

## LEAVING CERTIFICATE EXAMINATION, 1975

## CHEMISTRY—ORDINARY LEVEL

WEDNESDAY, 18 JUNE—AFTERNOON, 2 to 4.45

Six questions to be answered

All questions carry the same marks.

Atomic Weights: H = 1, C = 12, O = 16, Na = 23, Cl = 35.5.

Molar volume at S.T.P. = 22.4 litres.

Avogadro Constant (N) =  $6 \times 10^{23}$ .

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

- (a) What is a Brønsted-Lowry acid?  
 (b) In terms of the Brønsted-Lowry theory indicate the acids in the following equation:  

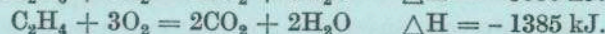
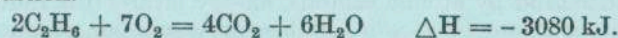
$$\text{HCl} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{Cl}^-$$
  
 (c) What do you understand by the Avogadro Constant (number) ( $6 \times 10^{23}$ )?  
 (d) What volume would 4.4 g of carbon dioxide occupy at S.T.P.?  
 (e) What do you understand by a strong acid?  
 (f) State Hess's Law.  
 (g) Which of the following ions have the same electronic structure as an inert gas:  $\text{Fe}^{++}$ ,  $\text{Na}^+$ ,  $\text{Cl}^-$ ?  
 (h) What is a polymer? Give an example.  
 (i) Write two possible structural formulae for butane.  
 (j) Name a common organic solvent.  
 (k) Give an example of a radioactive isotope and state one of its uses.  
 (l) Indicate the structure of the carbonyl group.  
 (m) Give a chemical test for the carbonate ion.  
 (n) Name any gas and mention briefly how it may be identified in the laboratory.  
 (o) Write an equation to show the formation of a salt of your choice.

2. Answer the following items with regard to the periodic table of the elements.

- (a) Explain what you understand by (i) a period (ii) a group.  
 (b) State how does atomic radius vary (i) within a period (ii) within a group.  
 (c) Give *one* reason for the general trends in first ionization energies of the elements (i) within a period (ii) within a group.  
 (d) Choose a group and mention any *two* chemical properties of its elements which demonstrate the similarity between them.  
 (e) Write down the name and the electronic configuration (s, p etc.) of any two elements in the group you have chosen.  
 Refer to Mathematics Tables, p. 44 and 45.

3. (a) Define heat of neutralisation. Why is its value more or less the same regardless of what strong acid or strong base is used?

- (b) Define heat of combustion.



- (i) Are these two combustion reactions exothermic or endothermic?  
 (ii) Calculate the heat change on complete combustion of 10 moles of ethane.  
 (iii) Calculate the volume of oxygen required for the complete combustion of 2,000 cm<sup>3</sup> of ethylene, all volumes being measured at S.T.P.

4. Tabulate (i) *three* characteristic properties of covalent compounds, (ii) *three* characteristic properties of ionic substances.

From the following elements

H, C, N, O, Na, Mg, S, Cl

choose

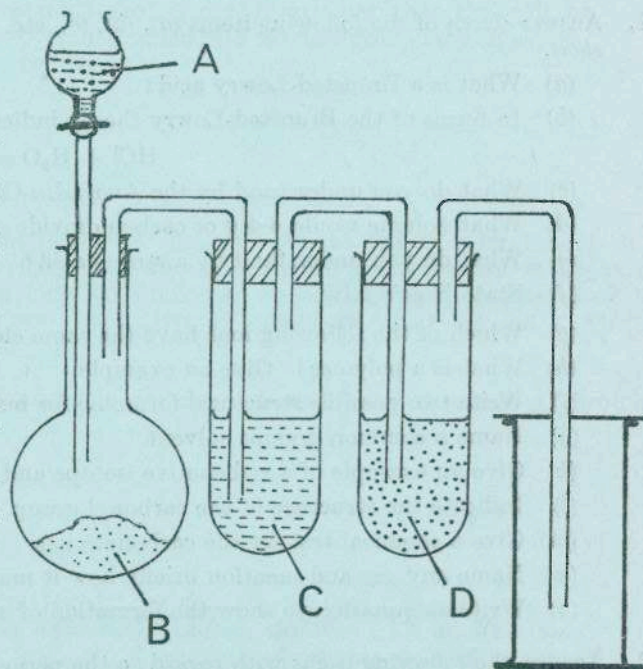
- (a) any two elements (except H) and give the formula of a chloride of each of them indicating whether the bonding is ionic or covalent in each case;  
 (b) any two elements and give the name and formula of a covalent compound of each with hydrogen; indicate also the shapes of the compounds you have chosen;  
 (c) any two elements and write equations to show how an oxide of each reacts with water;  
 (d) any two elements each of which can exist in two different physical forms.

