SOLUTION OF SEM- I
FULL TEST -1

1 (b) 1 mole of CH_4 contains 4 mole of hydrogen atom *i.e.* 4*g* atom of hydrogen.

2 (a) 6×10^{23} molecules has mass $=18gm$

1 molecules has mass $=\dfrac{18}{6\times10^{23}}=3\times10^{-23}gm$

$=3\times10^{-26}kg$.

3 (b) $\because$ 22400 *ml* at NTP has 6.023×10^{23} molecule

$\therefore$ 1 *ml* at NTP has $=\dfrac{6.023\times10^{23}}{22400}$

$=0.0002688\times10^{23}=2.69\times10^{19}$.

4 (a) 16*g* O_2 has no. of moles $=\dfrac{16}{32}=\dfrac{1}{2}$

14*g* N_2 has no. of moles $=\dfrac{14}{28}=\dfrac{1}{2}$

No. of moles are same, so no. of molecules are same.

5. (a) 1 mole of sucrose contains 6.023×10^{23} molecules

$\because$ 1 molecule of sucrose has 45 atoms

$\therefore$ 6.023×10^{23} molecule of sucrose has $45\times6.023\times10^{23}$ atoms/mole

6. (b) H_2SO_4 is dibasic $N=2M=2\times2=4$.

7. (d) *NaOH* *HCl*

$N_1V_1 = N_2V_2$; $20\times\dfrac{1}{10}=\dfrac{1}{20}\times V$; $V=40ml.$

8 (d) The equivalent weight of $H_3PO_4=\dfrac{\text{molecular weight}}{2}$

$\because$ mole wt of H_3PO_4 = 3 + 31 + 64 = 98

$\therefore$ $\dfrac{98}{2}=49$

9----- a

10 ------ c

11-------a

12 One mole of electron = 6.023×10^{23} electron

Mass of one electron = 9.1×10^{-28} *gm*

Mass of one mole of electrons

$=6.023\times10^{23}\times9.1\times10^{-28}gm = 5.48\times10^{-4}gm$

$=5.48\times10^{-4}\times1000\,mg = 0.548\,gm\approx0.55\,mg$.

13 (a) Charge on proton $=+1$ unit, charge on α particle = + 2 units, 2 : 1.

14. (b) Four unpaired electron are present in the Fe^{2+} ion $Fe^{2+}_{26}=[Ar]3d^6,4s^0$

15 (c) Na^+ has 10 electron and Li^+ has 2 electron so these are different number of electron from each other.

16 easy

17. (c) ${}_7X^{14}, n=14-7=7$

18 (c) α-particles pass through because most part of the atom is empty.

19 (d) The electron can move only in these circular orbits where the angular momentum is a whole number multiple of $\frac{h}{2\pi}$ or it is quantised.

20. (b) $E \propto \frac{1}{\lambda}$; $E_1 = \frac{1}{8000}$; $E_2 = \frac{1}{16000}$

$\frac{E_1}{E_2} = \frac{16000}{8000} = 2 \Rightarrow E_1 = 2E_2$

21 If $l = 2, m \neq -3.$ $=(-e \text{ to } +e)$.

22 (c) When $l = 3$ then

$m = -3, -2, -1, 0, +1, +2, +3$. $m = -l$ to $+l$ including zero.

23 **a** (b)For $n = 1, l = 0.$

24(a) Values of energy in the excited state $= -\frac{13.6}{n^2} eV$ $= \frac{-13.6}{4} = -3.4\ eV$ in which $n = 2, 3, 4$ *etc*.

25 (a) Both assertion and reason are true and reason is the correct explanation of assertion.

26. (d) $MnO_4^- \rightarrow Mn^{2+}$. In this reaction $5e^-$ are needed for the reduction of Mn^{2+} as:

$MnO_4^- + 5e^- \rightarrow Mn^{2+}$.

