FOUNDATION

C8F Chemical Analysis: Foundation Tier Practice

AQA 8462 · Calculator allowed · about 90 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Define the term "pure substance" in chemistry.

(a) Define the term "pure substance". **(1)**

(Total for Question 1 is 1 mark)

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2 State a laboratory observation that would show a sample is impure when it is melted.

(a) What observation on melting would suggest the sample is impure? **(1)**

(Total for Question 2 is 1 mark)

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3 Which simple separation method would you use to separate a soluble salt from sand in a mixture?

(a) Name the method to separate a soluble salt from sand. **(1)**

(Total for Question 3 is 1 mark)

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4 Chromatography separates mixture components. Answer parts a and b.

(a) Explain briefly how paper chromatography separates different coloured dyes. **(1)**

(b) State one practical use of chromatography in chemistry. **(1)**

(Total for Question 4 is 2 marks)

5 In a chromatography experiment a student places a spot of ink 2.0 cm from the base line. After running the solvent the solvent front moved 7.0 cm from the base line and the ink spot moved 4.2 cm from the base line. Calculate the Rf value for the ink.
Use Rf = distance travelled by substance / distance travelled by solvent.

(a) Calculate Rf and give your answer to two decimal places. **(2)**

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(Total for Question 5 is 2 marks)

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6 Give the flame-test colours for the following metal ions.

(a) Sodium ion **(1)**

(b) Lithium ion **(1)**

(c) Copper(II) ion **(1)**

(Total for Question 6 is 3 marks)

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7 Describe the simple test for hydrogen gas and the observation that confirms hydrogen is present.

(a) Test and observation for hydrogen gas. **(1)**

(Total for Question 7 is 1 mark)

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8 State how you would test for oxygen gas and the observation you would expect.

(a) Test and observation for oxygen. **(1)**

(Total for Question 8 is 1 mark)

9 Describe a simple test for carbon dioxide gas and the observation that confirms its presence.

(a) Test and observation for carbon dioxide. **(1)**

(Total for Question 9 is 1 mark)

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10 A student adds dilute hydrochloric acid to a sample and sees vigorous fizzing. This suggests the sample contains carbonate ions. State the gas produced and how to test that the gas is carbon dioxide.

(a) State the gas produced when acid is added to a carbonate. **(1)**

(b) Describe a test to confirm the gas is carbon dioxide. **(1)**

(Total for Question 10 is 2 marks)

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11 Describe the test for chloride ions in solution and the observation that indicates chloride is present. Include the reagents needed.

(a) Describe the chloride test and observation. **(2)**

(Total for Question 11 is 2 marks)

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12 Describe the test for sulfate ions in solution and the observation that indicates sulfate is present. Include the reagents needed.

(a) Describe the sulfate test and observation. **(2)**

(Total for Question 12 is 2 marks)

13 Describe a simple method to obtain a pure sample of a soluble ionic substance from its aqueous solution.

(a) Describe the steps to obtain solid from solution. **(2)**

(Total for Question 13 is 2 marks)

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14 A student dissolves 1.50 g of a soluble salt in 250 cm3 of water. Calculate the concentration in g per dm3. Show your working.

(a) Calculate concentration in g per dm3. **(2)**

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(Total for Question 14 is 2 marks)

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15 Give the typical pH value for each of the following and state whether it is acidic, neutral or alkaline.

(a) Neutral substance **(1)**

(b) A typical acidic substance **(1)**

(c) A typical alkaline substance **(1)**

(Total for Question 15 is 3 marks)

16 You are given two white solid samples. Sample A dissolves in dilute hydrochloric acid with effervescence. Sample B does not react with dilute hydrochloric acid. Explain a sequence of simple tests you would do to distinguish between sodium chloride and calcium carbonate, identify which sample is which, and how you would check the purity of each solid. Your answer should describe observations and give reasons.

(Total for Question 16 is 6 marks)

Mark scheme · C8F Chemical Analysis: Foundation Tier Practice

Question 1

- (a) **B1** contains only one type of element or compound or has fixed melting and boiling points, oe
- **(a) Answer: A substance that contains only one type of element or compound and has fixed melting and boiling points.**

Question 2

- (a) **B1** melts over a wide range of temperatures or does not have a sharp melting point
- **(a) Answer: It melts over a wide range of temperatures rather than at a sharp melting point.**

Question 3

- (a) **B1** filtration followed by evaporation or crystallisation
- **(a) Answer: Filtration to remove sand, then evaporate or crystallise the solution to get the salt.**

