FOUNDATION

# C4F Chemical Changes: Foundation Tier Practice

AQA 8462 · Calculator allowed · about 90 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** An acid is a substance that can release hydrogen ions when in water.

**(a)** Define the term 'acid' in terms of ions produced in water. **(1)**

**(Total for Question 1 is 1 mark)**

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**2** The pH scale runs from 0 to 14 and indicates how acidic or alkaline a solution is.

**(a)** State the pH value of a neutral solution (pure water). **(1)**

**(b)** State whether a solution with pH 3 is acidic, alkaline or neutral. **(1)**

**(Total for Question 2 is 2 marks)**

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**3** Indicators change colour depending on the pH of a solution.

**(a)** Name an indicator that gives a different colour for acids and alkalis and is commonly used to show the pH range (not just litmus). **(1)**

**(Total for Question 3 is 1 mark)**

**4** Hydrochloric acid is a common acid used in the laboratory.

**(a)** Give the chemical formula for hydrochloric acid when dissolved in water (aqueous form). **(1)**

**(b)** State the name of the ion produced when hydrochloric acid ionises in water. **(1)**

**(Total for Question 4 is 2 marks)**

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**5** An experiment tests the reaction between dilute hydrochloric acid and magnesium ribbon. The word equation for the reaction is given.

**(a)** State one gas produced in this reaction and give one test you would use to show the gas is hydrogen. **(2)**

**(b)** State the type of reaction (acid with metal) shown by the word equation. **(1)**

**(Total for Question 5 is 3 marks)**

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**6** A student neutralises 25.0 cm3 of 0.10 mol/dm3 hydrochloric acid with sodium hydroxide solution. The equation is HCl + NaOH -> NaCl + H2O.

**(a)** Calculate the number of moles of HCl in 25.0 cm3 of 0.10 mol/dm3 solution. Show your working and give the answer to 3 significant figures. **(2)**

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**(b)** Using the equation and the result from part (a), state the volume of 0.10 mol/dm3 NaOH needed to neutralise the acid. Show reasoning. **(1)**

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**(Total for Question 6 is 3 marks)**

**7** Neutralisation between an acid and an alkali produces a salt and water.

**(a)** Give the two products formed when hydrochloric acid reacts with sodium hydroxide. **(2)**

**(Total for Question 7 is 2 marks)**

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**8** A student says a soluble salt can be made by reacting an acid with an insoluble base and filtering off excess base.

**(a)** Explain why the student filters the mixture after reacting an acid with an insoluble base when making a salt. **(2)**

**(Total for Question 8 is 2 marks)**

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**9** A metal carbonate reacts with an acid producing a salt, water and carbon dioxide gas.

**(a)** Complete the word equation for the reaction between copper(II) carbonate and sulfuric acid. **(2)**

**(b)** State how you could test the gas produced to show it is carbon dioxide. **(1)**

**(Total for Question 9 is 3 marks)**

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**10** A metal displacement reaction can form a salt from a metal and a solution containing another metal ion.

**(a)** Predict what happens when a strip of iron is placed in copper(II) sulfate solution. **(2)**

**(Total for Question 10 is 2 marks)**

**11** Salt preparation by crystallisation is a method used to obtain solid salts from solution.

**(a)** State one step needed to obtain solid crystals from a salt solution after filtering to remove excess solid. **(1)**

**(b)** Give one safety precaution when heating a salt solution to evaporate water. **(1)**

**(Total for Question 11 is 2 marks)**

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**12** A student adds excess zinc to 50.0 cm3 of 0.20 mol/dm3 copper(II) sulfate solution and the reaction goes to completion. Use the equation Zn + CuSO4 -> ZnSO4 + Cu.

**(a)** Calculate the number of moles of CuSO4 present in 50.0 cm3 of 0.20 mol/dm3 solution. **(1)**

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**(b)** State the mass of copper metal that can form. Mr of Cu = 63.5. **(2)**

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**(Total for Question 12 is 3 marks)**

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**13** Some reactions are reversible. A reversible reaction can reach a dynamic equilibrium.

**(a)** Explain what is meant by a dynamic equilibrium in a reversible reaction. **(3)**

**(Total for Question 13 is 3 marks)**

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**14** A metal oxide can behave as a base and react with acids to form a salt and water.

**(a)** Give the product(s) when magnesium oxide reacts with hydrochloric acid. **(2)**

**(Total for Question 14 is 2 marks)**

**15** Describe how to make a pure, dry sample of potassium chloride crystals starting from aqueous potassium hydroxide and dilute hydrochloric acid. Your answer should include how you would carry out the neutralisation, how to purify the salt, and one safety precaution.

