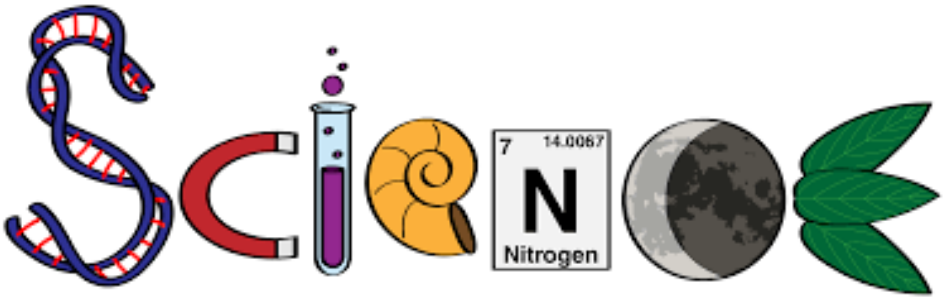
Meopham School



HOMEWORK BOOKLET

C6 Foundation

Rates of Reaction: Gas Production **Storyboard**

Each of the cards describes one stage in a method. The method is used to investigate the effect of changing the concentration on the rate of a reaction by measuring the production of a gas. Cut out the cards. Match the picture of each stage of the method with its description. Then, stick them into the correct place below.

01

02

03

Homework 1

Rates of Reaction: Gas Production **Storyboard**

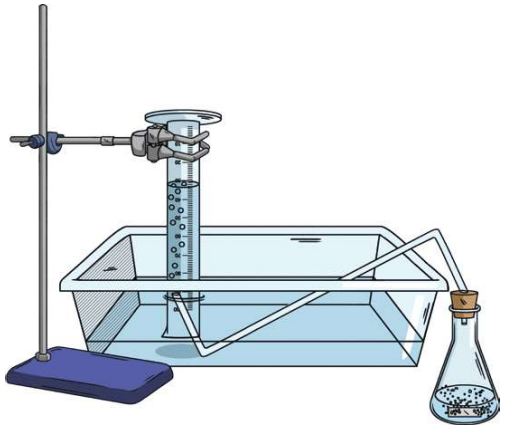
04

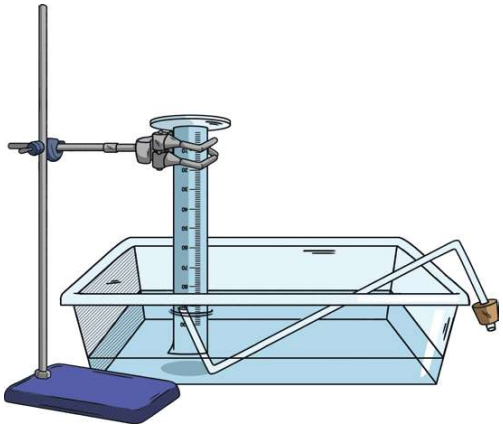
05

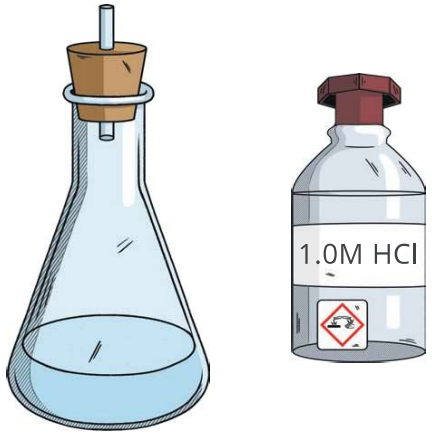
06

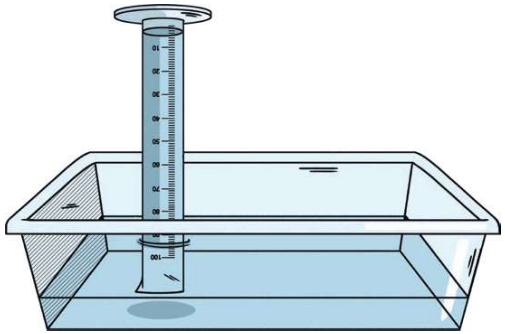
Homework 1

Rates of Reaction: Gas Production **Storyboard**









Homework 1

Rates of Reaction: Gas Production **Storyboard**

Clamp the measuring cylinder into place using a clamp stand. Place one end of a delivery tube into the upside-down measuring cylinder. Gently feed the other end through the hole in a rubber bung.