27 (d) $\overset{0}{4Fe} + 3O_2 \rightarrow 4\overset{3+}{Fe} + 6O^{2-}$, in this reaction metallic iron is oxidised to Fe^{3+}.

28. (b) $\overset{0}{Zn} + \overset{+2}{CuSO_4} \rightarrow ZnSO_4 + \overset{0}{Cu}$

In this reaction Cu^{2+} change in Cu^o, hence it is called as reduction reaction.

29. (b) Hydrogen peroxide (H_2O_2) act as a both oxidising and reducing agent.

30. (b) $[\overset{*}{Cr}(H_2O)_4Cl_2]^+$, take water +2-2 =0

$x + 0 + 2(-1) = +1$; $x - 2 = +1$

$x = +3$ for *Cr* in complex

31. (d) All are isoelectronic but O^{2-} has lowest charge among them. So it is largest in size.

32 (a) As effective nuclear charge on Na^+ is maximum. It has smallest size.

33. (d) As the nuclear charge per electron is maximum in P^{5+}. Therefore its size is smallest.

34 (c) $Na^+ - 10$ electron ; $Li^- - 4$ electron

35 (d) Hydrogen can loose one electron (*e.g. HF*). It can gain one electron (*e.g. NaH*), Hydrogen can also share one electron (*e.g. H – H*).

36. (c) Hydrogen resembles both alkali metals and halogens.

37. (b) Hardness of water is due to the presence of bicarbonates, chlorides and sulphates of *Ca* and *Mg* on it. These Ca^{2+} and Mg^{2+} ions react with the anions of fatty acids present in soaps to form curdy white precipitates. As a result, hard water does not produce lather with soap immediately.

38 (b) We know that

$2H_2O_2 \longrightarrow 2H_2O + O_2$

$2 \times 34g$ $22400\,ml$

$\because$ $2 \times 34\ gm = 68\ gm$ of H_2O_2 liberates

$22400\,ml$ O_2 at STP

$\therefore$ $.68\ gm$ of H_2O_2 liberates

$= \frac{.68 \times 22400}{68} = 224\,ml$

40. (b) When sodium bicarbonate $(NaHCO_3)$ is heated, sodium carbonate, CO_2 and water are formed.

$$2NaHCO_3 \xrightarrow{\Delta} \underset{\text{Sodium carbonate}}{Na_2CO_3} + CO_2 \uparrow + H_2O$$

41 -----(d) $MgSO_4.7H_2O$

42 --- ns2

43 (b) 3-methylhexane

44 (b) $CH_3-\overset{3}{CH}(\overset{2}{CH_2}-\overset{1}{CH_3})-\overset{4}{CH}(\overset{CH_3}{})-\overset{5}{CH_2}-\overset{6}{CH}(\overset{7}{CH_2}-\overset{8}{CH_3})-CH_3$

3,4 6-Trimethyloctane

45. (b)

		Element. No. of moles	Simple ratio
C	12	49.3/12 = 4.1	4.1/2.7 = 1.3 × 2 = 2.6 = 3
H	1	6.84/1= 6.84	6.84/2.7=2.5×2=5
O	16	43.86/16 = 2.7	2.7/2.7=1×2=2

Empirical formula = $C_3H_5O_2$

E.F. wt. = 12 × 3 + 1 × 5 + 16 ×2 = 73

Molecular wt = V.D. × 2 = 73 × 2 = 146

$$n = \frac{M.wt}{E.F.wt} = \frac{146}{73} = 2$$

Molecular formula = $(E.F)_n = (C_3H_5O_2)_2 = C_6H_{10}O_4$.