**(Total for Question 15 is 6 marks)**

# Mark scheme · C4F Chemical Changes: Foundation Tier Practice

## Question 1

- (a) **B1** produces hydrogen ions (H+) in aqueous solution, oe
- **(a) Answer: A substance that produces hydrogen ions (H+) in water.**

## Question 2

- (a) **B1** pH 7 cao
- **(a) Answer: pH 7**
- (b) **B1** acidic cao
- **(b) Answer: Acidic**

## Question 3

- (a) **B1** universal indicator
- **(a) Answer: Universal indicator**

## Question 4

- (a) **B1** HCl (aq) or HCl
- **(a) Answer: HCl (aq)**
- (b) **B1** hydrogen ion or H+
- **(b) Answer: Hydrogen ion, H+**

## Question 5

- (a) **B1** hydrogen
- (a) **B1** test: lighted splint makes a squeaky pop (or 'pop' sound), oe
- **(a) Answer: Hydrogen; test with a lighted splint which makes a squeaky pop.**
- (b) **B1** metal + acid -> salt + hydrogen is an acid-metal reaction (or 'acid reacts with a metal')
- **(b) Answer: An acid reacting with a metal (acid-metal reaction).**

## Question 6

- (a) **M1** uses n = concentration x volume (in dm3) and substitutes: n = 0.10 x 0.025
- (a) **A1** 0.00250 mol cao
- **(a) Answer: 0.00250 mol**
- (b) **B1** same moles of NaOH needed, so volume = moles / concentration = 0.00250 / 0.10 = 0.0250 dm3 or 25.0 cm3
- **(b) Answer: 25.0 cm3**

## Question 7

- (a) **B1** sodium chloride
- (a) **B1** water
- **(a) Answer: Sodium chloride and water.**

## Question 8

- (a) **B1** filtering removes excess insoluble base from the solution
- (a) **B1** this leaves a solution containing only the dissolved salt which can then be crystallised, oe
- **(a) Answer: Filtering removes the excess insoluble base, leaving a solution of the dissolved salt that can be crystallised.**

## Question 9

- (a) **B1** copper(II) sulfate
- (a) **B1** carbon dioxide (and water if split into two products) - both required for full 2 marks
- **(a) Answer: copper(II) sulfate + carbon dioxide + water**
- (b) **B1** bubble through limewater which turns cloudy (milky)
- **(b) Answer: Bubble it through limewater; the limewater turns cloudy.**

### Question 10

- (a) **B1** iron will displace copper from solution (if student states iron is more reactive than copper)
- (a) **B1** copper metal forms and solution becomes iron sulfate (or solution colour fades), oe
- **(a) Answer: Iron displaces copper; copper metal forms and the solution becomes iron sulfate (the blue colour fades).**

### Question 11

- (a) **B1** heat the solution to evaporate some water or allow to crystallise
- **(a) Answer: Warm or evaporate the solution to concentrate it, then allow to crystallise.**
- (b) **B1** use safety goggles, do not heat to dryness, use a heatproof mat, or similar safety point
- **(b) Answer: Use safety goggles and a heatproof mat; do not heat to complete dryness.**

### Question 12

- (a) **B1** 0.0100 mol (n = 0.20 x 0.0500)
- **(a) Answer: 0.0100 mol**
- (b) **M1** uses m = n x Mr with n = 0.0100 and Mr Cu = 63.5
- (b) **A1** 0.635 g cao
- **(b) Answer: 0.635 g**

### Question 13

- (a) **B1** a reversible reaction where the forward and reverse reactions occur
- (a) **B1** rates of the forward and reverse reactions are equal at equilibrium
- (a) **B1** concentrations of reactants and products remain constant (but not necessarily equal), oe
- **(a) Answer: In a dynamic equilibrium the forward and reverse reactions continue to occur but at equal rates, so the concentrations of reactants and products stay constant.**

### Question 14

- (a) **B1** magnesium chloride
- (a) **B1** water
- **(a) Answer: Magnesium chloride and water.**

### Question 15

- **Level 3** (5-6): Detailed description of the method, including accurate steps for neutralisation with correct indicators or measurement, purification by evaporation/crystallisation and drying, and a safety precaution. Logical sequence and reasons given.
- **Level 2** (3-4): Basic description with most steps present: neutralisation and crystallisation described but lacking some detail or reasoning; includes a safety point.
- **Level 1** (0-2): Limited or incomplete description. Missing important steps such as neutralisation, purification or safety.
- **Indicative content:**
  - Measure a known volume or amount of potassium hydroxide solution.
  - Add dilute hydrochloric acid slowly to the alkali while stirring, using universal indicator or phenolphthalein to know when neutral (colour change), or add until neutral measured by pH meter.
  - Alternatively, add acid until neutralisation and then add a little excess alkali and filter off if using insoluble reagents (not applicable here), so state careful addition and checking of pH.
  - Once neutral, evaporate some water by gentle heating until crystals start to form, then leave to cool to crystallise the potassium chloride.
  - Filter off the crystals, wash with a small amount of cold distilled water, then dry on filter paper or in a warm oven to obtain a pure dry sample.
  - Include a safety precaution such as wearing safety goggles, handle acids carefully, and do not boil to dryness.