### PHYSICS
1. [4]  
2. [2]  
3. [3]  
4. [1]  
5. [4]  
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9. [4]  
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17. [4]  
18. [2]  
19. [1]  
20. [4]  
21. [4]  
22. [4]  
23. [4]  
24. [2]  
25. [1]  
26. [4]  
27. [4]  
28. [2]  
29. [3]  
30. [3]  
31. [4]  
32. [1]  
33. [4]  
34. [4]  
35. [2]  
36. [4]  
37. [1]  
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39. [1]  
40. [2]  
41. [1]  
42. [1]  
43. [2]  
44. [3]  
45. [1]  

### CHEMISTRY
46. [2]  
47. [4]  
48. [3]  
49. [2]  
50. [4]  
51. [1]  
52. [1]  
53. [3]  
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55. [2]  
56. [4]  
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81. [4]  
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84. [2]  
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86. [1]  
87. [3]  
88. [3]  
89. [2]  
90. [1]  

### BOTANY
91. [4]  
92. [2]  
93. [4]  
94. [3]  
95. [3]  
96. [3]  
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98. [2]  
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101. [4]  
102. [3]  
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105. [1]  
106. [4]  
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108. [4]  
109. [3]  
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112. [4]  
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126. [4]  
127. [2]  
128. [1]  
129. [4]  
130. [3]  
131. [4]  
132. [1]  
133. [3]  
134. [4]  
135. [2]  

### ZOOLOGY
136. [4]  
137. [1]  
138. [3]  
139. [4]  
140. [2]  
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168. [3]  
169. [3]  
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171. [1]  
172. [3]  
173. [3]  
174. [3]  
175. [3]  
176. [2]  
177. [3]  
178. [1]  
179. [2]  
180. [3]
PHYSICS

1. [4] For $\theta$ and $90-\theta$ range are same so if angle is $\pi/3$ then another angle will be $\pi/6$

$H \propto \sin^2 \theta$

$y_1 \propto \sin^2 \pi/3$

$y_2 \propto \sin^2 \pi/6$

$\therefore y_2 = y_1/3$

2. [2]

\[ V_m \quad V_m \sin \theta \]

\[ \theta \]

\[ V_t \]

\[ t = \frac{d}{V_m \sin \theta} \]

$V_m \cos \theta = V_t$

3. [3] $E = \frac{hc}{\lambda}$

$[h] = \left[ \frac{[E][\lambda]}{[C]} \right]$

4. [1] dimension of b is same as V

$[P] = \left[ \frac{[\alpha]}{[V]} \right]^c$

5. [4] $K_x$ is dimensionless

6. [2] \[ \frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I} \]

7. [4] $T = 2\pi\sqrt{\frac{\ell}{g}}$

$T^2 \propto \frac{\ell}{g}$

$\frac{\Delta g}{g} = \frac{2\Delta T}{T} + \frac{\Delta \ell}{\ell}$

8. [1] $[R] = G^a H^b C^c$

9. [4] Let total distance is $5x$

$\frac{t_1}{u_1} = \frac{2x}{u_1}$

$\frac{t_2}{u_2} = \frac{3x}{u_2}$

$\langle v \rangle = \frac{5x}{t} = \frac{5x}{t_1 + t_2} = \frac{5u_1u_2}{3u_1 + 2u_2}$
10. \[ s_1 = \frac{1}{2} gt^2 \]
\[ s_2 = \frac{1}{2} g (2t)^2 \]
\[ s_2 = 4s_1 \]

11. [1] \[ S_n = u + \frac{a}{2} (2n - 1) \]
\[ = 10 / 3 \text{m} \]

12. [2] \[ \frac{dv}{dt} = \alpha t + \beta \]
\[ v = \frac{\alpha t^2}{2} + \beta t \]

13. [2] \[ \frac{dv}{dt} = -2.5\sqrt{v} \]
\[ \frac{dv}{\sqrt{v}} = -2.5 \text{dt} \]
\[ v^{\frac{1}{2}} = 2.5 \times t \]
\[ v^{\frac{1}{2}} + 1/2 \]
\[ 2\sqrt{6.25} = 2.5 \times t \]
\[ t = 2 \text{sec} \]