Repeat the investigation using 1.5M hydrochloric acid. Plot both sets of results on the same graph.

Lightly rub a 3cm piece of magnesium ribbon with sandpaper to remove its oxide layer. Add the piece of magnesium to the hydrochloric acid in the conical flask. Quickly replace the rubber bung. Start a stopwatch.

Measure the volume of gas produced every ten seconds until no more gas is produced. Record your results in a suitable table.

Half-fill a water trough with water. Submerge a measuring cylinder in the water trough and turn it upside-down, ensuring all air bubbles are removed. The bottom of the measuring cylinder should remain below the surface of the water to prevent any water from escaping.

Add 50cm3 of 1.0M hydrochloric acid to a conical flask. Ensure the rubber bung with the delivery tube fits securely in the top.

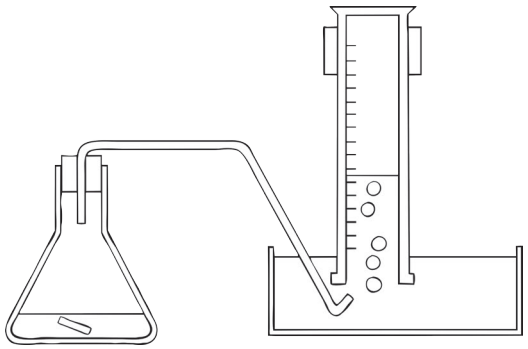
Homework 1

Homework 1

Rates of Reaction **Exam Style Quesitons**

Question 1

Omar wanted to investigate the rate of reaction between acid and metal and whether or not concentration affected it. He set up apparatus as shown in the diagram.



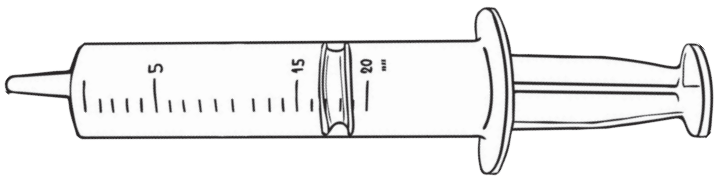
Write a plan for Omar to follow, using magnesium ribbon and dilute hydrochloric acid to investigate the rate of reaction. You may want to consider the following:

- The measurements you will take and why.
- How you will carry out the investigation.
- What you will change and what you will keep the same.

Assume safety precautions have been considered. **(6 marks)**

Question 2

Look at the gas syringe in the diagram; what is the volume of gas shown?



