

AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1988

CHEMISTRY—ORDINARY LEVEL

14124

WEDNESDAY, 22 JUNE—MORNING 9.30 to 12.30

Question 1 and five other questions must be answered. These five questions *must* include question 2 or question 3 but may include *both* question 2 and question 3.

All questions carry the same number of marks.

Relative atomic masses: H = 1, N = 14, O = 16, Na = 23, S = 32.
Molar volume at S.T.P. = 22.4 dm³

1. Answer *eleven* of the following items (a), (b), (c), etc. All items carry the same marks. *Keep your answers short.*

- (a) What is meant by the mass number of an element?
- (b) Name two allotropes of carbon.
- (c) What is the percentage composition (w/v) of a solution containing 45 g of copper sulphate in 150 cm³ of solution?
- (d) What is meant by ionisation energy?
- (e) Give *two* general properties of ionic substances.
- (f) What are isotopes?
- (g) What is meant by catalytic cracking?
- (h) Draw the structure of methylbenzene.
- (i) Give an example of (i) a molecule which has a linear shape, (ii) a molecule which has a tetrahedral shape.
- (j) Explain, in terms of electronic structure, why the elements sodium and potassium have similar chemical properties.
- (k) Give one use of the polymer poly(chloroethene) (polyvinyl chloride).
- (l) State Avogadro's law.
- (m) What is the pH of a 0.2 M HNO₃ solution?
- (n) State Le Chatelier's Principle.
- (o) What is meant by flocculation in the treatment of water?

(11 × 6)

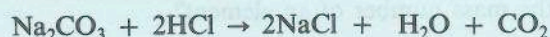
2. (a) In a student's account of a test for carbonate ions in a solution the following conclusion was made. "The solution in the test tube contained carbonate ions and not hydrogencarbonate (bicarbonate) ions". Describe the test used and give the equation for the reaction. (18)
- (b) The following statements appeared in the account of an experiment to prepare ethyne (acetylene). "Dilute acidified potassium manganate (VII) (permanganate) solution was used to show that the gas was ethyne (acetylene). The gas was also passed through a dilute solution of bromine in 1,1,1-trichloroethane." Describe how the tests were carried out in the laboratory stating what was observed in each case. (24)
- (c) The following statement concluded a student's account of an experiment. "The total suspended solids in a litre (dm³) of water was determined to be 150 p.p.m." What is meant by suspended solids? Describe (i) the apparatus used, (ii) the procedures followed which led to the above conclusion. (24)

3. What is meant by a standard solution? Why is anhydrous sodium carbonate used as a primary standard in volumetric analysis? (15)

25.0 cm³ of a 0.1 M sodium carbonate solution was titrated with a solution of hydrochloric acid. The following is a table of the readings obtained.

Titration	1	2	3
Initial reading/cm ³	0.0	0.8	2.2
Final reading/cm ³	41.4	40.8	42.2

- (i) List the apparatus used in the experiment. (9)
- (ii) Name a suitable indicator for the titration. (6)
- (iii) How would you ensure (a) that the level of the hydrochloric acid solution was read correctly, (b) that the endpoint of the titration was determined accurately? (18)
- (iv) The equation for the above titration reaction is:



Use the readings in the given table to find the molarity of the hydrochloric acid solution. (18)

4. Give an example in each case of (i) a period, (ii) a group, of the periodic table. (12)

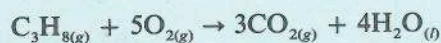
In what way are atoms of elements in (i) a period, (ii) a group, of the periodic table similar in terms of electron arrangement? (18)

State what is meant by an atomic orbital. Sketch the shape of (i) an s-orbital, (ii) a p-orbital. (12)

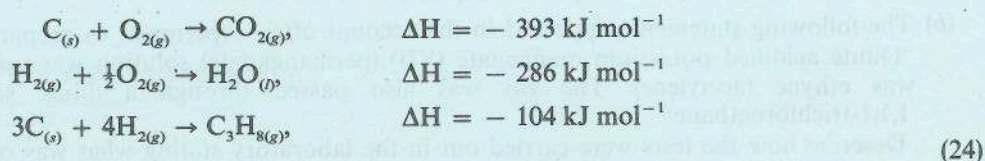
Certain elements give characteristic colours to the flame of a Bunsen burner. How may this be accounted for in terms of the arrangement of electrons in atoms of these elements? (24)

5. How does an endothermic reaction differ from an exothermic reaction? What is meant by heat of combustion? (15)

Propane combines with oxygen according to the equation:



Calculate the heat of combustion of propane given the following information.

