1. (b)

Sol. At t = 1 sec, i = 2 + 3 × 1 = 5A and $|e| = L\frac{di}{dt} \Rightarrow 9 \times 10^{-6} = L \times \frac{d}{dt}(2+3t) \Rightarrow L = 3 \times 10^{-3}$ H

So energy $U = \frac{1}{2}Li^2 = \frac{1}{2}(3\times10^{-3})\times(5)^2 = 37.5$ mJ.

2. (b)

Sol. $\because L \propto N^2 \Rightarrow \frac{L_1}{L_2} = \left(\frac{N_1}{N_2}\right)^2 \Rightarrow \frac{108}{L_2} = \left(\frac{600}{500}\right)^2$;

$L_2 = 75 mH$

3. (a)

Sol.

$$e = -L\frac{dI}{dt} = -10\times10^{-3}\frac{1.0}{0.01} = -1 volt \quad \therefore \quad |e| = 1 volt$$

4. (c)

Sol. The inductance of a coil is given as L = $\frac{\mu_0 N^2 A}{\ell}$ where N = total number of turns of the coil; A = area of cross section of the coil = π r^2; r = radius of the core of the coil, ℓ = length of the coil. If ℓ is doubled the total number of turns will be doubled

$$\Rightarrow \frac{L_2}{L_1} = \left(\frac{N_2}{N_1}\right)^2\left(\frac{A_2}{A_1}\right)\left(\frac{\ell_1}{\ell_2}\right) = \left(\frac{N_2}{N_1}\right)^2\left(\frac{\pi r_2^2}{\pi r_1^2}\right)\left(\frac{\ell_1}{\ell_2}\right) \Rightarrow$$

$$\frac{L_2}{L_1} = (2)^2(2)^2\left(\frac{1}{2}\right) = 8 \qquad \left(\because \frac{N_2}{N_1} = \frac{r_2}{r_1} = \frac{\ell_2}{\ell_1} = 2\right).$$

Hence (C) is correct.

5. (b)

Sol. $\mu = iA = \left(\frac{ew}{2\pi}\right)(\pi r^2) = \frac{ewr^2}{2}$

6. (a)

Sol. L will decrease as Bi is diamagnetic

$\therefore I = \frac{V}{X_L}$ will increase

7. (a)

Sol. By using $\phi = BA\cos\theta$; here $\theta = 0^0$

$\therefore \phi = BA = 10^3 \times 10^{-2} = 10$ weber

8. (a)

Sol. Since current setup in the coil P is anticlockwise which increases the dot's linked with coil Q hence induced current in coil Q will be clockwise.

9. (d)

Sol. No current is induced in position 1, anticlockwise current is induced in position 2 because it is a case of increase of flux, no current in position 3 as there is no change of flux, clockwise current is produced in position 4 because it is a case of decrease of flux.

10. (b)

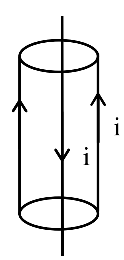
Sol. When north pole of the magnet is moved away, then south pole is induced on the face of the loop in front of the magnet i.e. as seen from the magnet side, a clockwise induced current flows in the loop. This makes free electrons to move in opposite i.e. direction, to plate b to a inside the loop. Thus excess positive charge appear on plate b.

11. (c)

Sol. $e = Bvl = 0.5 \times 1 \times 2 = 1 volt$

12. (b)

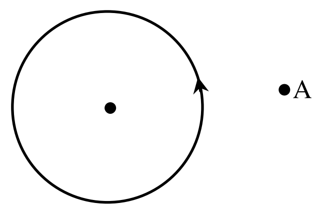
Sol.



$B_{out} = 0$

13. (a)

Sol.



The field at A is directed into the page.

14. (a)

Sol. When the magnet is pushed into the coil magnetic flux linked with the coil changes. An emf is induced in the coil which produces maximum deflection.

15. (d)

Sol. Magnetic flux linked with a coil

$\phi = NBA\cos\theta$

Since the magnetic field B is parallel to the area A,

i.e. $\theta = 90^\circ$

$\therefore \phi = 0$

16. (a)

Sol. AS the loops are brought closer the magnetic flux linked with them increases. An emf is induced in each loop which opposes the change in flux. So the current in each loop decreases.

