Paper - I

1.a.

2.***b.*** $\lambda_{max}/2 = 40 \Rightarrow \lambda_{max} = 8$

3.b.

4.b. Large aperture increases the amount of light gathered by the telescope increasing the resolution

5.c. KE = $\frac{1}{2}mv_{sec}^2 = \frac{1}{2}m(\sqrt{2gR})^2 = mgR$.

6.c. A voltmeter is a high resistance galvanometer and is connected in parallel to circuit and ammeter is a low resitance galvanometer so if we connect high resistance in series with ammeter its resistance will be much high.

7.a. In coil A, B = $\frac{\mu_0 2\pi I}{4\pi\ R}$ $\therefore B\alpha\frac{I}{R}$;

Hence $\frac{B_1}{B_2} = \frac{I_1}{R_1}.\frac{R_2}{I_2} = \frac{2}{2} = 1$

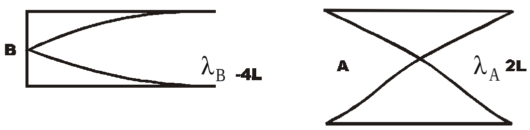
8.a.

No. of images, n = (360/ θ) - 1. As $\theta = 60^0$ so n = 5.

9.***b.*** $P_1 = V^2/R; P_2 = \frac{V^2}{(R/2)} + \frac{V^2}{(R/2)} = 4\frac{V^2}{R} = 4P_1$.

10.c. $E_n = -\frac{13.6}{n^2} \Rightarrow E_2 = -\frac{13.6}{2^2} = -3.4\ eV$

11.**c.**



$\frac{\lambda_A}{\lambda_B} = \frac{1}{2} \Rightarrow \frac{n_A}{n_B} = \frac{2}{1}$

12.b. The fact that placing wax decreases the frequency of the unknown fork and also the beat frequency states that the unknown fork is of higher frequency.

n - 288 = 4 $\Rightarrow$ n = 292 cps.

13.b. $y_1 + y_2$ = a sin(ω t - kx) -a sin(ω t + kx)

= -2a cos ω t $\times$ sinkx $\Rightarrow y_1 + y_2 = 0$ at x = 0.

14.a. W = qV $\Rightarrow V_A - V_B$ = 2/20 = 0.1V.

Here W is the work done in moving charge q from point A to B.

15.a. r = mv /Bq is same for both.

16.c. K. E. is maximum and P.E minimum at mean position.

17.c. Angular momentum = conserved.

$$\frac{1}{2}MR^2\omega_1 = 2mR^2\omega + \frac{1}{2}MR^2\omega \Rightarrow \omega = \frac{M\omega_1}{M+4m}$$

18.b. The condition to avoid skidding, v = $\sqrt{\mu rg}$

= $\sqrt{0.6\times150\times10} = 30$ m/s.

19.b. v = $\sqrt{2gh} = \sqrt{2\times10\times20} = 20$m/s .

20.b. $W = \int_{x_1}^{x_2} Fdx = \int_{x_1}^{x_2} Kxdx = K\left(\frac{x^2}{2}\right)_{x_1}^{x_2} = \frac{K}{2}[x_2^2 - x_1^2]$

= $\frac{800}{2}[(0.15)^2 - (0.05)^2] = 8$ j

21.c. Conserving Linear Momentem

$2Mv_c = 2Mv - Mv \Rightarrow v_c = v/2$.

22.b. It will compress due to the force of attraction between two adjacent coils carrying current in the same direction.

23.b.

24.c. Semiconductors are insulators at low temperature.

25.a.

26.c.

27.a. Neutrons can't be deflected by a magnetic field.

28.c. $hc/\lambda_0 = W_0$; $\frac{(\lambda_0)_1}{(\lambda_0)_2} = \frac{(W_0)_2}{(W_0)_1} = \frac{4.5}{2.3} = 2:1.$

29.a. Covalent bond formation is best explained by orbital theory which uses wave phenomena.

30.d.

31.b.

32.a. Amount left = $N_0/2^n = N_0/8$ (Here n = 15/5 = 3)

33.c. use $R_1 = R_0\left(\frac{T}{273}\right)$

34.b. E = $\sum\frac{1}{2}CV^2 = \frac{1}{2}CV^2$

35.a. Black body also emits radiation whereas nothing es capes a black hole.

