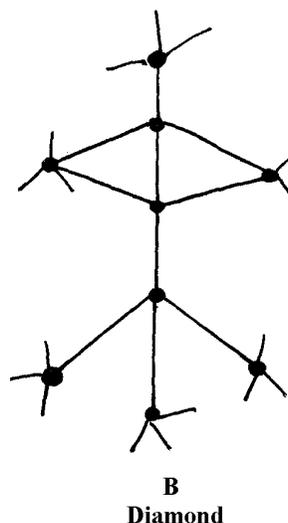
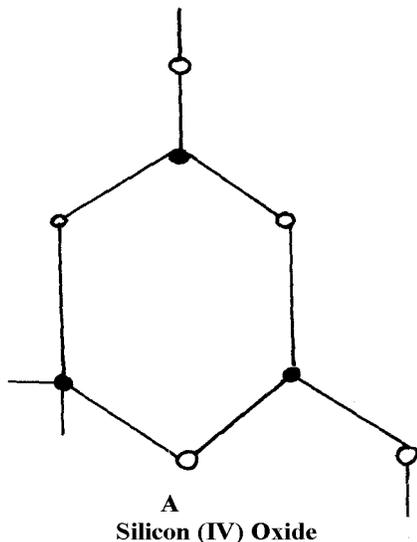


## Carbon and its compounds

1.
  - a) – making of pencil  
- As a lubricant
  - b) Graphite has delocalized in its structure hence it conducts electricity. Carbon uses all the four valency electrons to form covalent bonds hence do not have delocalized electrons to conduct electricity
  
2.
  - a) Carbon (IV) oxide (CO<sub>2</sub>) ✓1
  - b)  $2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$  ✓1
  - c) – Paper manufacture ✓1  
- Manufacture of glass.  
- Softening of hard water.
  
3. Magnesium has a higher affinity for combined oxygen than carbon. Mg is more reactive than carbon thus displaces it from its oxide.
  
4.
  - a) Carbon (iv) Oxide
  - b) Blue flame. Carbon (iv) oxide burns in air with a blue flame 1
  
5.
  - a) A brown solid is formed
  - b)  $\text{CuO}(\text{g}) + \text{C}(\text{g}) \rightarrow \text{Cu}(\text{g}) + \text{CO}(\text{g})$
  - c) As a fuel in water gas
  
6.
  - (a) Covalent bond is bond between non-metal atoms where shared electrons are donated equally by all the atoms involved.  
Dative bond is a bond in which shared electrons are donated by one atom.
  - (b) The presence of triple bond in nitrogen requires very high temperatures to break
  
7.
  - (a) Reduction by using carbon
  - b) J, carbon and H  
decreasing order of reactivity 7. Study the structures A and B:



8.
  - (i) Have giant atomic structure
  - (ii) To make drill bits or used in jewellery (any one)

9. (a) Allotropy is the existence of an element  $\sqrt{1}$  in more than one form without change of state.  
 (b) Graphite contains delocalized  $\sqrt{1}$  electrons between the layers while diamond has no 3 free  $\sqrt{1}$  electrons. Its atoms are strongly bonded.
10. (a)  $C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$   $\sqrt{1}$  (1 mk)  
 (b) Burn charcoal in sufficient  $\sqrt{1}$  oxygen Carbon (II) oxide 3  
 (being a reducing agent) is easily oxidized to carbon (IV) oxide.  $\sqrt{1}$  (1 mk)
11. (a) Black $\sqrt{1/2}$  solid changes to reddish brown $\sqrt{1/2}$   
 (b)  $CuO_{(s)} + CO_{(g)} \rightleftharpoons Cu_{(s)} + CO_{2(g)}$   $\sqrt{1}$  (1 mk) 2
12. (a) Difference forms of a substance at the same physical state;  
 (b) In graphite each carbon is bonded to 3 others and there are Vander waals forces between hexagous;  
 - In diamond each carbon atom is covalently bonded to four others making a rigid mass;
13. a) - Copper (ii) oxide changes  $\sqrt{1/2}$  from black to brown/ reddish brown/ red brown $\sqrt{1/2}$   
 - A white ppt forms in the boiling tube  $\sqrt{1/2}$   
 b)  $CO_{2(g)} + Ca(OH)_{2(aq)} \rightleftharpoons CaCO_{3(s)} + H_2O_{(l)}$   $\sqrt{1}$   
 c) Unreacted carbon (ii) Oxide is poisonous/ toxic/ pollutant it is converted to the less harmful gas  $CO_2$
14. a) A the substance is a gaining kinetic energy making it to vibrate vigorous up B,  
 at point B to C the kinetic energy a gained is used to beak down the particle in solid state at this point the substance start melting and the temperature is constant.  
 d) It is not water because the melting of water is  $100^0c$  not  $115^0c$ .  
 e) The melting point will be lower because of the impurity Nacl.  
 f) The temperature is constant.
15. (a) (i) Carbon (II) Oxide or CO – (reject Carbon monoxide)  
 (ii) Combines with haemoglobin to form caborhaemoglobin which prevents carrying of oxygen  
 (b) (i)  $CO_{(g)} + C_{(s)} \rightleftharpoons 2CO_{(g)}$   
 (ii)  $ZnO_{(s)} + CO_{(g)} \rightleftharpoons Zn_{(s)} + CO_{2(g)}$   
 (c) Orange/yellow Lead (II) Oxides turns grey  
 (d)  $CaCO_{3(s)} + 2HCl_{(aq)} \rightleftharpoons CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$   
 (e) Methanoic acid and concentrated sulphuric acid  
 (f)

