

THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF CHEMISTRY

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COMP # : 2018202006

COURSE : CHEM 2415

GENDER : MALE

ASSIGNMENT
: 5 five

PROGRAMME
OF STUDY : GEOLOGY

LECTURE : MR. A. CHILUFYA

DUE DATE : 15 - 07 - 2020

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QUESTION ONE (1)

BINARY HYDRIDES

These are the resultant compounds formed when Hydrogen reacts with almost all elements except noble gases to form Hydrides.

(i) Ionic or Saline Hydrides

- These are hydrides of Hydrogen with elements that are more electropositive than Hydrogen. e.g. Alkali and alkaline earth metals (LiH and BeH_2)

(ii) Covalent or Molecular Hydrides

- These are Hydrides of elements which are more electronegative than Hydrogen (e.g. P block metals (HCl and NH_3))

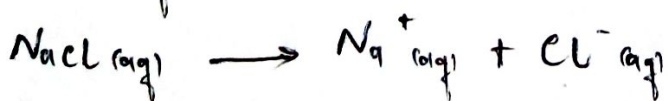
(iii) Metal - Interstitial Hydrides

- Are Binary compounds of Hydrogen and Transition metals e.g. (ScH_2 and TiH_2)

QUESTION TWO (2)

(i) Preparing sodium metal

- It is manufactured using electrolysis of NaCl mixture in a Down cell.
- Sodium is liberated at cathode while chlorine at Anode electrolysis reaction

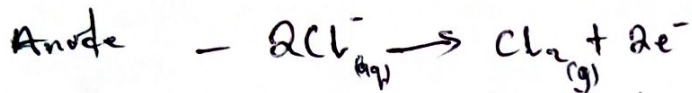
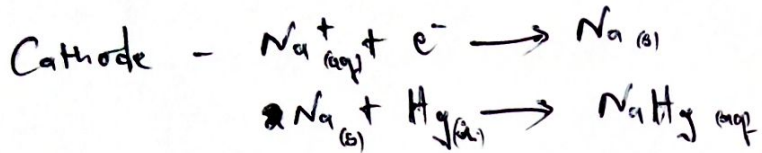


At cathode. $\text{Na}^+ + \text{e}^- \longrightarrow \text{Na (s)}$, sodium metal collected.

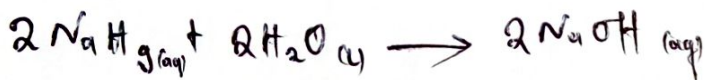
At Anode. $2\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$, chlorine gas collected

Sodium Hydroxide (NaOH)

- prepared using electrolysis of sodium chloride using castner Kellner cell
- Carbon anode and mercury cathode are used giving sodium hydroxide.
- at cathode, sodium amalgam is formed and chlorine gas is obtained at anode.

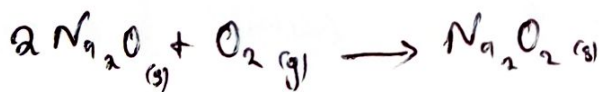
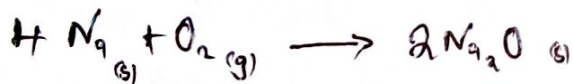


Sodium amalgam gives sodium hydroxide (NaOH) when reacted with water



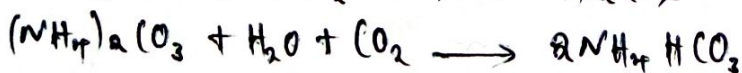
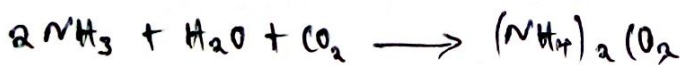
Sodium peroxide (Na₂O₂)

- sodium is heated in excess oxygen to form sodium peroxide
- Initially, Na₂O (sodium oxide) is obtained which reacts with more oxygen to form Na₂O₂

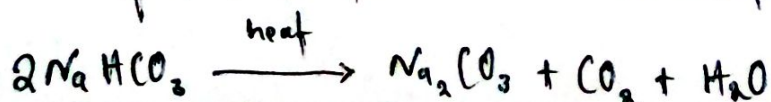


Sodium carbonate

- It is obtained by solvay process of ammonia soda process
- carbon dioxide is passed through a brine solution containing NaCl which is saturated with ammonia to form sodium carbonate.



