV^2}{8}$$

[CHEMISTRY]

SECTION-A

51. Answer (3)

Hint: The boiling point of straight chain alkanes increases with increase in carbon atoms while boiling point of isomeric alkanes, decreases with increasing branching due to less van der Waals forces.

Sol.:

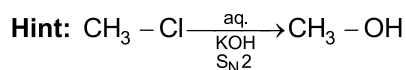
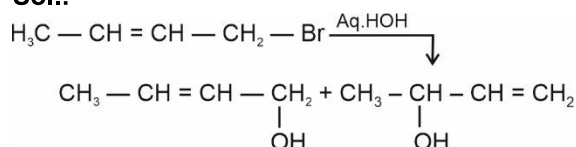
$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ n-Hexane	341.9 K
$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$ n-pentane	309.1 K

$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_3 \\ \text{2-methylbutane} \end{array}$	300.9 K
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ \\ \text{CH}_3 \\ \text{2, 2-dimethylpropane} \end{array}$	282.5 K

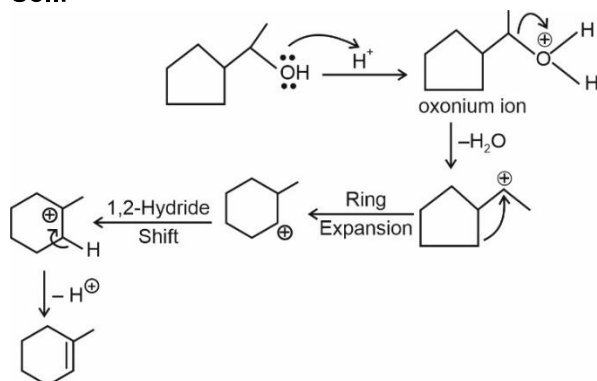
52. Answer (4)

Hint & Sol.: Kolbe's electrolysis method is used to prepare alkanes containing even number of atoms.

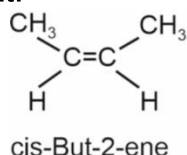
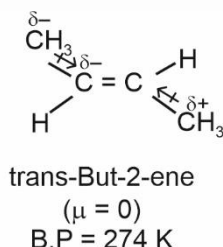
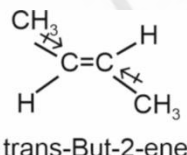
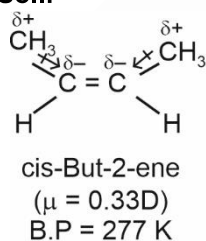
53. Answer (1)

**Sol.:**

54. Answer (2)

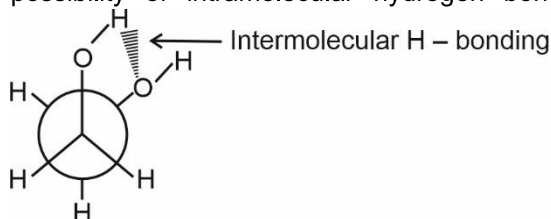
Hint: Hot and conc. H_2SO_4 is a dehydrating agent.**Sol.:**

55. Answer (3)

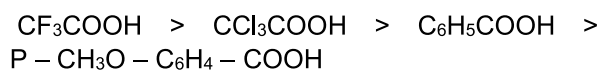
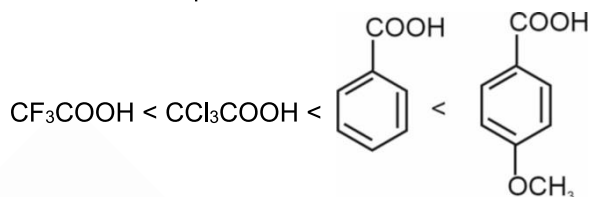
Hint:**Sol.:**

Due to more symmetry, trans isomer has higher melting point in solid state.

56. Answer (4)

Hint: A conformer will be more stable if it has a possibility of intramolecular hydrogen bonding.**Sol.:** In Gauche form of ethane-1,2-diol, there is a possibility of intramolecular hydrogen bonding

57. Answer (4)

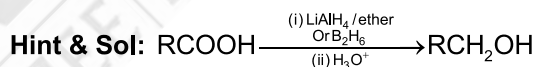
Hint: More the acidic nature, less will be the pK_a value of acid.**Sol.:** Order of acidic strength:So the order of pK_a value :

58. Answer (3)

Hint: Cold dilute and alkaline KMnO_4 is known as Baeyer's reagent.**Sol.:**

$\text{CrO}_3 - \text{H}_2\text{SO}_4$	Jones Reagent
Cold dilute Alkaline KMnO_4	Baeyer's Reagent
$[\text{Ag}(\text{NH}_3)_2]\text{NO}_3$	Tollen's Reagent
Aq. CuSO_4 and Rochelle salt (aq) in equal amount	Fehling solution A

59. Answer (2)



Sodium borohydride does not reduce the carboxyl acid.

60. Answer (1)

Hint: AlCl_3 is a Lewis acid and it is used as catalyst in Friedel - Crafts reactions.

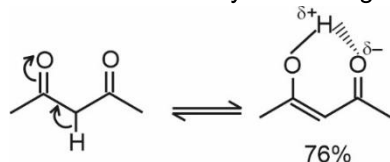
Sol.: In , -COOH group is deactivating group and carboxylic group gets bonded with Lewis acid AlCl_3 in Friedel - Crafts reaction.

61. Answer (3)

Hint: Higher the acidity of methylene proton, more the enol content.

Sol.: In case of , the acidity of methylene proton is maximum and also the enol

form is stabilised by H-bonding

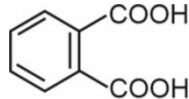


62. Answer (2)

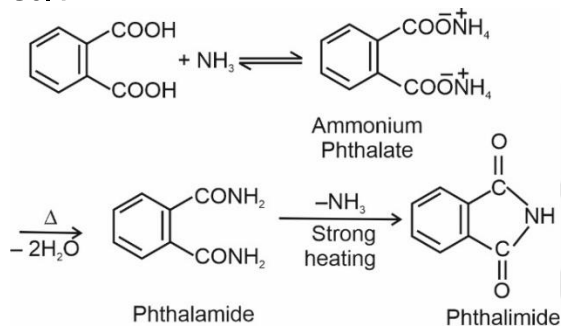
Hint and Sol: The reactivity order of halogens towards ethane is $F_2 > Cl_2 > Br_2 > I_2$

63. Answer (3)

Hint: Phthalic acid is a dicarboxylic acid



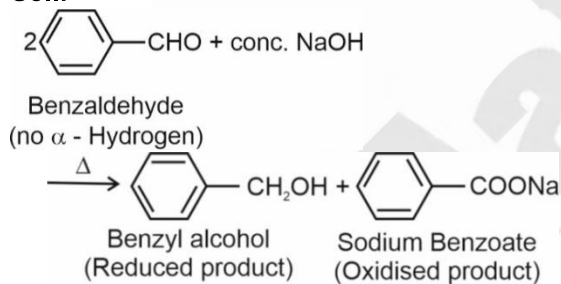
Sol.:



64. Answer (2)

Hint: In Cannizzaro reaction, one aldehyde molecule undergoes reduction while other undergoes oxidation.

