Reactions of acids and making salts

AQA 8462 Separate Chemistry · Foundation and Higher

Show your working where needed. Check the worked answers when you finish.

Name _____ Date _____

1. Read pH values

Solution A has pH 3, solution B has pH 7 and solution C has pH 11. Identify the acidic, neutral and alkaline solutions.

2. A metal reacts with an acid

Magnesium reacts with dilute hydrochloric acid. Name the salt and gas produced. Describe how to test for the gas and give a positive result.

3. A carbonate reacts with an acid

Write the complete word equation for calcium carbonate reacting with nitric acid.

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4. Compare two metals

Zinc and copper are placed separately in dilute hydrochloric acid. Bubbles form around the zinc. There is no visible change with the copper. Explain these results using the reactivity series.

5. Choose starting materials

A student wants to make copper(II) sulfate crystals from an insoluble metal oxide and a dilute acid. Name the oxide and acid. Explain why it helps to have some solid left at the end of the reaction.

6. Recover dry crystals

A student has a mixture of magnesium sulfate solution and excess magnesium oxide. Describe how to obtain dry magnesium sulfate crystals from it.

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7. Compare two acid solutions (Higher)

Dilute hydrochloric acid and ethanoic acid have the same concentration. Predict which solution has the lower pH and explain why.

8. pH and concentration (Higher)

Solution X has pH 2 and solution Y has pH 5. Which has the higher hydrogen ion concentration? Calculate how many times greater it is and show your working.

9. Extra challenge · Choose a route to a salt

Two students make zinc sulfate solution with dilute sulfuric acid. Student P uses zinc carbonate and Student Q uses zinc oxide. Predict how they can distinguish the reactions by a test on a product. Then explain how each student should separate dry zinc sulfate crystals from an excess of starting solid.

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Worked answers

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1. Read pH values

A is acidic, B is neutral and C is alkaline. An acid has a pH below 7 and an alkali has a pH above 7.

2. A metal reacts with an acid

The salt is magnesium chloride and the gas is hydrogen. Hold a lighted splint at the mouth of the gas container. Hydrogen burns with a squeaky pop.

3. A carbonate reacts with an acid

Calcium carbonate + nitric acid → calcium nitrate + water + carbon dioxide.

4. Compare two metals

Zinc is above hydrogen in the reactivity series, so it displaces hydrogen from dilute hydrochloric acid. Copper is below hydrogen, so it does not displace it.

5. Choose starting materials

Use copper(II) oxide and sulfuric acid. Excess solid oxide ensures that all the acid reacts. The unreacted solid can be removed by filtration.

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Worked answers

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6. Recover dry crystals

Filter off the excess magnesium oxide. Gently heat the filtrate to evaporate some water, then leave it to cool so crystals form. Separate the crystals from the remaining solution and pat them dry with filter paper.

7. Compare two acid solutions (Higher)

Hydrochloric acid has the lower pH. It completely ionises in water. Ethanoic acid only partially ionises, so at the same acid concentration it produces a lower concentration of hydrogen ions.

8. pH and concentration (Higher)

X has the greater hydrogen ion concentration. Lowering the pH by one unit increases the hydrogen ion concentration by a factor of ten. The difference is three pH units, so the factor is 10^3 = 1,000.

9. Extra challenge · Choose a route to a salt

P’s carbonate reaction produces carbon dioxide, which turns limewater cloudy. The oxide reaction makes zinc sulfate and water without a gas.

Filter to remove unreacted zinc carbonate or zinc oxide. Gently heat the clear filtrate to concentrate it, then cool to crystallise. Filter off the crystals and dry them.

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