## TEST - 6 (Code E)

### Test Date : 25/02/2018

### ANSWERS

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PHYSICS

1. \[ r = \frac{2mV}{qB^2} \]

\[ R_1 = \left( \frac{m_1}{m_2} \right)^{1/2} \]

\[ \Rightarrow \frac{m_1}{m_2} = \left( \frac{R_1}{R_2} \right)^2 \]

2. \[ f = \frac{QB}{2\pi nm} \]

\[ f \propto \frac{q}{m} \]

3. Two current-carrying wires with parallel current always attract each other.

4. Net force on current-carrying loop in uniform magnetic field is zero.

5. Magnetic force does not do any work.

Displacement by \( E \), \( S = \frac{1}{2} \left( \frac{qE}{m} \right) t^2 \)

Use work-energy theorem

\[ \vec{F} \cdot \vec{S} = \frac{1}{2} m \left( 2v_0^2 - v_0^2 \right) \]

\[ qE_0 \times \frac{1}{2} \left( \frac{qE_0}{m} \right) t^2 = \frac{1}{2} m (3v_0^2) \]

\[ \Rightarrow t = \frac{\sqrt{3m} v_0}{qE_0} \]

6. \( F = 2T \)

\( 2lrB = 2T \)

\( T = Bir \)

\[ v = \frac{\sqrt{\frac{T}{m}}}{\sqrt{m}} = \frac{Bir}{m} \]

7. \( T = mgsin\theta + \mu mg cos\theta \)

\( 2T = Bil \)

\[ \Rightarrow i = \frac{2mg \sin \theta + 2\mu mg \cos \theta}{Bil} \]

8. \( 2T \cos \theta = iLB \)

\[ 2T \left( \frac{x}{L/2} \right) = iLB \]

9. \[ B = \frac{\mu_0 l^2}{2(a^2 + r^2)^{3/2}} \] ...

\[ \Rightarrow T = \frac{Bil^2}{4x} \]

10. \( B = \frac{\mu_0 l^2}{2a} \)

Dividing equation (ii) by (i)

\[ B_{centre} = 250 \times 10^{-6} T \]

11. \( i = \frac{q}{T} = qn = en \)

\[ B = \frac{\mu_0 l}{2r} = \frac{\mu_0 en}{2r} \]

12. \( L = 2\pi R \)

\[ \therefore R = \frac{L}{2\pi} \]

\[ \therefore M = lA = l(\pi R^2) = ln \left( \frac{L}{2\pi} \right)^2 = \frac{IL^2}{4\pi} \]

13. \( L = n2\pi r \)

\[ r = \frac{L}{2\pi n} \]

\[ B = \frac{\mu_0 n l}{2r} = \frac{\mu_0 \pi l}{2L} \]

\[ B \propto n^2 \]
14. \[ I = \frac{m^2}{12} \]

\[ I' = 3 \left( \frac{m}{3} \right) \left( \frac{l}{3} \right)^2 = \frac{m^2}{12} \times 9 = \frac{l}{9} \]

\[ T' = \frac{l'}{I} \times \frac{M}{M'} \]

\[ T' = \frac{T}{\sqrt{l}} \]

\[ T' = \frac{T}{3} = \frac{2}{3} \text{s} \]

15. \[ \tan \delta' = \tan 60^\circ \]

\[ \delta' = \tan^{-1}(2) \]

16. \[ \begin{array}{c}
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B_1
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Resultant magnetic field,

\[ B = \sqrt{B_1^2 + B_2^2} = \sqrt{(B_1 \cos \alpha)^2 + B_2^2} \]

17. \[ e = -\frac{\Delta \phi}{\Delta t} \]

\[ e = -\frac{n(\phi_2 - \phi_1)}{t} \]

\[ i \times 5R = -\frac{n(\phi_2 - \phi_1)}{t} \]

\[ \therefore i = -\frac{n(\phi_2 - \phi_1)}{5Rt} \]

18. \[ L = 2 \text{ mH} \]

\[ R = 6 + \frac{12 \times 6}{12 + 6} = 6 + 4 = 10 \Omega \]

\[ \tau = \frac{L}{R} = 2 \text{ mH} \times \frac{10 \Omega}{10 \Omega} = 0.2 \text{ ms} \]

