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LEAVING CERTIFICATE EXAMINATION, 1973

CHEMISTRY—ORDINARY LEVEL

FRIDAY, 15 JUNE—AFTERNOON, 2 to 4.45

Six questions to be answered.

All questions carry the same number of marks.
Atomic weights: H = 1, C = 12, N = 14, O = 16, Mg = 24, S = 32, Cl = 35·5, K = 39.
Molar volume at S.T.P. = 22·4 litres.

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1. Describe the type of bonding involved when sodium combines with chlorine. List the general properties that you would expect to find in compounds with this type of bonding.
   Describe and discuss what happens when an electric current is passed through **either** (i) a melt of sodium chloride **or** (ii) acidulated water.

2. State briefly what you understand by (i) atomic orbitals, (ii) energy levels.
   Give the name and s, p, d configuration of (*a*) a noble (inert) gas, (*b*) a transition element, (*c*) a halogen.
   What is electronegativity? Indicate generally how the values of electronegativity vary (i) within a group, (ii) within a period. What predictions with regard to bond type may be made from a knowledge of these values?

3. Define (i) heat of formation, (ii) heat of combustion.
   State Hess' law.
   Given $C + O_2 = CO_2 \qquad \triangle H = -393$ kJ,
   (*a*) find $\triangle H$ for the equation $CO_2 = C + O_2$,
   (*b*) find the heat change involved when 4 g of carbon are burned completely in oxygen.
   Describe briefly how the heat of combustion of carbon might be measured.

4. What is (i) atomic weight, (ii) molecular weight? State Avogadro's law.
   Describe how you would find the molecular weight of a volatile liquid **or** the atomic weight of a solid element.
   Calculate the weight of salt and the volume of hydrogen at S.T.P., obtainable when 2 g of magnesium reacts completely with dilute hydrochloric acid.

5. There are three beakers on the bench. "A" contains a solution of strong acid, "B" contains carbonate ions CO_3^{--}, as in sodium carbonate solution, "C" contains Fe^{++} ions as in iron (II) sulphate solution. How would you confirm that the beakers are labelled correctly? What pH would you expect each to have?
   It required 25 cm³ of a nitric acid solution to neutralise 20 cm³ of a molar (or 2N) solution of sodium carbonate. Calculate the concentration of the acid solution in terms of (i) molarity (or normality), (ii) grams of nitric acid per litre (1,000 cm³).

6. Select **three** of the following functional groups

(i) $\diagdown\!\!\diagup C=C\diagdown\!\!\diagup$ (ii) $-OH$ (iii) $-\overset{\overset{O}{\|}}{C}-OH$ (iv) $-\overset{\overset{O}{\|}}{C}-H$, and write

(*a*) the name of the homologous series of which each of the selected groups is characteristic,

(*b*) the name and structural formula of a member of each of the three series,

(*c*) two reactions, typical of the series, of the member named in each case.

Describe with the aid of a labelled diagram the preparation of one of the compounds you have named.

7. Indicate the type of bonding which occurs in (*a*) sodium hydride, (*b*) ammonia, (*c*) hydrogen sulphide, (*d*) hydrogen chloride.

In the case of any **three** of the above describe (i) its general appearance, (ii) its reaction, if any, with water, together with reasons for the reaction, (iii) any one other typical reaction.

8. Write the structural formula for acetylene and benzene. Show that the two compounds have the same empirical formula.

Outline the principal physical and chemical properties of benzene. Use equations to illustrate the action of bromine on benzene and on acetylene. Mention the conditions under which (i) acetylene may be hydrated, (ii) benzene may be nitrated, (iii) acetylene may be converted into benzene.

9. Describe oxidation and reduction in terms of electron transfer.

Show the transfer of electrons in the following reactions and write the name of the substance which has been oxidised:

(i) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(ii) $Mg + Cl_2 \rightarrow MgCl_2$.

What does reaction (i) tell you about the relative positions of copper and zinc in the activity series? Describe how you would expect (*a*) copper, (*b*) zinc, to react with dilute hydrochloric acid and with water.

10. Answer **three** of the following:—

(i) Ammonium sulphate $(NH_4)_2SO_4$, and potassium nitrate, KNO_3 are used as fertilisers. Calculate the percentage of nitrogen in each of them.

(ii) What is an acid according to the Brønsted-Lowry theory? Indicate the acids, bases, conjugate pairs in the following:—

$$H_2S + H_2O \rightleftharpoons H_3O^+ + HS^-$$

(iii) What are (*a*) isotopes, (*b*) radioactive isotopes? Outline three uses of radioactive isotopes.

(iv) Show how the electron pair repulsion theory may be used in assigning shapes to any **two** of the following: water, ammonia, methane.