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Solutions:-
1. (2)
\[ \Delta KE = \frac{1}{2}mv^2 \]
\[ \Rightarrow \frac{1}{2}mv^2 - \frac{1}{2}mFv = \text{[FD]} \]
\[ \text{[M]} = \text{[FV}^2\text{D]} \]

2. (3)
\[ y = \pi \tan x \]
\[ dy = \frac{dx}{\sin x \cos x} \]
\[ dy = 2dx \]
\[ y = \sin 2x \]
\[ \frac{dy}{y} \text{ is minimum when } \sin 2x = 1 \]
\[ x = 45^\circ \]

3. (1)
\[ \ddot{g}_{eff.} = \ddot{g} - \ddot{a} \text{ is opposite to the velocity.} \]

4. (3)
\[ [x] = [hc] = [E\lambda] \]

5. (1)
\[ v_{av} = \frac{v_1 + v_2}{2} \]
\[ = (20 \pm 0.6) \text{ m/s} \]

6. (1)
\[ \frac{\Delta P}{P} = \frac{3}{a} \Delta a + \frac{1}{2} \Delta b + \frac{2}{c} \Delta c + \frac{\Delta d}{d} \]

7. (3)

8. (3)

9. (2)
\[ v = \sqrt{\frac{0^2 + 10^2}{2}} = 5\sqrt{2} \text{ m/s} \]

10. (1)
At \( t = 5 \text{ s} \), the particle is at maximum height
\[ u = 50 \text{ m/s}, h = \frac{u^2}{2g} \]
11. (2)
\( v^2 \) versus \( x \) graph is linear.

\( v^2 = u^2 + 2ax \) is valid

Slope = \( \frac{dv^2}{dx} = 0 + 2a = -2 \)

\( \Rightarrow a = -1 \text{ m/s}^2 \)

12. (2)

\( \Delta v = \int_{t_1}^{t_2} a \, dt \)

\[ = \int_{4}^{4} (2t + 5) \, dt \]

\[ = (t^2 + 5t)_{4}^{4} \]

\[ = (4^2 - 2^2) + 5(4 - 2) \]

\[ = 16 - 4 + 10 \]

\[ = 22 \text{ m/s} \]

13. (4)

\[ \frac{dt}{dx} = 2ax + b \]

\( \Rightarrow \frac{dx}{dt} = \frac{1}{2ax + b} \)

\( \Rightarrow v = \frac{1}{2ax + b} \)

14. (4)

Time of flight = 3 + 5 = 8 s

Time in which it falls from maximum height to ground is 4 s.

\( v = 10 \times 4 = 40 \text{ m/s} \)

15. (2)

When \( v \) is maximum,

\( \frac{dv}{dt} = 0 \)

\( \Rightarrow a = 0 \)

16. (1)

\( x = 2t^2 + 5t + 6 \)

\( v = \frac{dx}{dt} = 4t + 5 \)

\( a = \frac{dv}{dt} = 4 \)

17. (2)

Slope of speed-time graph will increase from 0 to \( t_1 \) then decrease from \( t_1 \) to \( t_2 \).

18. (4)
19. (1) 
\[ v = 2x + 10 \]
\[ a = v \frac{dv}{dx} = 2(2x + 10) \]

20. (2) 
\[ v^2 = \alpha x \Rightarrow a = \frac{\sigma}{2} \]
\[ \Rightarrow S = \frac{1}{2} at^2 = \frac{\alpha^2}{4} \]

21. (4)

22. (3) 
\[ b + \overrightarrow{RP} = \overrightarrow{\alpha} \]
\[ \overrightarrow{RP} = -\overrightarrow{RQ} \]
\[ b + \overrightarrow{RP} = \overrightarrow{c} \]

23. (1) 
\[ v_x = \frac{dx}{dt} \]
\[ v_y = \frac{dy}{dt} \]
\[ v = \sqrt{v_x^2 + v_y^2} \]

24. (1) 
\[ T_1 = \frac{2u \sin \theta}{g} \]
\[ T_2 = \frac{2u \cos \theta}{g} \]
\[ T_1T_2 = 2 \left( \frac{2 \sin \theta \cos \theta}{g} \right) \frac{u^2}{g} = \frac{2R}{g} \]

25. (3) 
\[ \Delta v = a\Delta t = g \frac{u \sin \theta}{g} = u \sin \theta \]

