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]