19. Diamagnetism is independent of temperature.

20. \[ V_0 - V_P = \frac{BoI^2}{2} \]

\[ V_0 - V_Q = \frac{BoI^2}{2} \]

\[ \therefore V_P - V_Q = 0 \]

21. \[ i = \frac{\varepsilon - \varepsilon_b}{R} \]

\[ 10 = \frac{115 - e_b}{1.5} = e_b = 100 \text{ V} \]

22. \[ N \phi = Li \]

\[ \phi = \frac{Li}{N} = \frac{8 \times 10^{-3} \times 5 \times 10^{-3}}{400} = 10^{-7} \text{ Wb} \]

\[ \mu_0 = \frac{4\pi}{3} \text{ Wb}\]

23. The induced emf \( e = B lv = 0.5 \times 2 \times 1 = 1 \text{ V} \)

The rate of work done \[ \frac{e^2}{R} = \frac{(1)^2}{6} = \frac{1}{6} \text{ W} \]

Or power, \[ P = \frac{B^2lv^2}{R} \]

24. \[ \tau = M \times B = 50 \times (0.5 \hat{i} + 3 \hat{j}) = 150 \hat{k} \text{ Nm} \]

25. \[ B_1 = \frac{\mu_0}{4\pi} \times \frac{2M}{r^3} = 10^{-7} \times \frac{2 \times 1}{1^3} = 2 \times 10^{-7} \text{ T} \]

\[ B_2 = \frac{\mu_0}{4\pi} \times \frac{M}{r^3} = 10^{-7} \times \frac{1}{1^3} = 10^{-7} \text{ T} \]

\[ B = \sqrt{B_1^2 + B_2^2} = \sqrt{5} \times 10^{-7} \text{ T} \]

26. All the factors can demagnetise a magnet.

27. \[ \frac{M_1}{M_2} = \frac{T_2^2}{T_1^2} = \left( \frac{60}{15} \right)^2 = \left( \frac{4}{6} \right)^2 = \frac{4}{9} \]

28. \[ \begin{array}{c}
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-\varepsilon
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\[ + \quad S \]

When contact is broken, the induced emf supports the current.

32. Power, \[ P = \frac{V_0I_0 \cos \frac{\pi}{2}}{2} = 0 \]

34. \[ X_L = \omega L = 2\pi \times 50 \times 0.2 = 63 \text{ \Omega} \]

\[ Z = \sqrt{R^2 + X_L^2} = 66 \text{ \Omega} \]

\[ i = \frac{V}{Z} = \frac{220}{66} = 3.33 \text{ A} \]

35. \[ Z = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + (\omega L)^2} \]

Power factor \[ \cos \phi = \frac{R}{Z} = \frac{R}{\sqrt{R^2 + (\omega L)^2}} \]
36. \( V = V_L - V_C \Rightarrow V = 50 - 50 = 0 \)
Because voltage across inductor and capacitor is 180° out of phase when connected in series.

37. \( X_C = \frac{1}{\omega C} \), for high frequency, reactance will be low

38. \( i_3 = 3 \sin \omega t + 4 \cos \omega t \)
\[ i_0 = \sqrt{(3)^2 + (4)^2 + 2 \times 3 \times 4 \cos 90°} \]
\[ \Rightarrow i_0 = 5 \]
\[ \tan \theta = \frac{4}{3} \]
\[ \Rightarrow \theta = 53° \]
\[ i_3 = 5 \sin(\omega t + 53°) \]

39. The range belongs to radio waves.

40. \( U_E = U_B \)
\[ \frac{E_0}{B_0} = c = \frac{\omega}{k} \]

42. Total power = Solar constant \( \times \) area
\[ = 10^4 \times (10 \times 10) = 10^6 \text{ W} \]

43. Radius of particle is same order of wavelength \( (\lambda) \)
\[ v = \frac{c}{\lambda} = \frac{3 \times 10^8}{3 \times 10^{-8}} = 10^{14} \]

44. \( S = E_v \times H_v = 100 \times 0.265 = 26.5 \text{ W/m}^2 \)

45. \( \nu_{\gamma\text{-rays}} > \nu_{\chi\text{-rays}} > \nu_{\text{uv\text{-rays}}} \)

