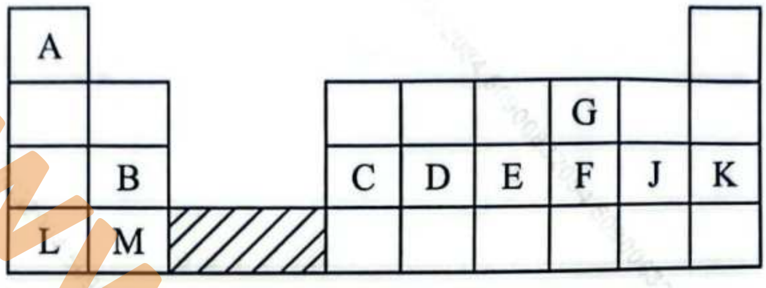
1 Use the section of the periodic table in **Table 1** to answer the questions that follow. The letters are not the actual symbols of the elements.

Table 1



(a) Write the electron arrangement of element **F**. (1 mark)

....

(b) Select **two** elements that exist as diatomic molecules. (1 mark)

....

(c) Select a metal that forms a stable divalent ion with the smallest ionic radius. (1 mark)

....

2 20.0 g of a compound of sodium and oxygen contains 8.2 g of oxygen. Given that the relative formula mass of the compound is 78, determine the:

(a) empirical formula of the compound $(O = 16.3; Na = 23.0)$. (2 marks)

....

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....

....

(b) molecular formula of the compound. (1 mark)

....

....

....

3 Carbon(II) oxide is prepared according to the following equation:

$$HCOOH \longrightarrow CO + H_2O$$

(a) Name the reagent necessary for the reaction to occur. (1 mark)

....

(b) Explain how:

(i) carbon(II) oxide is collected; (1 mark)

....

....

(ii) inhaling carbon(II) oxide gas causes poisoning. (1 mark)

....

....

....

4 Graham's law of diffusion is used to determine molecular masses of gases.

(a) State Graham's law of diffusion. (1 mark)

....

....

....

(b) In an experiment, it took 25.0 seconds for ammonia gas to diffuse through a membrane, while it took 36.6 seconds for an equal volume of gas X to diffuse through the same membrane. Calculate the relative molecular mass of gas X (N = 14.0; H = 1.0). (2 marks)

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5 (a) Using dots (•) and crosses (x) to represent electrons, draw the structure of ammonium chloride (H = 1; N = 7; Cl = 17). (2 marks)

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(b) Fluorine and iodine are in the same group of the periodic table. Explain why at room temperature, fluorine is a gas while iodine is a solid. (1 mark)

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6 (a) Sea water contains about 3 % sodium chloride. Describe how sodium chloride is obtained from the sea water. (2 marks)

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(b) State the reason why iodine is added to common salts for household use. (1 mark)

....

....

7 Consider the following standard redox potentials.

		E^θ Volts
I.	$Al^{3+} + 3e \longrightarrow Al$	- 1.66
II.	$Au^{3+} + 3e \longrightarrow Au$	+1.50
III.	$Na^+ + e \longrightarrow Na$	- 2.71
IV.	$Ag^+ + e \longrightarrow Ag$	+ 0.80

(a) Identify the strongest oxidising agent. Give a reason. (1 mark)

....

....

(b) Draw a labelled diagram of an electrochemical cell formed when half cell **I** and **IV** combine. (2 marks)

....

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....

8 **Figure 1** shows an energy level diagram for a reversible reaction.

