2.3 Chemical Reactions: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State whether each description matches an exothermic or an endothermic reaction.

(a) The temperature of the surroundings increases during the reaction. **(1)**

(b) The temperature of the surroundings decreases during the reaction. **(1)**

---

2 Amelia mixes vinegar and baking soda in an open container and sees fizzing. Which of the following is the gas produced?

- ☐ A) Oxygen
- ☐ B) Carbon dioxide
- ☐ C) Hydrogen
- ☐ D) Nitrogen

---

3 A student plans an experiment to investigate how temperature affects the rate of a reaction between potassium iodide solution and hydrogen peroxide that produces a brown colour. Identify one variable that must be kept the same to make this a fair test, and give a brief reason.

(2)

---

4 Describe how you would test a gas sample to show it is carbon dioxide using limewater. Include one observation you would expect.

(2)

© Revision Library | revisionlibrary.co.uk

5 Quickfire: circle the correct letter for each question.

(a) Which observation is the best evidence that a chemical reaction is taking place? **(1)**

- ☐ A) the substance is broken into smaller pieces
- ☐ B) a permanent colour change and a temperature rise happen together
- ☐ C) the substance changes shape when squashed
- ☐ D) the substance floats on water

(b) A white powder is heated and a colourless gas is given off that turns limewater cloudy. Which gas is most likely being produced? **(1)**

- ☐ A) oxygen
- ☐ B) hydrogen
- ☐ C) carbon dioxide
- ☐ D) nitrogen

(c) In a chemical reaction, the total mass of the products compared with the total mass of the reactants is: **(1)**

- ☐ A) always greater
- ☐ B) always less
- ☐ C) always equal (in a closed system)
- ☐ D) impossible to predict

(d) Which type of reaction always releases energy to the surroundings, shown by a temperature rise? **(1)**

- ☐ A) endothermic
- ☐ B) exothermic
- ☐ C) reversible
- ☐ D) neutral

---

6 A technician needs to add exactly 23.5 cm^3 of dilute acid, drop by drop, to a flask of alkali until it is neutralised, and needs to read the volume added precisely. Name the piece of apparatus the technician should use and give a reason for your choice.

(2)

© Revision Library | revisionlibrary.co.uk

7 Hydrogen peroxide solution decomposes very slowly at room temperature into water and oxygen gas. Adding a small amount of manganese dioxide powder makes it decompose rapidly, with lots of bubbling, but the mass of manganese dioxide is unchanged at the end of the reaction. Explain the role of manganese dioxide in this reaction.

(3)

8 Two students each react 2.0 g of calcium carbonate with 20 cm^3 of the same dilute hydrochloric acid. Student A uses calcium carbonate as a single large lump. Student B uses the same mass of calcium carbonate crushed into a fine powder. Explain which student's reaction is faster and why.

(3)

© Revision Library | revisionlibrary.co.uk

9 A student wants to find out how the concentration of hydrochloric acid affects the rate of its reaction with magnesium ribbon. She plans to measure the volume of hydrogen gas produced every 10 seconds using a gas syringe, for several different acid concentrations. Describe a method she could use, state at least two variables she should control and why, and explain how her results would show whether increasing concentration increases the rate of reaction. Mention how she should present her results.

(6)

---

10 Write a word equation for each reaction described.

(a) Zinc metal is added to blue copper sulfate solution. The blue colour fades and orange-brown copper metal is deposited, leaving colourless zinc sulfate solution. **(2)**

(b) Ethanol burns completely in plenty of oxygen. **(2)**

© Revision Library | revisionlibrary.co.uk

Mark scheme · 2.3 Chemical Reactions: 30-minute Pack

Question 1

(a) exothermic cao — **B1**

(a) Answer: **Exothermic**

(b) endothermic cao — **B1**

(b) Answer: **Endothermic**

Question 2

B cao — **B1**

Answer: **B) Carbon dioxide**

Question 3

identify one fair test variable eg concentration of reactants OR volume of reactants OR amount of catalyst OR surface area; must say one — **M1**

reason linking that variable to rate, eg keep concentration the same so rate only changes due to temperature — **A1**