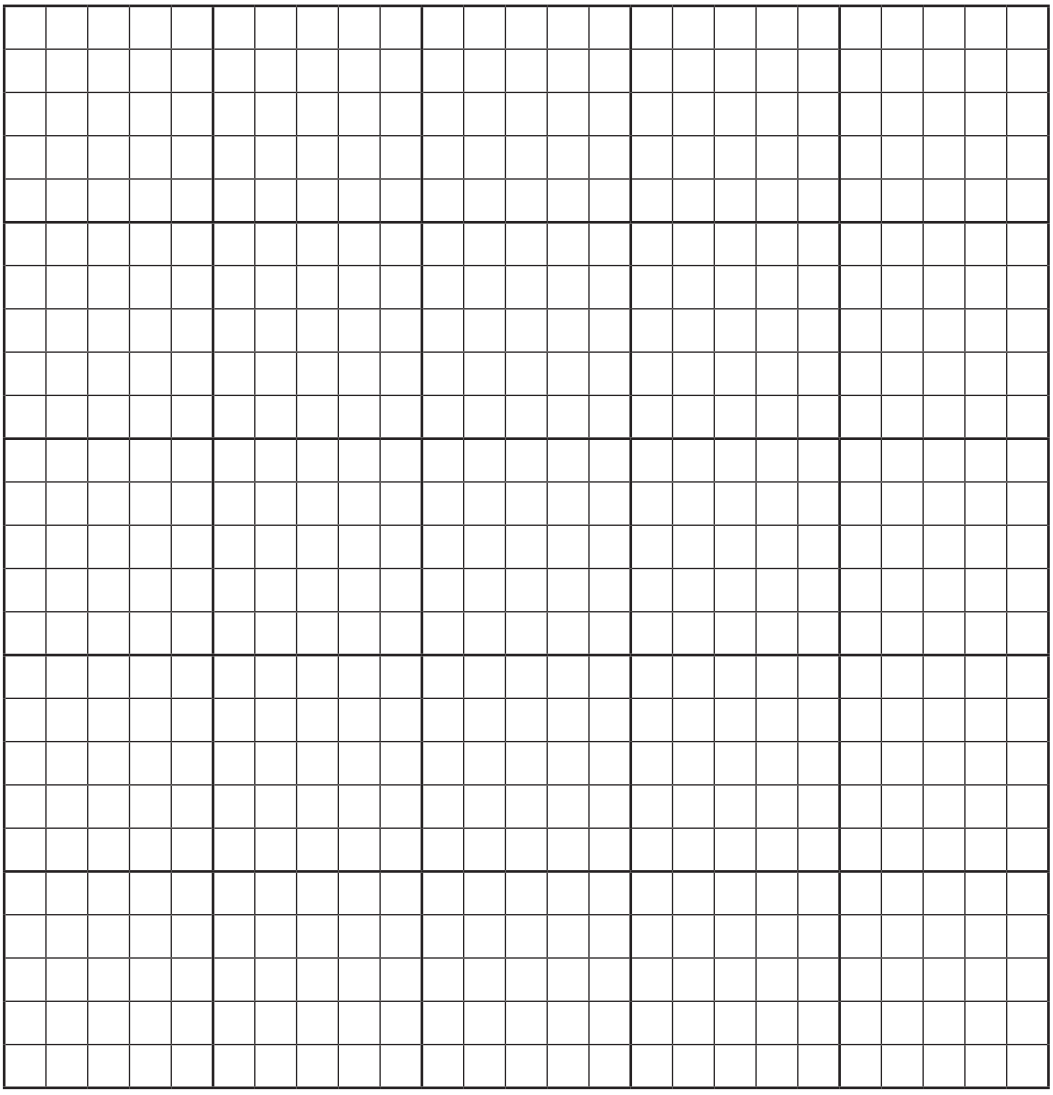
- 15.5cm^3 ☐
- 16.5cm^3 ☐
- 17cm^3 ☐
- 18cm^3 ☐

Question 3

Homework 1

Plot the results of the experiment on the graph paper below. **(4 marks)**

Time taken in seconds	Volume collected conc 1 (cm^3)	Volume collected conc 2 (cm^3)
0	0	0
10	23	32
20	34	49
30	53	61
40	79	82
50	86	95



Question 4:

Write one conclusion you can make from the graphs above in terms of rates of reaction and concentration of acid. **(1 mark)**

Homework 2

Rates of Reaction: Gas Production Sequencing

Each of the statements describes one stage in a method. The method is used to investigate the effect of changing the concentration on the rate of reaction by measuring the production of a gas. Add the numbers 1-6 in the box next to each statement to sequence the method in the correct order.

Lightly rub a 3cm piece of magnesium ribbon with sandpaper to remove its oxide layer. Add the piece of magnesium to the hydrochloric acid in the conical flask. Quickly replace the rubber bung. Start a stopwatch.	
Half-fill a water trough with water. Submerge a measuring cylinder in the water trough and turn it upside-down, ensuring all air bubbles are removed. The bottom of the measuring cylinder should remain below the surface of the water to prevent any water from escaping.	
Add 50cm^3 of 1.0M hydrochloric acid to a conical flask. Ensure the rubber bung with the delivery tube fits securely in the top.	
Repeat the investigation using 1.5M hydrochloric acid. Plot both sets of results on the same graph.	
Measure the volume of gas produced every ten seconds until no more gas is produced. Record your results in a suitable table.	
Clamp the measuring cylinder into place using a clamp stand. Place one end of a delivery tube into the upside-down measuring cylinder. Gently feed the other end through the hole in a rubber bung.	

Homework 2

The Rate and Extent of Chemical Change

Multiple Choice Questions

Set 1

Tick **one** box.

1. The reaction of magnesium metal with hydrochloric acid is shown by the word equation below.

magnesium + hydrochloric acid ⟶ magnesium chloride + hydrogen

Which word describes the magnesium in this reaction?