CHEMISTRY

46. Spectrochemical series.

47. Stability of complexes in (II) state increases from left to right in a transition series.

48. White P \( \xrightarrow{\text{dil. KOH}} \) HPO + KHPO
\( \xrightarrow{\text{heat}} \) Red P

49. Blister copper is mainly, copper containing impurities of CuO.

51. KI + Cl\(_2\) \( \rightarrow \) KCl + I\(_2\) (Violet colouration in CHCl\(_3\))

53. \([\text{Fe(H}_2\text{O)}\_6]^{2+} + \text{NO} \rightarrow [\text{Fe(H}_2\text{O)}\_3\text{NO}]^{2+} + \text{H}_2\text{O}\)], Brown

54. \( \Delta H_{\text{total}} = 1000 + 950 + 1100 - 750 = 2300 \text{ kJ/mol} \)

55. \( \text{in case of weak ligand minimum splitting will be observed hence maximum wavelength will be absorbed for excitation of electron.} \)

56. \( \text{Argentite : Ag}_2\text{S this sulphide ore is concentrated by leaching.} \)

59. Maximum number of unpaired e\(^-\) are present in [Cr(NH\(_3\))\(_6\)]\(^{3+}\) according to VBT.

60. Cu + 4HNO\(_3\) (conc.) \( \rightarrow \) Cu(NO\(_3\))\(_2\) + 2NO\(_2\) + 2H\(_2\)O

61. Fluorine is most reactive non metal which cannot be isolated easily in free state.

62. In KMnO\(_4\); Mn is present in its highest oxidation state \( i.e., +7 \) hence cannot be oxidized.

65. Ni : Monds process and Ti : Van Arkel process.

67. Interhalogens may be AX, AX\(_3\), AX\(_5\) or AX\(_7\) type compound.

68. Vacant orbitals are required for accepting lone pairs from ligands.

69. 4HNO\(_3\) + P\(_4\)O\(_{10}\) \( \rightarrow \) 4HPO\(_3\) + 2N\(_2\)O\(_5\)

70. NaCl \( \rightarrow \) Na\(^+\) + Cl\(^-\)

71. Colour is due to charge transfer from ligand to metal.
CuSO₄ + 2H₂O → Cu(OH)₂ + H₂SO₄
2K₂CrO₄ + H₂SO₄ → K₂Cr₂O₇ + H₂O + K₂SO₄
CuSO₄ + K₂Cr₂O₇ → CuCr₂O₇ + K₂SO₄

CuSO₄ + 2H₂O → Cu(OH)₂ + H₂SO₄
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 CuSO₄ + K₂Cr₂O₇ → CuCr₂O₇ + K₂SO₄

P-H bond gives reducing nature to the compound.

Starch gives violet colouration with I₂.

Cl is weak field ligand so pairing of e⁻ cannot take place in d orbital for Ni.

XeF₂ + AsF₅ → XeF₂ + [AsF₆]⁻

81. EAN = 26 – 3 + 12 = 35

82. Most abundant metals are Al > Fe.

83. H₃PO₄ is not a reducing agent, H₃PO₂ is not an oxidizing agent.

84. Cr₂O₃ is protective oxide.

85. HClO₄ : sp³ H₂SO₄ : sp³ HNO₃ : sp²
H₂SO₅ : sp³ HClO₃ : sp³ HNO₂ : sp²

86. In presence of sunlight decomposition of AgNO₃ takes place.

88. CaF₂ along with cryolite added to molten Al₂O₃ in order to decrease m.pt. and to increase conductivity.

89. Ag⁺ + KCN → K⁺[Ag(CN)₂]⁻
2[Ag(CN)₂]⁻ + Zn → [Zn(CN)₄]²⁻ + 2Ag

Due to small energy gap between ns and (n – 1)d orbitals they are involved in bonding.

**BIOLOGY**

91. (A) Intron
(B) 7 mG
(C) Poly A tail

92. Explant → callus → sub-culturing → regeneration (shoot, root) → hardening

93. QB phage—ss RNA, φ × 174 phage—ss DNA

94. (ii) 3000 bases
(iv) Less than 2% of genome

95. N₂ fixation, photoautotrophs

96. Electrophoresis

97. Multiple origin in eukaryotes

98. Wheat

99. Narrow spectrum insecticide

100. tRNA/soluble RNA/Adapter RNA

101. Propionibacterium sharmanii

102. Non-capsulated cells develop capsule (smooth sugar coat) during transformation

103. Morphological characteristics

104. Protease, lipase

105. RNA polymerase III — 5S rRNA
RNA polymerase I — 28, 5.8, 18S rRNA

106. Reverse central dogma.

107. (1) Pusa komal – for bacteria
(2) Pusa sadabahar – for virus
(3) Okra – Pusa sawani – Shoot and fruit borer