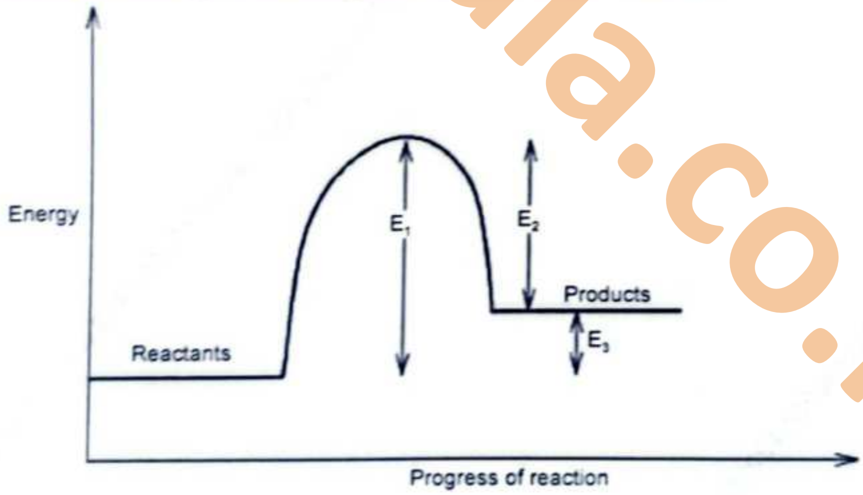

Figure 1

(a) State which of the energies E_1, E_2 and E_3 are affected by a catalyst. Give a reason. (2 marks)

....

....

....

(b) Explain how increase in temperature would affect the equilibrium. (1 mark)

....

....

....

9 100 cm^3 of 2 M sodium hydroxide was added to 150 cm^3 of 3 M sodium hydroxide. Determine the concentration of the resultant solution. (3 marks)

....

....

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....

10 Ethene can be obtained from $C_{10}H_{22}$ as shown in the following equation.

$$C_{10}H_{22} \xrightarrow[\text{pressure}]{\text{heat}} C_2H_4 + \text{compound } \mathbf{Y}$$

(a) Name this type of reaction. (1 mark)

....

(b) Write the molecular formula of compound **Y** and give its name. (1 mark)

....

....

(c) State **one** industrial use of ethene. (1 mark)

....

....

11 Nitrogen(II) oxide can be prepared by reacting copper turnings with nitric(V) acid.

(a) Write an equation for the reaction. (1 mark)

(b) Draw a set-up of apparatus to show how the gas can be prepared and collected. (2 marks)

12 The following two compounds react to form a polymer.

$$H_2N-(CH_2)_6-NH_2 \text{ and } HO-\overset{O}{\overset{\|}{C}}-(NH_2)_4-\overset{O}{\overset{\|}{C}}-OH$$

(a) Name the type of polymerisation reaction that takes place. (1 mark)

(b) Draw the general formula of the polymer. (1 mark)

(c) Explain the environmental effect of large scale use of this polymer. (1 mark)

13 **Table 2** shows pH values of solutions of substances **P, Q, R, S,** and **T**. Use the information to answer the questions that follow.

Table 2

Solution	**P**	**Q**	**R**	**S**	**T**
pH values	12.0	7.0	10.0	2.0	5.0

Identify and give a reason for a solution that is likely to be:

(a) lemon juice; ....(1 mark)

Reason.

....

(b) an antacid;..(1 mark)

Reason.

....

(c) aqueous sodium chloride.. (1 mark)

Reason.

....

14 (a) Describe how a dry sample of calcium sulphate can be prepared in the laboratory starting with solid sodium sulphate and solid calcium nitrate. (2 marks)

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(b) State **one** use of calcium sulphate. (1 mark)

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....

The set-up in **Figure 2** was used to isolate nitrogen gas from air.

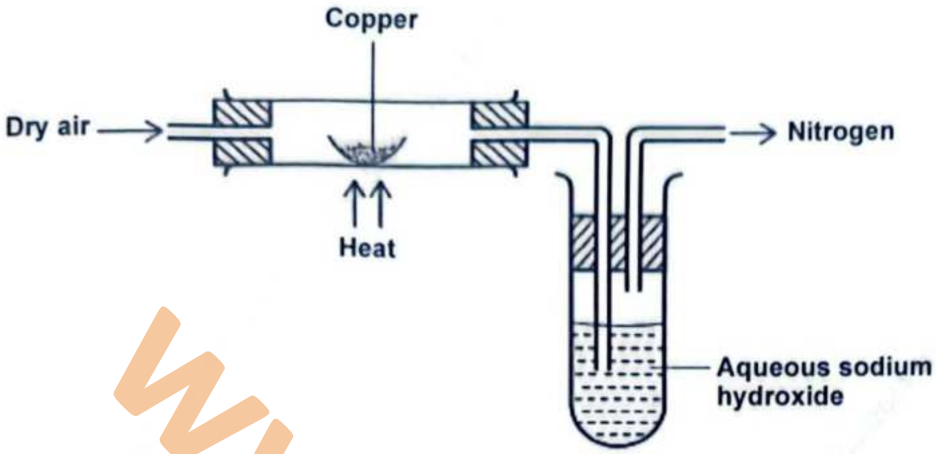

Figure 2

(a) State the observation made in the combustion tube. (1 mark)

....