17. (a)

Sol. Here $A = 0.4m^2, N = 100, dB = 0.04Wbm^{-2}$

$dt = 0.01s$

As $\varepsilon = \frac{d\phi}{dt} = NA\frac{dB}{dt} = 100 \times 0.4 \times \frac{0.04}{0.01} = 160V$

18. (d)

Sol. When the coils P and Q are brought nearer the magnetic flux linked with each coil will increase and so the induced current will try to decrease the flux and hence current in both P and Q decrease.

19. (b)

Sol. Direction of current induced in a wire moving in a magnetic field is found by using Fleming's right hand rule.

20. (b)

Sol. When the current in the wire AB decrease the magnetic flux linked with the loop (Which is out of the page) will decrease. Hence the current induced in the loop must be anticlockwise to oppose the decrease in magnetic flux.

21. (a)

Sol. $e = e_0 \sin \omega t$ where $e_0 = \omega NBA$

$e_0' = (9\omega)(4N)BA = 36e_0$

22. (c)

Sol. $P_{out} = V_s i_s = 140\ W, V_s = 24\ V, V_p = 240\ V, i_p = 0.7\,A$ $\eta = \frac{P_{out}}{P_{in}} \times 100 = \frac{P_{out}}{V_p i_p} \times 100 = \frac{140}{240 \times 0.7} \times 100 = 83.3\%.$

23. (a)

Sol. Comparing the given equation with $i = i_0 \sin \omega t$

$\Rightarrow \omega = 400\pi \Rightarrow 2\pi\nu = 400\pi \Rightarrow \nu = 200$ Hz.

Also $i_{rms} = \frac{i_0}{\sqrt{2}} = \frac{50\sqrt{2}}{2} = 50$ A.

24. (b)

Sol. By using $i = i_0 \sin \omega t = i_0 \sin 2\pi\nu t = i_{rms}\sqrt{2} \sin 2\pi\nu t$

$\Rightarrow i = 20\sqrt{2} \sin(150\pi t)$.

25. (b)

Sol. At t = 0, $i = 2\sin\left(0 + \frac{\pi}{3}\right) = 2 \times \frac{\sqrt{3}}{2} = \sqrt{3}A$.

26. (d)

Sol. Time difference T.D. $= \frac{T}{2\pi} \times \phi$ $\Rightarrow$ T.D.

$$= \frac{T}{2\pi} \times \frac{\pi}{3} = \frac{T}{6} = \frac{1}{6\nu} = \frac{1}{6 \times 60} = \frac{1}{360} sec$$

27. (a)

Sol. Peak value $V_0 = \sqrt{(8)^2 + (6)^2} = 10\, volt$ so

$v_{rms} = \frac{10}{\sqrt{2}} = 5\sqrt{2} = 7.05\, volt$.

28. (b)

Sol. By using $\cos\phi = \frac{R}{Z} \Rightarrow \cos 60^o = \frac{R}{200} \Rightarrow \frac{1}{2} = \frac{R}{200}$

$\Rightarrow R = 100\ \Omega$.

29. (a)

Sol. Impedance of the circuit = $\sqrt{R^2 + \omega^2 L^2}$

Amplitude of voltage $= V_o$

$\therefore$ Amplitude of current = $\frac{V_o}{\sqrt{R^2 + \omega^2 L^2}}$,

Hence (A) is correct.

30. (d)

Sol. If AC is the square wave then all these three options are possible

31. (d)

Sol. At resonance

$V_{BC} = 0$

$\therefore$ V_{AB} become equal to V_{AC}.

32. (c)

Sol. $10 = \sqrt{r^2 + X_L^2}$ and $\frac{X_L}{r} = \tan 60$

$10 = \sqrt{r^2 + (r\sqrt{3})^2}$ or r = 5 Ω, $X_L = 5\sqrt{3}\ \Omega$

$Z = \sqrt{(5+5)^2 + (5+\sqrt{3})^2} = \sqrt{175} = 13.2\ \Omega$

$\tan\phi = \frac{X_L}{R+r} = \frac{5\sqrt{3}}{10}$

or $\phi = \tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$.