108. IUCN/WCU—Biodiversity conservation

109. Q = 5’ end
P = 3’ end
1st Codon = GUG = Methionine
2nd Codon = GAG = Glutamic acid
3rd Codon = UUC = Phenylalanine
4th Codon = UGG = Tryptophan
5th Codon = UUU = Phenylalanine
5th Codon = UAA = Stop codon

110. Aphids

111. 23 S rRNA/peptidyl transferase

112. Hybridisation between Saccharum barberi and S. officinarum

113. Glomus — Mycorrhiza
Frankia — Actinomycetes, root nodules formation in non-legumes.

114. (A) = \( \frac{1}{10} \times 2400 \times 10³ \)
∴ A = 24 \times 10⁴
(B) \( \frac{1}{200} \times 2400 \times 10³ \)
∴ B = 1.2 \times 10⁴

115. Option (3) Crucial to the success of breeding
Option (4) Root of breeding programme

116. Anaerobic bacteria digest the aerobic bacteria and fungi

117. SCP

118. Solubilisation → Acidogenesis → Methanogenesis

119. ‘P’ in DNA, ‘S’ in protein

120. Cyclosporin A
121. $\beta$-galactoside/lactose
122. $\rho$ (rho) factor for termination of transcription
123. Monocistronic—mostly in eukaryotes
124. $15-15 \rightarrow [15-14, 15-14]$
    \hspace{1cm} \downarrow 
    \hspace{1cm} \text{First replication, } \frac{1}{2} \% \text{ of first PT}
    \hspace{1cm} \rightarrow [15-14, 14-14, 15-14, 14-14] 
    \hspace{1cm} \downarrow 
    \hspace{1cm} \text{Second replication, } \frac{1}{4} \% \text{ of first PT}
125. Antibiotics
126. Basic, +vely charged, non-histone protein called polyamines
127. In eukaryotes, at several levels
128. (a) Wine—Undistilled
    (b) Amylase, maltase, zymase are produced by yeast
130. Indiscriminate eradication of pest kills useful insects also.
132. Protina is lysine rich variety.
    Spinach Ca, Fe rich.
    IR – Semidwarf rice.
134. Five structural genes (E, D, C, B & A) codes three enzymes for the synthesis of tryptophan.
135. (1) Slow changes
    (2) Replica
136. Origin of universe occurred 20 bya
137. Louis Pasteur used killed yeast.
138. *Sphenodon* is an example of stasigenesis/living fossil.
139. Darwin’s finches represent all of these phenomena.
141. Coprolite is faecal matter preserved as fossil.
142. Origin of Pouter, Jacobin and Fantail from rock pigeon and creation of different breeds of dogs are examples of artificial selection.
143. Population is the basic unit of evolution.
144. Anamnestic response is secondary immune response.
145. HBV spreads through sexual contact and blood.
146. *P. falciparum* is most dangerous and causes malignant subtertian malaria, also called cerebral malaria
148. Sauropsids gave rise to modern reptiles and birds.
149. Increase in cranial capacity is the most significant event.
150. *Homo sapiens neanderthalensis* were the first to cover their bodies and bury their dead bodies.
151. Cellular Barriers - NK cells, Complement proteins - $C_1$ to $C_9$.
152. RBCs do not have MHCs.
153. IgG causes maximum immune reaction as it is the most abundant antibody.
154. Acid and tears are physiological barriers.
155. In typhoid, bacteria form ulcers in small intestine which can lead to perforations.
156. Plague is caused by *Yersinia pestis*.
158. Widal test confirms typhoid.
161. Lysozyme forms physiological barrier.
162. Vaccines provide active immunity.
164. Paleontological evidences are the most reliable evidences of evolution.
167. When two unrelated organism evolve together, it is co-evolution. eg. Parasite with host or symbiotic organisms.
168. All features may not follow recapitulation theory e.g. exoskeleton in chordates.
169. Two key concepts of Darwinism are branching descent and natural selection.
170. Bottleneck effect reduces genetic variability as many alleles are lost.
172. Non random mating changes allele frequency of a population.
173. Mutations are not explained in Darwin’s theory.
175. Chloropyta gave rise to all types of plants.
176. Study of banding patterns of chromosomes 3 and 6 shows maximum similarity between chimpanzee and humans.
178. Modern man arose during ice ages.
180. Antibiotic resistance is an example of directional natural selection.
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PHYSICS