36.d. The given circuit clearly shows that the inductors are in parallel we have, $\frac{1}{L} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$ or L = 1

37.c. As the velocity at the highest point reduces to zero. The K.E. of the ball also becomes zero.

38.b. As the ball moves down from height 'h' to ground the P.E. at height 'h' is converted to K.E. at the ground (Applying Law of conservation of Energy).

Hence, $\frac{1}{2}m_A v_A^2 = m_A gh_A$ or $v_A = \sqrt{2gh_A}$;

Similarly, $v_B = \sqrt{2gh}$ or $v_A = v_B$

39.a. Let the initial velocity of the body be v. Hence the final velocity = v/2

Applying $v^2 = u^2 - 2as \Rightarrow \left(\frac{v}{2}\right)^2 = v^2 - 2.a.3$

$\Rightarrow a = v^2/8$

In II[nd] case when the body comes to rest, final velocity = 0, initial velocity = $\frac{v}{2}$

Again, $(0)^2 = \left(\frac{v}{2}\right)^2 - 2.\frac{v^2}{8}.s;$ or s = 1cm

So the extra penetration will be 1 cm

40.c. When gravitational force becomes zero so centripetal force on satellite becomes zero so satellite wil escape its round orbit and becomes stationary.

41.a. The molecular kinetic energy increases, and so termperature increases.

42.b.

43.a. Because thermal energy decreases, therefore mass should increases.

44.c. Maximum in insulators and overlaping in metals

45.a.

46.d. $E = (PE)_{final} - (PE)_{Initial}$

$= \frac{-GMm}{3R} + \frac{GMm}{R} + \frac{GMm}{6R}$

47.b. Spring constant becomes n times for each place.

$T = 2\pi\sqrt{m/k}$

$\frac{T_1}{T_2} = \sqrt{\frac{nk}{k}}$ or $T_2 = T/\sqrt{n}$

48.b. The flux for both the charges exactly cancels the effect of each other.

49.b. $W = \frac{v^2}{R_{net}}$; $150 = \frac{(15)^2}{R} + \frac{(15)^2}{2} \Rightarrow R = 6\,\Omega$

50.d. Resolving power $\alpha\ (1/\lambda)$. Hence,

$\frac{(R.P)_1}{(R.P)_2} = \frac{\lambda_2}{\lambda_1} = \frac{5}{4}$.

51.b.T = $2\pi\sqrt{l_{eff}/8}$; decreases when the child stands up.

52.c. Man in the lift is in a non-inertial frame so we have to take into account the pseudo acceleration.

53.b. From Faradays law of electrolysis. m α it.

54.d. $v_{rms}\alpha\ \sqrt{T/m}$; $\sqrt{\frac{273+47}{32}} = \sqrt{\frac{T}{2}}$ or T = 20 k.

55.a. $T = 2\pi\ m/Bq$

56.d.

57.b. $I_1N_1 = I_2N_2 \Rightarrow I_2 = \frac{4\times14}{280} = 2A$.

58.c. Absolute zero temperature is practically not reachable

59.b.

60.a. Resultant of F_2 and F_3 is of magnitude F_1.

61.b. Use tan $\alpha = \frac{P\sin\theta}{Q + P\cos\theta}$

$\Rightarrow \tan 90^0 = \frac{P\sin\theta}{Q + P\cos\theta} = \infty \therefore Q + P\cos\theta = 0$

$\Rightarrow P\cos\theta = -Q$

$R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$ $R = \sqrt{P^2 + Q^2 - 2Q^2}$

or $R = \sqrt{P^2 - Q^2} = 12$

144 = (P + Q) (P - Q) or P - Q = 144/18 = 8.

$\therefore$ P = 13 N and Q = 5 N.

62.d. Use $u^2 = 2as$. a is same for both cases.

$s_1 = u^2/2a$; $s_2 = 16u^2/2a = 16s_1$ $\Rightarrow s_1 : s_2 = 1 : 16$.

63.c. γ for resulting mixture should be in between 7/5 and 5/3

64.d. Apply the condition for equilibrium of each charge.

65.a. $4\pi\in_0 R = 1.1\times10^{-10}$

66.b. $a = \frac{m_1 - m_2}{m_1 + m_2}g$; $\frac{1}{8} = \frac{m_1 - m_2}{m_1 + m_2}$ $\Rightarrow m_1 : m_2 = 9 : 7$.

67.a. Energy radiated α $R^2 T^4$.

