2.3 Chemical Reactions: Test Pack

Calculator allowed · about 45 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name the type of particle change that happens when a chemical reaction occurs.

(1)

---

2 Experiment design: Priya plans to compare rates of the reaction between magnesium ribbon and dilute hydrochloric acid using three different concentrations of acid. She will measure the time taken for the magnesium to completely dissolve.

(a) State one safety precaution Priya should take. **(1)**

(b) Identify one control variable she must keep the same. **(1)**

(c) Suggest one improvement to make her timing more accurate. **(2)**

---

3 Write a word equation for the reaction when magnesium ribbon burns in oxygen to make magnesium oxide.

(2)

© Revision Library | revisionlibrary.co.uk

4 Callum adds a small amount of dilute hydrochloric acid to calcium carbonate chips. He collects the gas produced and tests it with a glowing splint. What would the glowing splint result show, and write a brief word equation for the reaction between hydrochloric acid and calcium carbonate.

(3)

---

5 In an exothermic reaction, the reacting chemicals end up with less stored chemical energy than they started with. Explain why the surroundings get hotter.

(2)

---

6 15.0 g of solid copper carbonate is heated strongly in an open test tube until it has fully decomposed into black copper oxide and carbon dioxide gas, which escapes. The solid remaining (copper oxide) has a mass of 9.6 g.

(a) Calculate the mass of carbon dioxide gas released during heating. **(2)**

(b) Explain what would happen to the reading on a balance if this same reaction were carried out in a stoppered (sealed) flask instead of an open test tube. **(2)**

© Revision Library | revisionlibrary.co.uk

7 Practical investigation: Amelia adds 5 cm^3 portions of sodium hydroxide solution to 20 cm^3 of dilute hydrochloric acid in a polystyrene cup, stirring and recording the temperature after each addition. Volume of NaOH added (cm3): 0, 5, 10, 15, 20, 25. Temperature (°C): 20.0, 22.5, 25.0, 27.5, 25.0, 23.0.

(a) Identify the volume of sodium hydroxide at which the temperature is highest. **(1)**

(b) Calculate the temperature rise from the start of the experiment to the highest temperature reached. **(1)**

(c) Explain why the temperature is highest at this volume of sodium hydroxide. **(2)**

(d) Explain why the temperature falls again after 15 cm^3 has been added, even though more sodium hydroxide is still being added. **(2)**

8 State what each pH value shows when tested with universal indicator.

(a) pH 1 **(1)**

(b) pH 6 **(1)**

(c) pH 7 **(1)**

(d) pH 13 **(1)**

© Revision Library | revisionlibrary.co.uk

9 Complete each neutralisation word equation, including the name of the salt formed.

(a) hydrochloric acid + sodium hydroxide -> _____ + water **(2)**

(b) sulfuric acid + potassium hydroxide -> _____ + water **(2)**

© Revision Library | revisionlibrary.co.uk

10 The reactivity series can be used to predict how vigorously different metals react.

(a) Using the reactivity series you have learned, list these four metals in order of reactivity, most reactive first: copper, magnesium, zinc, iron. **(2)**

(b) A student reacts small, equal-sized samples of four unknown metals W, X, Y and Z with dilute hydrochloric acid and records their observations: W bubbles vigorously straightaway; X bubbles steadily; Y produces only a few slow bubbles; Z shows no reaction at all. Deduce the order of reactivity of these four metals, most reactive first. **(2)**

---

11 An iron nail is placed into a test tube of blue copper sulfate solution.

(a) Complete the word equation for the reaction that takes place: iron + copper sulfate -> _____ + _____ **(2)**

(b) Explain, using the reactivity series, why this displacement reaction happens. **(2)**

(c) Predict and explain what would happen (if anything) if a strip of copper metal were placed into a solution of iron sulfate instead. **(2)**

© Revision Library | revisionlibrary.co.uk

Mark scheme · 2.3 Chemical Reactions: Test Pack

Question 1

particles rearrange or bonds break and form (cao) **B1**

Answer: **Particles rearrange (bonds break and new bonds form).**

Question 2

(a) safety point eg wear safety goggles OR use gloves OR add acid to water not water to acid OR work in fume cupboard if gas produced **B1**

(a) Answer: **Wear safety goggles to protect eyes from splashes.**

(b) control variable eg mass/length of magnesium OR volume of acid OR temperature; one needed **B1**

(b) Answer: **Use the same mass (or length) of magnesium ribbon in each test.**

(c) improvement such as use a stopwatch with start/stop by the same person OR repeat each concentration and take mean OR use a sensor to detect end point **M1**

