2.14 Reactivity, Acids and Salts: 30-minute Pack

AQA 8464 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Different metals react differently with cold water and with steam.

(a) Describe what you would observe when a small piece of potassium is added to cold water. **(2)**

(b) Write a balanced symbol equation, including state symbols, for the reaction between calcium and water. **(2)**

(c) Iron does not react with cold water. Name the two products formed when iron reacts with steam. **(1)**

(Total for Question 1 is 5 marks)

2 Zinc metal is added to a solution of silver nitrate.

(a) Predict whether a reaction occurs. **(1)**

(b) Explain your answer in terms of reactivity, and name the products formed. **(2)**

(Total for Question 2 is 3 marks)

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3 Many household substances contain acids, and water itself has a specific pH.

(a) Name the acid found in vinegar. **(1)**

(b) Name the acid found in the human stomach. **(1)**

(c) State whether pure water is acidic, neutral or alkaline, and give its pH value. **(2)**

(Total for Question 3 is 4 marks)

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4 Explain how the position of a metal in the reactivity series (relative to carbon and to hydrogen) determines: (i) how vigorously it reacts with water or dilute acid, and (ii) the method needed to extract it from its ore. Use ideas about electron transfer in your answer.

(Total for Question 4 is 6 marks)

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5 A student added small, equal-sized pieces of four metals to separate test tubes of dilute sulfuric acid and recorded these observations:

Magnesium: rapid fizzing, and the test tube felt warm

Zinc: a steady stream of bubbles

Iron: slow, occasional bubbles

Copper: no bubbles seen

(a) Use the observations to identify the most reactive of the four metals. **(1)**

(b) Write a word equation for the reaction between magnesium and dilute sulfuric acid. **(2)**

(c) Describe a test for hydrogen gas and state the result that confirms it is present. **(2)**

(d) Explain why no bubbles were seen in the test tube containing copper. **(1)**

(Total for Question 5 is 6 marks)

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Mark scheme · 2.14 Reactivity, Acids and Salts: 30-minute Pack

Question 1

(a) potassium moves rapidly across the surface of the water and fizzes vigorously (oe) **B1**

(a) the metal melts into a ball and/or ignites, burning with a lilac flame (any one, oe) **B1**

(a) Answer: Potassium moves rapidly across the surface, fizzing vigorously; it may melt into a ball and ignite with a lilac flame.

(b) correct formulae shown (balanced or not): $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$ **M1**

(b) correctly balanced with state symbols: $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$ (cao) **A1**

(b) Answer: $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

(c) iron oxide and hydrogen (both needed, oe) **B1**

(c) Answer: Iron oxide and hydrogen.

Question 2

(a) yes, a reaction occurs **B1**

(a) Answer: Yes, a reaction occurs.

(b) zinc is more reactive than silver, so zinc displaces silver from the solution (oe) **B1**

(b) products: zinc nitrate and silver (both needed) **B1**

(b) Answer: Zinc is more reactive than silver, so it displaces silver from silver nitrate solution, forming zinc nitrate and silver metal.

Question 3

(a) ethanoic acid (oe: acetic acid) **B1**

(a) Answer: Ethanoic acid

(b) hydrochloric acid **B1**

(b) Answer: Hydrochloric acid

(c) neutral **B1**

(c) pH 7 **B1**

(c) Answer: Neutral, pH 7

Question 4

Level 3 A clear, logically linked explanation connects reactivity (in terms of how readily atoms lose electrons to form positive ions), the vigour of reactions with water/acid, and the extraction method (reduction with carbon versus other methods), for metals both above and below carbon/hydrogen in the series. **5-6**

Level 2 Relevant points about reactivity, reactions with water/acid, and extraction method are given, with some logical linking between at least two of these ideas. Some reference to electron transfer or to carbon's position may be included but not fully integrated. **3-4**

Level 1 Simple, isolated statements are made about the reactivity series (e.g. metal order, or that reactions with acid/water differ), with little or no linkage between reactivity, reactions and extraction. The answer may be largely descriptive. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- The reactivity series orders metals (and carbon, hydrogen) by how readily their atoms lose electrons to form positive ions.
- More reactive metals (e.g. potassium, sodium, calcium) lose electrons more easily and so react more vigorously with cold water and dilute acid, releasing hydrogen faster.
- Metals below hydrogen (e.g. copper, silver, gold) do not react with dilute acids because they cannot lose electrons readily enough to displace hydrogen.
- Oxidation and reduction can be defined in terms of oxygen (or, at Higher tier, electron transfer): the metal is oxidised (loses electrons) while H^+ ions are reduced (gain electrons) to form hydrogen gas.
- Metals less reactive than carbon (e.g. zinc, iron, copper) can be extracted from their oxides by reduction with carbon, because carbon can remove the oxygen from these metal compounds.
- Metals more reactive than carbon (e.g. sodium, calcium) cannot be extracted by reduction with carbon, since carbon cannot remove oxygen from their more stable compounds; other methods, such as electrolysis, are needed instead.
- Very unreactive metals such as gold have such a low tendency to lose electrons or form compounds that they are found in the Earth's crust as the uncombined element, requiring no chemical extraction.
- A well-linked answer connects all three ideas: the same underlying tendency to lose electrons explains both the vigour of a metal's reactions with water/acid and the method (or absence of need) for its extraction.

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Question 5

(a) magnesium **B1**

(a) Answer: Magnesium

(b) correct reactants: magnesium + sulfuric acid **M1**

(b) correct products: magnesium sulfate + hydrogen (oe order) **A1**

(b) Answer: magnesium + sulfuric acid -> magnesium sulfate + hydrogen

(c) hold a lit/burning splint at the mouth of the test tube (oe) **B1**

(c) a squeaky pop is heard (cao) **B1**

(c) Answer: A lit splint held at the mouth of the tube gives a squeaky pop.

(d) copper is less reactive than hydrogen, so it does not react with (cannot displace hydrogen from) dilute acids (oe) **B1**

(d) Answer: Copper does not react with dilute acids because it is less reactive than hydrogen.

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