Reactions of acids and making salts

Pearson Edexcel 1CH0 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. Prepare a pure sample of a salt

A student has a warm blue copper sulfate solution mixed with excess black copper oxide. Describe how to obtain dry hydrated copper sulfate crystals. Explain why the mixture should not be boiled dry.

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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 · A clear solution and a solid

A student making hydrated copper sulfate from copper oxide and dilute sulfuric acid adds just enough oxide for the black solid to disappear. The student boils the blue liquid until it is dry. Explain what could still be present when the solid disappears. Describe a better method that gives separate hydrated crystals.

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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. Prepare a pure sample of a salt

Filter to remove the black excess copper oxide, leaving a clear blue filtrate. Gently evaporate some water in a water bath, then leave the concentrated solution to cool and form crystals.

Filter off and dry the crystals. Strong heating to dryness can remove the water in hydrated crystals.

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 · A clear solution and a solid

Sulfuric acid could still be left in solution if all the added copper oxide has reacted. Add small portions of copper oxide to the warmed acid until some black solid stays and then filter off the excess.

Gently evaporate some water using a water bath and let the concentrated solution cool. Filter off and dry the crystals. Strong heating to dryness can drive off the water in the crystals.

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