Sol.:

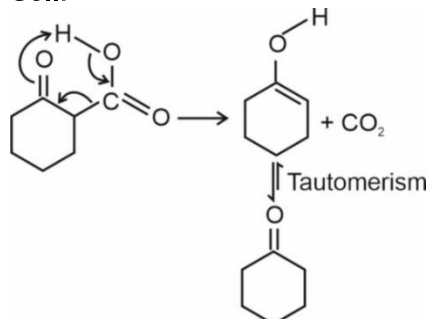


Disproportionation Reaction

65. Answer (3)

Hint: β -keto acids easily decarboxylate on heating.

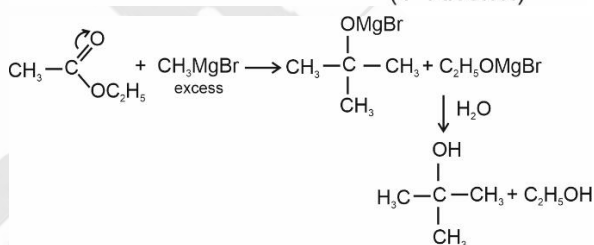
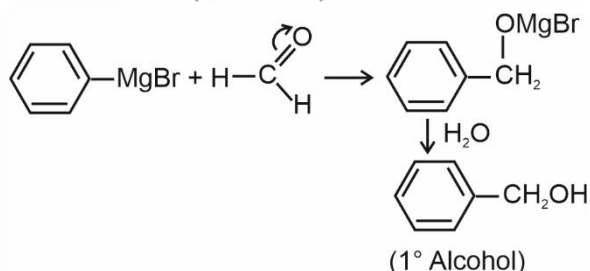
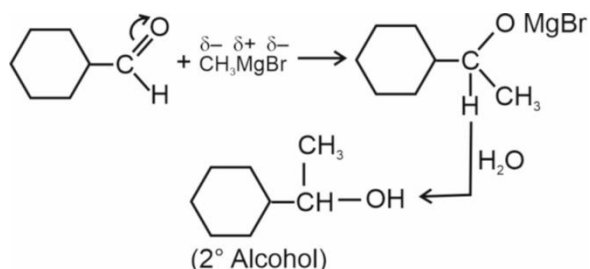
Sol.:



66. Answer (2)

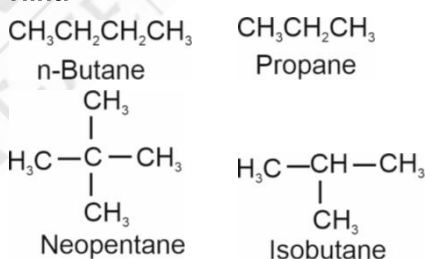
Hint: Reaction of Grignard reagent with an aldehyde is a nucleophilic addition.

Sol.:



67. Answer (1)

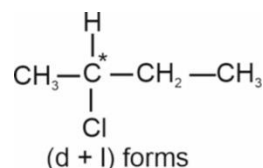
Hint:



Sol.: Monochlorination product of n-Butane



2-Chlorobutane has chiral carbon and it will show optical isomerism.



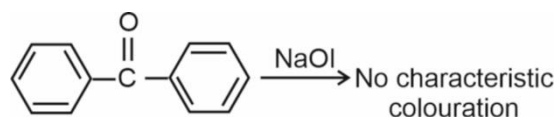
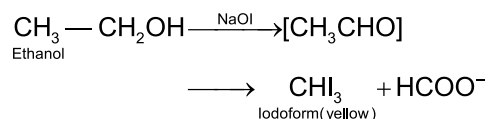
Hence, 3 monochlorination products are formed.

68. Answer (2)

Hint: Compounds containing $\text{CH}_3 - \text{C}(=\text{O}) -$ group

give positive iodoform test

Sol.:



(Ethanal) (Butanone)

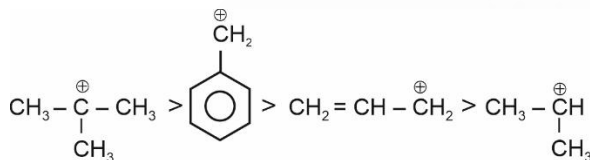
Both give positive iodoform test and can't be distinguished by iodoform test.

69. Answer (4)

Hint: Order to $\text{S}_{\text{N}}1$ depends upon stability of intermediate carbocation.

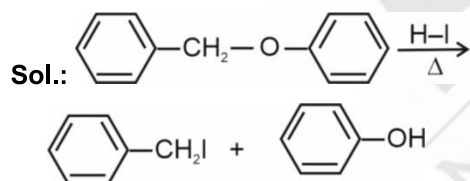
Sol.:

Stability of carbocation :



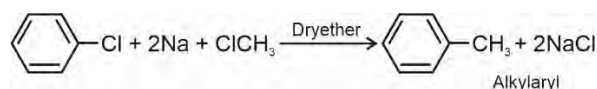
70. Answer (2)

Hint: C - O bond in phenol has partial double bond character.

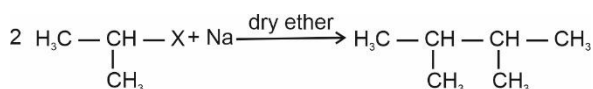


71. Answer (1)

Hint: Wurtz-Fittig Reaction:



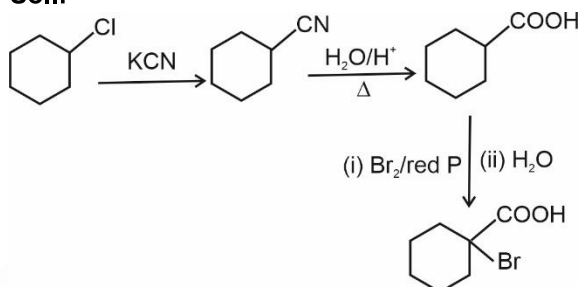
Sol.: Wurtz Reaction:



72. Answer (4)

Hint: In Hell-Volhard Zelinsky reaction, carboxylic acid reacts with halogen in the presence of red phosphorus to form α -halo-carboxylic acid.

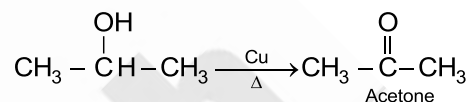
Sol.:



73. Answer (2)

Hint: On heating alcohol with Cu, dehydrogenation takes place.

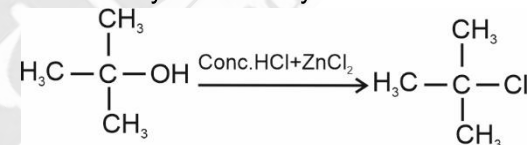
Sol.:



74. Answer (4)

Hint: Lucas reagent is conc. $\text{HCl} + \text{ZnCl}_2$

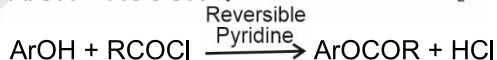
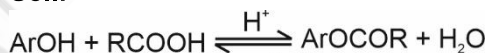
Sol.: Tertiary alcohol reacts fastest with conc. HCl in the presence of ZnCl_2 to form alkyl halide and form turbidity immediately.