A. catalyst ☐
B. gas ☐
C. product ☐
D. reactant ☐

2. How can the rate of a chemical reaction be found?

A. by measuring how long the reaction takes ☐
B. by measuring the quantity of the products formed ☐
C. by measuring the quantity of reactant used up or the quantity of the products formed over time ☐
D. by measuring the temperature of the reaction over time ☐

3. Which factor does **not** affect the rate of a chemical reaction?

A. pressure ☐
B. surface area ☐
C. temperature ☐
D. volume ☐

4. According to collision theory, when can chemical reactions occur?

A. when particles collide with each other ☐
B. when particles have enough energy ☐
C. when particles collide with each other with enough energy ☐
D. when particles collide with each other, have enough energy and are exposed to sunlight ☐

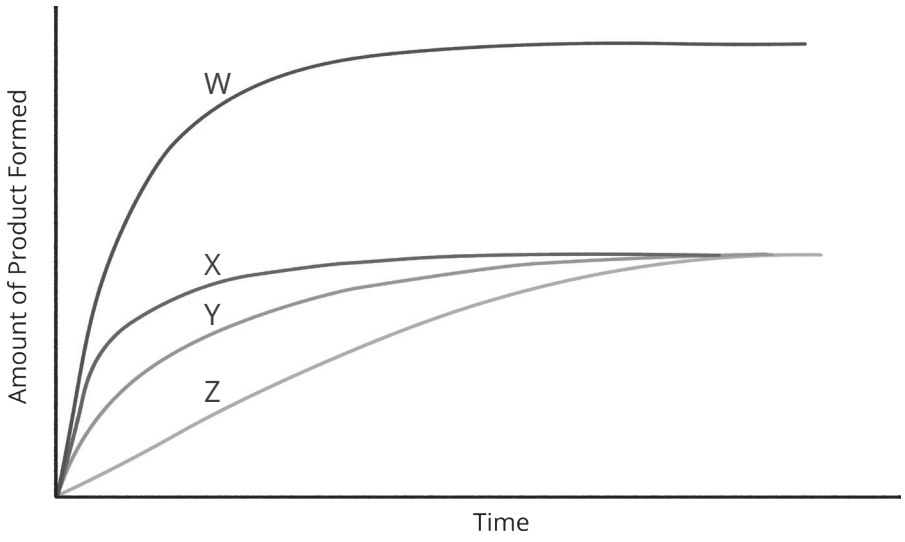
Homework 2

5. Which statement is **not** true?
   A. catalysts are used up in chemical reactions
   B. catalysts can help to reduce the cost of large-scale chemical reactions
   C. catalysts reduce the activation energy of chemical reactions
   D. different chemical reactions may need different catalysts

6. Why does increasing the concentration of a reactant increase the rate of a reaction?
   A. particles are more spread out
   B. particles collide more often
   C. particles have more energy
   D. particles move more quickly

7. **Figure 1** shows the amount of product formed over time in four different chemical reactions.

Figure 1



Which reaction was the slowest?
   A. W
   B. X
   C. Y
   D. Z

8. What does the symbol ⇌ represent?
   A. a catalysed reaction ☐
   B. an endothermic reaction ☐
   C. an exothermic reaction ☐
   D. a reversible reaction ☐

9. When anhydrous copper sulfate reacts with water there is a colour change from white to blue. This reaction releases 77.1kJ/mol of energy.

   anhydrous copper sulfate + water ⇌ hydrated copper sulfate

   How much energy is needed to turn hydrated copper sulfate into anhydrous copper sulfate?
   A. 15.0kJ/mol ☐
   B. 38.6kJ/mol ☐
   C. 77.1kJ/mol ☐
   D. 154.2kJ/mol ☐

10. If a reversible reaction takes place in a sealed container, when is equilibrium reached?
   A. when the chemical equation is balanced ☐
   B. when the concentration of the reactants is equal to the concentration of the products ☐
   C. when the forward and backward reactions occur at exactly the same rate ☐
   D. when the maximum possible amount of product has been made ☐

Homework 2

The Rate and Extent of Chemical Change

Multiple Choice Questions

Set 2

Tick **one** box.