....

....

(b) Give the role of sodium hydroxide in the boiling tube. (1 mark)

....

....

(c) Two compounds are formed when copper in the combustion tube is replaced with lithium metal. Give the formula of each compound. (1 mark)

....

....

16 Beryllium, magnesium and calcium are elements in group 2 of the periodic table, with atomic numbers **4**, **12** and **20** respectively.

(a) Explain why atomic radius increases from beryllium to calcium. (1 mark)

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....

....

(b) Select the **most** reactive metal. Give a reason. (1 mark)

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(c) Beryllium has the highest melting point. Give a reason. (1 mark)

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17 60 g of radioactive astatine-210, $^{210}_{85}At$ reduced to 3.75 g after 33.2 hours.

(a) The radioactive isotope, $^{210}_{85}At$ decays by alpha emission.

Determine the mass number and number of protons of the nuclide formed.

Mass number (½ mark)

....

Proton number (½ mark)

....

(b) Determine the half life of astatine (At). (2 marks)

....

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18 (a) Name **two** properties of an alloy that are different from those of individual metals. (1 mark)

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(b) Complete **Table 3** by writing **one** use of each alloy.

Table 3

Alloy	Composition	Use
Brass	Cu, Zn	
Duralumin	Al, Mg	

(2 marks)

19 The set-up in **Figure 3** was used to investigate the electrical conductivity of molten substances.

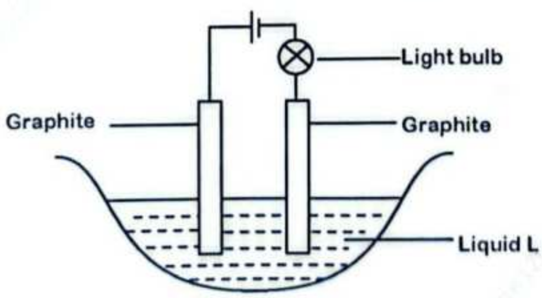

Figure 3

State and give a reason for the observation made in the set-up when liquid L is

(a) molten sulphur; (1 mark)

Observation ....

Reason ....

....

(b) molten lead(II) bromide; (1 mark)

Observation ....

Reason ....

....

(c) molten sodium metal. (1 mark)

Observation ....

Reason ....

....

20 Consider the following equilibrium:

$$\underset{\text{(Orange)}}{Cr_2O_7^{2-}(aq)} + 2OH^-(aq) \rightleftharpoons \underset{\text{(Yellow)}}{2CrO_4^{-2}(aq)} + H_2O(l)$$

State and explain the observation made when each of the following is added to the equilibrium mixture:

(a) aqueous sodium hydroxide;

Observation (½ mark)

....

Explanation (1 mark)

....

....

(b) dilute hydrochloric acid.

Observation (½ mark)

....

Explanation (1 mark)

....

....