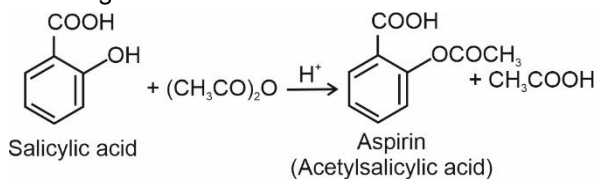
75. Answer (3)

Hint: Aspirin is acetylsalicylic acid

Sol.:



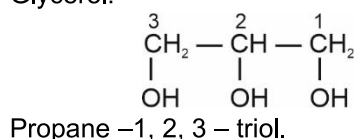
Pyridine neutralises HCl formed to shift equilibrium to the right hand side.



76. Answer (3)

Hint and Sol:

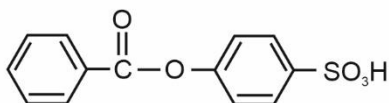
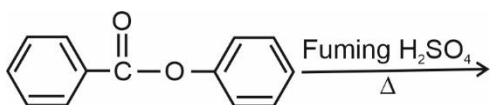
Glycerol:



77. Answer (1)

Hint: Electrophilic substitution will occur in the benzene ring which has more electron density.

Sol.:



78. Answer (4)

Hint: Least stable conformer of ethane is its eclipsed form.

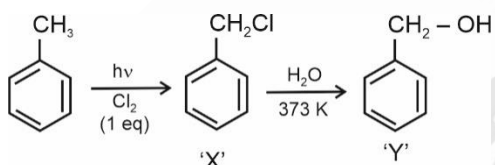
Sol.:

- Angle of rotation about C – C bond is termed as dihedral angle or torsional angle.
- Dihedral angle of least stable conformation of ethane is 0° .
- Conformers are interconvertible and non-separable.

79. Answer (1)

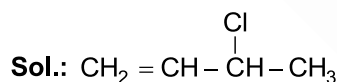
Hint: Halogenation of toluene in the presence of sunlight leads to side chain substitution.

Sol.:



80. Answer (3)

Hint : Optically active molecule has chiral carbon.



Above molecule has chiral carbon.

81. Answer (3)

Hint and Sol.:

In furan, 6π electrons are in conjugation.

82. Answer (2)

Hint: +R group increases the reactivity of benzene ring towards electrophilic substitution.

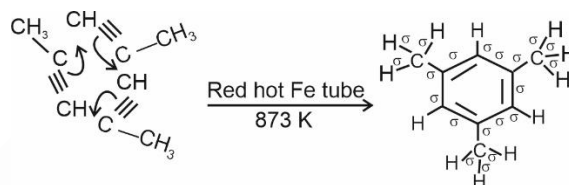
Sol.: OH group has +R effect and it increases reactivity towards electrophilic substitution.

–Cl is a +R group but it has – I effect too, hence it has less activating effect as compared to – OH towards electrophilic substitution. –NO₂ and –CHO groups have – R effect.

83. Answer (4)

Hint: Alkyne undergoes cyclic polymerisation to give aromatic hydrocarbon.

Sol.:



84. Answer (3)

Hint: Cyclic planar species with $(4n + 2)\pi$ delocalised electrons is aromatic. (Where $n = 0, 1, 2, 3, \dots$)

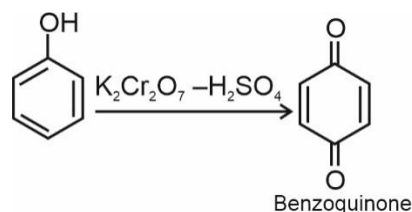
Sol.:

a.	 (Cyclobutenyl dication)	It is a cyclic planar species with 2π electrons so, $n = 0$. Hence, aromatic
b.	 (Cyclopenta-1,3-dienylanion)	It is a cyclic, planar species with 6π electrons where $n = 1$ Hence, aromatic
c.	 Cyclooctatetraene	It is not a planar species. Hence, non-aromatic
d.	 Cyclopenta-1, 3-dienylcation	It is a cyclic planar species with $4n\pi e^-$ electrons ($n = 1$). Hence, it is antiaromatic.

85. Answer (4)

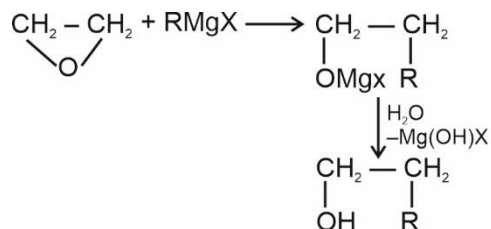
Hint: Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ is as strong oxidising agent

Sol.:



SECTION-B

86. Answer (3)

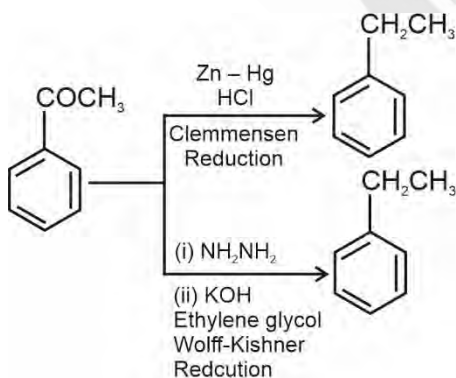
Hint and Sol.:

87. Answer (3)

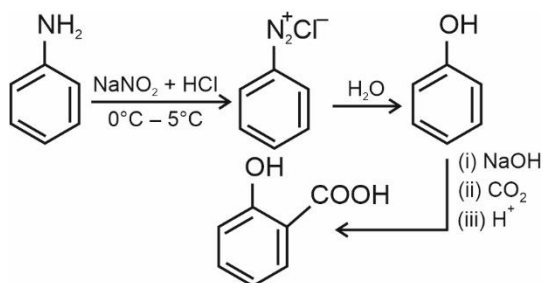
Hint: Double bond equivalent for $\text{C}_4\text{H}_{10}\text{O}$ is zero.**Sol.:**

(1)	$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array}$
(2)	$\begin{array}{c} \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\ \\ \text{OH} \end{array}$
(3)	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2\text{OH} \\ \\ \text{CH}_3 \end{array}$
(4)	$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$

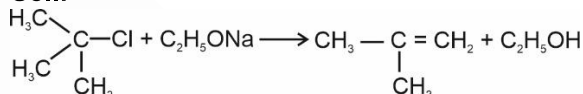
88. Answer (2)

Hint: Clemmensen reduction includes the reagent Zn-Hg/HCl and results in the conversion of carbonyl compound into alkane.**Sol.:**

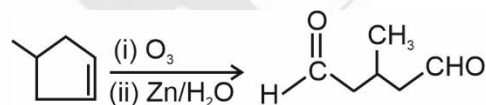
89. Answer (1)

Hint: Aniline undergoes diazotisation to form benzene diazonium chloride.**Sol.:**

90. Answer (1)

Hint: Tertiary halide reacts with a strong base then elimination takes place.**Sol.:**

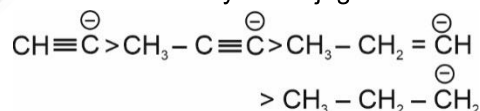
91. Answer (3)

Hint: Reductive ozonolysis of an alkene leads to the formation of aldehyde or ketone.**Sol.:**

92. Answer (3)

Hint: The C - O bond in methoxymethane is polar and hence ethers have net dipole moment.**Sol.:** Ethers do not react with sodium metal due to absence of H-bonding in $\text{CH}_3 - \text{O} - \text{CH}_3$, it has less boiling point as compared to ethanol.