The precipitate of sodium bicarbonate is filtered and dried then ignited to form sodium carbonate



QUESTION THREE (2)

Sodium

It is the major cation of extracellular fluid and it is responsible for one half of osmotic pressure gradient that exist between the interior of the cell and surrounding environment.

potassium

- It is the major Intracellular cation.
- helps establish the resting membrane potential in neuron and muscle fibre, after membrane depolarisation and action potential.

Magnesium

- Helps maintain normal blood circulation in our body
- plays an important role in neuromuscular function.

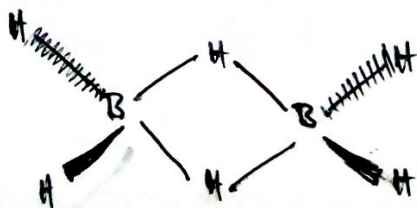
Calcium

- necessary for muscle contraction, enzyme activity and blood coagulation.
- In addition, calcium helps to stabilise cell membranes and it is essential for the release of neurotransmitter from neurons and hormones from Endocrine.

QUESTION 4

- The unusual feature of diborane is the existence of Boron - Hydrogen - Boron (B-H-B) Bridges as part of the cluster.
- * B-H-B Bridges makes a diborane molecule a (3c-2e bond), three-centre two electron bond as the three atoms are held together by a pair of electrons delocalised over three atoms making no existence of B-B bond in the structure

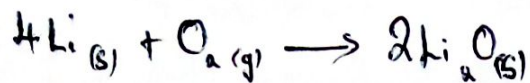
Structure



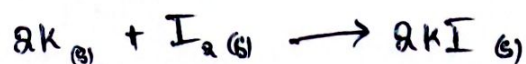
$$\begin{aligned} & \text{B}_2\text{H}_6 \\ \text{ve}^- &= 2(5) + 6 \\ &= 16 \end{aligned}$$

QUESTION FIVE (5)

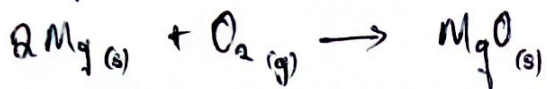
(a) Li react with O_2



(e) K reacts with I_2 (s)



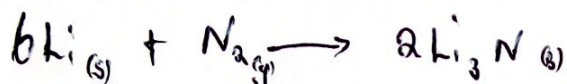
(b) Mg react with O_2



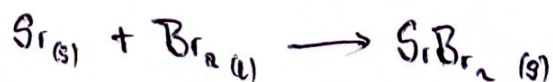
(f) Ba reacts with Cl_2



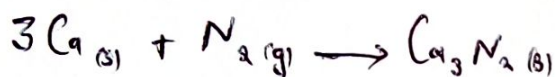
(c) Li react with N_2



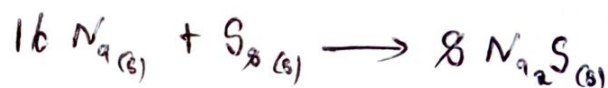
(g) Sr react with Br_2 (l)



(d) Ca reacts with N_2

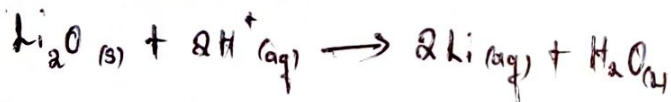


(h) Na react with S_8 (s)

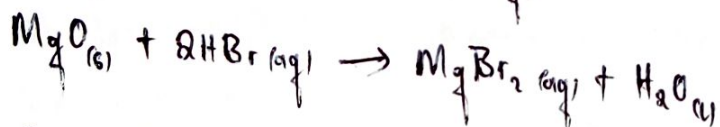


QUESTION SIX (6)

