**AN ROINN OIDEACHAIS**

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**LEAVING CERTIFICATE EXAMINATION, 1974**

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CHEMISTRY — ORDINARY LEVEL

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THURSDAY, 20 JUNE — AFTERNOON, 2 to 4.45

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**Six** questions to be answered.

All questions carry the same marks.

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

   (*a*) State Boyle's law.

   (*b*) When a given substance is heated with sodium hydroxide, ammonia is evolved. What element is shown, by this experiment, to be present in the given substance?

   (*c*) What is ionisation energy?

   (*d*) Complete the sentence: "Acetylene is obtained when water is added to . . . . . "

   (*e*) Calculate the pH of a solution containing 0·63 grams of nitric acid per litre (1000 $cm^3$). (H = 1, N = 14, O = 16).

   (*f*) Use a diagram to show the shape of the water molecule.

   (*g*) Write an equation for the action of a dilute acid on a metal carbonate.

   (*h*) Name an organic compound which can decolorise acidified potassium permanganate solution.

   (*i*) Write the name and formula for an ionic hydride.

   (*j*) How many molecules are there in 8 grams of oxygen?
   (O = 16; Avogadro's number = $6 \times 10^{23}$).

   (*k*) Use an equation to show the action of sodium on ethanol.

   (*l*) Indicate the electron transfer in the following oxidation/reduction reaction:

   $$Zn + 2H^+ \rightarrow Zn^{++} + H_2$$

   (*m*) What is an electrolyte?

   (*n*) In terms of the Brønsted-Lowry theory indicate the acids and the bases in the following:

   $$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

   (*o*) Name an element which exhibits variable valence.

2. Chlorine forms (i) ionic bonds with atoms such as sodium, (ii) covalent bonds with certain other elements, including itself. Explain, with the aid of diagrams, how these bonds are formed.
   Tabulate the general properties of covalent compounds.

3. Describe electrons, protons and neutrons in terms of (i) mass, (ii) charge, (iii) location.
   "An atom is mostly empty space": discuss briefly.
   Use a diagram to show the structure of the (*a*) hydrogen atom, (*b*) hydrogen molecule, (*c*) hydrogen ion.

4. Define heat of formation.
Distinguish between exothermic and endothermic reactions.
Calculate the heat of formation of propane $C_3H_8$ from the following data:—

$$C_{(s)} + O_{2(g)} = CO_{2(g)} \qquad \triangle H = -393 \text{ kJ}$$
$$H_{2(g)} + \tfrac{1}{2}O_{2(g)} = H_2O_{(g)} \qquad \triangle H = -286 \text{ kJ}$$
$$C_3H_{8(g)} + 5O_{2(g)} = 3CO_{2(g)} + 4H_2O_{(g)} \qquad \triangle H = -2211 \text{ kJ}$$

Mention a chemical reaction that can be brought about (i) by light energy, (ii) by electrical energy.

5. Name and explain what is meant by (i) a polar compound, (ii) a non-polar compound. In each case name a solvent in which the substance will dissolve readily.
Describe with the aid of a diagram any method of measuring molecular weights.
Find (i) the weight in grams, (ii) the number of molecules, (iii) the volume at S.T.P., in a half mole of carbon dioxide.

(C = 12, O = 16; Avogadro's number = $6 \times 10^{23}$)

6. Name and give the structural formula of (i) a saturated hydrocarbon, (ii) an unsaturated hydrocarbon, (iii) an aromatic hydrocarbon. In the case of each of the compounds you have named state (*a*) two of its physical properties, (*b*) a typical chemical reaction.
A hydrocarbon of molecular weight 42, contains 85·7% carbon. Find its molecular formula and suggest a possible structural formula for it.

7. What is (i) an acid, (ii) a base, in terms of Brønsted-Lowry theory?
Give one reaction in each case to show that water can act (i) as an acid, (ii) as a base.
In a titration 20 $cm^3$ of 0·1M (0·2N) sodium carbonate solution were required to neutralise 25 $cm^3$ of a hydrochloric acid solution. Calculate the concentration of the acid solution in terms of (i) molarity (or normality), (ii) grams of hydrochloric acid per litre (1,000 $cm^3$).
Indicate how you would prepare the above sodium carbonate solution.

(H = 1, C = 12, O = 16, Na = 23, Cl = 35·5)

8. Describe with the aid of a diagram how you would prepare and collect (i) hydrogen chloride, (ii) ammonia. Write an equation for the preparation in each case.
Use a diagram to illustrate the shape of a molecule of (i) hydrogen chloride, (ii) ammonia.

9. Indicate the functional group characteristic of (i) alcohols, (ii) aldehydes, (iii) carboxylic acids.
Name one compound from each of the above classes of compounds and give the structural formula in each case.
Indicate how the named alcohol could be converted to a carboxylic acid.

10. Select *three* good conductors of electricity from the following list:— distilled water, sulphur, mercury, a solution of sulphuric acid, copper sulphate solution, graphite.
Draw a labelled diagram of the apparatus you would use to prepare oxygen and hydrogen by electrolysis.
How would you show that electrolysis is an oxidation/reduction reaction?

11. Answer *three* of the following.
(*a*) Calculate the volume of oxygen at S.T.P. used and the weight of sulphur dioxide formed in the complete combustion of 4 grams of sulphur.

(O = 16, S = 32; molar volume at S.T.P. = 22·4 litres)

(*b*) Give the name and electronic configuration (*s*, *p*, *d*) of two Group II metals. Show how (i) their electronic configurations, (ii) their reactions with water, justify their position in the periodic table.
(See Mathematical Tables p. 44.)
(*c*) Write the name and formula of an acidic oxide, a basic oxide and an amphoteric oxide. Indicate the reaction, if any, of each of the oxides with water.
(*d*) What is (i) atomic number, (ii) mass number of an element? Use labelled diagrams to show the atomic structure of the isotopes $^{12}_{6}C$ and $^{14}_{6}C$.