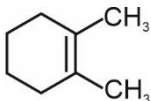
93. Answer (4)

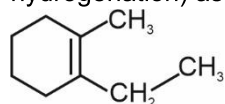
Hint: More the stability of conjugate base will lead to more acidic nature of compound.**Sol.:** Order of stability of conjugate bases.

94. Answer (3)

Hint: Less the stability of alkene, more the heat of hydrogenation.**Sol.:**

	5-hyperconjugative structures
5 α Hydrogen	
	6-hyperconjugative structures
6 α Hydrogen	

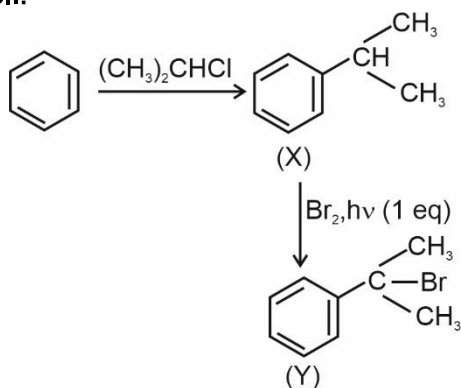
Hence,  is more stable (less heat of hydrogenation) as compared to



95. Answer (4)

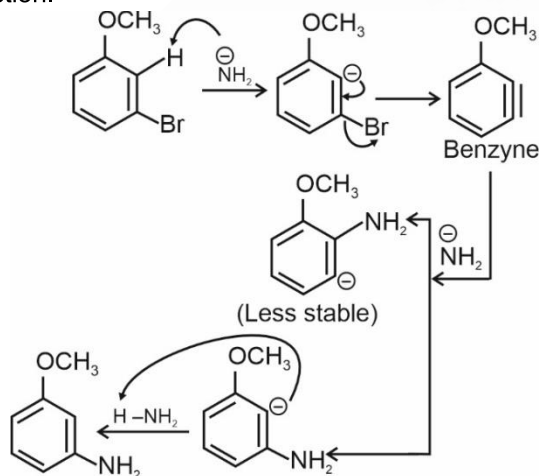
Hint: Reaction of alkyl halide with benzene ring in the presence of anhydrous AlCl_3 leads to Friedel-Crafts alkylation.

Sol.:



96. Answer (3)

Hint: NH_2^- is the attacking nucleophile in this reaction.

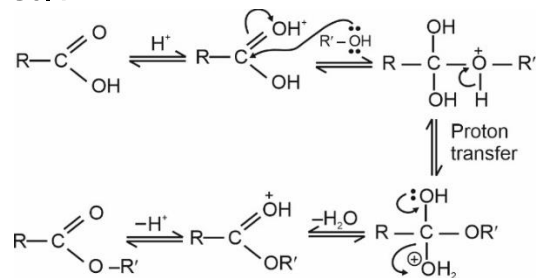


Sol.: m-methoxyaniline

97. Answer (4)

Hint: During esterification, tetrahedral intermediate is formed.

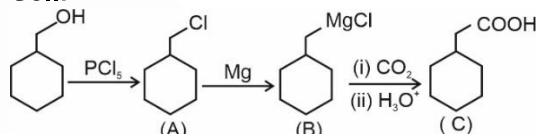
Sol.:



98. Answer (1)

Hint: Reaction of

Sol.:



99. Answer (4)

Hint: AgCN is a covalent compound and nitrogen is free to donate electron pair.

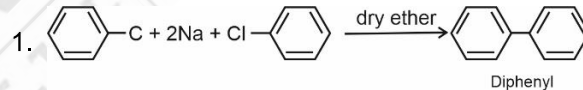
Sol.: In AgCN , nitrogen atom is free to donate electron pair forming isocyanide as the main product while reacting with alkyl halide



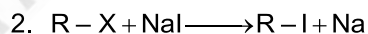
100. Answer (4)

Hint: Finkelstein and Swarts reactions are halogen exchange.

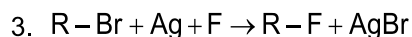
Sol.:



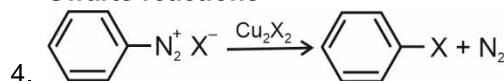
Fittig reaction



Finkelstein reaction



Swarts reactions



Sandmeyer reaction

[BOTANY]

SECTION-A

101. Answer (4)

Hint: 'X-body' term was given by Henking.

Sol.: Starch synthesis gene in pea (different grain sizes) shows incomplete dominance.

102. Answer (2)

Hint: Haemophilia is an X-linked recessive disorder.

Sol.:

♂	×	♀
XY or X ^h Y	×	X ^h X ^h
↓		
♀ ♂	X	Y
X ^h	X ^h X	X ^h Y
X ^h	X ^h X	X ^h Y

♀ ♂	X ^h	Y
X ^h	X ^h X ^h	X ^h Y
X ^h	X ^h X ^h	X ^h Y

All male children will be haemophilic.

103. Answer (2)

Hint: *Zostera* (Sea-grass) is a marine plant.**Sol.:** *Vallisneria* is a fresh water plant in which pollination occurs on the surface of water.

104. Answer (3)

Hint: Mendel proposed two general rules to consolidate his understanding of inheritance in monohybrid crosses.**Sol.:** Law of segregation is based on the fact that alleles do not show blending.

105. Answer (3)

Hint: Gene for cystic fibrosis is found on autosome.**Sol.:** Cystic fibrosis is an autosomal recessive disorder.

106. Answer (3)

Hint: All the events from pollen deposition on stigma until the pollen tube enters the ovule are together referred as pollen-pistil interaction.**Sol.:** Chemical components mediate pollen-pistil interaction. Embryo development occurs in the sequence of:

Proembryo → Globular embryo → Heart shaped embryo → Mature embryo

107. Answer (4)

Hint: The trait that expresses itself in homozygous condition is called as recessive trait.**Sol.:** Constricted pod shape of pea is a recessive trait.

108. Answer (3)

Hint: Mendel worked for 7 years on *Pisum sativum*.**Sol.:** Mendel conducted hybridisation experiments on garden peas for 7 years (1856-1863).