33. (c)

Sol. $E_0 = 200\sqrt{2}$ V and $\omega = 100$ rad./s

So $X_c = \frac{1}{\omega c} = \frac{1}{100\times10^{-6}} = 10^4\Omega$

As ammeter reads rms value of current

$\therefore\ I_{rms} = \frac{E_{rms}}{Z} = \frac{E_0}{(\sqrt{2})X_c}$

$= \frac{200\sqrt{2}}{\sqrt{2}\times10^4}$

= 20 mA

34. (c)

Sol. $P = \frac{1}{2}V_0 i_0 \cos\phi = \frac{1}{2}\times100\times(100\times10^{-3})\times\cos\left(\frac{\pi}{3}\right) = 2.5$ watt.

35. (d)

Sol. $V_p = 200\,V,\ V_s = 6V \Rightarrow P_{out} = V_s i_s \Rightarrow 30 = 6 \times i_s$

$\Rightarrow i_s = 5A$

From $\frac{V_s}{V_p} = \frac{i_p}{i_s} \Rightarrow \frac{6}{200} = \frac{i_p}{5} \Rightarrow i_p = 0.15\,A$

36. (c)

Sol. $Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} = \sqrt{(300)^2 + \left(1000\times0.9 - \frac{1}{1000\times2\times10^{-6}}\right)^2}$

$\Rightarrow Z = \sqrt{(300)^2 + (400)^2} = 500\ \Omega$.

37. (b)

Sol. By using $i = i_0\left(1 - e^{-\frac{Rt}{L}}\right)$; $i = \frac{5}{5}\left(1 - e^{-\frac{5\times2}{10}}\right)$

or $i = (1 - e^{-1})$

38. (c)
Sol. Pure resistive circuit

39. (c)
Sol. Here, $R = 100\Omega, V_{rms} = 220V, \upsilon = 50Hz$

$$\therefore I_{rms} = \frac{V_{rms}}{R} = \frac{220}{100} = 2.2A$$

40. (b)
Sol. Here, $I_{rms} = 25A$

$$\therefore I_m = \sqrt{2}\, I_{rms} = \sqrt{2} \times 25 = 35.36A.$$

41. (b)
Sol. $T = \frac{2\pi m}{Bq}$; $T \propto \frac{m}{q} \Rightarrow \frac{T_\alpha}{T_p} = \frac{m_\alpha}{q_\alpha} \times \frac{q_p}{m_p} = \frac{4}{2} = \frac{2}{1}$

$T_\alpha = 2T_p$

42. (c)
Sol. Characteristic X-rays are produced due to transition of electrons

43. (b)
Sol. Energy of γ-ray is maximum. So wavelength is minimum.

44. (c)
Sol. Maxwell's equations are as follows

(i) $\oint \vec{E}.\overrightarrow{dA} = \frac{q}{\varepsilon_0}$ (Gauss's law of electricity)

(ii) $\oint \vec{E}.\overrightarrow{dA} = 0$ (Gauss's law of magnetism)

(iii) $\oint \vec{E}.\overrightarrow{dA} = \frac{d\phi}{dt}$ (Faraday's law)

(iv) $\oint \vec{B}.\overrightarrow{dt} = \mu_0\varepsilon_0 \frac{d\phi_E}{dt}$ (Ampere – Maxwell law)

45. (b)
Sol. Displacement current

46. (a)
Sol. Displacement current arises when electric field in a region is changing with time. It will be so if the charge on a capacitor is changing with time.

47. (c)
Sol. Either ac or dc

48. (d)
Sol. Electromagnetic wave consists of periodically oscillating electric and magnetic vectors in mutually perpendicular planes but vibrating in phase.

49. (b)
Sol. Wavelength,

$$\lambda = \frac{c}{\upsilon} = \frac{3\times10^{8}\ \text{ms}^{-1}}{40\times10^{6}\,\text{s}^{-1}} = 7.5\,\text{m}$$

50. (a)
Sol. Both magnetic and electric fields have zero average value in a plane electromagnetic wave.

SECTION-A

51. (d)

Positive charge on $-\overset{+}{C}H_2$ is dispersed due to electron repelling nature of methoxy group.

52. (d)

In phenol – OH group has more +M effect than –I effect so the ring becomes activated and easily attacked by an electrophile

53. (b)

Open chain carboxylic acid having $C_nH_{2n}O_2$ formula.

54. (a)

It is fact

55. (c)

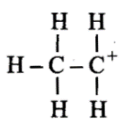
Solid substances are directly converted into vapour during sublimation.

56. (b)

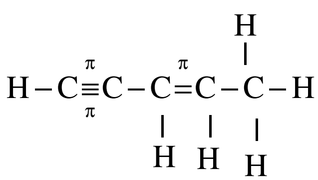
Fractional distillation is used to separate compounds which differ in boiling point.