26. (1) 
\[ v^2 = u^2 - 2gh \]
\[ \Rightarrow \frac{1}{2}mv^2 = \frac{1}{2}mu^2 - mgh \]
\[ \Rightarrow E = E_0 - mgh \]
27. \( \text{avg.} = u \cos \theta \)

28. \( \text{(2)} \)
   \( \text{At ground} \)
   \[ K = \frac{1}{2} mu^2 \]
   \( \text{At maximum height} \)
   \[ K' = \frac{1}{2} mu^2 \cos^2 \theta \]
   \[ = \frac{K}{4} \]

29. \( \text{(1)} \)
   \( \text{At range} \ x = R \)
   \( y = 0 \implies R = \frac{\alpha}{\beta} \)

30. \( \text{(3)} \)

31. \( \text{(3)} \)
   \[ y = 8 \left( \frac{x}{6} \right) - 5 \left( \frac{x}{6} \right)^2 \]
   \( x = R, \ y = 0 \)
   \[ 0 = \frac{4}{3} R - 5 \frac{R^2}{36} \]
   \[ \implies R = \frac{48}{5} = 9.6 \text{ m} \]

32. \( \text{(3)} \)
   \( \text{Vertical component of velocity is same for both.} \)

33. \( \text{(3)} \)
   \( \ddot{u} = u i, \ddot{a} = -g j \)
   \( \dot{v} = \ddot{u} + \ddot{a} t \)
   \[ = u i - g T j \]
   \[ \implies \dot{v} = \sqrt{u^2 + g^2 T^2} \]

34. \( \text{(1)} \)
\[ R = \frac{2(v \cos \theta)(v \sin \theta)}{g} \]

\[ R' = \frac{2(v \cos \theta)(\frac{v \sin \theta}{2})}{g} = \frac{R}{2} \]

35. (4)

36. (3)

37. (1)
\[ \Delta v = 2v \sin \frac{\Delta \theta}{2} \]
\[ = 2v \sin 30^\circ \]
\[ a_{av} = \frac{2v \sin \theta}{T} = \frac{6v}{T} \]

38. (2)
\[ \omega = \frac{u \sin \theta}{\sqrt{a^2 + b^2}} \]

39. (3)
\[ v = at \]
\[ a_t = \frac{dv}{dt} = a \]

40. (2)
\[ a_c = \frac{v^2}{r} \Rightarrow g = \frac{u^2}{r} \Rightarrow r = \frac{u^2}{g} \]

41. (2)
\[ v - u = \int_0^t a \, dt = \int_0^t 2t \, dt \]
\[ \Rightarrow v = \left[ t^2 \right]_0^3 \]
\[ = 9 \text{ m/s} \]

42. (1)
43. \[ \begin{align*}
\text{v}_{\text{MG}} &= \text{velocity of man w.r.t. ground} \\
\text{v}_{\text{RG}} &= \text{velocity of rain w.r.t. ground} \\
\text{v}_{\text{RM}} &= \text{velocity of rain w.r.t. man} \\
\sin 30^\circ &= \frac{10}{v_{\text{RG}}} 
\end{align*} \]

44. \[ (1) \]

45. \[ (2) \]

46. \[ (3) \]

47. \[ (4) \]

\[ m = \frac{15}{98(100\times1.1-15)} = 1.6 \]

48. \[ (1) \]

Meq. Of oxalic acid = Meq. of NaOH

\[ \frac{6.3}{63} \times \frac{1000}{250} \times 10 = 0.1\times V \]

\[ \therefore \quad V = 40 \text{ mL} \]

49. \[ (2) \]

\[ g\text{-atom of metal} = \frac{60}{24} \]

\[ g\text{-atom of oxygen} = \frac{40}{16} \]

\[ \text{simple ratio is } \frac{60}{24} : \frac{40}{16} \text{ or } 1 : 1 \]

50. \[ (1) \]

Mole fraction

\[ \frac{n_1}{n_1 + n_2} = \frac{n_1 \times N_A}{n_1 \times N_A + n_2 \times N_A} \]

\[ = \frac{\text{Molecules of solute}}{\text{Total molecules of solute and solvent}} \]
\[ \frac{10^{24}}{10^{24} + 10^{25}} = \frac{1}{11} = 0.09 \]