109. Answer (3)

Hint: Number of heterozygous loci decides the number of gametes formed.**Sol.:** Types of gametes = 2ⁿ

Here, n = 3

$$\therefore 2^3 \Rightarrow 8$$

110. Answer (4)

Hint: AB human blood group shows co-dominance.**Sol.:**

	I ^O	I ^A
I ^O	I ^O I ^O	I ^A I ^O
I ^B	I ^O I ^B	I ^A I ^B

In a cross of I^OA^A and I^OA^B, 'O' blood group can be obtained in the progeny.

111. Answer (3)

Hint: In honey bees, male produce sperms by mitosis**Sol.:** In honey bees, an unfertilised egg develops as a male (drone) by parthenogenesis. Males do not have father and thus cannot have sons, but have a grandfather and can have grandsons.

112. Answer (2)

Hint: Megasporogenesis is the process of formation of megaspores from megaspore mother cell through meiosis.**Sol.:** Ovule (megasporangium) is diploid

113. Answer (1)

Hint: In some seeds, remnants of nucellus are also persistent.**Sol.:** The residual, persistent nucellus is perisperm, e.g. beet, black pepper.

114. Answer (3)

Hint: In rice and wheat, pollen grains lose viability within 30 minutes of their release.**Sol.:** In *Michelia*, gynoecium is multicarpellary apocarpous. In Rosaceae, Leguminosae and Solanaceae, pollen grains maintain viability for months.

115. Answer (2)

Hint: Mendelian disorders are mainly determined by alteration or mutation in a single gene.**Sol.:** Down's syndrome is not a Mendelian disorder rather a chromosomal disorder. Affected individual has an extra autosome.

116. Answer (3)

Hint: Yellow colour and round seed shape of pea is dominant over green colour and wrinkled seed shape.**Sol.:** In a dihybrid cross, the genotypes obtained are:

2 Rr YY

2 RR Yy

4 RrYy

2 rrYy

2 Rryy

$$\text{So, } \frac{12}{16} \times 1000 \Rightarrow 750$$

117. Answer (3)

Hint: Haemophilia is also called as bleeder's disease

Sol.: Sickle cell anaemia is a qualitative problem of synthesising incorrectly functioning globin molecules.

118. Answer (3)

Hint: Fruit which develops from ovary is called a true fruit.

Sol.: Banana is a parthenocarpic fruit, developed without the process of fertilization whereas rest of them are false fruits.

119. Answer (2)

Hint: Mendel's results pointed to general rules of inheritance rather than being unsubstantiated ideas.

Sol.: Mendel used a large sampling size which gave credibility to his results.

120. Answer (4)

Hint: Two anther lobes are attached to each other by a band of vascular sterile tissue known as connective.

Sol.: Synergids have special cellular thickenings at the micropylar tip called filiform apparatus.

121. Answer (2)

Hint: Chalaza represents the basal part of the ovule in a typical angiosperm.

Sol.: Enclosed within the integuments is a mass of cells called nucellus having abundant reserves food.

122. Answer (1)

Hint: The genotype with all the dominant alleles will have the darkest skin colour.

Sol.: Human skin colour is an example of polygenic inheritance or quantitative inheritance.

123. Answer (2)

Hint: In incomplete dominance, F_1 did not resemble either of the two parents and is in between the two.

Sol.:

		Phenotypic ratio
Test cross	–	1 : 1

Incomplete dominance – 1 : 2 : 1

124. Answer (4)

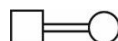
Hint: In a pedigree chart, the symbols for affected individuals are shaded completely.

Sol.:

• Mating between diseased individuals →



• Consanguineous mating →



• Sex unspecified →



• Parents with affected female child →



125. Answer (3)

Hint: In the grass only one cotyledone is found.

Sol.: Epiblast refers to the remains of second cotyledon.

126. Answer (4)

Hint & Sol.: Double fertilization and triple fusion are unique to flowering plants.

127. Answer (4)

Hint: In heterozygous condition, pink coloured flowers are observed in snapdragon.

Sol.: In patients of Down's syndrome, big and wrinkled tongue is observed. In *Drosophila*, 4 pairs of chromosomes are present. Flower colour of snapdragon shows incomplete dominance.

128. Answer (2)

Hint: In autogamy, pollination is achieved in the same flower.

Sol.: Geitonogamy is functionally cross-pollination involving a pollinating agent. Genetically, it is similar to autogamy.

129. Answer (1)

Hint: Scutellum is a shield shaped cotyledon

Sol.: Coleorhiza encloses the root cap and radicle.

130. Answer (4)

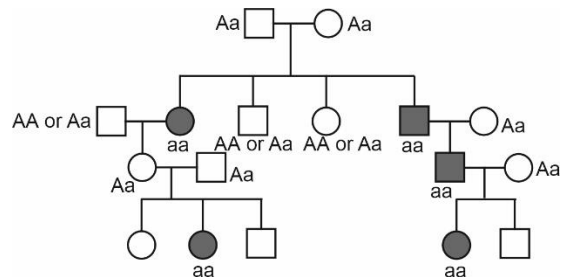
Hint: Test crosses are performed to know the genotype of a dominant phenotype.

Sol.: Test cross is carried between organism with dominant phenotype and the recessive one.

131. Answer (3)

Hint: Sex-linked trait like colour blindness shows criss-cross inheritance.

Sol.:



Trait will be expressed only in homozygous recessive condition.

132. Answer (4)

Hint: Law of independent assortment is based on the results obtained from dihybrid crosses.

Sol.: Morgan obtained 1.3% recombinant in F_2 generation when he crossed yellow bodied white eyed female with brown bodied red eyed male.

133. Answer (4)

Hint: Cleistogamous flowers do not open at all

Sol.: *Viola* and *Commelina* produce both chasmogamous and cleistogamous flowers. Cleistogamous flowers are invariably autogamous as there is no chance of cross-pollen landing on stigma.

134. Answer (2)

Hint: Long, sticky unwettable stigma is found in water pollinated plants.

Sol.:

<i>Zostera</i>	Marine plant showing hydrophily
Bamboo	Wind pollinated plant
<i>Yucca</i>	Insect pollinated plant showing presence of nectaries
Water lily	Pollinated by insects or wind

135. Answer (3)

Hint: The innermost layer of anther wall surrounds the sporogenous tissue.

Sol.: Cells of tapetum layer are polyploid and show increase in their DNA content.

SECTION-B

136. Answer (4)

Hint: In phenylketonuria, the affected individual lacks an enzyme called phenylalanine hydroxylase.

Sol.: In affected individuals of phenylketonuria there is a reduction in hair and skin pigmentation. It is an autosomal recessive disorder. Phenylalanine is accumulated in the brain of patients.

137. Answer (2)

Hint: Pollens can be preserved as fossils due to the presence of sporopollenin in exine.

Sol.: Vegetative cell is bigger in size, having abundant food reserve and a large irregularly shaped nucleus. Sporopollenin can withstand high temperature, strong acids and alkali.

