   In the case of each of the following reactions, name the substance oxidised, the substance reduced and the reducing agent:
   (i) \( S + O_2 = SO_2 \)
   (ii) \( 2FeCl_3 + Cu = 2FeCl_2 + CuCl_2 \)
   (iii) \( Cu^{2+} + Fe = Fe^{2+} + Cu \)
   Excluding substances already mentioned in this question, name two reducing agents. Illustrate, by means of equations, the use of each of the agents you name. (66 marks)

4. (a) Describe how you would prepare a normal solution of sodium carbonate.
    25 c.c. of 1 N sodium carbonate were neutralised by 20 c.c. of a given solution of hydrochloric acid. Express the concentration of the hydrochloric acid solution in terms of (i) normality, (ii) grams of hydrochloric acid per litre.
    (b) A given solution contains 8.32 gm. of barium chloride per litre. What weight of barium sulphate would be precipitated if 50 c.c. of the solution were treated with excess sulphuric acid? (66 marks)

5. Describe how you would prepare and collect dry ammonia and give an account of its properties.
   Write the name and formula for each of any three ammonium salts and describe how you would prepare one of them. (66 marks)

6. Write the structural formula for each of the following compounds: (i) methane, (ii) acetaldehyde, (iii) nitrobenzene. Give an account of the principal properties of each of these compounds and describe how one of them may be prepared. (66 marks)

7. A compound of vapour density 14 has the following gravimetric composition: carbon 83.72%, hydrogen 16.28%. Name the compound, describe its principal properties, write its structural formula and discuss its structure. (67 marks)

8. What is osmotic pressure? Describe, with the aid of a sketch of the apparatus, how the osmotic pressure of a solution may be measured.
   Two solutions have the same osmotic pressure. One contains 1.08 gm. of glucose (\( C_6H_{12}O_6 \)) per litre; the other contains 0.56 gm. per litre of a given compound. Find the molecular weight of the given compound.
   What is the effect of temperature on the osmotic pressure of a solution? (66 marks)

OR

8. Use chemical equations to illustrate (a) the action of heat on (i) potassium chlorate, (ii) a mixture of ammonium chloride and sodium nitride, (iii) a crystalline ferrous sulphate; (b) the action of water on (i) sodium, (ii) quicklime. In each case describe what may be observed during the reaction and name the products formed. (67 marks)

9. State what you understand by (i) a calorie, (ii) an endothermic reaction, (iii) heat of reaction.
   Find the heat of formation of ethane from the following data and explain your method:
   \( 2CaH_2 + 7O_2 = 4CO_2 + 6H_2O + 736 \text{ k.cal.} \)
   \( C + O_2 = CO_2 + 44 \text{ k.cal.} \)
   \( 2H_2 + O_2 = 2H_2O + 137 \text{ k.cal.} \) (67 marks)

10. Describe the principal properties of each of any four of the following substances: (i) white phosphorus, (ii) red phosphorus, (iii) phosphine, (iv) phosphorus pentoxide, (v) orthophosphoric acid, (vi) metaphosphoric acid, (vii) pyrophosphoric acid. Describe how you would prepare any two compounds of phosphorus. (67 marks)