51. (3)

\[ M_{H_2SO_4} = \frac{98 \times 1.80}{98 \times 100} \times 1000 = 18.0 \]

\[ M_1V_1 = M_2V_2 \]

\[ 18.0 \times V = 1 \times 0.1 \]

\[ V = 5.55 \times 10^{-3} \text{ litre} \]

52. (1)

Molar mass of S2 is lowest. Thus, \( n = \frac{w}{m} \) highest for S2,

53. (2)

\[
100 \text{g Fe}_2\text{O}_3 = \frac{100 \times 20}{100} \text{g pure Fe}_2\text{O}_3 \\
= \frac{20}{160} \text{mole Fe}_2\text{O}_3 \\
(\text{molar mass of Fe}_2\text{O}_3 = 160) \\
= \frac{20}{160} \times 2 \text{mole Fe} \\
= 0.25 \times 6.025 \times 10^{23} \text{atom of Fe} \\
= 0.25 N_A \text{atoms of Fe}
\]

54. (2)

Let, \( V_1 \) mL of 80% and \( V_2 \) mL of 20% are mixed

\[ V_1 \times 80 + V_2 \times 20 = 40(V_1 + V_2) \]

\[ 40V_1 = 20V_2 \]

\[ 40V_1 = 20V_2 \]

\[ \therefore \frac{V_1}{V_2} = \frac{1}{2} \]

55. (3)

\[ 2\text{Al} + \frac{3}{2}\text{O}_2 \rightarrow \text{Al}_2\text{O}_3 \]

\[
0.2 \quad 0.1 \\
\frac{2}{3} \times 0.1 = \frac{0.2}{0} = 0.0667
\]

56. (3) Let the number of photons required (\( n \))

\[ n \frac{hc}{\lambda} = 10^{-17} \]
57. \( \text{(4) } \text{NaOH} + \text{H}_3\text{PO}_4 \rightarrow \text{NaH}_2\text{PO}_4 \) 

\[ \text{EW} = \frac{\text{MW}}{\text{no. of ionisable } H^+} = \frac{98}{1}. \]

58. \( \text{(4) } \nu = \frac{1}{\lambda} = R_H \left[ \frac{1}{2^2} - \frac{1}{3^2} \right]; n_i = 2 \) for Blamer series and \( n_2 = 3 \) for first line or \( H_\alpha \) line of Balmer series.

59. \( \text{(3) } \)

\[ r_{n^+} = \frac{r_H}{4} \times 2^2 \]

\[ \therefore r_{2H} = r_H \times 2^2 \text{ and } r_{n^+} = \frac{r_H}{n} \]

60. \( \text{(4) } \)

\[ \text{KE} = \frac{1}{2} m u^2 \]

Also,

\[ u = \frac{h}{m \lambda} \]

\[ \therefore \text{KE} = \frac{1}{2} m \times \frac{h^2}{\lambda^2} = \frac{1}{2} \frac{h^2}{m \lambda^2} \]

\[ \therefore \frac{1}{2} \frac{h^2}{m \lambda_1^2} = \frac{1}{2} \times \frac{h^2}{2 m \lambda_2^2} \]

\[ \therefore \lambda_1^2 = 2 \]

\[ \therefore \lambda_2 = \sqrt{2} \]

61. \( \text{(2) } \)

\[ E_2 - E_1 = -\frac{E_1}{4} + E_1 = \frac{3E_1}{4} \]

\[ E_4 - E_3 = \frac{E_3}{16} + \frac{E_1}{9} = \frac{7E_1}{16 \times 9} \]

\[ \therefore \frac{E_2 - E_1}{E_4 - E_3} = \frac{3E_1}{4} \times \frac{16 \times 9}{7E_1} = 15.4 \]

62. \( \text{(3) } \)

\( n + l = 3 + 2 = 5; \) Higher is \( n + l \) for an orbital, higher is energy level.