1. How can the mean rate of a reaction be calculated?
   - A. mean rate of reaction = quantity of reactant used × time taken ☐
   - B. mean rate of reaction = quantity of reactant used ÷ time taken ☐
   - C. mean rate of reaction = time taken × quantity of product formed ☐
   - D. mean rate of reaction = time taken ÷ quantity of product formed ☐

2. A reaction produces 45cm^3 of carbon dioxide in 30 seconds. What is the mean rate of reaction?
   - A. 0.6cm^3/s ☐
   - B. 1.5cm^3/s ☐
   - C. 45cm^3/s ☐
   - D. 75cm^3/s ☐

3. The reaction between calcium carbonate and sulfuric acid is shown in the equation below.

$$CaCO_3(s) + H_2SO_4(aq) \longrightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$$

   How could the rate of reaction be increased?
   - A. decrease the temperature ☐
   - B. dilute the sulfuric acid ☐
   - C. grind the calcium carbonate into a powder ☐
   - D. increase the pressure ☐

4. Which term describes the minimum energy that particles must have to react?
   - A. activation energy ☐
   - B. collision energy ☐
   - C. reaction energy ☐
   - D. starting energy ☐

Homework 2

A student is investigating the effect of temperature on the rate of reaction between sodium thiosulfate and hydrochloric acid. The student mixes the reactants together in a conical flask which they place over a piece of paper marked with an 'X'. The student records the time it takes for the 'X' to be obscured by the yellow precipitate which forms in the reaction.

5. Which piece of equipment is needed to measure the dependent variable in the above investigation?
   A. conical flask ☐
   B. piece of paper marked with an 'X' ☐
   C. thermometer ☐
   D. timer ☐

6. Which piece of equipment is needed to measure the independent variable in the above investigation?
   A. conical flask ☐
   B. piece of paper marked with an 'X' ☐
   C. thermometer ☐
   D. timer ☐

7. What effect does increasing the temperature of a reaction have on its rate?
   A. the rate decreases because the collisions are more energetic ☐
   B. the rate increases because the frequency of collisions is increased ☐
   C. the rate increases because the collisions are less energetic ☐
   D. the rate increases because the surface area of the reactants is increased ☐

8. Which term describes a reversible reaction occurring in a closed container where the forward and reverse reactions happen at the same rate?
   A. balanced ☐
   B. complete ☐
   C. equilibrium ☐
   D. equivalent ☐

9. When ammonium chloride is heated it breaks down to form ammonia and hydrogen chloride. This reaction is reversible and is shown in the equation below.

$$\text{ammonium chloride} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{ammonia} + \text{hydrogen chloride}$$

How could this reaction be reversed to reform ammonium chloride?

A. apply more heat ☐
B. cool the mixture down ☐
C. open the reaction container ☐
D. this reaction cannot be reversed ☐

10. Ammonia is made in a reversible reaction, as shown by the equation below.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

The forward reaction is exothermic. Which word describes the backward reaction?