68.b. Apply Newton's second law.

$F - T_{ab} = ma$; $T_{ab} - T_{bc} = ma$ $\therefore$ $T_{bc} = 7.8$ N.

69.c. T - 60g = 60a; T = 3000 N;

$\therefore$ a = 4 ms^{-2}

70.d. Zero, line of motion through the point P.

71.a.

72.a. $v_{esc} = \sqrt{2gR}$, where R is radius of the planet.

Hence escape velocity is independent of m.

73. c. β - rays are the beam of fast moving electrons.

74.a. Both have the dimension $M^1L^2T^2$.

75.c.

76.c.

77.c.

78.b.

79.a.

80.b. The nitro group can attach to metal through nitrogen as ($-NO_2$) or through oxgen as nitrito (-ONO).

81.b. - CH_3 group has + I effect, as number of $-CH_3$ group increases, the inductive effect increases.

82.b. Bond between C of organic molecule and metal atom.

83.a. $(HSO_4)^-$ can accept and donate a proton

$(HSO_4)^- + H^+ \rightarrow H_2SO_4$

$(HSO_4)^- - H^+ \rightarrow SO_4^{2-}$

84.a.

85.a. $Mg(OH)_2 \rightarrow [Mg^{2+}] + 2[OH^-]$

x 2x

$K_{sp} = [Mg]\ [OH]^2 = [x][2x]^2 = x.4x^2 = 4x^3$

86.a. K= $(mol\ L^{-1})^{1-n}\ sec^{-1}$, n = 0, 1.

87.d

XeF_2	sp^3d	3 lone pairs
XeF_4	sp^3d^2	2 lone pairs
XeF_6	sp^3d^3	1 lone pairs

88.a.

89.a. Order is the sum of the power of the concentrations terms in rate law expression.

90.b.

91.b. According to bond order values the given order is the answer. Bond order values are +1, $+1\frac{1}{2}$, +2 and + $2\frac{1}{2}$, higher bond order means stronger bond.

92.b. ΔH + ve at low temperature and ΔS +ve at low temperature shows that reaction is non-spontaneous.

At high temperature (boiling point) becomes feasible.

93.a. Some mechanical energy is always converted (lost) to other forms of energy

94.c.

95.a. According to their positions in the periods, these values are in the order:

$Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$

At . Nos. 70 61 58 57

This is due to lanthanide contraction

96.a. KO_2 is a very good oxidising agent

97.c.

98.c.

99.a. $_7N = 1s^2 2s^2 3p^3$; $_{15}P = 1s^2 2s^2 2P^6 3s^2 3P^3$

In phosphorous the 3 d- orbitals are available.

100.c. PV = nRT (number of moles = n/V) $\therefore$ n/v = P/RT.

101.a.

102.a.

103.d. NH_4^+ ions are increased to suppress release of OH^- ions, hence solubility product of $Fe(OH)_3$ is attained . Colour of precipitate is different.

104..c. According to molecular weight given.

105.d.

106.b.

107.a. 2nd excited state will be the 3rd energy level.

$$En = \frac{13.6}{n^2} ev \quad or \quad E = \frac{13.6}{9} eV = 1.51 ev$$

108.c.

109.c.

110.c. $CH_3CH_2COOH \xrightarrow[\text{red P}]{Cl_2} CH_3CHClCOOH$

$\xrightarrow[\text{-HCl}]{\text{alc.KOH}} CH_2 = CHCOOH$ (Acrylic acid)

111.c. Alumina is mixed with cryolite which acts as an electrolyte.

112.b. Silver ore forms a soluble complex with NaCN from which silver is precipitated using scrap zinc.

$Ag_2S + 2NaCN \rightarrow Na[Ag(CN)_2] \xrightarrow{zn}$

$Na_2[zn(CN)_4] + Ag\downarrow$

sod. argento -
cynanide (soluble)

113.c.