57. (a)

Sol. In carbocations, the carbon atom with positive charge has only 6 electrons in its valence shell.

e.g., $CH_3\overset{+}{C}H_2$ =  (total 3 pairs of electrons)

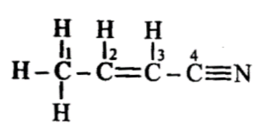
58. (b)

Sol. 

No. of σ - bonds = 10; No. of π - bonds = 3

59. (a)

Sol.



From left, $1-sp^3, 2-sp^2, 3-sp^2, 4-sp$

60. (a)

Sol. Due to displacement of σ - electrons towards more electronegative atom the bond becomes polar. The polar bond induces polarity to the adjacent bonds.

61. (a)

Sol. The order of +I effect of alkyl group is given as

$$-H < -CH_3 < -CH_2-CH_3 < CH_3-\underset{}{\overset{\overset{\displaystyle CH_3}{|}}{C}}H-$$

62. (d)

Sol. Electron deficient species act as electrophiles.

63. (a)

Sol. Hydrogen does not exert I – effect. Its inductive effect is taken as zero. Electron releasing or electron with drawing capability of other atoms are compared by hydrogen.

64. (b)

Sol. (i) – Addition, (ii) – Substitution,

(iii) – Decomposition, (iv) – Elimination

65. (d)

Sol. $-NO_2$ shows maximum electron withdrawing or

– I effect.

66. (c)

Sol. Alumina or silica gel are generally used as adsorbent in column chromatography.

67. (c)

Sol. Compounds which dissociate below their boiling points or which have very high boiling points are distilled under reduced pressure.

68. (b)

Sol. Crystallisation is based on the difference in the solubilities of the compound and the impurities in a suitable solvent.

69. (a)

Sol. CCl_4 being covalent will not furnish chloride ions which on reaction with Ag^+ form a white ppt.

70. (d)

Sol. Thin layer chromatography method can give the best results as it can be used to separate the components present in a small amount of the sample.

71. (a)

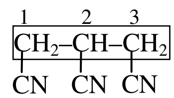
Sol. $H_2\overset{sp^2}{C}=\overset{sp^2}{C}H-\overset{sp}{C}\equiv\overset{sp}{C}H$

72. (a)

Sol. The organic substance being more soluble in organic solvent is transferred from aqueous layer to the organic layer.

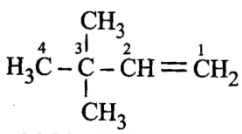
73. (c)

Sol.



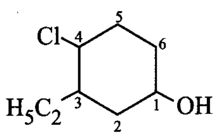
74. (c)

Sol.



3,3-Dimethylbut-1-ene

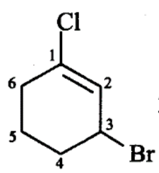
75. (d)



Sol. 4-Chloro-3-ethylcyclohexanol

76. (c)

Sol.



3-bromo-1-chlorocyclohexene

77. (a)

Sol. Rest all show less tendency to donate electron pair due to resonance

78. (a)

Sol. HNO_3 accepts a proton from H_2SO_4

$$H_2SO_4 \rightleftharpoons H^+ + HSO_4$$

$$HNO_3 + H^+ \longrightarrow H_2O + NO_2^+ H_2SO_4$$

79. (c)

Sol. o-,m- and p-isomers, i.e., position isomers

80. (d)

Sol. Alcohols show position isomerism; Ethers show metamerism; Alcohol and ethers shows functional isomerism

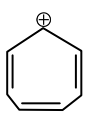
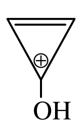
81. (d)

Sol. If more heat is released on burning an isomeric compound, It is more unstable.

