

3.7 CHEMISTRY (233)

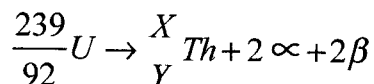
3.7.1 Chemistry Paper 1 (233/1)

1. **Table 1** shows the atomic numbers and the first ionisation energies of three elements. The letters are not actual symbols of the elements. Use it to answer the questions that follow.

Table 1

Element	Atomic number	First ionisation energy kJmol ⁻¹
A	3	519
B	11	494
C	19	418

- (a) Explain the trend in first ionisation energy from A to C. (2 marks)
- (b) Write the electronic configuration for the ion of C. (1 mark)
2. Calculate the values of X and Y in the following nuclear equation. (2 marks)



3. The diagram in **Figure 1** shows a section of a dry cell. Study it and answer the questions that follow.

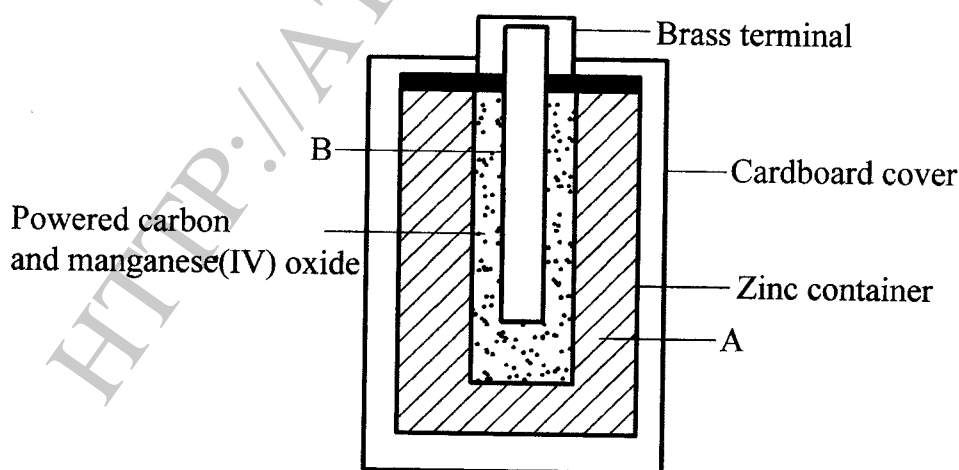


Figure 1

- (a) Name the part labelled B. (1 mark)
- (b) The part labelled A is a paste. Give a reason why it is not used in dry form. (1 mark)
- (c) What is the purpose of the zinc container? (1 mark)

4. The empirical formula of lead(II) oxide was determined by passing excess dry hydrogen gas over 6.69 g of heated lead(II) oxide.
- (a) What was the purpose of using excess dry hydrogen gas? (2 marks)
- (b) The mass of lead was found to be 6.21g. Determine the empirical formula of the oxide. (Pb = 207.0 ; O = 16.0) (2 marks)
5. The set-up in **Figure 2** was used to prepare a sample of ethane gas. Study it and answer the questions that follow.

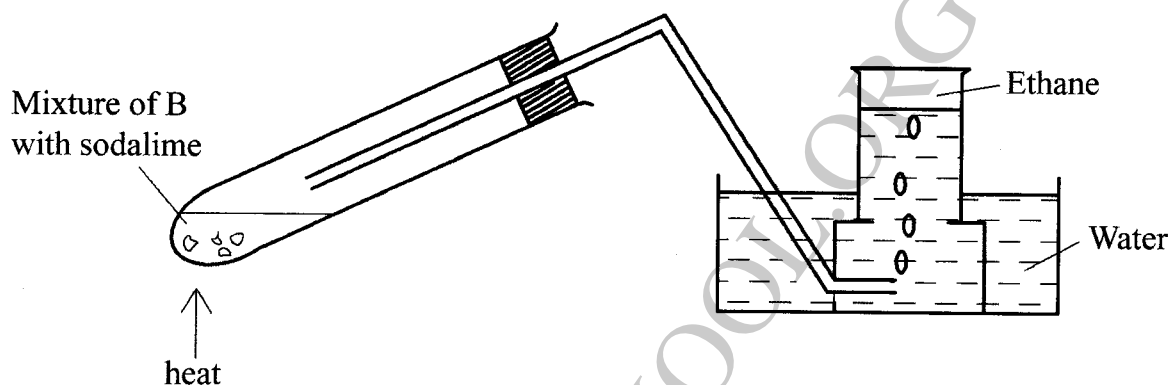


Figure 2

- (a) Name **B** (1 mark)
- (b) Write an equation for the complete combustion of ethane. (1 mark)
- (c) State **one** use of ethane. (1 mark)
6. (a) State Charles' Law. (1 mark)
- (b) Explain why the pressure of a fixed mass of a gas increases, when the volume of the gas is reduced at constant temperature. (2 marks)
7. A sample of water is suspected to contain sulphate ions. Describe an experiment that can be carried out to determine the presence of sulphate ions. (3 marks)
8. (a) State **one** characteristic of a reaction where equilibrium has been attained. (1 mark)
- (b) The following equation is in a state of equilibrium:
 $C \rightleftharpoons D$
 Use it to sketch a graphical representation of concentration against time in seconds for the equilibrium. (2 marks)
9. Copper(II) ions react with excess aqueous ammonia to form a complex ion.
- (a) (i) Write an equation for the reaction that forms the complex ion. (1 mark)
- (ii) Name the complex ion. (1 mark)