[P.T.O.]

5. A solution of sodium hydroxide containing 1.5 g in 250 cm<sup>3</sup> of solution was titrated with a solution of 0.1 M (0.1 N) hydrochloric acid.
- Write down the molarity (normality) of the sodium hydroxide solution.
  - What volume of acid would be needed to react with 20 cm<sup>3</sup> of the alkali solution?
  - What is the pH of the sodium hydroxide solution and the hydrochloric acid solution?
  - Name a suitable indicator for the titration.
  - Outline, briefly, how you would carry out this titration.
6. The aliphatic hydrocarbons consist of three different homologous series.
- Explain the underlined terms.
  - Give the name and general formula of each series.
  - Name a compound from each series and write its structural formula.
  - Classify each series as consisting of saturated or unsaturated compounds.
  - Describe a chemical test by which you could distinguish between a saturated and an unsaturated compound.
  - Choose a compound from (c) above and show how it may be prepared.

7. The sketch shows an apparatus for the preparation of chlorine.

- Give the names of the liquid *A*, the solid *B* and the liquids *C* and *D*.
- Is it necessary to heat the flask containing *B* during the preparation?
- Explain the function of the liquids *C* and *D*.
- Show how the chlorine *A* reacts with (i) sodium, (ii) hydrogen.
- Explain in terms of electron transfer how the reaction of chlorine with sodium may be classified as an oxidation/reduction reaction.
- What volume would 3.55 g chlorine occupy at S.T.P. and how many molecules would be present?



8. How would you carry out *three* of the following conversions?

- An alcohol to an ester.
- An alcohol to an aldehyde.
- An alcohol to an unsaturated hydrocarbon.
- An aldehyde to a carboxylic acid.
- A carboxylic acid to a salt.

Use an equation to illustrate each of the three conversions chosen.

A hydrocarbon of molecular weight 78 consists of 92.3% carbon and 7.7% hydrogen.

- Name the hydrocarbon.
- Write its structural formula.
- Outline its principal properties.

9. (a) (i) What do you understand by atomic orbitals, energy levels? (ii) Indicate the shape of *s* orbitals, *p*-orbitals. (iii) What is meant by atomic number, mass number, atomic weight?
- (b) What are isotopes? Illustrate your answer by referring to the isotopes of (i) hydrogen, (ii) chlorine. Show the atomic structure of the isotopes of these two elements.
10. (a) Tabulate the reactions of (i) water, (ii) oxygen, (iii) dilute hydrochloric acid, with each of the following metals: sodium, copper, iron. From the results of these reactions, arrange these metals in order of chemical activity. State what happens when a piece of iron is placed in a solution of copper sulphate. Why does this happen?
- (b) Use a diagram to show the electrolysis of a simple melt. Name the substance being electrolysed and indicate where the products are formed. At which electrode does oxidation take place?

11. Answer *two* of the following:

- What do you understand by (i) a linear molecule, (ii) a planar molecule, (iii) a tetrahedral molecule. Give an example of each type of molecule and explain its shape in terms of the electron pair repulsion theory.
- "*A*" is a white solid which sublimes. It contains nitrogen. A solution of "*A*" forms a dense white precipitate "*B*" when silver nitrate solution is added. When "*A*" is heated with concentrated sulphuric acid, it gives off a pungent-smelling gas "*C*" which readily dissolves in water to give an acid solution. When "*A*" is heated with calcium hydroxide another pungent-smelling gas "*D*" is evolved which is readily soluble in water to give an alkaline solution.  
Name the substances *A*, *B*, *C* and *D* and write equations for the reactions mentioned.
- Explain briefly how an indicator works. Give an example and mention when and why you would use it