82. (c)
Sol. $E^{\oplus}$ will attack on ring with more e^- density
83. (a)
Sol. $—NO_2 > —C \equiv N > —F > —C_6H_5$
↓
(Cationic rature)
84. (b)
Sol. A.S. $\propto -I \propto \frac{1}{+I}$
85. (a)
Sol. (1) $CH_3–CH_2–Cl$
R.S. = 0
(2) $CH_2=CH–Cl$
R.S. = 2
(3) $C_6H_5–Cl$
R.S. = 4

R.S. $\propto \frac{1}{\text{Bond length of single bond}}$

SECTION-B

86. (c)
Sol. (1)  (2) $CH_2=CH–\overset{\oplus}{C}H_2$
Aromatic R.S. = 2
(3) $C_6H_5–\overset{\oplus}{C}H_2$ (4) $CH_3–\overset{\oplus}{C}H–CH_3$
R.S. = 4
87. (a)
Sol.  $4n + 2 = 2\pi e^- \Rightarrow n = 0$
88. (a)
Sol. $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3 \rightleftharpoons CH_2 = \underset{\underset{:\ddot{O}H}{|}}{C} - CH_3$

Acetone Isopropenyl alcohol
keto form enol form

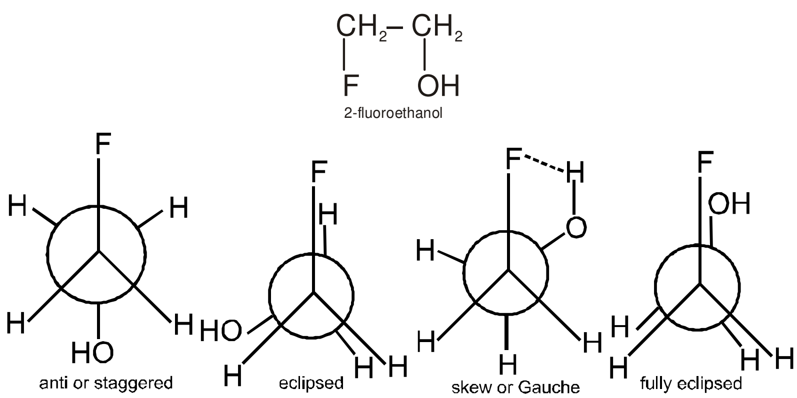
$[9\sigma + 1\pi + 2\ell.p.]$
89. (d)
Sol. Compound does not containing chiral carbon atom so enantiomer not possible.

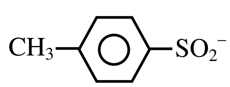
90. (d)
Sol. This is fact.
91. (d)
Sol. Self explanatory.
92. (b)
Sol. Negative charge on more electronegative atom is more stable.
93. (c)
Sol. $[CH_3]_3\,CBr + H_2O \longrightarrow [CH_3]_3COH + HBr$

It is S_N1 reaction

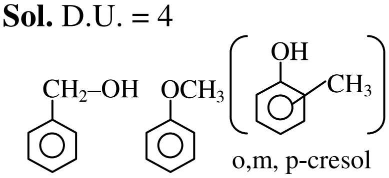
$[CH_3]_3CBr + H_2O \longrightarrow [CH_3]_3COH + HBr$

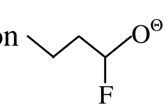
94. (a)
Sol. $R - OH \xrightarrow{H^{\oplus}}$ this step is initiation step.
95 (a)
Sol. Nucleophilicity $\propto$ size [in a group].
96. (c)
Sol. Weaker bases are better leaving group.
97. (c)
Sol.



Gauche form is more stable due to intramolecular H-bonding
98. (d)
Sol. Tossyl group contains 

99. (d)
Sol. D.U. = 4



100. (d)
Sol. Due to more stable anion 

BOTANY	
Q. NO.	[ANS]
101	C
102	C
103	B
104	C
105	A
106	C
107	B
108	C
109	B
110	B
111	B
112	C
113	A
114	D
115	A
116	C
117	B
118	C
119	B
120	B
121	B
122	A
123	C
124	C
125	B

ZOOLOGY	
Q. NO.	[ANS]
151	C
152	B
153	D
154	D
155	B
156	A
157	B
158	D
159	B
160	D
161	B
162	D
163	B
164	C
165	D
166	B
167	D
168	D
169	B
170	B
171	D
172	B
173	A
174	D
175	B

BOTANY	
126	B
127	B
128	B
129	B
130	C
131	B
132	D
133	B
134	A
135	C
136	D
137	D
138	A
139	A
140	C
141	B
142	A
143	C
144	B
145	C
146	C
147	B
148	A
149	A
150	A

ZOOLOGY	
176	C
177	D
178	C
179	A
180	B
181	A
182	A
183	B
184	C
185	C
186	A
187	C
188	A
189	C
190	C
191	C
192	A
193	A
194	C
195	C
196	B
197	C
198	A
199	C
200	B