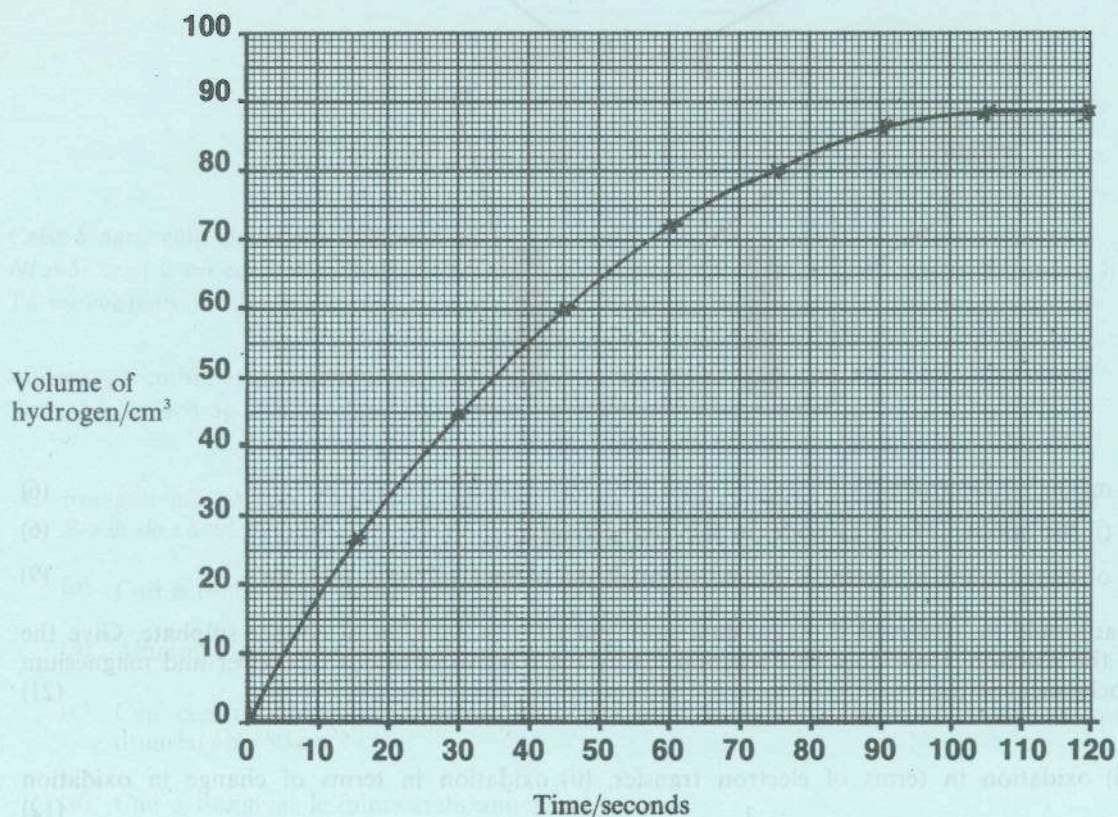


Propane is commonly used as a fuel. What is the importance of the kilogram calorific value of a fuel? (9)

Outline a laboratory experiment to measure the heat of combustion of a substance. (18)

6. What is meant by the rate of a chemical reaction? State *three* factors which may affect the rate of a chemical reaction. (21)

Dilute hydrochloric acid was added to magnesium and the volume of hydrogen produced was noted every 15 seconds over a period of 2 minutes. The graph shown below was obtained.



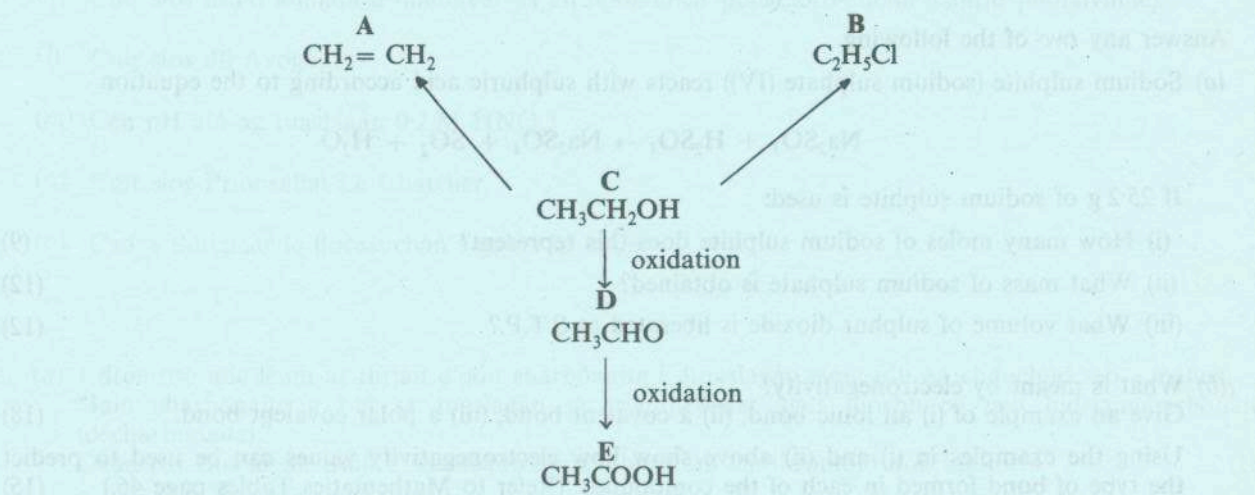
Draw a diagram of the apparatus suitable for this experiment. (12)

From the graph answer the following.

