

## LEAVING CERTIFICATE EXAMINATION, 1982

## CHEMISTRY—ORDINARY LEVEL

WEDNESDAY, 23 JUNE—AFTERNOON 2.00 to 5

Six questions to be answered  
All questions carry the same marks

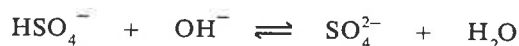
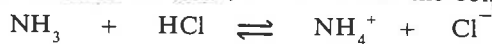
Relative atomic masses (atomic weights): H = 1, N = 14, O = 16, Mg = 24, Cl = 35.5, K = 39.  
Avogadro's constant (number) =  $6 \times 10^{23} \text{ mol}^{-1}$   
Faraday's constant = 96,500 coulombs  $\text{mol}^{-1}$   
Molar Volume at S.T.P. = 22.4 litres ( $\text{dm}^3$ )

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

(a) Complete the following equation:



- (b) Give a chemical test for the carbonate ion.
- (c) State (i) the number of electrons, (ii) the number of neutrons present, in  $^{59}_{27}\text{Co}$ .
- (d) How many molecules are there in 8 g of oxygen?
- (e) Write down the electronic configuration (s,p) of calcium (atomic number = 20).
- (f) State Pauli's exclusion principle.
- (g) Define the heat of neutralisation of an acid.
- (h) Select (i) an ionic crystal, (ii) a molecular crystal from the following list:  
potassium sulphate, copper, iodine and iron
- (i) Write the structural formula for phenol.
- (j) What is meant by the ground state of an atom?
- (k) Name two homologues of methane and give the formula of each.
- (l) State the general gas equation.
- (m) What is the functional group in ketones?
- (n) Explain what is meant by the term dipole moment.
- (o) What chemicals may be used to prepare a sample of hydrogen chloride?
2. (a) What is meant by (i) mass number, (ii) relative atomic mass (atomic weight), (iii) the mole?
- (b) Define the terms *isotope* and *allotrope*. Use carbon as an example in support of your answer.
- (c) What is meant by ionisation energy?  
Account for the general decrease in ionisation energy values down a group of the Periodic Table.  
(Refer to Mathematics Tables p.45)
3. Show, by means of diagrams, the electronic arrangement in each of the following elements: carbon, sodium, phosphorus.  
Each of these elements combines with chlorine. Give the electronic arrangement in each of the three compounds formed (one chloride only for phosphorus).  
With the aid of electronegativity values suggest the type of bonding present in the compounds.  
(Refer to Mathematics Tables p.46)  
State two general properties of ionic substances and two of covalent substances.
4. Why do metals in the solid state readily conduct electricity but a salt (such as sodium chloride) conducts only in the molten state or in solution?  
State Faraday's laws of electrolysis.  
Using inert electrodes, a current of 10 amperes is passed through molten magnesium chloride ( $\text{MgCl}_2$ ) for 965 seconds. Calculate (i) the mass of magnesium, (ii) the volume of chlorine (at S.T.P.) produced.
5. On the basis of the Brønsted-Lowry theory, define (i) an acid, (ii) a base, (iii) a conjugate acid, (iv) a conjugate base.  
In each of the equations below, indicate the acids, the bases and the conjugate acid-base pairs.



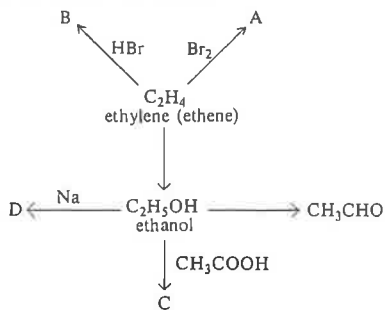
Distinguish between (a) a strong acid and a weak acid, (b) a concentrated acid and a dilute acid.

6. Potassium hydroxide reacts with sulphuric acid according to the equation:



In a titration it was found that 20.0 cm<sup>3</sup> of a solution of potassium hydroxide, of concentration 2.8 g per litre (dm<sup>3</sup>), neutralised a certain volume of 0.02 M sulphuric acid solution.

- What was the concentration of potassium hydroxide solution in moles per litre (dm<sup>3</sup>)?
  - How many moles of potassium hydroxide were present in 20.0 cm<sup>3</sup> of the above solution?
  - What volume of the acid solution was required for the neutralisation?
  - Outline how you would carry out the titration, naming a suitable indicator.
  - How would you confirm the presence of sulphate ions in an aqueous solution?
7. Study the reaction scheme below and answer the questions which follow.

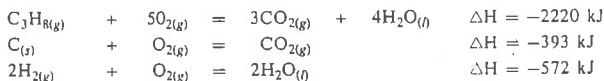


- Write the structural formula for ethylene (ethene).
  - Name the compounds A, B, C, D.
  - Give the chemical formula of each of the compounds A, B, C, D.
  - Name the compound CH<sub>3</sub>CHO and write its structural formula.
  - Give two of the principal chemical properties of the compound CH<sub>3</sub>CHO and state under what conditions it may be prepared from ethanol in the laboratory.
8. Benzene and acetylene (ethyne) are *hydrocarbons* with the same *empirical formulae* but different *molecular formulae*. Explain the terms in italics. Benzene undergoes mainly *substitution reactions* while acetylene (ethyne) undergoes mainly *addition reactions*. Give two examples in each case of such reactions. Use equations to illustrate your answer.
- What is meant by *polymerisation*? Name two polymers and state one use for each.
9. How are (i) oxides classified, (ii) hydrides classified?  
From the following list, classify appropriately each of any *four* of the compounds:  
K<sub>2</sub>O, Al<sub>2</sub>O<sub>3</sub>, NO, NaH, H<sub>2</sub>S
- With regard to each of the four compounds selected, describe (i) its appearance, (ii) its reaction (if any) with water. Outline a method for the preparation of either nitric oxide (nitrogen (II) oxide) or hydrogen sulphide in the laboratory.

10. Answer any *two* of the following:

(a) State Hess's Law.

Find the heat of formation of propane (C<sub>3</sub>H<sub>8</sub>) given the following data:



- (b) "The presence of lone pairs and of bond pairs of electrons in molecules, influence their shapes to a large extent".  
Sketch the shapes of each of the following molecules: NH<sub>3</sub>, H<sub>2</sub>O, BF<sub>3</sub>.  
Show that the shape of each molecule is in agreement with the above statement.
- (c) The relative positions of three metals in the electrochemical (activity) series are as follows:  
Mg, Zn, Cu.

Describe different experiments, one in each case, to

- confirm the position of zinc relative to copper.
- confirm the position of zinc relative to magnesium.

Define *oxidation* and *reduction* in terms of electron transfer. Show where oxidation and reduction take place in either *one* of the experiments described.

(d) What is the pH-scale?

If a solution of hydrogen chloride has a pH of 1, what is its concentration in grams per litre (dm<sup>3</sup>)? Find the pH of a solution containing 0.63 g per litre (dm<sup>3</sup>) of pure nitric acid (HNO<sub>3</sub>).