14. [1] \[ V_{ca} = 45 - 36 \]
\[ = 18 \text{km/hu} \]
\[ = 5 \text{m/s} \]
\[ S = V_{ca} \times t \]

15. [1] \[ \vec{V}_{AB} = \vec{V}_A - \vec{V}_B \]


17. [4] \[ V_{SG} = 15 \]
\[ v = u + at \]
\[ v = 15 - 2 \times 10 = 5 \text{m/s} \]

18. [2]
\[
H - \frac{1}{2}gt^2 \\
H = 5t^2 \rightarrow (1) \\
H - 40 = \frac{1}{2}g(t - 2)^2 \\
H - 40 = 5(t - 2)^2 \\
5t^2 - 40 = 5(t^2 + 4 - 4t) \\
5t^2 - 40 = 5t^2 + 20 - 20t \\
t = 60 \\
t = 3 \\
H = \frac{1}{2}gt^2 = \frac{1}{2}(10)(g) = 45m
\]

19. [1] It will remain same because their relative acceleration is zero
21. [4] In graph one slope is continuously decreasing and in graph 2 it is continuously decreasing
22. [4] \(v_{t=2} = 18\)
    \(v_{t=5} = 10 + 2 \times 25 = 60\)
    \(\langle a \rangle = \frac{60 - 18}{3} = \frac{42}{3} = 14\)
23. [4] \(V_{PT} = 10 - 9\)
    \(= 1\)
    \(t = \frac{100}{1} = 100\) sec
24. [2] \(v^2 \propto\) tendency to over turn
25. [1] Theoretical

26. [4] \(\Delta V = \vec{V}_t - \vec{V}_i\)
    \(|\Delta v| = \sqrt{v_1^2 + v_2^2 + 2v_1v_2 \cos \theta}\)
    \(|\vec{V}_i| = |\vec{V}_2|\)
    \(\phi = \pi/2\)
27. [4] \(R = 2H\)
    \(\tan \theta = 2\)
    \(R = \frac{u^2 \sin 2\theta}{g} = \frac{u^2 \times 2}{g \times \sqrt{5}} \times \frac{1}{\sqrt{5}}\)
    \(= \frac{4u^2}{5g}\)
28. [2] \(\langle s \rangle = 31.4\)
30. [3] \(v = \sqrt{\mu Rg}\)
31. \[ \omega = \frac{d\theta}{dt} \]
\[ \alpha = \frac{d\omega}{dt} \]

32. \[ H = \frac{U_y^2}{2g} \]
\[ R = \frac{2U_xU_y}{g} \]

33. \[ \frac{R}{2} = H \]
\[ R = 2H \]
\[ 20m \]

34. \[ y = x \tan \theta \left(1 - \frac{x}{R}\right) \]

35. \[ t_1 \propto \sin \theta \]
\[ t_2 \propto \sin(90 - \theta) \propto \cos \theta \]
\[ R \propto \sin \theta \cos \theta \]
\[ \therefore R \propto t_1t_2 \]

36. \[ R \propto u_yu_x \]
\[ U_y \text{ is same for all} \]

37. \[ F = \frac{ML\omega^2}{2} \]


39. [1] \[ \tan \theta = \frac{v_y}{v_x} = \frac{4}{3} \]

40. [2] \[ \theta = \frac{R}{H} = \frac{T \times V}{H} \]
\[ T = \frac{2H}{\sqrt{g}} \]
\[ \theta = \frac{2H}{\sqrt{g}} \times \frac{V}{H} \]

41. [1] Theoretical

42. [1] Theoretical

43. [2] Theoretical

44. [3] Theoretical

45. [1] Theoretical

CHEMISTRY

46. [2] 100 mL of 1 (N) \( \text{H}_2\text{SO}_4 = N \times V = 100 \times 1 = 100 \text{ meq H}^+ \)

100 mL of 1 (M) \( \text{NaOH} = 100 \text{ mL} (N) \text{NaOH} \)
\[ = 100 \text{ meq OH}^- \]

Therefore, solution is neutral
47. [4] Average isotopic mass = \( \frac{90}{100} \times 200 + \frac{8}{100} \times 201 + \frac{2}{100} \times 202 \) = 200 amu