46 (c) $\underset{5\sigma,\,1\pi}{CH_2 = CH_2}$

47 (a) $Br-\underset{sp^2}{\overset{1}{CH}}=\underset{sp^2}{\overset{2}{CH}}-Br \xrightarrow[\text{Catalyst}]{H_2} Br-\underset{sp^3}{\overset{3}{CH_2}}-\underset{sp^3}{\overset{4}{CH_2}}-Br$

48 (d) $H-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}-\overset{H}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-\overset{CH_2CH_3}{\underset{H}{\overset{|}{\underset{|}{C}}}}-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}-\overset{CH_3}{\underset{H}{\overset{|}{\underset{|}{C}}}}-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}-H$

2, 5 d; methyl 4 -ethylheptane (5 Methyl group)

49. (a) $\underset{\text{Methyl carbanion}}{CH_3^-} > \underset{1^o}{R-CH_2^-} > \underset{2^\circ}{R-\overset{R}{\underset{|}{\overset{|}{CH^-}}}} > \underset{3^\circ}{R-\overset{R}{\underset{R}{\overset{|}{\underset{|}{C^-}}}}}$

50---- (C) substitution

PART – B 2 MARKER

(1) $K_2Cr_2O_7 + xH_2SO_4 + ySO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + zH_2O$

The values of x, y, z are:

(a) 1, 3, 1 (b) 4, 1, 4 (c) 3, 2, 3 (d) 2, 1, 2

Ans. (a)

Hint: $K_2Cr_2O_7 + H_2SO_4 + 3SO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$

(2) To form 10% w/w solution, 36.5 g HCl must be dissolved in _____ g of water.

(a) 328.5 (b) 365 (c) 401.5 (d) 715.5

Ans. **(a)**

Hint: 10% w/w = $\frac{36.5}{36.5+w} \times 100$

$\therefore 36.5 + w = 365$

$\therefore w = 328.5\,g$.

(3) If the electronic configuration of nitrogen had $1s^7$, it would have energy lower than that of normal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. Yet $1s^7$ is not observed because it violates:

(a) Heisenberg uncertainty principle

(b) Hund's rule

(c) Pauli's exclusion principle

(d) Bohr postulates of stationary orbits

Ans: (c)

(4) The uncertainty in momentum of an electron is $1\times10^{-5}\ \text{kg ms}^{-1}$. The uncertainty in its position will be:

(a) $1.05\times10^{-28}\text{m}$ (b) $5.27\times10^{-26}\text{m}$ (c) $1.05\times10^{-30}\text{m}$ (d) $5.25\times10^{-28}\text{m}$

Ans: (c)

Hint: $\Delta x \cdot \Delta p = \dfrac{h}{4\pi}$

$$\therefore \qquad \Delta x = \frac{6.626\times10^{-34}}{1\times10^{-5}\times4\times3.14} = 5.27\times10^{-26}\text{m}$$

(5) Which one is descending order of atomic radius of elements of third period.

Na (Z = 11), Mg (Z = 12), Al (Z = 13) and Si (Z= 14)?

(a) Si > Al > Mg > Na (b) Na > Mg > Al > Si

(c) Na < Mg < Al < Si (d) Na > Al > Mg > Si

Ans: (b)

Hint: Atomic radius decreases from left to right in a period.

(6) Which order is true with reference to size of species?

(a) $Pb < Pb^{2+} < Pb^{4+}$ (b) $Pb^{4+} > Pb^{2+} > Pb$

(c) $Pb > Pb^{2+} > Pb^{4+}$ (d) $Pb^{2+} < Pb < Pb^{4+}$

Ans: (c)

Hint: As the positive charge of cations increases its atomic radius decreases.

(7) Which substance is the reducing agent in the reaction?

$$CH_3CHO + Ag_2O \rightarrow CH_3COOH + 2Ag$$

(a) CH_3CHO (b) Ag_2O (c) CH_3COOH (d) Ag

Ans: (a)

Hint: CH_3CHO reduces Ag_2O to Ag and oxidizes itself to $CH_3COOH.$ Hence it is the reducing agent.

(8) What is the oxidation number of N in N_3H?

(a) 2 (b) 1 (c) –1/3 (d) 0

Ans: (c)

Hint: Oxidation number of N in N_3H is, 3x + (+1) =0. ∴ x = –1/3

(9) What is formed when calcium carbide reacts with heavy water?