138. Answer (4)

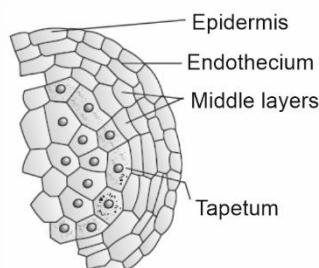
Hint: Haemophilia is a X-linked recessive disorder.

Sol.: Sickle cell anaemia is caused by substitution of glutamic acid by valine at the sixth position. α -thalassemia is controlled by two closely linked genes HBA1 and HBA2 on chromosome 16 of each parent.

139. Answer (3)

Hint: Outer three anther wall layers perform the function of protection and help in dehiscence of anther to release pollen.

Sol.: Tapetum nourish the developing pollen grains.



140. Answer (2)

Hint: In a dihybrid cross, the phenotypic ratio obtained is 9 : 3 : 3 : 1

Sol.: Law of dominance is not universally applicable

141. Answer (4)

Hint: In some plants, pollination is done by Gecko lizard.

Sol.: In over 60 percent of angiosperms, pollen grains are shed at 2-celled stage.

142. Answer (2)

Hint: Fruit fly is a tiny fly of about 2 mm size and a life cycle of about 2 weeks

Sol.: Fruit fly has a life cycle of about 2 weeks. Female body is larger in size as compared to males and hereditary variation can be seen with a low power microscope.

143. Answer (1)

Sol.: Human genome project utilised genetic maps.

144. Answer (4)

Hint: *Hydrilla* is a fresh water plant

Sol.: *Hydrilla* is a water pollinated plant, having light, unwettable pollen grains. Presence of single non-sticky pollen is a characteristic of wind pollinated plants.

145. Answer (4)

Hint: Colour blindness is an X-linked recessive disease.

Sol.: Colour blindness occurs in about 8 percent of males and only about 0.4 percent of female. This is because the genes that lead to red-green colour blindness are on the X-chromosome.

146. Answer (3)

Hint: In monoecious plants, male and female flowers are produced on the same plant.

Sol.: Castor prevents autogamy but not geitonogamy.

147. Answer (3)

Hint: Sex-determination in honey bees is based on the number of sets of chromosomes an individual receives.

Sol.: Birds: ZW type of sex determination.

Honey bee : Haplo-diploid sex determination

Grasshopper : XO type of sex determination

Butterflies : ZO type of sex determination

148. Answer (1)

Hint: Cryopreservation is done in liquid N₂ at the temperature of – 196°C

Sol.: Pollen grains are formed from microsporogenesis and have taxonomic significance.

149. Answer (1)

Hint: Morgan coined the terms linkage and recombination.

Sol.: T. H. Morgan and his colleagues verified the chromosomal theory of inheritance experimentally.

150. Answer (2)

Hint: Turner's syndrome is caused due to the absence of one of the X chromosomes.

Sol.: An individual suffering from Turner's syndrome has rudimentary ovaries and lacks other secondary sexual characters.

[ZOOLOGY]

SECTION-A

151. Answer (3)

Hint: Promotes well-being of individuals in reproduction related aspects

Sol.: Improved programmes covering wider reproduction related areas are currently in operation under the popular name 'Reproductive and Child Health Care (RCH) programmes'. Creating awareness among people about various reproduction related aspects and providing facilities and support for building up a reproductively healthy society are the major tasks under these programmes.

Awareness of problems due to uncontrolled population growth, social evils like sex-abuse and sex related crimes need to be created.

152. Answer (3)

Hint: Gamete is transferred

Sol.: GIFT - (Gamete Intra Fallopian Transfer) - Transfer of an ovum collected from a donor into the fallopian tube of another female cannot produce one, but can provide suitable environment for fertilisation and further development.

ZIFT is Zygote Intra Fallopian Transfer.

ICSI is Intra Cytoplasmic Sperm Injection.

IUI is Intra Uterine Insemination.

153. Answer (1)

Hint: Less than 2 per cent

Sol.: According to the 2011 census report, the population growth rate was less than 2 per cent, i.e., 20/1000/year.

Administration of progestogens or progestogen-estrogen combinations or IUDs within 72 hours of coitus have been found to be very effective as emergency contraceptives as they could be used to avoid possible pregnancy due to rape or casual unprotected intercourse.

Spermicidal creams, jellies and foams are used along with barriers (condoms, etc) to increase their contraceptive efficiency.

154. Answer (1)

Hint : Micropipette is used to inject sperm into the center of the egg.

Sol.: In ICSI (Intra Cytoplasmic Sperm Injection), a sperm is directly injected into the ovum to form an embryo in the laboratory.

In AI (Artificial insemination), the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – Intra-uterine insemination) of the female.

GIFT is gamete intra fallopian transfer.

155. Answer (2)

Hint: Prevents ovulation

Sol.: Pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle. After a gap of 7 days (during which menstruation occurs) it has to be repeated in the same pattern till the female desires to prevent conception. They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

156. Answer (3)

Hint: Paired accessory gland

Sol.: The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of penis.

157. Answer (3)

Hint: Body fluid should get exchanged for transmission.

Sol.: Some of the STIs can be transmitted by sharing of injection needles, surgical instruments, etc., with the infected person, transfusion of blood, or from an infected mother to the foetus too.

158. Answer (3)

Hint: Same chemical composition

Sol.: Progestogens alone or in combination with estrogen can be used by females as injections or implants under the skin. Their mode of action is similar to that of pills but their effective periods are much longer.

They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms.

Diaphragm, cervical caps and vaults are barriers made of rubber that are inserted into female reproductive tract to cover the cervix during coitus.

159. Answer (1)

Hint: Opposite effect of Cu^{2+} ions

Sol.: IUDs increase phagocytosis of sperms within the uterus and the Cu^{2+} ions releasing IUDs suppress sperm motility and the fertilising capacity of sperms. The hormone releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms.

160. Answer (2)

Hint: Helps in fertilization of ovum

Sol.: Acrosome is a cap-like structure, present in the anterior portion of sperm head. Head also contains an elongated haploid nucleus. Middle piece possesses numerous mitochondria which help in sperm motility.

161. Answer (2)

Hint: There can be various reasons for infertility.

Sol.: The reason for infertility can be many-physical, congenital, diseases, drugs, immunological or even psychological.

- MTP are considered relatively safe during the first trimester, i.e., up to 12 weeks of pregnancy.
- Nirodh is a popular brand of condom used by males.

162. Answer (4)

Hint: Isthmus joins uterus

Sol.: In human females, last part of oviduct, isthmus has a narrow lumen and it joins the uterus. The uterus opens into vagina through a narrow cervix.

163. Answer (4)

Hint: Good health services have increased the longevity.

Sol.: Increased health facilities along with better living conditions have an explosive impact on the growth of population. A rapid decline in death rate, maternal mortality rate (MMR) and infant mortality rate (IMR) as well as an increase in number of people in reproductive age are probable reasons for population explosion.

