

AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1980

CHEMISTRY—ORDINARY LEVEL

FRIDAY, 20 JUNE—AFTERNOON, 2 to 5

Six questions to be answered
All questions carry the same marks

Relative atomic masses (atomic weights): H = 1, C = 12, N = 14, O = 16, Na = 23, S = 32, Cl = 35.5

Molar volume at S.T.P. = 22.4 litres (dm³)

Avogadro's constant (number) = 6×10^{23}

1. Answer *eleven* of the following items (a), (b), (c), etc. All items carry the same marks. *Keep your answers short.*
- Write down the electronic configuration (s,p) of sulphur (atomic number = 16).
 - Give an example of a radioactive isotope and state one of its uses.
 - State one of Faraday's laws of electrolysis.
 - Write the structural formula for benzoic acid.
 - What is an atomic orbital?
 - What is the pH of a 0.01M HCl solution?
 - State Hess's Law.
 - What is an amphoteric oxide? Give an example.
 - Give an example of a molecular crystal.
 - State the shape of the carbon dioxide molecule.
 - What is the functional group in alkenes?
 - Give two reasons why the first ionisation energy of magnesium is larger in value than that of sodium?
 - How many molecules are there in 7.1 grams of chlorine?
 - State Pauli's exclusion principle.
 - How may benzene be converted to nitrobenzene?
2. "In general, metals combine with non-metals forming ionic bonds; non-metals combine with each other forming covalent bonds; while the metal atoms themselves are held together by metallic bonds".
- Using suitable examples and diagrams, explain what is meant by
- ionic bonds,
 - covalent bonds,
 - metallic bonds.
- State *two* properties of metals which may be accounted for in terms of metallic bonding. Outline the general properties of ionic substances and the general properties of covalent compounds.
3. (a) Define oxidation and reduction in terms of electron transfer. State with reasons, which, (if any), of the following reactions are oxidation—reduction (redox) reactions:
- $2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$
 - $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{AgCl} + \text{NaNO}_3$
 - $\text{Mg} + \text{S} \longrightarrow \text{MgS}$
- (b) Outline what happens when an electric current is passed through *either* a solution of potassium chloride *or* acidulated water, using inert electrodes.

4. In a titration, 20 cm³ of 0.15 M sodium hydroxide solution were required to neutralise 30 cm³ of a nitric acid solution.
- Calculate the concentration of the acid solution in terms of (a) molarity, (b) grams per litre (dm³).
 - Describe fully how you would carry out the titration giving the name of a suitable indicator.
 - Nitric acid is a strong acid and sodium hydroxide is a strong base. Explain the underlined terms.

5. Two organic compounds A and B were both found to be composed of 92.3% carbon and 7.7% hydrogen, by weight. The relative molecular mass (molecular weight) of A is 26 while the relative molecular mass (molecular weight) of B is 78.

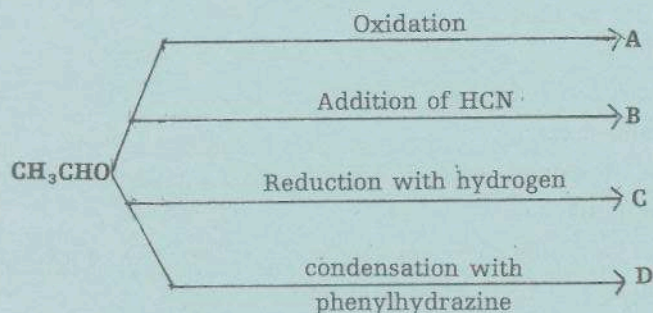
Compound A is found to be highly reactive and undergoes addition reactions very readily with bromine water causing the bromine water to be decolourised. Compound B does not undergo addition reactions with bromine water.

Using the data given, find the molecular formula of A and the molecular formula of B. Name the compounds and show the structural formula of each. Give two other chemical properties of compound A and two other chemical properties of compound B.

6. Describe the influence of electron pairs on the shapes of each of the following molecules: ammonia, hydrogen chloride and hydrogen sulphide. Show by means of an equation, the reaction of these compounds (if any) with water.

Using a labelled diagram, describe a laboratory preparation of any one of the above compounds and state the principal chemical properties of the compound chosen.

7. Acetaldehyde (ethanal) undergoes the following reactions:

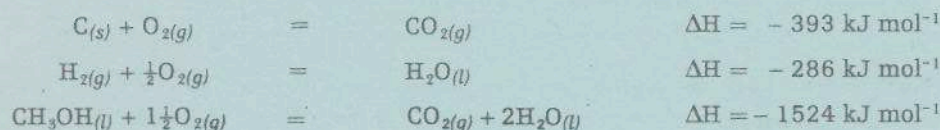


- Name the compounds A, B, C and D. Give the structural formula of each compound.
- Name any oxidising agent suitable for the preparation of A.
- What products are obtained if compound C is reacted with sodium?
- The acetaldehyde (ethanal) is prepared by the controlled oxidation of ethanol. Outline this preparation by means of a labelled diagram.

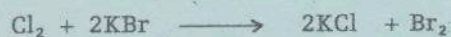
8. (a) Define (i) endothermic reaction,
(ii) heat of solution.

Calculate the heat change for the reaction: $C_{(s)} + \frac{1}{2}O_{2(g)} + 2H_{2(g)} \longrightarrow CH_3OH_{(l)}$

given the following data:



- (b) What do the following reactions tell about the relative positions of (i) zinc and copper, (ii) chlorine and bromine, in the electrochemical series. (Assume the reactions take place under the conditions which apply to the series).



9. Answer the following questions by reference to the Periodic Table where appropriate. (Refer to Mathematics Tables p. 44)

- (i) State the numbers of electrons, protons and neutrons in an atom of the isotope ${}_{19}^{39}\text{K}$.
- (ii) Write the formula for the compound that the element of atomic number 35 would form with hydrogen and indicate, showing outer electrons only, the type of bonding present.
- (iii) Write the formula for a hydride in which the bonding is different from that in (ii).
- (iv) Give the name of an element with variable valence stating two of its valence values.
- (v) Give the formula of a basic oxide showing its reaction with water.
- (vi) Give the formula of an acidic oxide showing its reaction with water.

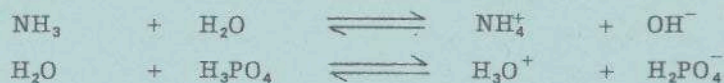
10. Answer any two of the following.

(a) Show how electronegativity values may be used to predict the type of bond formed when any two elements combine. (Refer to Mathematics Tables p. 46).
Why is sodium chloride soluble in water and carbon tetrachloride (tetrachloromethane) insoluble in water?

(b) The reaction of 12.6 g sodium sulphite (sodium sulphate(IV)) with sulphuric acid occurs as follows:-



- (i) How many moles of Na_2SO_3 does 12.6 g represent?
 - (ii) What mass of water is obtained?
 - (iii) Calculate the volume of sulphur dioxide liberated at S.T.P.
- (c) On the basis of the Brønsted-Lowry theory indicate the acid-base pairs in the following equations:



State the merits of the Brønsted-Lowry theory compared with earlier theories on acids and bases.

- (d) Describe a chemical test to confirm the presence of any *three* of the following in aqueous solution:
(i) sulphate ions, (ii) nitrate ions, (iii) carbonate ions, (iv) chloride ions.