(a) CaD_2 and C_2H_2 (b) C_2D_2 and CaH_2

(c) $Ca(OH)_2$ and D_2 (d) C_2D_2 and $Ca(OD)_2$

(10) One mole of calcium phosphide on reaction with excess of water gives:

(a) One mole of phosphine (b) Two mole of phosphoric acid

(c) Two mole of phosphine (d) One mole of phosphorous (V) oxide **Ans: (c)**

Hint: $Ca_3P_2 + 3H_2O \rightarrow 3Ca(OH)_3 + 2PH_3$

(11) The first ionisation energies of alkaline earth metal are higher than those of the alkali metals. This is because:

(a) there is increase in the nuclear charge of the alkaline earth metal.

(b) there is decrease in the nuclear charge of the alkaline earth metal.

(c) there is change in nuclear charge.

(d) none of the above

Ans: **(a)**

Hint: Due to presence of two paired electrons in alkaline earth metal, their first ionisation energies are higher than alkali metals which have only 1 unpaired electron.

(12) What is produced on passing CO_2 gas through an aqueous solution of Na_2CO_3?

(a) NaOH (b) $NaHCO_3$ (c) OH (d) H_2O

Ans: **(b)**

Hint: $Na_2CO_3 + H_2O + CO_2 \rightarrow 2NaHCO_3$

PART – C 3 MARKERS

(1) The volume of 32 gram CH_4 gas, 710 gram Cl_2 gas and 64 gram O_2 gas at STP is....., ...and .....litre respectively.

(a) 22.4, 71, 22.4 (b) 44.8, 710, 22.4 (c) 22.4, 710, 44.8 (d) 44.8, 710, 44.8

Ans: **(d)**

Sol: Molecular wt. of CH_4 gas

= 16 gram per mole

Cl_2 gas is 71 gram per mole and O_2 gas is 32 gram per mole

Mole of $CH_4 = \frac{32}{16} = 2$

Mole of $Cl_2 = \frac{710}{71} = 10$

Mole of $O_2 = \frac{64}{32} = 10$

At STP volume of 1 mole of gas is 22.4 Ltr.

Volume of 2 mole of CH_4 is 44.8 Ltr.

10 mole of Cl_2 is 710 Ltr. and 2 mole of O_2 is 44.8 Ltr.

(2) The angular momentum of an electron of hydrogen atom in L orbit is.....J.S.

(a) 1.1102 (b) 6.626 (c) 2.2086 (d) 2.1102

Ans: **(d)**

Sol: The value of n for an electron present in L orbit = 2

The angular momentum of an electron

$$= \frac{nh}{2\pi} = \frac{2 \times 6.626 \times 10^{-34} \text{ J.S.}}{2 \times 3.14} = 2.1102 \text{ J.S.}$$

(3) The correct sequence which shows decreasing order of the ionic radii of the elements is.....

(a) $Na^+ > F^- > Mg^{+2} > O^{-2} > Al^{+3}$ (b) $O^{-2} > F^- > Na^+ > Mg^{+2} > Al^{+3}$

(c) $Al^{+3} > Mg^{+2} > Na^+ > F^- > O^{-2}$ (d) $Na^+ > Mg^{+2} > Al^{+3} > O^{-2} > F^{-1}$

Ans: **(b)**

(4) The sum of oxidation number of each H, each peroxide bonded oxygen and each sulphur in H_2SO_5 is.....

(a) + 4 (b) + 6 (c) + 7 (d) + 8

Ans: **(b)**

Sol: Each H atom has oxidation number +1.

Each peroxide bonded oxygen has oxidation number –1 $\rightarrow$ S has oxidation number + 6.

(5) Match list-I with list-II and select the correct answers using the codes given below the list.