Answer: **Keep the concentration of hydrogen peroxide the same; otherwise any change in rate might be caused by concentration not temperature.**

Question 4

description of method eg bubble gas through limewater or pass gas into limewater — **M1**

observation eg limewater goes cloudy or milky cao — **A1**

Answer: **Bubble the gas through limewater; the limewater will turn cloudy (milky).**

Question 5

(a) B cao — **B1**

(a) Answer: **B) a permanent colour change and a temperature rise happen together**

(b) C cao — **B1**

(b) Answer: **C) carbon dioxide**

(c) C cao — **B1**

(c) Answer: **C) always equal (in a closed system)**

(d) B cao — **B1**

(d) Answer: **B) exothermic**

Question 6

burette cao — **B1**

a reason, e.g. a burette has a fine-control tap (valve) allowing liquid to be added drop by drop, with a scale precise enough to read small volumes accurately, oe — **B1**

Answer: **A burette, because it has a tap that allows the acid to be added drop by drop and a precise scale for reading the volume added.**

Question 7

manganese dioxide is acting as a catalyst — **B1**

a catalyst speeds up a chemical reaction without being used up (chemically unchanged) at the end, oe — **B1**

this is why the mass of manganese dioxide is the same before and after the reaction — **B1**

Answer: **Manganese dioxide is acting as a catalyst: it speeds up the decomposition of hydrogen peroxide without being used up itself, which is why its mass is unchanged.**

Question 8

Student B's reaction (using powder) will be faster — **B1**

the powder has a much larger total surface area than the single lump, for the same mass — **B1**

a larger surface area exposed to the acid means more frequent collisions between acid particles and calcium carbonate particles each second, oe — **B1**

Answer: **Student B's powdered calcium carbonate reacts faster, because crushing it into a powder greatly increases its surface area, allowing more frequent collisions with acid particles.**

© Revision Library | revisionlibrary.co.uk

Question 9

Level 1 Simple or partial statements, such as change the concentration and measure the gas, with little or no detail about controls, timing or how results would be presented or interpreted. **1-2**

Level 2 A sensible method with at least one clear control variable and a correct statement about the expected trend, but explanation of how the results would be shown or interpreted lacks detail or precision. **3-4**

Level 3 A detailed, logically ordered method: prepares a range of acid concentrations, uses a fixed length/mass of magnesium each time, names at least two other control variables with reasons, records gas volume at regular time intervals, and explains clearly how a steeper initial slope (or shorter time to reach a fixed volume) for higher concentrations would show a faster rate, with a description of presenting results in a table and as a rate-against-concentration graph. **5-6**

Indicative content:

- Independent variable: concentration of hydrochloric acid, prepared as a range of known values (e.g. by diluting a stock acid with water) while keeping total volume of acid the same each time.
- Controls: use the same length (or mass) of magnesium ribbon each time, the same total volume of acid, the same temperature (e.g. room temperature, checked with a thermometer), and start timing consistently as soon as the magnesium is added.
- Method detail: connect the flask to a gas syringe with a bung and delivery tube, start a stopwatch as the magnesium is added, and record the volume of gas collected every 10 seconds until the reaction finishes (volume stops increasing).
- Repeat each concentration at least twice/three times and calculate a mean, to check for anomalies and improve reliability.
- How results show the effect: plot volume of gas against time for each concentration on the same axes; a steeper initial gradient, and reaching the maximum (final) volume sooner, shows a faster rate of reaction.
- Alternatively calculate mean rate for each concentration (e.g. volume in first 10 s / 10 s) and plot rate against concentration; if rate increases as concentration increases, this supports the idea that a higher concentration increases the rate.
- Presentation: record raw and mean gas volumes and calculated rates in a table, then plot a line graph of volume against time for each concentration (or rate against concentration), labelling axes with units.

Question 10

(a) zinc + copper sulfate -> **B1**

(a) -> zinc sulfate + copper **B1**

(a) Answer: **zinc + copper sulfate -> zinc sulfate + copper**

(b) ethanol + oxygen -> **B1**

(b) -> carbon dioxide + water **B1**

(b) Answer: **ethanol + oxygen -> carbon dioxide + water**

© Revision Library | revisionlibrary.co.uk