SECTION A

1. Air is a mixture consisting mainly of two gases X and Y in the ratio 1:4 by volume respectively

   a) Name gas

      i) X .... (01 mark)

      i) Y .... (01 mark)

   b) i) State a suitable method by which the mixture of X and Y can be separated industrially. (01 mark)

      ....

      ii)Give a reason for the choice of the method you have stated in b(i) above. (01 mar

         ....

         ....

   c) Name one process during which the concentration of X in the atmosphere can be increased. (0 ½ mark)

      ....

   d) State one industrial use of Y. (0 ½ mark)

      ....

2. a) State the difference between hard water and soft water. (01 mark)

   ....
   ....

   b) Name one substance that causes

      i) temporary hardness of water. (01 mark)

         ....

      ii) permanent hardness of water. (01 mark)

         ....

   c) State one method that can be used to remove

i) temporary hardness in water   (01 mark)

....

ii) permanent hardness in water.   (01 mark)

....

3.   The number of electrons, protons and neutrons in the atoms of elements A, B, C, D and E are shown in the table below.

Atoms	Electrons	Protons	Neutrons
A	8	8	8
B	13	13	14
C	16	16	16
D	Y	11	11
W	8	Z	10

a)   Determine the values of

i)   Y...   (0 ½ mark)

ii)   Z ....   (0 ½ mark)

b) State the mass number of atom C.   (0 ½ mark)

....

....

c) Indicate which of the atoms

i)   are isotopes   (0 ½ mark)

....

ii)   belong to the same group in the periodic table.   (1 ½ marks)

....

d)   Write the electronic configuration of

i)   atom C ....(0 ½ mark)

ii) ion A^{2+} ....(0 ½ mark) iii) ion B^{3+} ....(0 ½ mark)

4.   An oxide W of formula mass 160 consists of 70.0% iron

a)   i)   Calculate the empirical formula of W.(Fe=56, O=16)   (2 ½ marks)

....

....

....

....

b)   ii)   Deduce the formula of W.   (1 ½ marks)

....

....

....

c)   Write the chemical name of W.   (01 mark)

....

....

5.   In the preparation of ammonia in the laboratory, a mixture of ammonium chloride and calcium hydroxide is heated. The gas evolved is passed into a tower packed with calcium oxide before it is collected using upward delivery method.

a)   i) Write an equation for the reaction that leads to the formation of ammonia. (1 ½

....

....

ii)   State why ammonia is passed into the tower packed with calcium oxide (½

....

iii)   Give a reason why ammonia is collected using upward delivery method.

.... (0 ½ mark)

b)   i)   Name one reagent that can be used to identify ammonia.   (01 mark)

....

ii)   State what would be observed if ammonia was treated with the reagent you have named in b(i) above.   (01 mark)

,,

,,

c)   Name the catalyst that is used in the oxidation of ammonia during the manufacture of nitric acid.   (1 ½ marks)

....

6   a)   Hydrogen chloride can be produced from potassium chloride

     i)   Name another reagent that is used with potassium chloride to produce

     hydrogen chloride. ....   (0 ½ mark)

     ii)   Write an equation for the reaction leading to the formation of

hydrogen chloride.   (1 ½ marks)

     ....

     b)   Write an equation for the reaction between hydrogen chloride and

i)   Silver nitrate solution.   (1 ½ marks)

....

....

ii)   iron in the presence of water.   (1 ½ marks)

....

....

7.   Ethene is classified as an alkene and can be prepared in the laboratory by dehydration of ethanol

     a)   i)   State what is meant by the term alkene.   (01 mark)

     ....

     ....

     b)   ii)   Write the structural formula of ethene.   (01 mark)

     ....

     ....

 iii) Name the reagent which is used as a dehydrating agent in the preparation of ethene.
     ....(01 mark)

     c)   Bromine was added to ethene. Write equation for the reaction that took place.