21 Figure 4 shows an energy cycle diagram for caesium chloride.

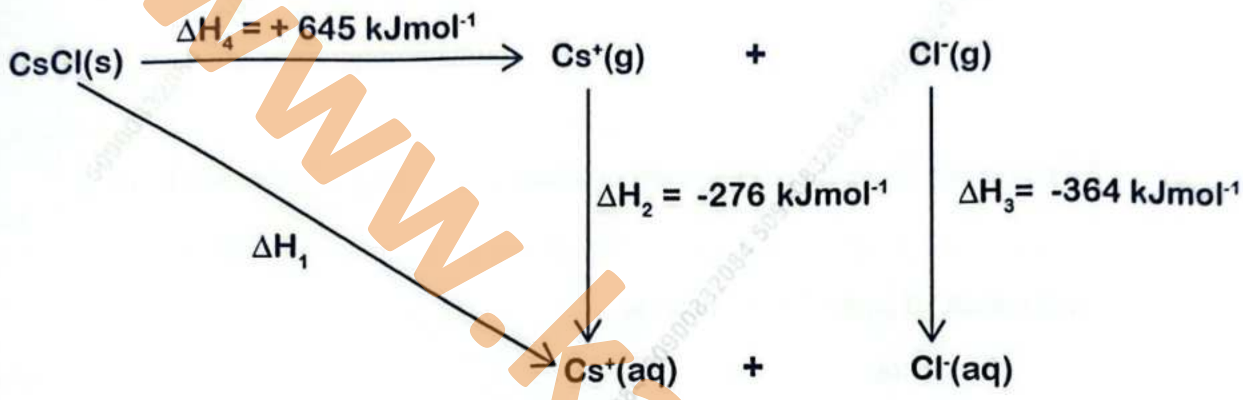

Figure 4

(a) Give a reason for each of the following:

(i) the sign for ΔH_2 is negative (exothermic); (1 mark)

....

....

(ii) the sign for ΔH_4 is positive (endothermic). (1 mark)

....

....

(b) Calculate the value of ΔH_1. (1 mark)

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....

....

22 (a) Zinc oxide is an amphoteric oxide. State what is meant by the term *amphoteric*. (1 mark)

....

....

(b) When a few drops of aqueous sodium hydroxide are added to aqueous zinc sulphate, a white precipitate is formed. The white precipitate dissolves when excess sodium hydroxide is added. Write ionic equations for the two reactions. (2 marks)

....

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23 (a) Name the apparatus that can be used to separate a mixture of water and hexane. (1 mark)

....

(b) State the use of each of the following:

(i) desiccator; (1 mark)

....

....

(ii) ion exchange resin. (1 mark)

....

....

24 Oxygen gas can be prepared in the laboratory using aqueous hydrogen peroxide.

(a) State the necessary condition for this reaction. (1 mark)

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(b) Describe how a dry sample of oxygen gas can be collected. (2 marks)

....

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25 Study the flow chart in **Figure 5**.

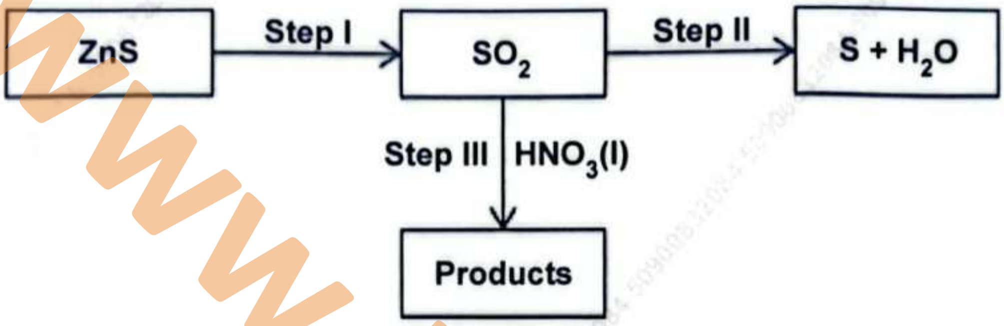

Figure 5

(a) State the conditions required for step **I.** (1 mark)

....

....

(b) Name the reducing reagent used in step **II.** (1 mark)

....

(c) Write a formula of the sulphur compound formed in step **III.** (1 mark)

....

....

26 The following is a formula of a certain cleansing agent.

$CH_3(CH_2)_{16}COO^-Na^+$

(a) Write the formula of the organic compound used to make the cleansing agent. (1 mark)

....

....

(b) Describe how the cleansing agent works during the cleaning process. (2 marks)

....

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27 Chlorofluoromethane is an example of CFC.

(a) State **one** industrial use of CFCs. (1 mark)

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(b) State **one** effect of the use of CFCs to the environment. (1 mark)

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