114.b. $$\Delta T_b = K_b \frac{W_B}{M_B \times W_A} \times 1000 ;$$

$$\Delta T_f = K_f \frac{W_B}{M_B \times W_A} \times 1000 ;$$

$$\frac{\Delta T_b}{\Delta T_f} = \frac{K_b}{K_f} = \frac{\Delta T_b}{-0.186} = \frac{0.512}{1.86} = 0.0512^0 C$$

115.c. E_{cell} = Reduction potential of cathode (right) - reduction potential of anode (left) = $E_{right} - E_{left}$

116.c $\Delta x . \Delta v = \frac{h}{2\pi m}$

117.a. Acetylene reacts with the other three as:

$$CH \equiv CNa \xleftarrow[\text{liq. } NH_3]{Na} CH \equiv CH \xrightarrow{+HCl} \begin{matrix} CH_2 \\ | \\ CHCl \end{matrix} \xrightarrow{+HCl} \begin{matrix} CH_3 \\ | \\ CHCl_2 \end{matrix}$$

$$\downarrow [AgNO_3 + NH_4OH]$$

$$AgC \equiv CAG + NH_4NO_3$$

white ppt

118.a. In this reaction the ratio of number of moles of reactants to products is same i.e. 2 : 2, hence change in volume will not alter the number of moles.

119.d. Δ H negative shows that the reaction is spontaneous. Higher value for Zn shows that the reaction is more feasible.

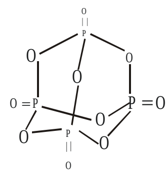
120.a. Mn^{2+} has the maximum number of unpaired electrons (5) and therefore has maximum moment .

121.b. In molecules (a), (c) and (d), the carbon atom has a multiple bond, only (b) has sp^3 hybridization.

122d.

123.d.

124.d.



125.d.

126.d. Beryllium shows anomalous properties due to its small size.

127.a. $E_{cell} = E_{right\ (cathode)} - E_{left\ (anode)}$

128.c. $$C \equiv CH + \xrightarrow{HOCl} \begin{matrix} CHOH \\ \| \\ CHCl \end{matrix}$$

$$\xrightarrow{HOCl} \begin{pmatrix} CH(OH)_2 \\ | \\ CHCl_2 \end{pmatrix} \xrightarrow{-H_2O} \begin{matrix} CHO \\ | \\ CHCl_2 \end{matrix}$$

dichloroacetaldehyde

129.b. Aldehydic group gets oxidised to carboxylic group.

Double bond breaks and carbon gets oxidised to carboxylic group

130.c. The E^0 of cell will be zero

131.d.

132.a. $C_2H_5NH_2 + CHCl_3 + 3KOH \rightarrow$

$C_2H_5N \equiv C + 3KCl + 3HCl$

Ethl isocyanide

133.a.

134.b.

135.d. After every 5 years amount is becomeing half.

$$\therefore 64\,g \xrightarrow{5yrs} 32\,g \xrightarrow[(10)]{5\,yrs} 16\,g \xrightarrow[(15)]{5\,yrs} 8\,g$$

after 15 years

136.d. Forms a soluble complex which is precipitated with zinc.

137.a.

138.c Volume increases with rise in temperature.

139.a.

140.d.

141.d.Pure metal always deposits are at cathode.

142.b.A more basic ligand forms stable bond with metal ion, CI^{-1} is most basic amongst all.

143.c. ${}_0n^1 \rightarrow +_1P^1 + -1^{e^0}$

144.b. [$\Delta H_{mix} < 0$]

145.b.

146.d.BCC - points are at corners and one in the centre of the unit cell.

Number of atoms per unit cell = $8 \times \frac{1}{8} + 1 = 2$

FCC - points are at the corners and also centre of the six faces of each cell.

Number of atoms per unit cell = $8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$

147.a.Fe (no. of moles) = $\frac{558.5}{55.85} = 10$ moles

C (no.of moles = 60/12 = 5 moles.

148.c. $\overset{+3}{Mn_2}O_3 \xleftarrow{-4e} [K\overset{+7}{mno}O_4] \xrightarrow{-e-} [MnO_4]^{-1}$

$[KmnoO_4] \xrightarrow{-5e} Mn^{2+}$

$[KmnoO_4] \xrightarrow{-3e} \overset{+4}{M}nO_2$

149.d.The oxidation states show a change only in reaction (d)

$\overset{0}{Z}n + w\overset{+1}{A}gCN \xrightarrow[+2e-]{-2e-} 2A\overset{0}{g} + \overset{+2}{Z}n(CN)_2$

150.c. $K_p = K_c(RT)^{\Delta n}; \Delta n = 1 - \left(1 + \frac{1}{2}\right) = 1 - \frac{3}{2} = -\frac{1}{2}$

$\therefore \frac{k_p}{k_c} = (RT)^{-1/2}$