CHEMISTRY - ORDINARY LEVEL

WEDNESDAY, 16th JUNE - Morning, 9.30 to 12

1971
(LC)
B1

Six questions to be answered

1. Distinguish between a covalent bond and an ionic bond, using chlorine and sodium chloride as examples.
Tabulate (i) the characteristic properties of covalent compounds (ii) the characteristic properties of ionic substances.
Describe with the aid of a diagram, a simple electrical experiment you might perform to decide if a given substance were covalent or ionic.

(66 marks)

2. Define the terms (i) atomic number, (ii) mass number, (iii) formula weight, and illustrate each by means of an example.
Write the electronic configurations (s,p,d) for lithium, sodium and potassium. Show from these configurations why the elements are placed in the same group of the periodic table. Mention any three properties or reactions of these elements which demonstrate the similarity between them.

(66 marks)

3. What is meant by (i) a linear molecule, (ii) a planar molecule, (iii) a tetrahedral molecule ?
Classify each of the following as linear, planar or tetrahedral: beryllium hydride, boron trifluoride, methane, hydrogen sulphide. Justify your answer in each case.

(66 marks)

4. What do you understand by an oxidation-reduction reaction ? Define reduction (i) in terms of loss or gain of an element, (ii) in terms of electron transfer.
Show by comparing the reactions

$$Mg + \tfrac{1}{2}O_2 \rightarrow MgO \quad \text{and} \quad Mg + Cl_2 \rightarrow MgCl_2$$

that the latter reaction is also considered to be an oxidation-reduction reaction.
State which substance has been oxidised in the reaction represented by the equation $Cu^{++} + Fe \rightarrow Fe^{++} + Cu$. Why does this reaction take the direction indicated rather than the reverse direction ?

(66 marks)

5. Describe, with the aid of a diagram, how you would prepare and collect acetylene.
State the principal properties of acetylene and use an equation in each case to show its reaction (i) with hydrogen, (ii) with a hydrogen halide, (iii) on oxidation with potassium permanganate, (iv) on polymerisation, (v) on hydration using dilute sulphuric acid and mercuric sulphate.

(66 marks)

6. Use equations to show the preparation of (i) ammonia, (ii) hydrogen chloride, (iii) chlorine, (iv) ammonium chloride.
Mention the reaction of each of these substances with water and indicate whether the pH of the resulting solution is less than seven, equal to seven or more than seven.

(66 marks)

7. What is (i) an alkane, (ii) an alkene, (iii) a homologous series ? Write the structures for the first four members of the alkane series. Why are there two structures for the fourth member of the series ?
A hydrocarbon of molecular weight 28 forms a compound of molecular weight 188 by reaction with bromine. Write the structural formula for the hydrocarbon, an equation for the reaction and name the product. (H = 1, C = 12, Br = 80)

(67 marks)

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8. State what you understand by (i) electronegativity, (ii) ionisation energy.
Discuss the use of electronegativities in predicting the nature of the bond formed between any two elements. (Refer to the table of electronegativities given in the Mathematical Tables, page 46.)
Comment on the general increase in ionisation energy across the periodic table from left to right and on the general decrease in ionisation energy from top to bottom of each group. (Refer to the table of first ionisation energies given in the Mathematical Tables, page 45.)

(67 marks)

9. Define (i) heat of formation, (ii) heat of combustion, (iii) heat of neutralisation.
Calculate the heat of formation of carbon monoxide from the following data:-

$C + O_2 = CO_2 \quad \Delta H = -94$ kcal. (= -393 kJ)

$CO + \frac{1}{2}O_2 = CO_2 \quad \Delta H = -68$ kcal. (= -285 kJ)

Why is it difficult to measure the heat of formation of carbon monoxide directly ?
Outline briefly how you would measure the heat of neutralisation of a strong acid and a strong base. Why is the result always the same, regardless of what strong acid or strong base is used ?

(67 marks)

10. It required 20 cm^3 of a given solution of sodium hydroxide to neutralise 25 cm^3 of normal hydrochloric acid solution. Express the concentration of the sodium hydroxide solution in terms of (i) normality, (ii) grams of sodium hydroxide per litre (1,000 cm^3).
Explain what an indicator is and how it works. Name any indicator which could be used in the above titration. (H = 1, O = 16, Na = 23)

(67 marks)