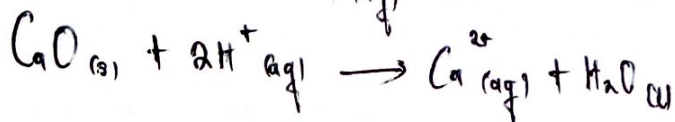
(a) Li_2O react with H^+ (aq)



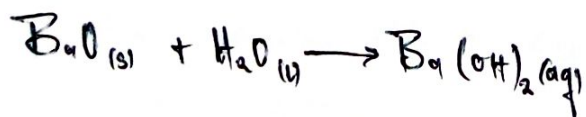
(b) MgO reacts with HBr (aq)



(c) CaO react with H^+ (aq)



(d) BaO react with H_2O



(e) N_2O (s) + H_2O (l) \rightarrow $2NO$ (aq) + H_2O (l)

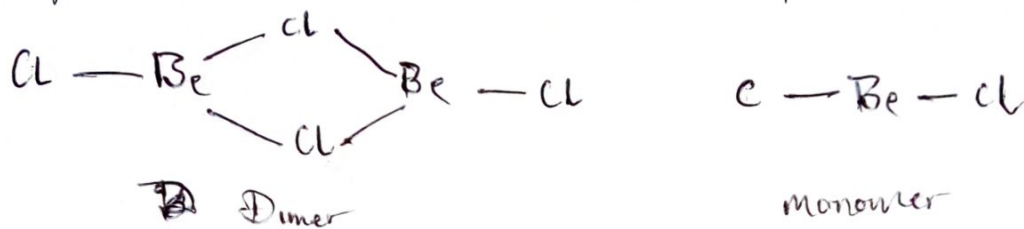
(f) Li_2O (s) + H_2O (l) \rightarrow $2LiOH$ (aq)

QUESTION (7) SEVEN

- (a) - upon reaction with water, all alkali earth metals hydroxides are bases except $\text{Be}(\text{OH})_2$ which is Amphoteric.
- upon reaction with Halogens, Beryllium chloride has a chain structure in the solid state and a linear in a gas state.

(b) Structure of BeCl_2 (vapour)

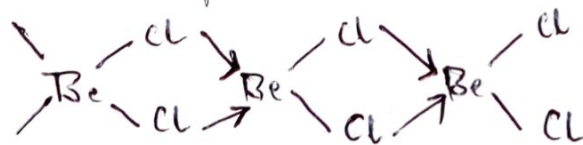
In the vapour state, Beryllium chloride exist as dimer (Be_2Cl_4) which dissociates into monomers (BeCl_2) at a given temperature giving monomer a linear structural shape.



(ii) BeCl_2 in solid state

- In solid state, BeCl_2 has polymeric chain structure due to it's electron deficient. Be atom is tetrahedrally surrounded by four Cl atom - two are bonded by covalent bond while the other two by coordinate bonds.
- It has only four electrons in valence shell and can accept two pairs of electrons from neighbouring chlorine atoms to complete their octet.

$$V_e^- = 2 + 7(2) = 16$$



- (c) Bonding in BeCl_2 is covalent while MgCl_2 or CaCl_2 is Ionic.
- BeCl_2 is covalent because Beryllium as compared to other group two members has a High Electronegativity and Ionisation Energy.
- MgCl_2 or CaCl_2 has Ionic or MgCl_2 being more covalent than CaCl_2 is because they are less electronegative and has lower Ionisation energy due to their atomic size and radius larger than Beryllium.

(d) Aluminium

→ Diagonal relationship

QUESTION 8 (EIGHT)

- (a) an example can be given when combined with Oxygen under standard conditions, Li and Mg form only normal oxides where as Na forms Peroxide and metals below Na, in addition form Superoxide
- (b) lithium has more properties in common with magnesium than sodium is because of charge density factor. The ionic potential of lithium and magnesium is roughly the same. The charge density of lithium is much closer to that of magnesium to those of the other alkali metals of different atomic size and radius. This is called Diagonal relationship.