	List – I		**List – II**
1.	Liquid hydrogen	a.	Haber process

2.	Heavy water	b.	Temperature hardness
3.	Hydrogen peroxide	c.	Honey comb
4.	Dihydrogen	d.	Spaceshuttles
5.	Clark's method	e.	Production of fertilizers
6.	$Na_2AlSi_4O_{12}$	f.	Perhydral

(a) 1 → f, 2 → e, 3 → d, 4 → a, 5 → b, 6 → c

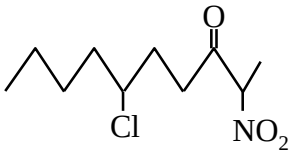
(b) 1 → d, 2 → e, 3 → f, 4 → a, 5 → b, 6 → c

(c) 1 → d, 2 → e, 3 → f, 4 → a, 5 → c, 6 → b

(d) 1 → e, 2 → d, 3 → f, 4 → a, 5 → b, 6 → c

Ans. **(b)**

(6) The IUPAC name of the compound



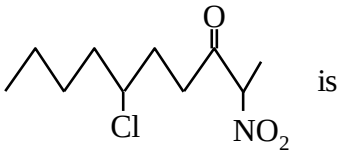
is

(a) 5 – chloro – 1 – nitro nonan – 2 - one (b) 6 – chloro – 2 – nitro decan – 3 – one

(c) 5 – chloro – 9 – nitro decan 3 – one (d) 5 – chloro – 9 – nitro nonan – 3 – one

Ans. **(b)**

Hint:



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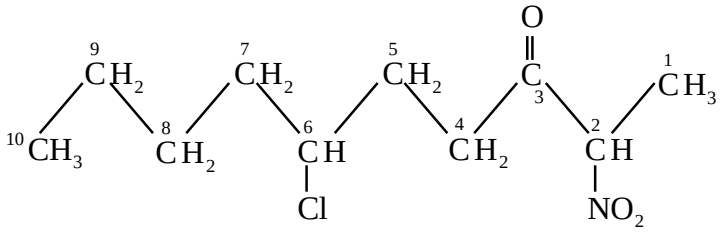
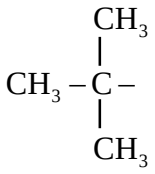
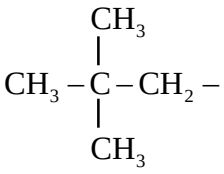


6 - chloro - 2 - nitro decan - 3 - one

PART – D 4 MARKERS

(1) Match list-I and list-II and find the correct answer from the code given below.

	List – I **Alkyl functional**		**List – II** **Name of functional group**
1.	$CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-$	a.	Normal pentyl
2.	$CH_3-(CH_2)_3-CH_2-$	b.	Neopentyl
3.	$C_2H_5-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-$	c.	Isobutyl
4.	$CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2-$	d.	Tert. Butyl

5.		e.	Sec.butyl
6.		f.	Isopropyl

(a) 1 → c, 2 → e, 3 → a, 4 → f, 5 → b, 6 → d

(b) 1 → f, 2 → a, 3 → c, 4 → e, 5 → d, 6 → b

(c) 1 → f, 2 → a, 3 → e, 4 → c, 5 → d, 6 → b

(d) 1 → f, 2 → e, 3 → a, 4 → c, 5 → d, 6 → b

Ans. **(c)**

2. The mole fraction of the solute in one molal aqueous solution is **[CBSE PMT 2005]**

(a) 0.027 (b) 0.036

(c) 0.018 (d) 0.009

ANS (c) $W = 1000\,gm \quad (H_2O);\ n = 1\ mole$

$$N = \frac{W}{M} = \frac{1000}{18} = 55.55$$

$$x_{\text{Solute}} = \frac{n}{n+N} = \frac{1}{1+55.55} = 0.018.$$

3. The normality of $0.3M$ phosphorus acid (H_3PO_3) is

[IIT 1999; AIIMS 2000]

(a) 0.1 (b) 0.9

(c) 0.3 (d) 0.6

ANS . (d)Basicity of H_3PO_3 is 2.

Hence $0.3\ M\ H_3PO_3 = 0.6\ N$.