16. (a) (i) - Ammonia gas ✓1  
 - Calcium carbonate. ✓1  
 - Brine ✓1 or Concentrated sodium chloride.  
 - Coke (Any three materials)
- (ii) - Carbon (IV) oxide. ✓1  
 - Ammonia gas. ✓1  
 - Water (Any two)
- (iii) Chamber 3 ✓1  
 Chamber 2 ✓1
- (iv) U – Ammonia chloride ✓1  
 V – Sodium hydrogen carbonate. ✓1
- (b) (i)  $\text{HN}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + \text{NaCl}(\text{aq}) \qquad \text{NH}_4\text{Cl}(\text{aq}) + \text{NaHCO}_3(\text{s})$   
 OR  
 $\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) \qquad \text{NH}_4\text{HCO}_3(\text{aq})$   
 $\text{NH}_4\text{HCO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \qquad \text{NH}_4\text{Cl}(\text{aq}) + \text{NaHCO}_3(\text{s})$
- (ii)  $\text{NaHCO}_3 \qquad \text{Na}_2\text{CO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
- (iii)  $\text{Ca}(\text{OH})_2(\text{s}) + 2\text{NH}_4\text{Cl}(\text{aq}) \qquad \text{CaCl}_2 + 2\text{NH}_3(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
- c) - Manufacture of glass.  
 - Softening of hard water.  
 - Manufacture of papers.  
 - Manufacture of soap.  
 - Refining of metals.
17. (a) (i) – The gas is collected over water  
 - The gas is not passed through a drying agent  
 (ii)  $\text{PbCl}_2$  is formed which is insoluble hence prevents contact between the carbonate and the acid  
 (iii)  $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \xrightarrow{\text{Heat}} 2\text{CO}(\text{g})$   
 $\text{CO}_2(\text{g}) + 2\text{NaOH}(\text{aq}) \qquad \text{Na}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- (iv) – Solid  $\text{CO}_2$  used as a refrigerant  
 ■ Used in making aerated drinks  
 ■ Solid  $\text{CO}_2$  is used in cloud-seeding  
 ■  $\text{CO}_2$  used as an ingredient/air material in solvary process
- (v) – Denser than air  
 - Does not support combustion (burning)
- (b) Reducing Property  
 (c)-  $\text{Al}_2(\text{CO}_3)_3$  hydrolyses in water/moisture forming  $\text{H}^+$  ions which reacts with the carbonate and dissolves
- (d)  $(\text{NH}_4)_2\text{CO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
18. Brown fumes of a gas are produced as the charcoal dissolves in the acid. The charcoal reduces nitric (V) acid to nitrogen (IV) oxide gas that is brown while the charcoal is oxidized to carbon (IV) oxide.

19. (a) Due to formation of calcium hydrogen carbonate which is a soluble salt



(- Award 1mk if equation is correctly balanced

- Penalize ½ mk if equation if not balanced)

20. a) A – Concentrated sulphuric acid (vi) acid √1

b)



Hence;  $\text{HCOOH}_{(l)} \rightarrow \text{CO}_{(g)} + \text{H}_2\text{O}_{(l)}$

Accept conc  $\text{H}_2\text{SO}_4$  (reject where concentrated is not mentioned)

Workability √1

Correct method of collection √1

Of the gas √1

The two equations should be mentioned 2 mks