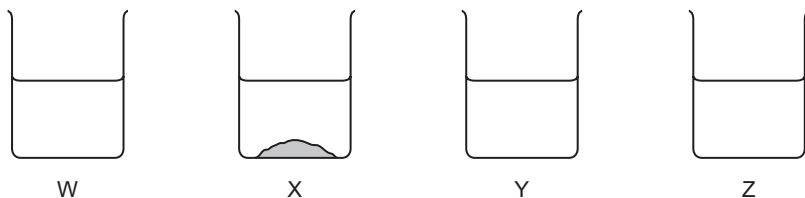


20 Which statement describes a property of ethanoic acid?

- A It does **not** produce carbon dioxide when added to sodium carbonate.
- B It does **not** produce hydrogen when added to magnesium.
- C It only donates some of its protons when added to excess aqueous sodium hydroxide.
- D It only partially dissociates when added to water.

21 A student adds different solid salts to an excess of water. The student stirs the mixtures to determine the solubilities of the salts.

The results are shown.



What could the four different salts be?

	W	X	Y	Z
A	calcium sulfate	lead(II) chloride	ammonium nitrate	potassium sulfate
B	ammonium nitrate	sodium carbonate	calcium sulfate	lead(II) chloride
C	sodium carbonate	calcium sulfate	potassium sulfate	ammonium nitrate
D	lead(II) chloride	ammonium nitrate	sodium carbonate	calcium sulfate

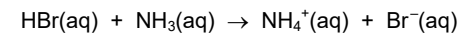
22 Four metal oxides are listed.

- 1 Al_2O_3
- 2 CaO
- 3 CuO
- 4 ZnO

Which metal oxides are amphoteric?

- A 1 and 4
- B 1 only
- C 2, 3 and 4
- D 2 and 3 only

22 The equation shows the reaction between aqueous hydrogen bromide and aqueous ammonia.



Which statement describes the role of aqueous hydrogen bromide?

- A It is a catalyst.
- B It is a reducing agent.
- C It is a proton acceptor.
- D It is a proton donor.

- 3** A student prepares a sample of the insoluble salt barium sulfate, BaSO_4 .
The student adds aqueous sodium sulfate, $\text{Na}_2\text{SO}_4(\text{aq})$, to aqueous barium chloride, $\text{BaCl}_2(\text{aq})$.

The student carries out the following steps.

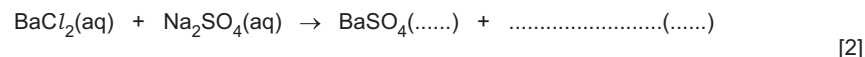
step 1 Dissolve 0.100 moles of solid BaCl_2 in 100cm^3 of distilled water in a beaker to form $\text{BaCl}_2(\text{aq})$.

step 2 Add an aqueous solution which contains 0.100 moles of $\text{Na}_2\text{SO}_4(\text{aq})$ to the beaker containing the $\text{BaCl}_2(\text{aq})$ from **step 1**.

step 3 Stir the mixture and then filter it.

step 4 Dry the solid left in the filter paper.

- (a) Complete the symbol equation for the reaction. Include state symbols.



[2]

- (b) Calculate the mass of solid BaCl_2 dissolved in **step 1**.

mass = g [2]

- (c) The concentration of $\text{Na}_2\text{SO}_4(\text{aq})$ in **step 2** is 1.25mol/dm^3 .

Calculate the volume, in cm^3 , of 1.25mol/dm^3 $\text{Na}_2\text{SO}_4(\text{aq})$ added in **step 2** which contains 0.100 moles of Na_2SO_4 .

volume = cm^3 [1]

- (d) State the colour of the solid formed in **step 2**.

..... [1]

- (e) The mixture is filtered in **step 3**.

State the general term given to a solid left in the filter paper after filtration.

..... [1]

- (f) The actual mass of dry BaSO_4 collected in **step 4** is greater than the expected mass. This is because the student should do an additional step between **step 3** and **step 4**.

Suggest what the student should do in this additional step, and explain why the actual mass collected is greater than the expected mass.

.....

 [2]

- (g) State the name of this method of salt preparation.

..... [1]

- (h) State the name of a different:

- barium salt that can be used in place of BaCl_2
- sulfate salt that can be used in place of Na_2SO_4
- barium salt that can be made by this method.

[3]

[Total: 13]

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.

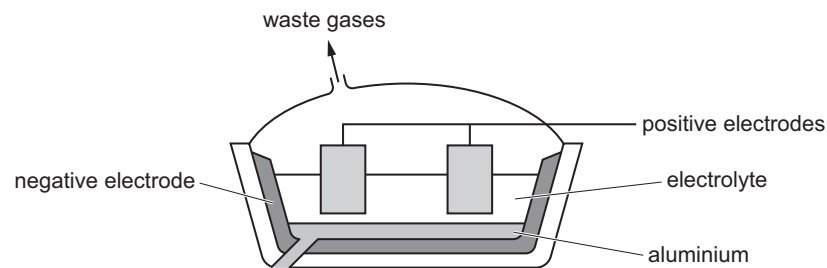
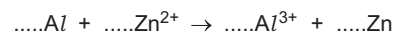


Fig. 3.1

- (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.



[1]

- (iii) State the oxidation number of zinc in:

Zn^{2+}

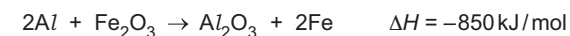
Zn.

[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:

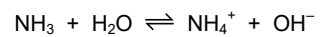
• gallium(III) bromide

• gallium(III) sulfate.

[2]

[Total: 17]

19 Aqueous ammonia forms an equilibrium with water.



In this equilibrium, which particle acts as an acid and which particle acts as a base?

	acid	base
A	NH_3	H_2O
B	NH_3	OH^-
C	H_2O	NH_3
D	H_2O	NH_4^+