1. \(\nu_{\gamma}\)-rays > \(\nu_{x}\)-rays > \(\nu_{uv}\)-rays
2. \(S = E \times H = 100 \times 0.265 = 26.5 \text{ W/m}^2\)
3. Radius of particle is same order of wavelength (\(\lambda\))
   \[\nu = \frac{c}{\lambda} = \frac{3 \times 10^8}{3 \times 10^{-6}} = 10^{14}\]
4. Total power = Solar constant \(\times\) area
   \[= 10^4 \times (10 \times 10) = 10^6 \text{ W}\]
5. \(\frac{E_0}{B_0} = c = \frac{\omega}{k}\)
6. \(U_E = U_B\)
7. The range belongs to radio waves.
8. \(i_3 = 3 \sin \omega t + 4 \cos \omega t = i_0 \sin (\omega t + \theta)\)
   \[i_0 = \sqrt{(3)^2 + (4)^2 + 2 \times 3 \times 4 \cos 90^\circ}\]
   \[\Rightarrow i_0 = 5\]
   \[\tan \theta = \frac{4}{3}\]
   \[\Rightarrow \theta = 53^\circ\]
   \[i_3 = 5 \sin(\omega t + 53^\circ)\]
9. \(X_c = \frac{1}{\omega C}\), for high frequency, reactance will be low.
10. \(V = V_L - V_C\)
    \[\Rightarrow V = 50 - 50 = 0\]
    Because voltage across inductor and capacitor is 180° out of phase when connected in series.
11. \(Z = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + (\omega L)^2}\)
    Power factor \(\cos \phi = \frac{R}{Z} = \frac{R}{\sqrt{R^2 + (\omega L)^2}}\)
12. \(X_L = \omega L = 2\pi \times 50 \times 0.2 = 63 \Omega\)
    \[Z = \sqrt{R^2 + X_L^2} = 66 \Omega\]
    \[i = \frac{V}{Z} = \frac{220}{66} = 3.33 \text{ A}\]
14. Power, \(P = \frac{V_0 i_0}{2} \cos \frac{\pi}{2} = 0\)
18. When contact is broken, the induced emf supports the current.
   \[\frac{M_1}{M_2} = \frac{T_1^2}{T_2^2} = \left(\frac{60}{15}\right)^2 = \left(\frac{4}{6}\right)^2 = \frac{4}{9}\]
20. All the factors can demagnetise a magnet.
21. \(B_1 = \frac{\mu_0}{4\pi} \times \frac{2M}{r^3} = 10^{-7} \times \frac{2 \times 1}{1^3} = 2 \times 10^{-7} \text{ T}\)
    \[B_2 = \frac{\mu_0}{4\pi} \times \frac{M}{r^3} = 10^{-7} \times \frac{1}{1^3} = 10^{-7} \text{ T}\]
    \[B = \sqrt{B_1^2 + B_2^2} = \sqrt{5 \times 10^{-7}} \text{ T}\]
22. \(\tau = \vec{M} \times \vec{B} = 50\hat{i} \times (0.5\hat{i} + 3\hat{j}) = 150\hat{k} \text{ Nm}\)
23. The induced emf \(e = Blv = 0.5 \times 2 \times 1 = 1 \text{ V}\)
    The rate of work done = \(\frac{e^2}{R} = \frac{(1)^2}{6} = \frac{1}{6} \text{ W}\)
    Or power, \(P = \frac{B^2l^2v^2}{R}\)
24. \(\phi = \frac{Li}{N} = 8 \times 10^{-3} \times 5 \times 10^{-3} = 10^{-7} \text{ Wb}\)
    \[\frac{\mu_0}{4\pi} = \frac{\phi}{400} = 10^{-7} \text{ Wb}\]
25. \(i = \frac{e - e_b}{R}\)
    \[10 = \frac{115 - e_b}{1.5} \Rightarrow e_b = 100 \text{ V}\]
26. \(V_0 - V_P = \frac{B_0 l^2}{2}\)
    \[V_0 - V_Q = \frac{B_0 l^2}{2}\]
    \[\therefore V_P - V_Q = 0\]
27. Diamagnetism is independent of temperature.

