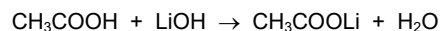


- 8 The equation for the reaction between dilute ethanoic acid and aqueous lithium hydroxide is shown.



In an experiment, 20.0 cm^3 of 0.050 mol/dm^3 aqueous lithium hydroxide is exactly neutralised by 12.5 cm^3 of dilute ethanoic acid.

Which statement is correct?

- A The amount of lithium hydroxide is equal to $0.050 \times \frac{1000}{20}$ mol.
 B The amount of ethanoic acid reacted is 0.0010 mol .
 C The concentration of the dilute ethanoic acid is 0.16 mol/dm^3 .
 D The volume of aqueous lithium hydroxide used is 0.20 dm^3 .

- 3 This question is about aluminium and other metallic elements.

- (a) Aluminium is extracted from purified bauxite by electrolysis. Fig. 3.1 shows a diagram of the electrolytic cell used.

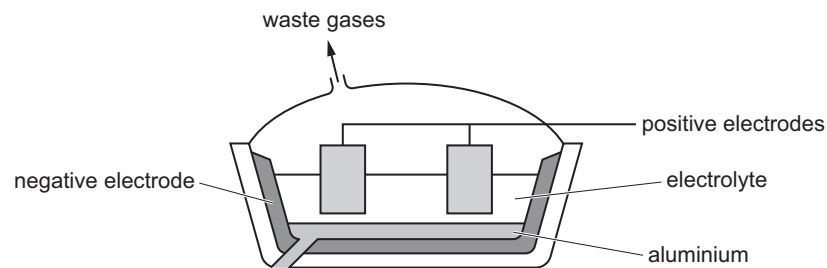
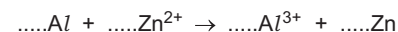


Fig. 3.1

- (i) State the name of the aluminium compound present in bauxite.
 [1]
- (ii) Name the substance that purified bauxite is dissolved in before electrolysis is carried out.
 [1]
- (iii) Name the substance that is used for the positive electrodes.
 [1]
- (iv) Write the ionic half-equation for the production of aluminium at the negative electrode.
 [2]
- (b) Aluminium is above zinc in the reactivity series.
- (i) When a piece of aluminium foil is added to aqueous zinc sulfate, a reaction is **not** immediately observed even though aluminium is above zinc in the reactivity series.
 Explain why a reaction is **not** immediately observed.

 [1]
- (ii) After a few minutes, a displacement reaction occurs between aluminium and aqueous zinc ions.
 Complete the ionic equation for this reaction.



(iii) State the oxidation number of zinc in:

 Zn^{2+}

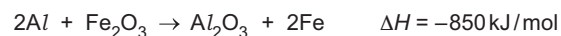
Zn.

[2]

(iv) Define the term reduction in terms of oxidation number.

..... [1]

(c) Aluminium reacts with iron(III) oxide. The equation is shown.



(i) State the meaning of the symbol ΔH .

..... [1]

(ii) State what can be deduced about the reaction from the negative sign in $\Delta H = -850 \text{ kJ/mol}$.

..... [1]

(d) Gallium has many similarities to aluminium. Gallium(III) oxide is an amphoteric oxide.

State what is meant by the term amphoteric.

..... [1]

(e) The reaction of gallium(III) oxide, Ga_2O_3 , with aqueous sodium hydroxide forms a salt which contains the negative ion GaO_2^- . The only other product is water.

Write a symbol equation for this reaction.

..... [2]

(f) Deduce the formula of:

- gallium(III) bromide
- gallium(III) sulfate.

[2]

[Total: 17]

7 When 65 g of zinc reacts with 32 g of sulfur, 97 g of zinc sulfide is produced.

When 65g of zinc reacts with 40g of sulfur, the mass of zinc sulfide produced is still 97 g.

Which statement explains this observation?

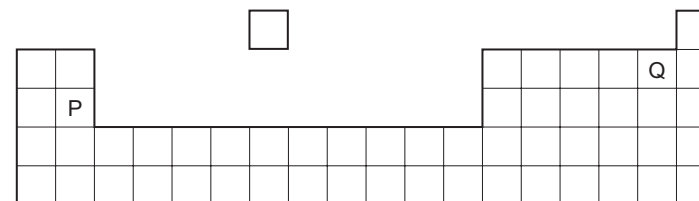
- A** Some of the zinc sulfide evaporates.
- B** The reaction rate is slow.
- C** The reaction stops before it is complete.
- D** Zinc is the limiting reactant.

10 Molten zinc oxide is electrolysed using inert electrodes.

Which row identifies the product at each electrode?

	anode	cathode
A	zinc	oxygen
B	hydrogen	oxygen
C	oxygen	zinc
D	oxygen	hydrogen

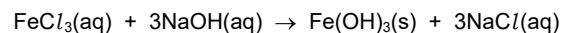
5 The diagram shows the positions of elements P and Q in the Periodic Table.



What is the formula of the compound that is formed between P and Q?

- A** PQ **B** P₂Q **C** PQ₂ **D** P₂Q₇

7 The equation for the reaction between iron(III) chloride and sodium hydroxide is shown.

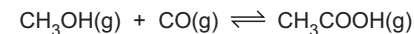


What is the ionic equation for this reaction?

- A** $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}^{3+}(\text{s}) + 3\text{OH}^{-}(\text{s})$
- B** $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$
- C** $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq})$
- D** $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{NaCl}(\text{aq})$

5 Ethanoic acid is manufactured in the reaction between methanol and carbon monoxide.

An equilibrium mixture is produced.



(a) State **two** characteristics of an equilibrium.

- 1
- 2 [2]

(b) Both a high yield of ethanoic acid and a high rate of reaction are needed.

The reaction is carried out at 300 °C.

The forward reaction is exothermic.

(i) State the disadvantage of using a temperature:

- below 300 °C
-
- above 300 °C.
- [2]

(ii) Complete Table 5.1 using **only** the words **increases**, **decreases** or **no change**.

Table 5.1

	effect on the equilibrium concentration of $\text{CH}_3\text{COOH}(\text{g})$	effect on the rate of the forward reaction
catalyst is added		increases
pressure is increased		

[3]

(iii) Suggest which element from the list is a suitable catalyst for the reaction.

Give a reason for your answer.

aluminium carbon cobalt magnesium sodium

catalyst

reason

[2]

(c) Ethanoic acid is a member of the carboxylic acid homologous series.

(i) Name the carboxylic acid that contains only one carbon atom.

..... [1]

(ii) State the molecular formula of a carboxylic acid that contains four carbon atoms.

..... [1]

(d) Carboxylic acids react with alcohols to form esters.

(i) Draw the displayed formula of the ester which contains two carbon atoms.

[2]

(ii) Propyl butanoate is an ester.

Name the carboxylic acid and alcohol that react to produce propyl butanoate.

carboxylic acid

alcohol

[2]

(e) An organic compound has the following composition by mass:

C, 58.82%; H, 9.80%; O, 31.38%.

Calculate the empirical formula of the compound.

empirical formula = [3]

[Total: 18]