

**7** Which statement explains why solid magnesium is a good conductor of electricity?

- A** Magnesium has delocalised electrons that can move through the lattice.
- B** Magnesium has strong attractions between ions.
- C** Magnesium consists of a giant lattice of anions in a 'sea' of delocalised electrons.
- D** Magnesium consists of metal ions that move through the lattice.

**9** Which row describes the structure and bonding in cobalt?

|          | structure | bonding  |
|----------|-----------|----------|
| <b>A</b> | giant     | ionic    |
| <b>B</b> | simple    | ionic    |
| <b>C</b> | giant     | metallic |
| <b>D</b> | simple    | metallic |

**3** This question is about copper and compounds of copper.

**(a) (i)** Describe the bonding in a metallic element such as copper.

.....  
 .....  
 .....  
 .....  
 ..... [3]

**(ii)** Explain how solid copper conducts electricity.

..... [1]

**(b)** Copper is in alloys such as brass.

**(i)** State **one** reason why alloys are more useful than pure metals.

..... [1]

**(ii)** Name the substance that is present in brass, other than copper.

..... [1]

**(c)** Copper(II) sulfate crystals are made by the reaction between copper(II) carbonate and dilute sulfuric acid, using the following steps.

The sulfuric acid has a concentration of 0.100 mol/dm<sup>3</sup>.

**step 1** Powdered copper(II) carbonate is added to dilute sulfuric acid. The mixture is stirred. A reaction occurs.

**step 2** More copper(II) carbonate is added, with stirring, until the reaction stops.

**step 3** Unreacted copper(II) carbonate is separated from aqueous copper(II) sulfate by filtration.

**step 4** Aqueous copper(II) sulfate is heated until some of the water evaporates.

**step 5** The remaining solution is allowed to cool and crystallise.

**step 6** The crystals are removed and dried.

**(i)** Give **two** observations in **step 1**.

1 .....  
 2 ..... [2]

(ii) State why the reaction stops in **step 2**.

..... [1]

(iii) Name the residue in **step 3**.

..... [1]

(iv) Name a substance, other than copper(II) carbonate, that can be added to dilute sulfuric acid to produce aqueous copper(II) sulfate.

..... [1]

(v) The solution at the end of **step 4** contains the maximum amount of copper(II) sulfate that will dissolve at that temperature.

State the term used to describe this type of solution.

..... [1]

(vi) **Step 1** is repeated using sulfuric acid of concentration  $0.200 \text{ mol/dm}^3$  instead of  $0.100 \text{ mol/dm}^3$ .

All other conditions are the same.

The rate of reaction increases.

Explain why the rate of reaction increases. Give your answer in terms of particles.

.....

.....

..... [2]

(vii) Copper(II) sulfate crystals have the formula  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .

State the term used to describe a substance that is chemically combined with water.

..... [1]

[Total: 15]

3 This question is about zinc and compounds of zinc.

(a) Zinc is held together by electrostatic forces of attraction between particles.

(i) Name the type of bonding in zinc.

..... [1]

(ii) Name the **two** types of particles held together by the bonding in (a)(i).

1 .....

2 .....

[2]

(iii) Name the type of particle whose movement allows zinc to conduct electricity.

..... [1]

(b) Zinc is present in alloys such as brass.

(i) State the meaning of the term alloy.

..... [1]

(ii) Name the substance that is present in brass, other than zinc.

..... [1]

(c) Zinc sulfate crystals are made by the reaction between zinc carbonate and dilute sulfuric acid, using the following steps.

**step 1** An excess of powdered zinc carbonate is added to dilute sulfuric acid.

**step 2** Excess zinc carbonate is separated from aqueous zinc sulfate by filtration.

**step 3** Aqueous zinc sulfate is heated until a saturated solution is formed.

**step 4** The saturated solution is allowed to cool and crystallise.

**step 5** The crystals are removed and dried.

(i) Give **two** observations which show that the zinc carbonate is in excess in **step 1**.

1 .....

2 .....

[2]

(ii) Name the filtrate in **step 2**.

..... [1]

- (iii) Name a compound, other than zinc carbonate, that can be added to dilute sulfuric acid to produce aqueous zinc sulfate in **step 1**.

..... [1]

- (iv) State what is meant by the term saturated solution.

.....  
 ..... [2]

- (v) **Step 1** is repeated using large pieces of zinc carbonate instead of powdered zinc carbonate.

All other conditions are the same.

The rate of reaction decreases.

Explain why the rate of reaction decreases. Give your answer in terms of particles.

.....  
 .....  
 ..... [2]

- (vi) Hydrated crystals form in **step 4**.

State what is meant by the term hydrated.

..... [1]

[Total: 15]

- 8 Which row identifies the positive and the negative particles present in a giant metallic lattice?

|          | positive particles | negative particles    |
|----------|--------------------|-----------------------|
| <b>A</b> | anions             | cations               |
| <b>B</b> | anions             | delocalised electrons |
| <b>C</b> | cations            | anions                |
| <b>D</b> | cations            | delocalised electrons |