28. \( L = 2 \, \text{mH} \)

\[
R = \frac{6 + 12 \times 6}{12 + 6} = \frac{6 + 4}{2} = 10 \, \Omega
\]

\[
\tau = \frac{L}{R} = \frac{2 \, \text{mH}}{10 \, \Omega} = 0.2 \, \text{ms}
\]

29. \( e = -\frac{\Delta \phi}{\Delta t} \)

\[
e = -\frac{n(\phi_2 - \phi_1)}{t}
\]

\[
i \times 5R = -\frac{n(\phi_2 - \phi_1)}{t}
\]

\[
\therefore \, i = \frac{n(\phi_2 - \phi_1)}{5Rt}
\]

30. \( B \)

Resultant magnetic field,

\[
B = \sqrt{B_1^2 + B_2^2} = \sqrt{(B_1 \cos \alpha)^2 + B_2^2}
\]

31. \( \tan \delta' = \tan 60^\circ \cos 30^\circ = 2 \)

\[
\delta' = \tan^{-1}(2)
\]

32. \( I = \frac{m^2}{12} \)

\[
'l' = 3 \left(\frac{m}{3}\right) \left(\frac{l}{3}\right)^2 = \frac{ml^2}{12 \times 9} = \frac{l}{9}
\]

\[
\frac{T'}{T} = \sqrt{\frac{l'M}{l'M}}
\]

\[
\frac{T'}{T} = \frac{1}{9}
\]

\[
\frac{T'}{3} = \frac{2}{3} \, \text{s}
\]

33. \( L = n2\pi r \)

\[
r = \frac{L}{2\pi n}
\]

\[
B = \frac{\mu_0 nI}{2r} = \frac{\mu_0 \pi l}{L} n^2
\]

\[
B \propto n^2
\]

34. \( r = \sqrt{x^2 + y^2} \)

\[
\vec{B} = B \sin \theta \hat{i} - B \cos \theta \hat{j}
\]

\[
\frac{\mu_0 I}{2\pi r} \left[ \frac{y_j - x_j}{r} \right]
\]

\[
\frac{\mu_0 l}{2\pi r^2} \left( y_i - x_i \right)
\]

\[
\frac{\mu_0 l}{2\pi} \left( x_i^2 + y_i^2 \right)
\]

35. \( L = 2\pi R \)

\[
\therefore \, R = \frac{L}{2\pi}
\]

\[
\therefore \, M = lA = l(nR^2) = \ln\left( \frac{L}{2\pi} \right)^2 = \frac{L^2}{4\pi}
\]

36. \( i = \frac{q}{T} = qn = en \)

\[
B = \frac{\mu_0 l}{2r} = \frac{\mu_0 en}{2r}
\]

37. \( B = \frac{\mu_0 a^2}{2(a^2 + r^2)^{3/2}} \) ... (i)

\[
B_{centre} = \frac{\mu_0 l}{2a} \) ... (ii)

Dividing equation (ii) by (i)

\[
B_{centre} = 250 \times 10^{-6} \, \text{T}
\]

38. \( 2T \cos \theta = iLB \)

\[
2T \left( \frac{x}{L/2} \right) = iLB
\]

\[
\Rightarrow T = \frac{Bil}{4x}
\]

39. \( T = mgsin\theta + \mu mgcos\theta \)

\[
2T = Bil
\]

\[
\therefore \, i = \frac{2mg \sin \theta + 2\mu mg \cos \theta}{Bl}
\]
40. \( F = 2T \)
\[ 2iB = 2T \]
\[ T = Bir \]
\[ v = \sqrt{\frac{T}{m}} = \sqrt{\frac{Bir}{m}} \]

41. Magnetic force does not do any work.

Displacement by \( \vec{E} \), \( \vec{S} = \frac{1}{2} \left( \frac{qE}{m} \right) t^2 \)

Use work-energy theorem
\[ F \vec{S} = \frac{1}{2} m (2v_0^2 - v_0^2) \]
\[ qE_0 \times \frac{1}{2} \left( \frac{qE_0}{m} \right) t^2 = \frac{1}{2} m (3v_0^2) \]
\[ \therefore t = \frac{\sqrt{3mv_0}}{qE_0} \]