A. endothermic ☐
B. equilibrium ☐
C. exothermic ☐
D. none of the above ☐

Homework 3

The Rate and Extent of Chemical Change

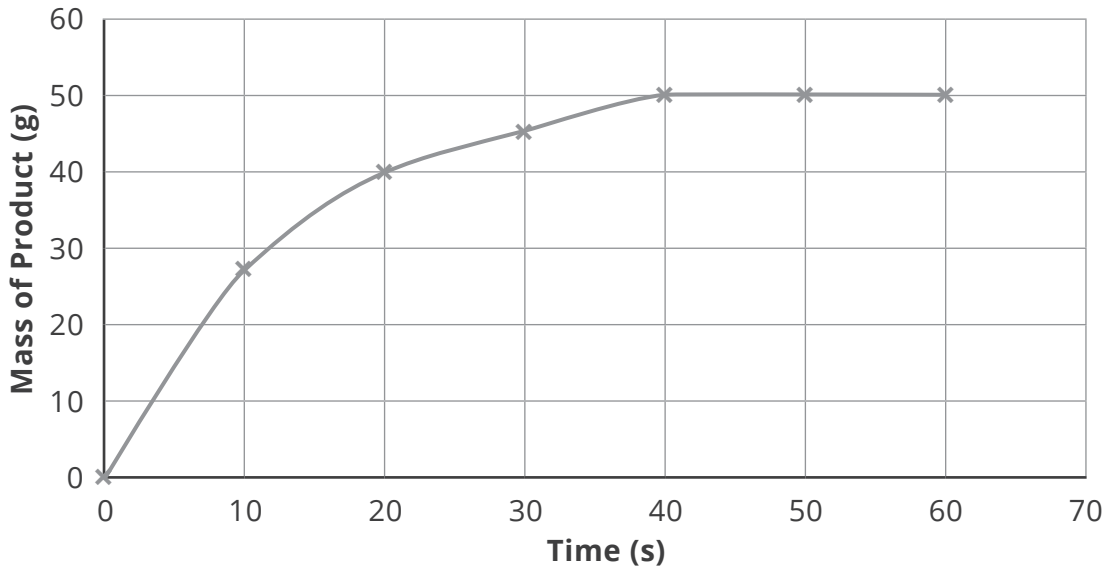
Multiple Choice Questions

Set 3

Tick **one** box.

Figure 1 is a graph showing how the mass of product formed in a chemical reaction changed over time.

Figure 1

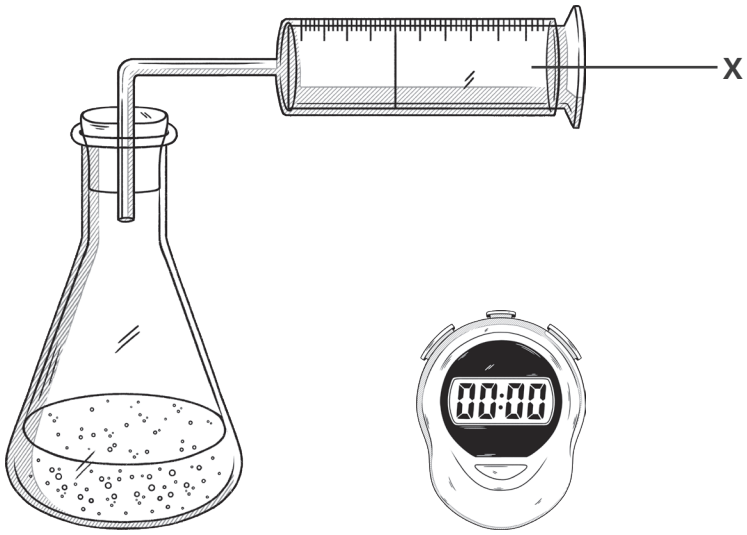


1. After how many seconds was the chemical reaction in **Figure 1** complete?
   - A. 30 ☐
   - B. 40 ☐
   - C. 50 ☐
   - D. 60 ☐

2. What was the mean rate of reaction for the chemical reaction in **Figure 1**?
   - A. 0.8g/s ☐
   - B. 1.25g/s ☐
   - C. 40g/s ☐
   - D. 50g/s ☐

Figure 2 shows apparatus which could be used to find the rate of a chemical reaction.

Figure 2



3. What is the name of the piece of equipment labelled X?
   A. conical flask
   B. gas syringe
   C. measuring cylinder
   D. timer