- In what way does the rate of formation of hydrogen change as the reaction proceeds? (9)
- What is the volume of hydrogen liberated after 40 seconds? (9)
- After what period of time was the reaction complete? (9)

State one way in which the rate of the reaction might be increased. (6)

7. Study the reaction scheme below and then answer the following questions.

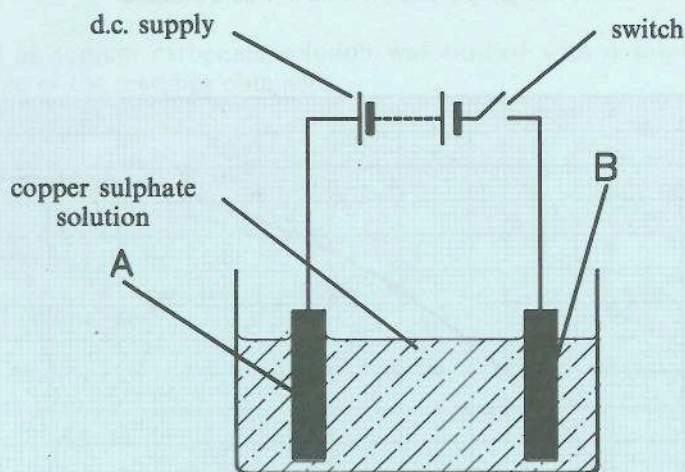


- Name the compounds A, B, C in the above reaction scheme. (9)
- Give the structural formula for compound D and for compound E. (12)
- Write a balanced equation for the conversion of compound C to compound B. (9)
- State what is observed when compound D reacts (i) with a solution of ammoniacal silver nitrate, (ii) with Fehling's reagent. (12)
- Write the equation for the reaction of compound E with sodium hydroxide. (9)
- Outline, with the aid of a diagram, the experimental procedure by which compound C may be converted to compound A. (15)

P.T.O.

8. Outline the main stages in the extraction of copper. (24)

The diagram shows apparatus used for the purification of copper by electrolysis, using copper electrodes.



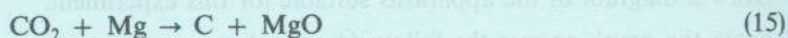
- (i) What is meant by electrolysis? (6)
 (ii) Indicate (i) the anode, (ii) the cathode, in the above diagram. (6)
 (iii) What is observed when a current is passed through the copper sulphate solution? (9)

Describe what would be observed if magnesium were placed in a solution of copper sulphate. Give the equation for the reaction. How does this reaction justify the relative positions of copper and magnesium in the electrochemical series? (21)

9. (a) Define (i) oxidation in terms of electron transfer, (ii) oxidation in terms of change in oxidation number. (12)

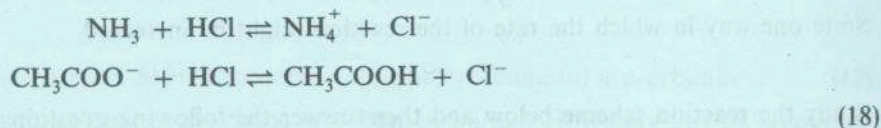
What is the oxidation number of phosphorus in (i) PCl_3 , (ii) H_3PO_4 , (iii) PH_3 ? (9)

Balance the following equation and state which species is being oxidised and which is being reduced.



- (b) What is (i) an acid, (ii) a base, (iii) a conjugate acid-base pair, in terms of the Bronsted-Lowry theory? (12)

Indicate the acids, the bases and the conjugate acid-base pairs in the following.



10. Answer any two of the following.

- (a) Sodium sulphite (sodium sulphate (IV)) reacts with sulphuric acid according to the equation.



If 25.2 g of sodium sulphite is used:

- (i) How many moles of sodium sulphite does this represent? (9)
 (ii) What mass of sodium sulphate is obtained? (12)
 (iii) What volume of sulphur dioxide is liberated at S.T.P.? (12)
- (b) What is meant by electronegativity? (18)
 Give an example of (i) an ionic bond, (ii) a covalent bond, (iii) a polar covalent bond. (18)
 Using the examples in (i) and (ii) above show how electronegativity values can be used to predict the type of bond formed in each of the compounds. (Refer to Mathematics Tables page 46.) (15)
- (c) In the case of each of the following oxides state whether it is acidic, basic or neutral. (18)



Give the equation for the reaction (if any) of each of the oxides with water. (24)

Aluminium oxide (Al_2O_3) is said to be an amphoteric oxide. Explain the meaning of the underlined term. (9)

- (d) What is meant by the natural fixation of nitrogen? State two ways in which this process occurs. (21)

The fertiliser ammonium sulphate may be used in order to increase the amount of nitrogen in the soil. Calculate the percentage of nitrogen in ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$. Name one other commonly used fertiliser. (12)