- (b) Explain why CH_4 is not acidic while HCl is acidic yet both compounds contain hydrogen. (1 mark)
10. 20 cm^3 of ethanoic acid was diluted to 400 cm^3 of solution. Calculate the concentration of the solution in moles per litre. (C = 12.0 ; H = 1.0 ; O = 16.0)
(Density of ethanoic acid = 1.05 g/cm^3) (3 marks)
11. An oxide of element **K** has the formula K_2O_5 .
- (a) Determine the oxidation number of **K**. (1 mark)
- (b) To which group of the periodic table does **K** belong? (1 mark)
12. Potassium nitrate liberates oxygen gas when heated. Draw a diagram of a set-up that shows heating of potassium nitrate and collection of oxygen gas. (3 marks)
13. Explain the observation made when chlorine gas is passed through a solution of potassium iodide. (3 marks)
14. Using the elements chlorine, calcium and phosphorus:
- (a) Select elements that will form an oxide whose aqueous solution has a pH less than 7. (1 mark)
- (b) Write an equation for the reaction between calcium oxide and dilute hydrochloric acid. (1 mark)
- (c) Give **one** use of calcium oxide. (1 mark)
15. Starting with copper, describe how a pure sample of copper(II) carbonate can be prepared. (3 marks)
16. In an experiment, concentrated nitric(V) acid was reacted with iron(II) sulphate. State and explain the observations made. (2 marks)
17. The flow chart in **Figure 3** shows the process of obtaining a sample of nitrogen gas. Study it and answer the questions that follow.

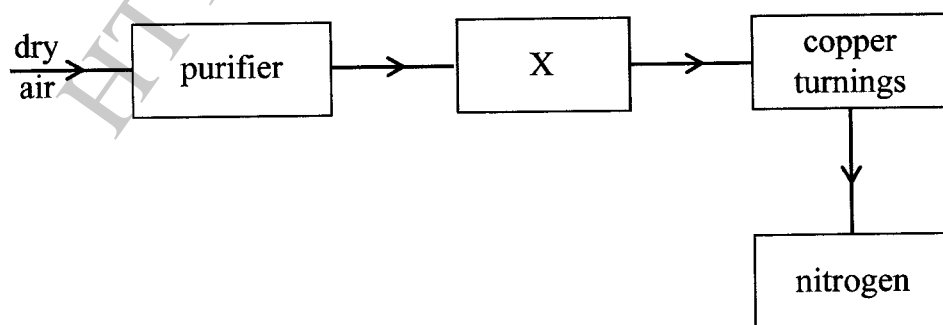


Figure 3

- (a) Identify X (1 mark)

- (b) Write an equation for the reaction with heated copper turnings. (1 mark)
- (c) Name an impurity in the sample of nitrogen gas. (1 mark)