48. [3] \( \text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2 \)
   
   65 Zn envoles 22400 mL \( \text{H}_2 \)
   
   Now, 22400 mL \( \text{H}_2 \) = 65 g Zn
   
   \[ \therefore 1.12 \text{mL} \cdot \text{H}_2 = \frac{65}{22400} \times 1.12 \]
   
   \[ = 32.5 \times 10^{-4} \text{ g} \]

49. [2] 0.05 mole \( \text{B}_2\text{A}_3 = 9 \text{g} \)
   
   \[ \therefore 0.1 \text{mole} \cdot \text{B}_2\text{A}_3 = \frac{9}{0.05} = 180 \text{g} \] (1)

   0.1 mole \( \text{B}_2\text{A} = 10 \text{g} \)
   
   \[ \therefore 0.1 \text{mole} \cdot \text{B}_2\text{A} = \frac{10}{0.1} = 100 \text{g} \] (2)

   \( 2 \text{B} + 3 \text{A} = 180 \)
   
   \( 2 \text{B} + \text{A} = 100 \)
   
   \( 2 \text{A} = 80 \)
   
   \( \text{A} = 40; \)
   
   \( 2 \text{B} + 3 \text{A} = 180 \)
   
   \( 2 \text{B} + 120 = 180 \)
   
   \( 2 \text{B} = 60 \)
   
   \( \text{B} = 30 \)

50. [4] 3 m NaOH solution means \( \frac{3 \text{moles NaOH}}{1000 \text{g solution}} \)
   
   \[ \therefore n_{\text{solvent}} = \frac{1000 \text{g}}{18 \text{g}} = 55.5 \]

   Hence \( x_{\text{solvent}} \) (mole fraction) = \( \frac{55.5}{55.5 + 3} = 0.95 \)

51. [1]

52. [1] Equivalent mass of a metal displaces equivalent volume of gas (i.e. 11.2 L)
   
   Now, 11.2 L of \( \text{H}_2 \) gas = 28 g metal
   
   \[ \therefore 0.7 \text{L of} \ \text{H}_2 \text{gas} = \frac{28}{11.2} \times 0.7 \]
   
   = 1.75 g metal

53. [3] \( \text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2 \)
   
   65 g Zn = 22400 mL \( \text{H}_2 \)
   
   Now 22400 mL \( \text{H}_2 \) evolved from 65 g Zn
   
   \[ \therefore 224 \text{mL} \cdot \text{H}_2 \text{evolved from} \frac{65}{100} \]
   
   = 0.65 g Zn

54. [1] \( 4 \text{NH}_3 + 5 \text{O}_2 \rightarrow 4 \text{NO} + 6 \text{H}_2 \)
   
   4 mols : 5 mols 4 mols : 6 mols
   
   5 mol \( \text{O}_2 \) reacts with 4 mole \( \text{NH}_3 \)
   
   1 mol \( \text{O}_2 \) reacts with 0.8 mol \( \text{NH}_3 \)
   
   All the \( \text{O}_2 \) will be consumed
55. [2] \[ \text{BaCO}_3 \rightarrow \text{BaO} + \text{CO}_2 \]
\[ 197 \text{g} \rightarrow 22.4 \text{L} \]
\[ :9.85 \text{g} \rightarrow \frac{22.4}{197} \times 9.85 \]
\[ = 1.12 \text{ L} \]

56. [4] For d-orbital, \( \ell = 2 \)
\[ \therefore \text{Angular momentum} = \sqrt{\ell + 1} \frac{\hbar}{2\pi} \]
\[ = \sqrt{2(2+1)} \frac{\hbar}{2\pi} \]
\[ = \sqrt{6} \frac{\hbar}{2\pi} \]

\[ E = E_0 + K.E \]
\[ \therefore K.E = E - E_0 \]

58. [3] For He\(^+\): \[ \frac{1}{\lambda} = RZ^2 \left( \frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \]
\[ = R \times 2^2 \left( \frac{1}{4^2} - \frac{1}{6^2} \right) \]
\[ = R \left( \frac{1}{2^2} - \frac{1}{3^2} \right) \]
\[ \because \text{Li}^{2+}: \frac{1}{\lambda} = R \times 3^2 \left( \frac{1}{6^2} - \frac{1}{9^2} \right) \]
\[ n = 9 \text{ to } n = 6 \]

59. [1] The given set of quantum members is not correct since acceptable values of \( n \) are 0 to \( n-1 \) thus 1,1,1+1/2 is not correct.