164. Answer (2)

Hint: Ovulation occurs prior to luteal phase

Sol.: Periodic abstinence is a natural method of contraception in which the couple should avoid coitus from day 10 to 17 of the 28 days menstrual cycle. So, in case of menstrual cycle of 30 days, coitus should be avoided from day 12 – 19

165. Answer (4)

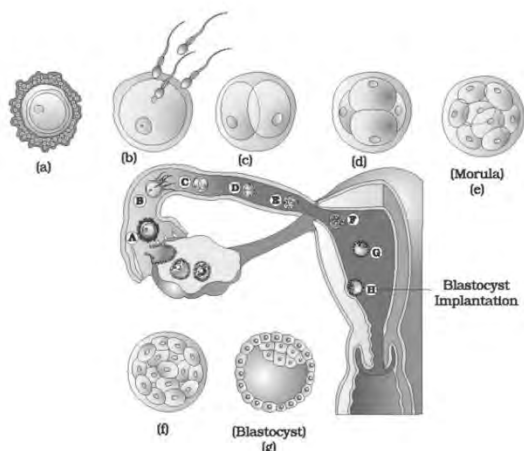
Hint: Reason why sterilisation method is not opted to space children.

Sol.: An ideal contraceptive should be user-friendly, easily available, effective and reversible with no or least side-effects. It also should in no way interfere with the sexual drive, desire or the sexual act of the user.

166. Answer (3)

Hint: Cleavage division starts as the zygote moves through the isthmus.

Sol.:



The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The embryo with 8 to 16 blastomeres is called a morula (Represented by 'e'). The morula continues to divide and transforms into blastocyst (Represented by 'g') as it moves further into the uterus. The trophoblast layer then gets attached to the endometrium (Represented by 'H') called implantation.

167. Answer (3)

Hint: Sertoli cells are nurse cells.

Sol.: After spermiogenesis, sperm head becomes embedded in the Sertoli cell, and are finally released from the seminiferous tubules by the process called spermiation.

168. Answer (1)

Hint: Observed during end of second month of pregnancy.

Sol.: In human beings, after one month of pregnancy (almost 4 weeks), the embryo's heart is formed. The first sign of growing foetus may be noticed by listening to the heart sounds through the stethoscope. By the end of the second month of pregnancy (almost 8 weeks), the foetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well developed. The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month.

169. Answer (1)

Hint: This hormone plays a role in thickening of endometrium.

Sol.: In the luteal phase, the endometrium is thickened due to estrogen hormone secreted by the corpus luteum.

Secretions of gonadotropins (LH and FSH) increase gradually during the follicular phase and stimulate the follicular development and secretion of estrogen by the growing follicles.

Relaxin is secreted in the later stages of pregnancy.

170. Answer (3)

Hint: Closest to the number of bones in a limb of humans.

Sol.: In spermatogenesis, each primary spermatocytes undergoes two meiotic divisions. The first meiotic division produces 2 secondary spermatocytes from each primary spermatocyte. Each secondary spermatocyte then undergoes the second meiotic division to form two spermatids.

Thus, 16 primary spermatocytes



Will form 32 secondary spermatocytes

32 meiotic divisions ↓

Will form 64 spermatids

171. Answer (4)

Hint: Urinogenital ducts carry urine and sperms.

Sol.: In human males, urethra acts as the urinogenital duct. Urinogenital duct refers to the duct that transports both urine and sperms.

- Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells.
- The hymen is often torn during the first coitus (intercourse). However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horse back riding, cycling, etc.

Thus, it is not a reliable indicator of sexual experience.

172. Answer (3)

Hint: It is one of the female accessory ducts.

Sol.: During *in vitro* fertilisation, the zygote or early embryo (with upto 8 blastomeres) is transferred into the fallopian tube (ZIFT – Zygote Intra Fallopian Transfer). Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus.

- Labia majora → Fleishy folds of tissue which extend down from the mons pubis and surround the vaginal opening.

- Uterus → It is an inverted pear shaped structure and is supported by ligaments attached to the pelvic wall.
 - Clitoris → A tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.
- Embryos with more than 8 blastomeres are transferred into the uterus.

173. Answer (2)

Hint: Fertilisation and pregnancy are chance events.

Sol.: Fertilisation can only occur, if the ovum and the sperms are transported simultaneously to the ampullary region. Thus, it is the reason why not all copulations lead to fertilisation and pregnancy.

Sperms show rapid whiplash movements of the tail part and reach the ampullary-isthmic junction.

Ovum reaches ampulla region of oviduct, the site of fertilization, by the ciliary action of ciliated columnar epithelial lining of oviduct.

174. Answer (3)

Hint: A yellow-coloured temporary gland develops during this phase.

Sol.: Uterine events of menstrual cycle include:

- (1) Menstrual phase
- (2) Proliferative phase
- (3) Secretory phase

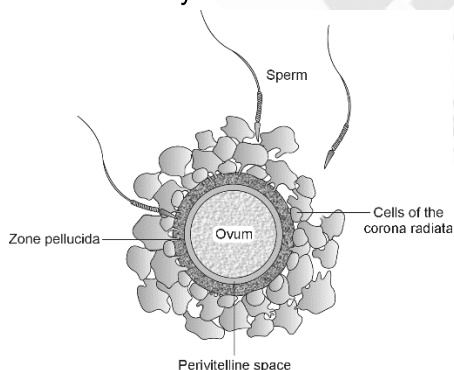
* Ovarian events of menstrual cycle include:

- (1) Follicular phase
- (2) Ovulatory phase
- (3) Luteal phase

175. Answer (1)

Hint: An acellular layer

Sol.:



During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms.

Thus, it ensures that only one sperm can fertilise an ovum.

Zona pellucida is a non-cellular and glycoprotein layer that surrounds the mammalian oocytes. It is present between the plasma membrane of oocyte and the corona radiata.

In the Graafian follicle, the secondary oocyte forms a new membrane surrounding it, called zona pellucida.

176. Answer (3)

Hint: Secreted by a temporary endocrine gland

Sol.: In the absence of fertilisation, the corpus luteum degenerates; the level of progesterone hormone fall in the blood. This causes disintegration of the endometrium, leading to menstruation, marking a new cycle.

Progesterone – estrogen combinations or progestogens alone, prevent ovulation as well as alter the quality for cervical mucus.

Relaxin is a proteinaceous hormone which is released in the later part of pregnancy from ovaries.

177. Answer (4)

Hint: Oogenesis starts since foetal stage.

Sol.: The oogonial cells start division and enter into prophase-I of the meiotic division, and get temporarily arrested at this stage called primary oocytes. Each primary oocyte gets surrounded by a layer of granulosa cells and then called primary follicle.

Primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles. The secondary follicle soon transforms into tertiary follicle which is characterised by antrum. The tertiary follicle further matures into Graafian follicle.

178. Answer (2)

Hint : Can be removed by a procedure called circumcision.

Sol.: The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination. The enlarged end of penis called glans penis is covered by a loose fold of skin called foreskin.