42. Net force on current carrying loop in uniform magnetic field is zero.

43. Two current carrying wires with parallel current attract each other.

44. \( f = \frac{qB}{2nm} \)
\[ f \propto \frac{q}{m} \]

45. \( r = \frac{2mv}{qB^2} \)
\[ \frac{R_1}{R_2} = \left( \frac{m_1}{m_2} \right)^\frac{1}{2} \]
\[ \Rightarrow \frac{m_1}{m_2} = \left( \frac{R_1}{R_2} \right)^2 \]

**CHEMISTRY**

46. Due to small energy gap between ns and \((n - 1)d\) orbitals they are involved in bonding.

47. \( Ag^+ + KCN \rightarrow K^+[Ag(CN)_2]^- \)
\[ 2[Ag(CN)_2]^- + Zn \rightarrow [Zn(CN)_4]^{2-} + 2Ag \]

48. CaF\(_2\) along with cryolite added to molten Al\(_2\)O\(_3\) in order to decrease m.pt. and to increase conductivity.

50. In presence of sunlight decomposition of AgNO\(_3\) takes place.

51. \( HClO_4 : sp^3 \quad H_2SO_4 : sp^3 \quad HNO_3 : sp^2 \)
\( H_2SO_5 : sp^3 \quad HClO_3 : sp^3 \quad HNO_2 : sp^2 \)

52. Cr\(_2\)O\(_3\) is protective oxide.
76. \( \text{Cu} + 4\text{HNO}_3(\text{conc.}) \rightarrow \text{Cu(NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O} \)

77. Maximum number of unpaired e\(^-\) are present in [Cr(NH\(_3\))\(_6\)]\(^{3+}\) according to VBT.

79. Argentite : Ag\(_2\)S this sulphide ore is concentrated by leaching.

80. \[ \text{Xe} \rightarrow \text{Xe}^{1+} \] lone pair at Xe and 3 lone pairs at each F.

81. In case of weak ligand, minimum splitting will be observed hence maximum wavelength will be absorbed for excitation of electron.

82. \( \text{M}(s) \rightarrow \text{M}^{2+}(\text{aq}) + 2\text{e}^- \)
\[ \Delta H_{\text{total}} = 1000 + 950 + 1100 - 750 = 2300 \text{ kJ/mol} \]

83. \[ \text{[Fe(H}_2\text{O)}\text{6]}^{2+} + \text{NO} \rightarrow \text{[Fe(H}_2\text{O)}\text{6NO]}^{2+} + \text{H}_2\text{O} \]

85. \( \text{KI} + \text{Cl}_2 \rightarrow \text{KCl} + \text{I}_2 \) (Violet colouration in CHCl\(_3\))

87. Blister copper is mainly, copper containing impurities of Cu\(_2\)O.

88. White P \( \rightarrow \) dil. KOH \( \rightarrow \) PH\(_3\) + KH\(_2\)PO\(_4\)
Red P \( \rightarrow \) Heat \( \rightarrow \) Cl\(_2\) \( \rightarrow \) Cl\(_2\) \( \rightarrow \) PH\(_3\) + KH\(_2\)PO\(_4\)

89. Stability of complexes in (II) state increases from left to right in a transition series.

90. Spectrochemical series.

**BIOLOGY**

91. (1) Slow changes
(2) Replica

92. Five structural genes (E, D, C, B & A) codes three enzymes for the synthesis of tryptophan.

94. Protina is lysine rich variety.
Spinach Ca, Fe rich.
IR – Semidwarf rice.

96. Indiscriminate eradication of pest kills useful insects also.

98. (a) Wine—Undistilled
(b) Amylase, maltase, zymase are produced by yeast.