Question 4

- (a) **B1** different dyes travel different distances because they have different solubilities in the solvent and different attraction to the paper
- **(a) Answer: Dyes travel different distances because they have different solubilities in the solvent and different attraction to the paper.**
- (b) **B1** to identify substances in an ink, food colouring or drug testing, oe
- **(b) Answer: To identify substances in inks, food colourings or to check purity of a sample.**

Question 5

- (a) **M1** substitutes distances measured from the origin: Rf = (4.2 - 2.0) / (7.0 - 2.0)
- (a) **A1** 0.44 cao
- **(a) Answer: 0.44**

Question 6

- (a) **B1** yellow
- **(a) Answer: Yellow**
- (b) **B1** crimson or red
- **(b) Answer: Crimson (red)**
- (c) **B1** green or blue-green
- **(c) Answer: Green / blue-green**

Question 7

- (a) **B1** bring a lighted splint near the gas and a squeaky pop or small explosion is heard
- **(a) Answer: Bring a lighted splint near the gas; a squeaky pop sound shows hydrogen is present.**

Question 8

- (a) **B1** place a glowing splint into the gas and it relights or glows brighter
- **(a) Answer: Put a glowing splint into the gas; the splint relights showing oxygen is present.**

Question 9

- (a) **B1** bubble the gas through limewater and it turns milky or cloudy
- **(a) Answer: Bubble the gas through limewater; the limewater turns milky or cloudy.**

Question 10

- (a) **B1** carbon dioxide
- **(a) Answer: Carbon dioxide**
- (b) **B1** bubble the gas through limewater which turns cloudy/milky
- **(b) Answer: Bubble the gas through limewater; it turns cloudy, confirming carbon dioxide.**

Question 11

- (a) **B1** acidify with dilute nitric acid or dilute hydrochloric acid to remove carbonate ions
- (a) **B1** add silver nitrate and a white precipitate of silver chloride forms
- **(a) Answer: Acidify the solution with dilute nitric acid then add silver nitrate; a white precipitate (silver chloride) shows chloride ions are present.**

Question 12

- (a) **B1** acidify with dilute hydrochloric or nitric acid to remove carbonate
- (a) **B1** add barium chloride and a white precipitate of barium sulfate forms
- **(a) Answer: Acidify with dilute acid then add barium chloride; a white precipitate of barium sulfate indicates sulfate ions.**

Question 13

- (a) **B1** evaporate some solvent or heat to concentrate until crystals form (evaporation/crystallisation)
- (a) **B1** cool the concentrated solution and filter off crystals, then dry the crystals
- **(a) Answer: Evaporate the solvent or concentrate the solution until crystals start to form, cool, filter off the crystals and dry them to obtain a pure solid.**

Question 14

- (a) **M1** converts volume and substitutes: concentration = 1.50 g / 0.250 dm3
- (a) **A1** 6.0 g per dm3 cao
- **(a) Answer: 6.0 g per dm3**

Question 15

- (a) **B1** pH 7 and neutral
- **(a) Answer: pH 7, neutral**
- (b) **B1** pH 2-3 and acidic
- **(b) Answer: pH 2 or 3, acidic**
- (c) **B1** pH 11-12 and alkaline
- **(c) Answer: pH 11 or 12, alkaline**

Question 16

- **Level 3** (5-6): Detailed explanation using a clear sequence of tests, correct observations, and correct reasons that distinguish sodium chloride and calcium carbonate and give methods to check purity.
- **Level 2** (3-4): Some correct tests and observations with partial reasons, but the sequence or purity checks are incomplete or partly incorrect.
- **Level 1** (1-2): Limited or vague description of tests with little or no correct reasoning.
- **Indicative content:**
  - Add dilute hydrochloric acid to a sample: calcium carbonate reacts with effervescence producing CO2; sodium chloride does not fizz.
  - Confirm gas is CO2 by bubbling through limewater which turns cloudy; this identifies carbonate.
  - For sodium chloride, dissolve sample in water and test with silver nitrate after acidification: a white precipitate (silver chloride) forms for chloride ions.
  - To check purity of calcium carbonate, measure melting point is not suitable; instead check that adding acid always gives CO2 and that remaining solid gives expected mass loss on heating (if described simply), or compare with a pure sample reaction strength; for sodium chloride, evaporate solution to recrystallise and check crystals and melting point or compare conductivity of solution.
  - Give reasons: carbonate reacts with acid to produce CO2 because CO3(2-) + 2H+ -> CO2 + H2O; chloride gives silver chloride precipitate because Ag+ + Cl- -> AgCl(s).
  - Clear sequence: acid test first to separate which is carbonate, then confirm chloride test on the other; show how recrystallisation or consistent sharp melting point / consistent test results indicate purity.