18. The set-up in **Figure 4** can be used to prepare nitrogen(II) oxide. Use it to answer the questions that follow.

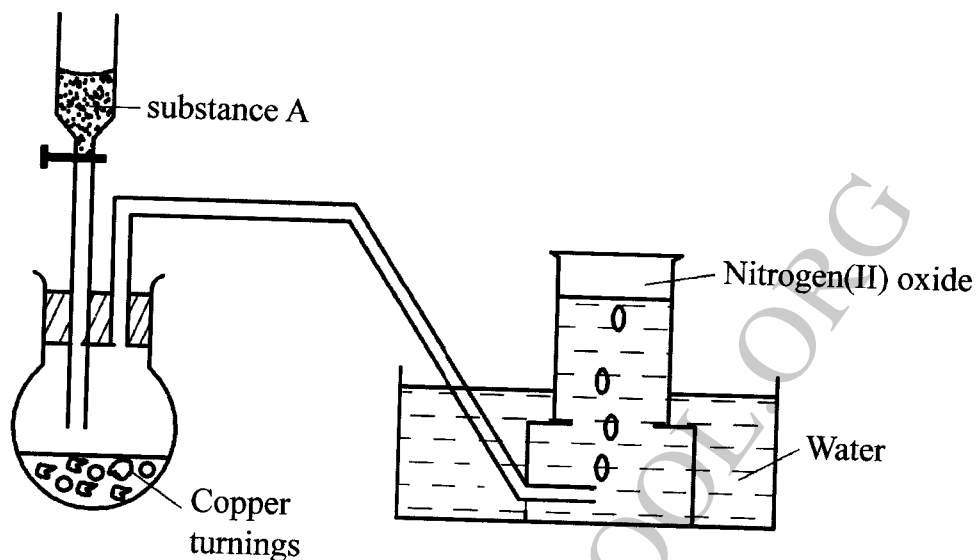


Figure 4

- (a) Name substance A. (1 mark)
- (b) When the gas jar containing nitrogen(II) oxide is exposed to air, a brown colour is observed. Explain. (1 mark)
- (c) Write an equation for the reaction which occurred in the flask. (1 mark)
19. The following procedure was used to investigate the temperature changes that occur when sodium hydroxide solution is added to dilute hydrochloric acid.
- Place the acid in a glass beaker and record its temperature.
 - Add a known volume of sodium hydroxide solution.
 - Stir the mixture and record the highest temperature reached.
 - Repeat steps (ii) and (iii) with different volumes of sodium hydroxide solution.
- (a) State **two** factors that must be kept constant in this experiment (1 mark)
- (b) Explain how the use of a polystyrene cup will affect the results. (1 mark)



20. Study the flow chart in **Figure 5** and answer the questions that follow.

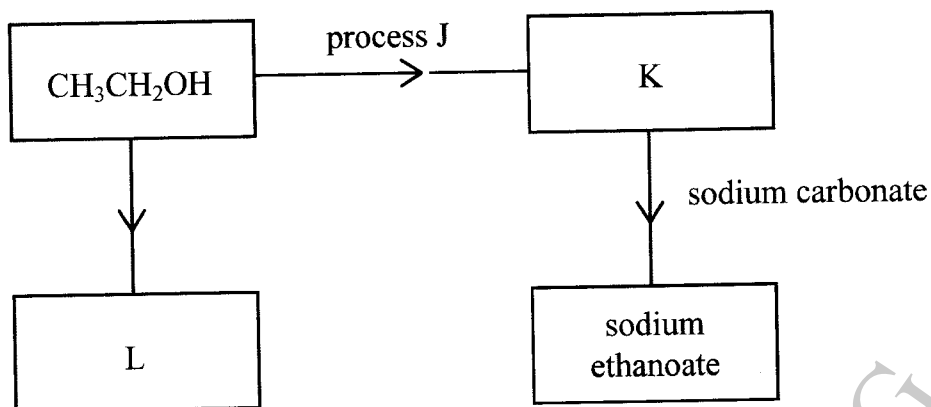


Figure 5

- (a) Identify substances **K** and **L**.
- K:** (1 mark)
- L:** (1 mark)
- (b) Name **one** reagent that can be used to carry out process **J**. (1 mark)
21. The atomic numbers of some elements **P**, **Q**, **R** and **S** are 6, 8, 12 and 17 respectively.
- (a) Draw the dot (•) and cross (X) diagrams for the compounds formed when:
- (i) **R** and **Q** react (1 mark)
- (b) Explain why the melting point of the compound formed by **P** and **S** is lower than that formed by **R** and **Q**. (1 mark)
22. (a) What is an inert electrode? (1 mark)
- (b) State the products formed when brine is electrolysed using inert electrodes.
- Anode: (1 mark)
- Cathode: (1 mark)
23. Explain how a student can establish whether a liquid sample extracted from a plant is pure. (2 marks)

24. **Figure 6** shows part of the periodic table. The letters are not the actual symbols of the elements. Study it and answer the questions that follow.

H					K		
			L				
M				N		P	

Figure 6

- (a) Write an equation for the reaction between M and K. (1 mark)
- (b) Select the element which can form an ion with a charge of +3. (1 mark)
- (c) An element J has atomic number 15. Indicate with a tick (✓), on the part of the periodic table the position of J. (1 mark)
25. In terms of structure and bonding, explain why graphite is used as a lubricant in machines. (3 marks)
26. (a) What is meant by the term bleaching? (1 mark)
- (b) Write the formula of the bleaching agent formed when chlorine gas reacts with aqueous sodium hydroxide. (1 mark)
- (c) State the role of chlorine in water treatment. (1 mark)
27. (a) Name **two** ores in which sodium occurs. (1 mark)
- (b) During extraction of sodium using the down's process, calcium chloride is added to the ore. Give a reason for the addition of calcium chloride. (1 mark)
- (c) State **two** uses of sodium. (1 mark)
28. When an aqueous solution of compound X was mixed with a few drops of bromine water, the colour of the mixture remained yellow. When another portion of solution X was reacted with acidified potassium dichromate(VI), the colour of the mixture changed from orange to green.
- (a) What conclusion can be made from the use of:
- (i) bromine water? (1 mark)
- (ii) acidified potassium dichromate(VI)? (1 mark)
- (b) Solution X was reacted with a piece of a metal and a colourless gas was produced. Describe a simple experiment to identify the gas. (1 mark)

