SECTION A (50 MARKS)

Answer **all** *questions in this section.*

1. (a) (i) Name the **three** fundamental particles of an atom. *(1½ marks)*

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(ii) Draw a labelled diagram to show the location of the particles you have named in (a)(i) in a typical atom. *(2½ marks)*

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(b) The atomic numbers of elements **Y** and **Z** are 15 and 17 respectively. Write the;

(i) electronic configuration of **Y** and **Z**. *(01 mark)*

.....

.....

(ii) formula of **one** possible compound that can be formed when **Y** reacts with **Z**. *(01 mark)*

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2. (a) Name;

(i) the alloy of magnesium, which is used for making parts of an aircraft. *(01 mark)*

.....

.....

(ii) **one** other element with which magnesium is combined to make the alloy you have named in (a) (i). *(½ mark)*

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(b) State **one** property of magnesium, which is the reason for its use in the alloy you have named in (a)(i). (½ *mark*)

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(c) (i) State **one** use of steel. (½ *mark*)

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(ii) Give **two** reasons why steel is used more widely than pure iron. (*01mark*)

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(d) State;

(i) the constituents of brass. (*01 mark*)

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(ii) **one** use of brass. (½ *mark*)

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3. Weighed samples of copper(II) nitrate, sodium carbonate and magnesium ribbon were separately heated until there was no further change. On cooling, each sample was reweighed.

(a) State which of the substances showed;

(i) increase in mass. (½ *mark*)

.....

(ii) decrease in mass. (½ *mark*)

.....

(iii) no change in mass. (½ *mark*)

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(b) Lead(II) carbonate when heated, decomposes according to the following equation.

$$PbCO_{3(s)} \longrightarrow PbO_{(s)} + CO_{2(g)}$$

Calculate the change in mass that would occur when 3.3 g of lead(II) carbonate was heated. (03 *marks*)

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4. Copper(II) sulphate was electrolysed using weighed copper electrodes. After the electrolysis, the electrodes were dried and reweighed.

(a) State how the mass of each of the following electrodes would change;

(i) anode. (½ *mark*)

.....

(ii) cathode. (½ *mark*)

.....

(b) Give reasons for your answers in (a)(i) and (ii). (*01 mark*)

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(c) Write an equation to show the reaction that took place at the; (01 mark)

(i) anode.

.....

(ii) cathode. (01 mark)

.....

(d) State **one** practical application of the electrolysis. (01 mark)

.....

5. (a) Ethanol burns completely in air according to the following equation.

$C_2H_5OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2\,(g)} + 3H_2O_{(l)} + Heat$

(i) From the equation, state why ethanol is used as a fuel. (01 mark)

.....

(ii) State **one** other use of ethanol. (01 mark)

.....

(b) When 0.6 g of a hydrocarbon **X** was burnt in excess air, the heat evolved raised the temperature of 200 g of water from 25.5 ^{o}C to 60.9 ^{o}C. Calculate the heat of combustion of **X**. (The specific heat capacity of water = 4.2Jg^{-1} ^{o}C $^{-1}$; The formula mass of **X** = 58) (03 marks)

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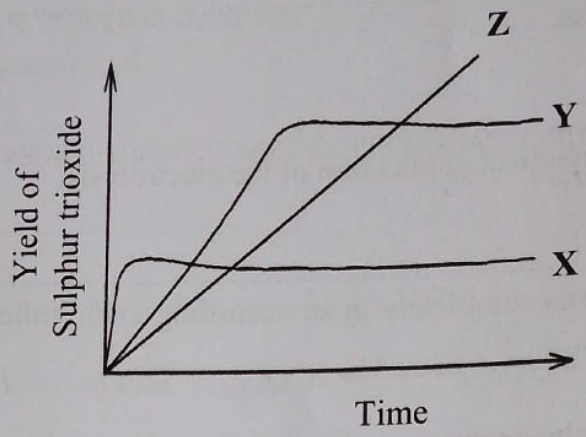
6. (a) The reaction between sulphur dioxide and oxygen to produce sulphur trioxide is exothermic. The curves in the diagram below show the effects of different temperatures on the yield of sulphur trioxide.



Identify the curve which represents the reaction at;

(i) 500 °C..... (*01 mark*)

(ii) 180 °C..... (*01 mark*)

(iii) 750 °C..... (*01 mark*)

(b) State;

(i) **two** factors, other than temperature, which favour the yield of sulphur trioxide in the contact process during the manufacture of sulphuric acid. (*01 mark*)

.....

(ii) **one** commercial use of sulphuric acid. (*01 mark*)

.....

7. (a) The anhydrous form of a compound **Q**, of molecular formula $C_wH_xO_y.nH_2O$ consisted of carbon 26.7%, hydrogen 2.2% and oxygen 71.1%. When gently heated, 3.15 g of **Q** gave 2.25 g of its anhydrous form.

(i) Calculate the empirical formula of anhydrous form of **Q**.
(*02 marks*)

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(ii) Determine the molecular formula of anhydrous form of **Q**. (*01 mark*)
($C_wH_xO_y = 90$)

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(iii) Calculate the number of moles of water of crystallisation, ***n***, in a hydrated form of **Q**. (*02 marks*)

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8. (a) State what is observed when zinc carbonate is strongly heated and then allowed to cool. (*1½ marks*)

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(b) When dilute ammonia solution was added to zinc sulphate solution, a white precipitate which dissolved in excess ammonia was formed. Write;

(i) an equation leading to the formation of the white precipitate. (*1½ marks*)

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.....

