AN ROINN OIDEACHAIS

(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1953.

CHEMISTRY—HONOURS.

TUESDAY, 16th JUNE.—AFTERNOON, 3 TO 5.

Not more than *six* questions to be answered.

Chemical changes should be expressed by equations as well as in words.

Atomic weights :—N=14 ; Na=23 ; C=12 ; O=16 ; K=39 ; Mn=55 ; Fe=56 ; S=32 ; Ca=40.

The gram-molecular volume=22·4 litres.

1. Describe fully how you would measure the density of hydrogen sulphide relative to that of hydrogen and explain how its molecular weight may be found from its relative density.

[66 marks.]

2. Describe, with a sketch of the apparatus, how you would prepare and collect pure nitrogen peroxide, and give an account of its chief properties.

How does it react with the following : (*a*) a solution of sodium hydroxide in water, (*b*) a solution of potassium iodide in water, (*c*) sulphuric acid, (*d*) hydrogen sulphide ?

[66 marks.]

3. Give a brief account of the views held by scientists at various times on the nature of chlorine and of hydrochloric acid.

Sketch the apparatus you would use in preparing pure dry chlorine in the laboratory.

Explain how chlorine acts as an oxidising agent and illustrate your explanation by referring to its action on solutions in water of the following : (*a*) sulphur dioxide, (*b*) hydrogen sulphide, (*c*) ferrous chloride.

[66 marks.]

4. Describe an industrial method for the production of washing soda and explain by means of chemical equations the reactions involved.

Describe the action of washing soda on (*a*) lime water, (*b*) hard water, (*c*) a solution of ortho-phosphoric acid in water.

[66 marks.]

5. Describe, with a sketch of the apparatus, how you would prepare dry ammonia, how you would pass it over hot cupric oxide and how you would collect the products formed.

When dry ammonia was passed over hot cupric oxide, the oxide lost 0·63 g m. of its weight ; 0·71 gm. of water and 330 c.c. of nitrogen (measured at 15° C. and at a pressure of 720 mm. of mercury) were collected. Calculate the equivalent of oxygen and the gravimetric composition of ammonia.

State the additional information which would enable you to establish the formula for ammonia from its gravimetric composition and explain the method of doing so.

[66 marks.]

6. An element A combines with an element B to form a compound containing 36·3% by weight of B, and another element C combines with the element B to form a compound containing 88·8% by weight of B. The element A combines with the element C to form a compound containing 82·2% by weight of A. Show that these statements illustrate one of the fundamental laws of chemistry. State the law and show how it is explained by the atomic theory.

[66 marks.]

7. What is meant by a $\frac{N}{10}$ solution ? Illustrate your answer by referring to $\frac{N}{10}$ solutions of sodium carbonate, oxalic acid and potassium permanganate.

Describe in detail how you would prepare a $\frac{N}{10}$ solution of oxalic acid and how you would use it to standardize a solution of potassium permanganate.

It is found that 20 c.c. of a $\frac{N}{10}$ solution (factor 0·90) of potassium permanganate are required to oxidize 25 c.c. of a solution containing 20 gms. of crystalline ferrous sulphate per litre. Calculate the percentage of water of crystallisation in the ferrous sulphate.

[67 marks.]

8. Explain the following terms and in the case of each illustrate your answer by one example : (*a*) saturated hydrocarbon, (*b*) unsaturated hydrocarbon, (*c*) carbohydrate, (*d*) fermentation, (*e*) hydrolysis.

What are the characteristic chemical properties of an unsaturated hydrocarbon ?

[67 marks.]

9. Write structural formulae for formic acid, methyl alcohol, acetaldehyde, and state the evidence on which the structural formula for acetaldehyde is based.

Show by means of simple chemical equations the results of oxidising those substances.

[67 marks.]

10. Give an account of the sources and properties of zinc. Write the formulae for any four of its compounds and describe their properties.

Give two tests for distinguishing zinc salts from aluminium salts.

[67 marks.]