     ....(01 mark)

     d)   Under high temperature and pressure, ethene molecules can react with one another to form a big molecule Z.

     i)   Name Z ....   (0 ½ mark)

     ii)   ii) State one use of Z..   (0 ½ mark)

8. In the extraction of sodium from sodium chloride, calcium chloride is added to sodium chloride and the mixture is melted. The molten mixture is then electrolyzed using graphite electrodes.

a) State the purpose of adding calcium chloride. (0 ½ mark)

....

b) Write the equation for the reaction that takes place at the

   i) Anode...(1 ½ marks)

   ii) cathode... (1 ½ marks)

c) Bromine vapour was passed over heated sodium. Write an equation for the reaction that took place. (1 ½ marks)

....

9 a) Hydrogen peroxide decomposes quite easily at room temperature.

   i) Write the equation for the decomposition of hydrogen peroxide. (01 mark)

   ....

   ....

   ii) State two ways by which the decomposition can be made faster. (02marks)

   ....

b) Using the space below, on the same axes sketch graphs of concentration of hydrogen peroxide versus time for the decomposition of the peroxide at

   i) room temperature (01 mark)

   ii) one of the conditions you have stated in a(ii) (01 mark)

   ....

   ....

   ....

   ....

10. a) State the conditions under which sulphuric acid can react with

   i) sucrose $C_{12}H_{22}O_{11}$ .... (0 ½ mark)

   ii) zinc oxide .... (0 ½ mark)

   c) Write equation for the reaction of sulphuric acid with
   i) sucrose   (1 ½ marks)

   ....

   ....

   ii) zinc oxide

   ....

   .... (1 ½ marks)

   d) State the property of sulphuric acid which is shown by its reaction with

   i) sucrose   .... (0 ½ mark)

   ii) zinc oxide..(0 ½ mark)

SECTION B (30 MARKS)

Answer two questions from this section

11. a) Describe how a pure sample of carbon dioxide can be prepared in the laboratory

   from calcium carbonate and write the equation for the reaction that takes place.

   (Diagram is not required)   (07 marks)

   b) Explain with the aid of equations the changes that take place when excess carbon

   dioxide is bubbled into sodium hydroxide solution.   (5 ½ marks)

   c) Potassium hydrogen carbonate decomposes when heated according to the

   following equation: $2KHCO_{3(s)}$ $K_2CO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$

   Calculate the mass of carbon dioxide evolved when 8g of potassium hydrogen

   carbonate is heated strongly (H = 1, C = 12, O = 16, K = 39)   (2 ½ marks)

12. a) One of the ores from which iron is extracted is spathic iron ore

   i) Write the formula of the iron compound that is the ore.   (01 mark)

   ii) Describe how impure iron is extracted from spathic iron ore. (Your answer

should include equation)   (07 marks)

   b) Write equation(s) where possible and state the condition(s) for the reaction of iron

   with

i)   Water   (04 marks)   ii) chlorine   (2 ½ marks)

c)   State one use of iron.   (0 ½ mark)

13.   a)   The elements copper, zinc and sulphur react with oxygen to form their oxides. Write the formula of the oxide of each of the elements and state the type of oxide

whose formula you have written.   (03 marks)

b)   Hydrogen gas was passed separately over the heated oxides of copper and zinc.

i)   State what was observed in each case and explain   (04 marks)

ii)   ii)   Write equation for any reaction that took place.   (1 ½ marks)

c)   Excess dilute sodium hydroxide solution was added to a mixture of the oxides of zinc and copper. State what was observed and give a reason for your observation.

(2 ½ marks)

d) A mixture of oxides of zinc and copper was added to excess dilute sulphuric acid and warmed. State what was observed and write equation(s) for the reaction(s) that took place. (04 marks)

14. a) i) Write the equation for the complete combustion of ethanol. (01 mark)

ii) Outline an experiment that can be carried out in the laboratory to determine the enthalpy of combustion of ethanol. (6 ½ marks) (A diagram is not required, but your answer should include how the enthalpy of combustion of ethanol can be calculated from the experiment results)

b) When 0.15g of compound W, molecular mass 60g was burnt, it caused the temperature of 150cm^3 of water to rise by 80^{0}C. Calculate the enthalpy of combustion of W. (Density of water = 1.0gcm^{-3}, specific heat capacity

of water = 4.2Jg^{-1}K^{-1})