Hymen is a membrane which partially covers the opening of vagina.

The urethra originates from urinary bladder and extends through the penis to its external opening called urethral meatus.

179. Answer (4)

Hint: Contractions occur in the middle layer during parturition.

Sol.: In human females, the wall of uterus has three layers of tissues. They are:

1. Perimetrium → External thin membranous layer
2. Myometrium → Middle thick layer of smooth muscle; undergoes contractions
3. Endometrium → Inner glandular layer; undergoes cyclical changes during the menstrual cycle

180. Answer (3)

Hint: The structure to lodge testes.

Sol.: Extra abdominal testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes ($2 - 2.5^{\circ}\text{C}$ lower than the normal internal body temperature), which is necessary for spermatogenesis.

181. Answer (3)

Hint: It lies at the base of the bladder and surrounds the first part of the urethra.

Sol.: In humans, the male reproductive accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands (Cowper's gland). Penis is not a gland.

182. Answer (3)

Hint: It is located along the posterior surface of each testis.

Sol.: Sperms released from the seminiferous tubules follow the pathway as mentioned below:

Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra

An extra-testicular duct system consists of tubes which conduct sperms from the testes to the outside.

Epididymis is an extra-testicular duct which stores the sperms temporarily and leads to vas deferens.

183. Answer (4)

Hint: Location of Leydig cells

Sol.: Leydig cells synthesise and secrete testicular hormones called androgens and are located in interstitial spaces of testis.

Rete testis is sex accessory duct in human males. Seminiferous tubules are lined on its inside by male germ cells and Sertoli cells.

184. Answer (2)

Hint: During intrauterine life

Sol.: Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary. First menstruation begins at the puberty. Menstrual cycle ceases around 50 years of age; that is termed as menopause.

185. Answer (3)

Hint: Year of second republic day in India.

Sol.: To attain total reproductive health as a social goal, some programmes called 'family planning' were initiated in India in 1951 and were periodically assessed over the past decades.

SECTION-B

186. Answer (3)

Hint: Leads to formation of second polar body

Sol.: Entry of sperm within ovum induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum.

187. Answer (4)

Hint: Gamete transport will be blocked.

Sol.: Ejaculation will not get affected if vasectomy is performed. Hormone levels will also not get affected due to vasectomy. But the semen produced will not contain any sperm as gamete transport will be inhibited.

188. Answer (2)

Hint: Exclude the method that involves *in vivo* fertilization.

Sol.: In ZIFT, the zygote or early embryos (with upto 8 blastomeres) are transferred into the fallopian tube of the female.

AI is artificial insemination. IUI is intra uterine insemination. GIFT is gamete intra fallopian transfer.

189. Answer (1)

Hint: To get pregnant

Sol.: Absence or less significant symptoms in the early stages of infection and the social stigma attached to the STIs, deter the infected individual from going for timely detection and proper treatment. This could lead to complications later, which include pelvic inflammatory diseases (PID), abortions, still births, ectopic pregnancies, infertility or even cancer of the reproductive tract.

190. Answer (1)

Hint: Used by females exclusively**Sol.:** Diaphragms, cervical caps and vaults are barriers made of rubber that are inserted into the female reproductive tract to cover the cervix during coitus. They prevent conception by blocking the entry of sperms through the cervix.

But, they do not protect the users from STIs.

Male condoms protect the users from STIs.

191. Answer (3)

Hint: $\frac{2}{5}$ th part**Sol.:** In a normal ejaculate, 60% of sperms must have normal shape and size and 40% of them must show vigorous motility.

192. Answer (4)

Hint: Estrogen peaks twice during the menstrual cycle**Sol.:** Estrogen peaks during the first half of the menstrual cycle, during mid-follicular phase and then drops after ovulation.

The second rise in estrogen levels is observed during the mid-luteal phase with a decrease at the end of the menstrual cycle.

The menstrual phase is followed by the follicular phase.

New follicles are formed during the follicular phase.

Progesterone level peaks only once during luteal phase.

193. Answer (4)

Hint : Formation of secondary oocyte**Sol.:** The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles.

The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The theca layer is organised into an inner theca interna and an outer theca externa. At this stage, the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division.

Spermatids are differentiated into spermatozoa, this is called spermiogenesis.

194. Answer (4)

Hint: Several mammary ducts join to form a wider mammary ampulla**Sol.:** Several mammary ducts join to form a wider mammary ampulla, which is connected to lactiferous duct through which milk is sucked out.

195. Answer (1)

Hint: Exclude the hormone secreted by anterior pituitary.**Sol.:** Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogen, progestogens, etc. Prolactin is secreted by anterior pituitary.

196. Answer (1)

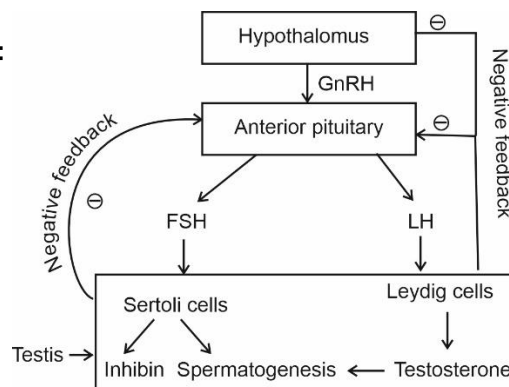
Hint: Its causative agent is *Human papilloma virus*.**Sol.:** Genital warts is a common sexually transmitted infection caused by the *Human papilloma virus* (HPV).

Chlamydia, syphilis and the gonorrhoea are bacterial STIs.

197. Answer (4)

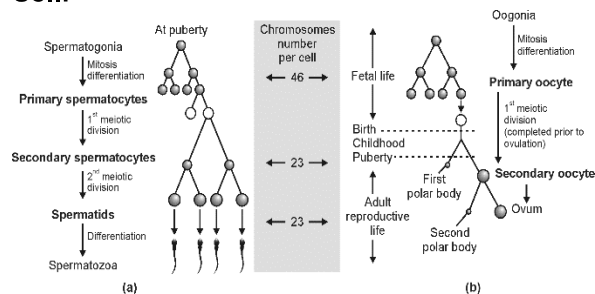
Hint: The hormone which is only released in a pregnant female.**Sol.:** Pregnancy tests work by detecting the human chorionic gonadotropin (hCG) in the body of human females.

198. Answer (3)

Hint: Spermatogenesis starts at the age of puberty due to the significant increase in secretion of gonadotropins.**Sol.:**

199. Answer (2)

Hint: Primary oocyte and primary spermatocyte undergo meiosis.

Sol.:

200. Answer (4)

Hint: Estrogen receptors are present at the site of implantation.

Sol.: 'Saheli' is an oral contraceptive that contains a non-steroidal preparation. It is a 'once a week' pill with very few side effects and high contraceptive value.

It blocks the estrogen receptors in the uterus and prevents eggs from getting implanted. Thus, it prevents implantation, not ovulation. It was developed by scientists at Central Drug Research Institute (CDRI) in Lucknow, India.