(c) explanation of how it improves accuracy eg repeats reduce random error OR sensor reduces human reaction time error **A1**

(c) Answer: **Repeat each test and take the mean time, which reduces random error and gives a more reliable result.**

Question 3

magnesium + oxygen -> magnesium oxide or equivalent word order **M1**

magnesium + oxygen -> magnesium oxide cao **A1**

Answer: **magnesium + oxygen -> magnesium oxide**

Question 4

glowing splint will be extinguished or splint goes out because gas is carbon dioxide **M1**

word equation showing acid and carbonate produce salt + water + carbon dioxide eg calcium carbonate + hydrochloric acid -> calcium chloride + water + carbon dioxide **M1**

correct equation cao **A1**

Answer: **The glowing splint is extinguished (carbon dioxide present); calcium carbonate + hydrochloric acid -> calcium chloride + water + carbon dioxide**

Question 5

the products have less stored chemical energy than the reactants **B1**

the difference in energy is transferred to the surroundings, usually raising their temperature, oe **B1**

Answer: **The products end up with less stored chemical energy than the reactants; the difference in energy is transferred to the surroundings, which is why the surroundings get hotter.**

Question 6

(a) 15.0 - 9.6 **M1**

(a) 5.4 (g) cao **A1**

(a) Answer: **5.4 g**

(b) the total mass on the balance would stay the same (would not decrease), oe **B1**

(b) because the carbon dioxide gas cannot escape and is still weighed as part of the sealed system, so no atoms are lost, oe **B1**

(b) Answer: **The total mass would stay the same, because the carbon dioxide produced could not escape and would still be weighed inside the sealed flask.**

Question 7

(a) 15 cm^3 cao **B1**

(a) Answer: **15 cm^3**

(b) 27.5 - 20.0 = 7.5 (°C) cao **B1**

(b) Answer: **7.5°C**

(c) this is close to (or at) the point where exactly enough sodium hydroxide has been added to neutralise all the acid **B1**

(c) up to this point, all the sodium hydroxide added is reacting (releasing energy); after this point, extra sodium hydroxide is not reacting and simply dilutes/cools the mixture, oe **B1**

(c) Answer: **This is around the neutralisation point, where all the acid has just been neutralised; up to here, all the alkali added is reacting and releasing energy, but any alkali added after this point is not reacting, so the mixture cools instead.**

(d) once all the acid has reacted, any extra sodium hydroxide solution added does not react further **B1**

(d) the extra solution is at room temperature and dilutes the mixture, so the average temperature falls, oe **B1**

(d) Answer: **After neutralisation, extra sodium hydroxide added does not react; it simply dilutes and cools the mixture, since it is added at room temperature, so the temperature falls.**

Question 8

(a) strong acid cao **B1**

(a) Answer: **Strong acid**

(b) weak acid cao **B1**

(b) Answer: **Weak acid**

(c) neutral cao **B1**

(c) Answer: **Neutral**

(d) strong alkali cao **B1**

(d) Answer: **Strong alkali**

© Revision Library | revisionlibrary.co.uk

Question 9

(a) sodium chloride, oe **B1**

(a) correctly links hydrochloric acid to a chloride salt, cao **B1**

(a) Answer: **sodium chloride**

(b) potassium sulfate, oe **B1**

(b) correctly links sulfuric acid to a sulfate salt (not sulfide or sulfite), cao **B1**

(b) Answer: **potassium sulfate**

Question 10

(a) magnesium first and copper last **M1**

(a) magnesium, zinc, iron, copper (fully correct order) cao **A1**

(a) Answer: **Magnesium, zinc, iron, copper**

(b) correctly links faster bubbling to greater reactivity **M1**

(b) W, X, Y, Z (fully correct order) cao **A1**

(b) Answer: **W, X, Y, Z**

Question 11

(a) iron sulfate, oe cao **B1**

(a) copper cao **B1**

(a) Answer: **iron sulfate + copper**

(b) iron is more reactive than copper, oe **B1**

(b) so iron atoms displace (push out) copper from the copper sulfate solution, forming iron sulfate and releasing copper metal, oe **B1**

(b) Answer: **Iron is more reactive than copper, so iron displaces copper from the copper sulfate solution, forming iron sulfate and depositing copper metal onto the nail.**

(c) no visible reaction would take place, oe **B1**

(c) because copper is less reactive than iron, so it cannot displace iron from the iron sulfate solution, oe **B1**

(c) Answer: **No reaction would occur, because copper is less reactive than iron and so cannot displace iron from iron sulfate solution.**

© Revision Library | revisionlibrary.co.uk