99. In eukaryotes, at several levels.

100. Basic, +vely charged, non-histone protein called polyamines.

101. Antibiotics
102. 15-15 \( \rightarrow \) [15-14, 15-14]
\[ \text{First replication,} \quad \frac{1}{2} \% \text{ of first PT} \]
\[ \rightarrow [15-14, 14-14, 15-14, 14-14] \]
\[ \text{Second replication,} \quad 1\% \text{ of first PT} \]

103. Monocistronic—mostly in eukaryotes
104. \( \rho \) (rho) factor for termination of transcription
105. \( \beta \) -galactoside/lactose
106. Cyclosporin A
107. 'P' in DNA, 'S' in protein
108. Solubilisation \( \rightarrow \) Acidogenesis \( \rightarrow \) Methanogenesis
109. SCP
110. Anaerobic bacteria digest the aerobic bacteria and fungi

111. Option (3) Crucial to the success of breeding
Option (4) Root of breeding programme

112. \( (A) = \frac{1}{10} \times 2400 \times 10^3 \)
\[ \therefore A = 24 \times 10^4 \]
\[ (B) \frac{1}{200} \times 2400 \times 10^3 \]
\[ \therefore B = 1.2 \times 10^4 \]

113. *Glomus* – Mycorrhiza
*Frankia* – Actinomycetes, root nodules formation in non-legumes.

114. Hybridisation between *Saccharum barberi* and *S. officinarum*

115. 23 S rRNA/peptidyl transferase

116. Aphids

117. Q = 5’ end
P = 3’ end
1\(^{st}\) Codon = GUG = Methionine
2\(^{nd}\) Codon = GAG = Glutamic acid
3\(^{rd}\) Codon = UUC = Phenylalanine
4\(^{th}\) Codon = UGG = Tryptophan
5\(^{th}\) Codon = UUU = Phenylalanine
5\(^{th}\) Codon = UAA = Stop codon
118. IUCN/WCU—Biodiversity conservation
119. (1) Pusa komal – for bacteria
    (2) Pusa sadabahar – for virus
    (3) Okra – Pusa sawani – Shoot and fruit borer
120. Reverse central dogma.
121. RNA polymerase III — 5S rRNA
    RNA polymerase I — 28, 5.8, 18S rRNA
122. Protease, lipase
123. Morphological characteristics
124. Non-capsulated cells develop capsule (smooth sugar coat) during transformation
125. Propionibacterium sharmanii
126. tRNA/soluble RNA/Adapter RNA
127. Narrow spectrum insecticide
128. Wheat
129. Multiple origin in eukaryotes
130. Electrophoresis
131. N₂ fixation, photoautotrophs
132. (ii) 3000 bases
    (iv) Less than 2% of genome
133. QB phage—ss RNA, φ × 174 phage—ss DNA
134. Explant → callus → sub-culturing → regeneration (shoot, root) → hardening
135. (A) Intron
    (B) 7 mG
    (C) Poly A tail
136. Antibiotic resistance is an example of directional natural selection.
138. Modern man arose during ice ages.
140. Study of banding patterns of chromosomes 3 and 6 shows maximum similarity between chimpanzees and humans.
141. Chloropyta gave rise to all types of plants.
143. Mutations are not explained in Darwin's theory.
144. Non random mating changes allele frequency of a population.
146. Bottleneck effect reduces genetic variability as many alleles are lost.
147. Two key concepts of Darwinism are branching descent and natural selection.
148. All features may not follow recapitulation theory eg. exoskeleton in chordates.
149. When two unrelated organism evolve together, it is co-evolution. eg. Parasite with host or symbiotic organisms.
152. Paleontological evidences are the most reliable evidences of evolution.
154. Vaccines provide active immunity.
155. Lysozyme forms physiological barrier.
158. Widal test confirms typhoid.
160. Plague is caused by Yersinia pestis.
161. In typhoid, bacteria form ulcers in small intestine which can lead to perforations.
162. Acid and tears are physiological barriers.
163. IgG causes maximum immune reaction as it is the most abundant antibody.
164. RBCs do not have MHCs.
165. Cellular Barriers - NK cells, Complement proteins - C₁ to C₉.
166. Homo sapiens neanderthalensis were the first to cover their bodies and bury their dead bodies.
167. Increase in cranial capacity is the most significant event.
168. Sauropsids gave rise to modern reptiles and birds.
170. P. falciparum is most dangerous and causes malignant subtertian malaria, also called cerebral malaria.
171. HBV spreads through sexual contact and blood.
172. Anamnestic response is secondary immune response.
173. Population is the basic unit of evolution.
174. Origin of Pouter, Jacobin and Fantail from rock pigeon and creation of different breeds of dogs are examples of artificial selection.
175. Coprolite is faecal matter preserved as fossil.
177. Darwin’s finches represent all of these phenomena.
178. Sphenodon is an example of stasigenesis/living fossil.
179. Louis Pasteur used killed yeast.