(ii) the formula of the substance formed when ammonia was added in excess. (*01 mark*)

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(c) State what is observed if sodium hydrogencarbonate solution is added to zinc sulphate solution. *(01 mark)*

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9. Polymers can be classified as synthetic or natural.

(a) State what is meant by the term **polymer**. *(01 mark)*

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.....

(b) Give **one** example of a;

(i) synthetic polymer. *(½ mark)*

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.....

(ii) natural polymer. *(½ mark)*

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(c) The structure of a certain polymer is shown below.

$$-(CH_2 - CH_2)_n-$$

Write the;

(i) name of the polymer. *(½ mark)*

.....

(ii) structural formula of the monomer. *(01 mark)*

.....

(d) State **one** disadvantage of the polymer you have named in (c)(i). *(01 mark)*

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10. (a) Nitric acid can be prepared by reacting potassium nitrate with concentrated sulphuric acid. Write an equation for the reaction leading to the formation of nitric acid. *(1½ marks)*

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(b) State what would be observed if nitric acid was heated. *(½ mark)*

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(c) (i) Name the reagent(s) which can be used to distinguish between dilute solutions of nitric and hydrochloric acids. *(01 mark)*

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(ii) State what would be observed if the acids were treated separately with the reagent(s) you have named in (c) (i). *(01 mark)*

.....

(d) State **one** industrial use of nitric acid. *(01 mark)*

.....

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SECTION B (30 MARKS)

Answer any **two** *questions from this section.*

Additional question(s) answered will ***not*** *be marked.*

11. (a) In the extraction of iron using the blast furnace, iron is formed by the reaction between iron(III) oxide and carbon monoxide. Write an equation for the reaction leading to the formation of iron. *(1½ marks)*

(b) Hydrogen can be prepared in the laboratory using iron.

(i) State the condition under which hydrogen can be prepared in the laboratory from iron. *(01 mark)*

(ii) Write an equation for the reaction leading to the formation of hydrogen. *(1½ marks)*

(c) The reaction between iron and water to form iron(II, III) oxide is reversible.

(i) State what is meant by the term **reversible reaction**. *(01 mark)*

(ii) Write an equation for the reaction leading to the formation of iron(II, III) oxide and state the condition(s) for the reaction. *(2½ marks)*

(iii) State the condition(s) for the reverse of the reaction in (c) (ii). *(01 mark)*

(d) Iron reacts with water and another substance, **Y**, to form rust. Write the;

(i) chemical name of rust. *(01 mark)*

(ii) name of the substance **Y**. *(½ mark)*

(e) (i) Describe an experiment to show that rusting does not occur in the absence of the substance you named in (d)(ii). *(04 marks)*
(Diagrams not required)

(ii) State **one** method of preventing rusting. *(01 mark)*

12. (a) (i) Write an equation to show how hydrogen chloride can be prepared from sodium chloride. *(1½ marks)*

(ii) Explain how aqueous hydrogen chloride can be prepared in the laboratory. *(4½ marks)*
(No diagram or equation is required)

(b) State what is observed , and in each case write an equation for the reaction that takes place when aqueous hydrogen chloride is added to;

(i) copper(II) oxide and the mixture is warmed. *(2½ marks)*

(ii) lead(II) nitrate solution and the mixture is warmed. *(03 marks)*

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(c) Aqueous hydrogen chloride gives effervescence with magnesium carbonate whereas a solution of hydrogen chloride in methylbenzene does not.

(i) Give a reason for the above observation. *(01 mark)*

(ii) Write an ionic equation for the reaction of aqueous hydrogen chloride with magnesium carbonate. *(1½ marks)*

(d) State **one** use of aqueous hydrogen chloride. *(01 mark)*

13. (a) Sodium sulphate can be prepared by the reaction of dilute solutions of sodium hydroxide and sulphuric acid.

(i) Write an equation for the reaction leading to the formation of sodium sulphate. *(1½ marks)*

(ii) Describe how a dry sample of sodium sulphate can be prepared using the reagents stated. *(6½ marks)*

(b) Explain how sodium sulphate and sodium sulphite solutions can be differentiated using barium nitrate solution. *(06 marks)*
(*Your explanation should include equations*)

(c) Name **one** reagent that can react with sodium sulphate to form lead(II) sulphate. *(01 mark)*

14. (a) Draw a labelled diagram of the setup of the apparatus that can be used to prepare a dry sample of ammonia from ammonium chloride. *(2½ marks)*

(b) State what would be observed and write an equation for the reaction that would take place if;

(i) concentrated hydrochloric acid was passed near an open jar containing ammonia. *(2½ marks)*

(ii) dry ammonia was passed over heated lead(II) oxide. *(03 marks)*

(c) Write an equation for the reaction that takes place when ammonia is burnt is oxygen. *(1½ marks)*

(d) Ammonia is oxidised by oxygen in the presence of a catalyst according to the following equation;

$$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(l)}$$

(i) Name the catalyst used. *(½ mark)*

(ii) Describe how the product of the oxidation can be used to manufacture nitric acid. (*Equations are required*) *(05 marks)*

END

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