

CHEMISTRY - HONOURS

TUESDAY, 18th JUNE - Morning, 10 to 12.30.

Not more than six questions may be attempted.Chemical reactions should be expressed by equations as well as in words.

Atomic weights:- H = 1, C = 12, O = 16, Na = 23, Mg = 24.3, Al = 27, Cl = 35.5, Ar = 40.

1. Give an account, with the aid of a sketch of the apparatus, of how you would prepare and collect pure dry chlorine.

Describe the physical properties of chlorine.

By means of chemical equations show the action of chlorine on (a) hydrogen sulphide, (b) ammonia, (c) aqueous potassium iodide, (d) cold dilute sodium hydroxide solution, (e) hot concentrated sodium hydroxide solution.

(66 marks.)

2. Outline the preparation of (i) sulphur dioxide, (ii) hydrogen sulphide, and describe how the volumetric composition of each of them may be measured.

(66 marks.)

3. Describe fully an industrial process for the manufacture of nitric acid, starting from nitrogen.

Give three different reactions in which nitric acid acts as an oxidising agent.

Summarise the effect of heat on the nitrates of the metals.

(66 marks.)

4. Explain the terms (a) chemical equivalent, (b) normal solution.

0.33 gm. of a metal was dissolved in 50 c.c. of N hydrochloric acid and the resulting solution was made up to 250 c.c. with water. 25 c.c. of this solution required 13.2 c.c. of 0.1N sodium hydroxide solution for neutralisation. Calculate the chemical equivalent of the metal. If the specific heat of the metal is 0.22, (i) deduce the formula of its oxide, (ii) find its exact atomic weight.

Outline three other methods for measuring the chemical equivalent of metals.

(66 marks.)

5. (i) In the case of iron or tin, describe the chemistry of the element and of its principal compounds.

(ii) A litre of a given solution contains both ferrous sulphate and ferric sulphate. Indicate briefly how you would measure the amount of each present in the solution.

(66 marks.)

6. The metallic radical of a given salt is either lead or calcium, and the acidic radical is either a carbonate or a nitrate. What tests would you perform to identify the given salt and what confirmatory tests would you apply?

(66 marks.)

7. State Avogadro's hypothesis. Define (a) vapour density, (b) molecular weight, and deduce the relation between them.

A compound has the following gravimetric composition:- carbon = 40%, hydrogen = 6.6% and oxygen = 53.3%. If the vapour density of the compound is 15, find its molecular formula and write its structural formula.

Another compound has the same gravimetric composition as above but its vapour density is 30. Write the structural formula for this compound and mention a few of its properties.

(67 marks.)

8. Explain each of the following terms:- (a) homologous series, (b) unsaturated hydrocarbon, (c) substitution reaction, (d) saponification, (e) fermentation. Give two examples each in the case of (a), (b), (c), and one example each in the case of (d), (e).

(67 marks.)

9. Describe the chief chemical properties of (i) ethylene, (ii) ethyl alcohol, (iii) acetaldehyde, and write the structural formula for each compound.

Starting from ethylene, indicate how acetaldehyde may be obtained.

(67 marks.)

10. Give a brief account of the structure of the atom.

Show, by means of a diagram, the structure of an atom of (i) sodium, (ii) magnesium, (iii) aluminium, (iv) chlorine, (v) argon. Refer to the position in the periodic table of each of these elements.

(67 marks.)