63. \( \text{(1) } \)

\( \psi_{4,2,0} \text{ means } n = 4, l = 2, m = 0; \therefore 4d_2 \)

64. \( \text{(3) } \)

\( _{24}\text{Cr} \text{ is: } 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^1 \)
65. (2)
Angular momentum in 3\textsuperscript{rd} orbit = \frac{nh}{2\pi} = \frac{3h}{2\pi} \\
Angular momentum in 3d-orbital = \frac{h}{2\pi} \sqrt{(l+1)} = \frac{h}{2\pi} \times \sqrt{6}
\therefore \text{ratio} = \frac{3}{2} \times \frac{2}{\sqrt{6}} = \frac{3}{\sqrt{2}}
66. (1)
Dipole moment of CH\textsubscript{4} = 0.
67. (2)
The size of isoelectronic decreases with increase in atomic number.
68. (2)
Bond angles of ClF\textsubscript{3}, PF\textsubscript{3}, NF\textsubscript{3} and BF\textsubscript{3} are (180\textdegree, 90\textdegree), (101\textdegree), (106\textdegree) and (120\textdegree) respectively.
69. (4)
EA\textsubscript{1} for elements is exothermic and EA\textsubscript{2} is endothermic. Also EA\textsubscript{2} for O > EA\textsubscript{1} for O.
70. (4)
PCl\textsubscript{3} < PBr\textsubscript{3} < PI\textsubscript{3}, the bond angle order is explained in terms of increasing electronegativity of halogens, whereas, PF\textsubscript{3} > PCl\textsubscript{3}, bond angle order is explained in terms of \(\pi-\pi\) bonding in PF\textsubscript{3}.
71. (1)
Carbon (I) has 2\(\sigma\)- and 2\(\pi\) - bond; Carbon (II) has 3\(\sigma\) – and 1\(\pi\) - bond.
72. (3)
Notice configuration of N\textsuperscript{+}, C\textsuperscript{+}, O\textsuperscript{+} and F\textsuperscript{+}.
73. (1)
CO has bond order 3; NO\textsuperscript{-} has bond order 2.
74. (1)
\begin{align*}
\text{H}_2 & \quad \text{Li}_2 & \quad \text{B}_2 \\
\text{B.E.} & \quad 438 & \quad 110 & \quad 290 \text{ kJ mol}\textsuperscript{-1}
\end{align*}
H\textsubscript{2} has no antibonding electron and thus most stable. Also Li\textsubscript{2} and B\textsubscript{2} have 2 and four antibonding electrons, however small size of B\textsubscript{2} leads to more stability than Li\textsubscript{2}.
75. (1)
Both have \(sp^3\) -d-hybridization.
76. (1)
B.E.; N\textsubscript{2} > HF > O\textsubscript{2} > H\textsubscript{2} \\
keal/mol 225.08 > 134.6 > 118.32 > 104.18
77. (4)
Xenon in XeO\textsubscript{2}F\textsubscript{2} shows \(sp^3d\)-hybridization having one lone pair of electron
78. (2)  
The point at which the radial function acquires zero value is called a node. Examine the graph the answer is (b). (c) graph contains in nodes (a) and (d) none.

79. (1)  
From de-Broglie equation,  
\[ \lambda = \frac{h}{\sqrt{2V_{em}}} \]  
\[ \lambda = \frac{h}{\sqrt{2V_{emp}}} \text{ (for proton)} \]  
\[ \lambda = \frac{h}{\sqrt{2V_{3em_{Li}}}} \text{ (for Li}^{3+}) \]  
\[ \therefore \frac{\lambda_{Li}^{3+}}{\lambda_p} = \frac{\sqrt{2V_{emp}}}{\sqrt{6V_{emp} \times 9}} = \frac{1}{3\sqrt{3}} \]

80. (4)

81. (3)  
Due H – bonding in H – F its boiling point is more than HCl.

82. (3)  

Dipole moments of 2Cl and 5Cl are vectorically cancelled.  
It is due \( \mu = \mu_1 + \mu_2 + 2\mu_1\mu_2\cos\theta \)  
\[ = (1.5)^2 + (1.5)^2 + 2 \times 1.5 \times 1.5 \cos 120 \]  
\[ \therefore \mu = 1.5 \text{ D} \]

83. (1)  
F and O belong to 2\textsuperscript{nd} period whereas Cl and Br belong to 3\textsuperscript{rd} and 4\textsuperscript{th} periods respectively. Hence the sequence of the E.N. is F > O > Cl > Br

84. (1)  
Addition of an electron to F\textsuperscript{+} and Cl\textsuperscript{ions} will involve repulsions whereas in case of Na\textsuperscript{+}ion, hence EA of Li\textsuperscript{+} highest among these.