60. [2] Applying \((n+l)\) rule we can find the orbital having maximum energy.
Hence, \( n + l = 4+2 = 6 \) i.e. 4d-orbital.

61. [4] The maximum number of electron in nth orbit = \( 2n^2 \)
Here, \( n = 4 \); max. no. of electron = 32

62. [1]

63. [4] (ii) \( n = 2, \frac{\ell}{\ell} = \frac{2}{1}, m = 1, s = +1/2 \)
(iv) \( n=1, \ell=0, \) \( m=-1, \) \( s=-1/2 \)
\( m=0, \text{max} \)
(v) \( n=3, \) \( \ell=2, \) \( m=3, \) \( s=-1/2 \)
\( m=2, \text{max} \)

64. [4]

65. [3] \( 2 \ell+1 \) gives the number of maximum no of electrons in any orbital having same spin, e.g.
\[
\begin{array}{c}
\uparrow \\
\uparrow \\
\uparrow \\
\end{array}
\]
\( 2\ell+1 = 1 \) for p-orbital
\[
\therefore 2\ell+1 = 2 \times 1 + 1 = 3
\]
i.e. 3 electrons maximum in same spin.

66. [3] The given electronic configuration \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^3 \) is of element phosphorous (P). For the element below it i.e. arsenic (As), the configuration is \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 3d^{10} \ 4s^2 \ 4p^3 \) whose atomic number is 33.

67. [4] Une → Unnilennium

68. [1] The shielding effect order is \( s > p > d > f \)

69. [4] In \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^1 \) there is max energy gap between 1\(^{st}\) and 2\(^{nd}\) I.E.'s.

70. [4] In \( \text{O}^2^- \) due to greater number of electrons higher is electronic repulsion and hence larger radii than \( \text{O}^- \)

71. [3] I.E is amount of energy required to remove an electron from the valence shell of an isolated, GASEOUS atom in its ground state.
\[
\therefore \text{Hg}_{(g)}^(-) \rightarrow \text{Hg}_{(g)}^+ + e^-
\]

72. [2] All other being E.A.'s are released, only \( \text{H} \rightarrow \text{H}^+ \) is I.E. and is required.

73. [2] \( \text{P} < \text{Si} < \text{Be} < \text{Mg} < \text{Na} \)

74. [1] \( \text{Ca} < \text{Al} < \text{C} < \text{O} < \text{F} \)

75. [2] \( \text{Na}^+ > \text{Mg}^{2+} > \text{Si}^{4+} > \text{Cl}^{-7} \)
Ionic radii for iso-electronic species decreases across the period.

76. [2] B.O. of \( \text{N}_2 = \frac{N_{\text{B}} - N_{\Lambda}}{2} \)
\[
= \frac{10 - 4}{2} = 3
\]

77. [1] \( \text{AF}_6 \) having 6 bond-pair and , lone-pair has coordination number 7, i.e. \( \text{sp}^3 \text{d}^3 \) hybridisation and hence the geometry capped octahedral or distartedoct.

78. [2] Bond moment migrates from electropositive atom H to electronegative atom N.
And lone pair moment migrates away from central atom.

79. [1] The chloro groups at 1, 3, 5 positions nullify their bond moments. The only net bond moment is along Cl-grp at 2 position, resembling only chlorobenzene. Hence dipole moment is 1.1 D.
80. [2] The given cyclic amine has 3 bond-pairs and 1 lone-pair and hence, N is sp³ hybrid.

81. [4] In H₂O₂ the O–H bonds are polar whereas O–O bond is non-polar.

82. [2]

8 sp² carbon atoms

83. [3] In NH₄Cl the NH₄⁺ ion contains three N-H covalent bonds, one N-H coordinate bond and NH₄⁺Cl⁻ ionic bonds.