85. (2)  
Closed shell (Ne), half filled (P) and completely filled configuration (Mg) are the cause of higher value of I.E.
86. (3) 
The ionic radii must follow the order $N^{3-} > O^{2-} > F^-$

87. (2) 
\begin{align*}
\text{Ion} &= & \text{Mn}^{2+} & \text{Cu}^{2+} & \text{Fe}^{2+} & \text{Ne}^{2+} \\
\text{EC} &= & 3d^5 & 3d^9 & 3d^6 & 3d^8 \\
\text{Number of unpaired Electron} &= & 5 & 1 & 4 & 2 \\
\text{Hence lowest paramagnetism is shown by CuSO}_4.5\text{H}_2\text{O}
\end{align*}

88. (3) 
The valancy of Beryllium is +2 while that of aluminium is +3

89. (2) 
On moving along a period ionization enthalpy increases from left to right and decreases from top to bottom in a group. But this trend breaks in case of atoms having fully or half filled stable orbitals. In this case P has a stable orbitals filled electronic configuration hence its ionisation enthalpy is greater in comparison to S. Hence the correct order is $B < S < P < F$.

90. (2) 
The alkali metals are highly reactive because their first ionisation potential is very low and hence they have great tendency to lose ns’ electron to form unipositive ion. On moving down a group from Li to Cs ionisation enthalpy decreases hence the reactivity increases. The halogens are most reactive elements due to their low bond dissociation energy, high electron affinity and high enthalpy of hydration of halide ion however their reactivity decreases with increase in atomic number due to following factors.

(i) X-X bonds have low dissociation energy.
(ii) The electronegativity decreases from F to 1 due to which bond between halogen and other elements becomes weaker and weaker.
(iii) As the size increases, the attraction for an additional electron by the nucleus becomes less. Thus reactivity decreases.

91. NCERT Pg No. 19
92. NCERT Pg No. 10
93. NCERT Pg No. 27
94. NCERT Pg No. 21
95. NCERT Pg No. 11,12,13
96. NCERT Pg No. 23
97. NCERT Pg No. 23
98. NCERT Pg No. 17
99. NCERT Pg No. 4
100. NCERT Pg No. 11
101. NCERT Pg No. 23
102. NCERT Pg No. 24
103. NCERT Pg No. 23
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<tr>
<td>114</td>
<td>Morels and neurospora both come under ascomycetes</td>
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<td>119</td>
<td>3 domains include 6 kingdoms</td>
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<td>129</td>
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<tr>
<td>130</td>
<td>Bacteria divides once in 30 mins, Given duration is 720; hence 24 generations</td>
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<td>134</td>
<td>Toadstool and albugo both area belong to kingdom fungi</td>
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<tr>
<td>135</td>
<td>Penicillium</td>
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<tr>
<td></td>
<td>Yeast</td>
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<td>Neurospora</td>
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<td>Morels</td>
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<td>Bulles</td>
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<td>Above mentioned names belongs to ascomycetes</td>
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<td>136</td>
<td>Mitotic divisions transform zygote into embryo</td>
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<td>137</td>
<td>Obelia shows radial symmetry</td>
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<td>141</td>
<td>Silverfish – insect, sea urchin – echinoderm earthworm – annelid</td>
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<td>142</td>
<td>Periplaneta (arthropod), pila (molluse) both shows open circulatory sys.</td>
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<td>143</td>
<td>Silver fish – terrestrial – arthropod</td>
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<td>Dog fish – closed circulatory system</td>
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<td></td>
<td>Jellyfish – radial symmetry</td>
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<td>144</td>
<td>Parapodia is in Annelids</td>
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<td>Radula is a masticatory organ.</td>
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<td>145</td>
<td>Musca – Arthropod</td>
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<td>Lion – protected in Girforests</td>
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<td>E. coli – Escherichia coli</td>
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</table>
146. Sea urchin does not show jointed appendages Taenia – Metameric segmentation is absent
   Sea anemone & sea cucumber shows radial symmetry
150. Obelia exhibits metagenesis
156. Flatworms are acoelomate triploblastic
159. 2nd stage juvenile is infective stage of Ascaris, It shows monogenetic life cycle.
160. Ascaric has renette cells for excretion
162. Scorpion – Arachnid – 4 pairs of legs
163. Pheritima shows both internal & external segmentation whereas periplaneta shows only external
   segmentation whereas periplaneta shows only external segmentatum
165. Not all annelids have parapodia
   Echinoderms show bilateral symmetry during their larval stage
172. Fasciola – acoelomate
174. Comb jelly – marine
   Flatworms – Triploblastic
175. Circular muscles came for the 1st time from Annelids