84. [2] In O₂⁻ molecular orbital, the electronic configuration is

\[
6\,^1s^2 \quad \left[6^1s^2 \right] \quad 6^2s^2 \quad \left[6^1s^2 2^1p^2 \right] \quad \pi^2 2p_z^2 \quad \pi^2 2p_y^2 \quad \pi^2 2p_z^2 \quad \pi^2 2p_y^2
\]

and number of anti-bonding electrons are 7.

85. [1] From O₂ to O₂²⁻ electrons are added to π* orbitals

86. [1] Law of equivalence states that equivalents of reactants combine to form equivalents of products Therefore, \( n_{eq} = n \times n.f. \)

87. [3] Zinc salts are diamagnetic and they do not contain any unpaired electron.

88. [3] Na₂O is more basic than Al₂O₃ since, sodium is more electropositive than aluminium.

89. [2] Bond angle of BF₃ is 120° while that of NF₃ is around 107°.

The two molecules have different shapes but this is not the reason for different bond angles, in fact hybridisation is the main reason.

90. [1] Lattice energy of ionic salts is directly proportional to the charges of cations and anions.

BOTANY

91. [4]


93. [4] Defining, non-defining

94. [3] Metabolism is a defining feature

95. [3] Growth and reproduction

96. [3] New name of ICBN is ICN – International Code of Nomenclature For Algae, Fungi and Plants

97. [3] fungi

98. [2] P – Family, Q – Reproductive and vegetative

99. [3] ds DNA

100. [3] Keys are generally analytical in nature

101. [4] Species is the most cohesive unit (closely united)

102. [3] They allow ex-situ conservation of germplasm

103. [1]

104. [3]

105. [1] monera

106. [4] Protista
107. [1] Chromatophores
110. [1] protista
111. [4] chrysophytes
112. [4] dianoflagellates
114. [2] protein rich pellicle/perioplast
115. [3] Protozoans
117. [2] Toadstool and Albugo belong to fungi
118. [3] TMV is depicted in the diagram
119. [3] TMV is depicted in the diagram
120. [3] Protozoans
121. [3] Trypanosoma gambiense
122. [2] Mushroom produces exogenous basidiospores
123. [2] Penicillium, yeast, Claviceps, Neurospora, Aspergillus, Morels, Truffles
124. [3] Saccharomyces
125. [4] RNA in viroid is ss and of low molecular weight
126. [1] Bilayered condition is seen in cell membrane of eubacteria and monolayered appearance in archaeabacteria
127. [4] Complexity of cell structure, body organization, mode of reproduction, mode of nutrition, phylogenetic analysis
128. [3] special cell wall structure
129. [4] Slime moulds are saprophytic protists
130. [1] Porifera has choanocytes or collar cells.
131. [6] Platyhelminthes are acoleomate
132. [3] Porifera lacks neurons
133. [2] Cnidoblasts are embedded in outer layer i.e epidermis
134. [3] Adult echinoderms are radially symmetrical while their larva is bilaterally symmetrical
135. [4] Aschelminthes have complete alimentary canal.
136. [4] Echinoderms are exclusively marine
137. [3] Water vascular system is a characteristic feature of echinodermata)
138. [2] no circular muscles in Aschelminths
139. [3] Gorgonia is Sea fan
140. [4] Aurelia is a number of phylum cridaria
141. [4] adult echinoderms are radially symmetrical while their larva is bilaterally symmetrical
142. [3] Aschelminthes have complete alimentary canal.
143. [1] Echinoderms are exclusively marine
144. [4] water vascular system is a characteristic feature of echinodermata)
145. [2] no circular muscles in Aschelminths
146. [3] Gorgonia is Sea fan
147. [1] Dipleura larva is in Echinodermata
Nereis is dioecious

*Cliona* is a boring sponge which bores into the shell of mollusca

Lumbricus - polychaetae

Taenia shows anaerobic respiration. Octopus shows bilateral symmetry. And Taenia lacks cnidoblasts

Frog lacks neck, Obelia donot have collar and Asterias have water vascular system

Parapodia are seen in annelids and radula is for mastication.

Metagenesis is phenomenon shown by cnidarians

Round worms are pseudocoelomate, prawn, moth and scorpion belong to the same phylum arthropoda and Bipinnaria is larva of Echinoderms.

*Balanoglossus* is tongue worm

Water flows out through Osulum