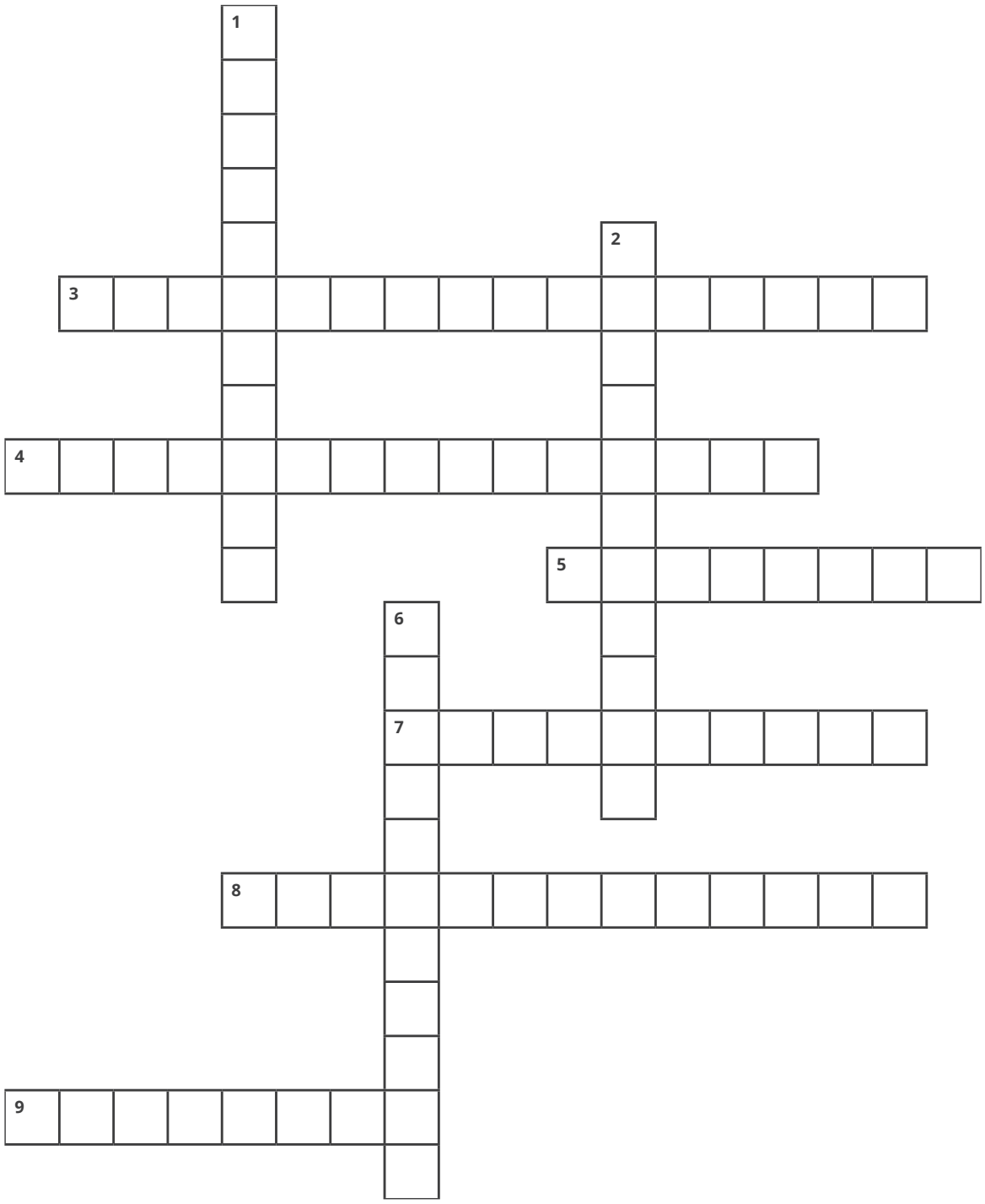
4. What is a hypothesis?
   A. a method used to investigate the rate of chemical reactions
   B. a prediction
   C. an idea that can be tested
   D. the correct answer to an investigation

5. How does a catalyst increase the rate of a reaction?
   A. it changes the products of the reaction
   B. it increases the temperature of the reaction
   C. it provides reactants with the energy they need to react
   D. it reduces the activation energy of the reaction

Homework 3

The Rate and Extent of Chemical Reactions
Crossword

Each of the answers to the clues relates to the rate and extent of chemical reactions. Solve the clues to complete the crossword. Choose the answers from the box below. The numbers at the end of each clue tell you how many letters there are in the answer.



activation energy	concentration	reversible
catalyst	equilibrium	surface area
collision theory	pressure	temperature

Homework 3

Across

3. The minimum amount of energy that particles must have to react. (10,6)

4. The theory that explains how various factors affect rates of reaction. Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. (9,6)

5. A substance that increases the rate of a chemical reaction by lowering the activation energy without being used up in the reaction. (8)

7. A word to describe a reaction in which the products can react to produce the original reactants. This type of reaction can be represented by: $A + B \rightleftharpoons C + D$. (10)

8. A factor that affects both the rate of a reaction and the position of equilibrium of a reversible reaction. This factor is a measure of the mass of solute per given volume of solution. (13)

9. A factor that can affect both the rate of a reaction and the position of equilibrium of a reversible reaction involving gaseous reactants. (8)

Down

1. A stable situation reached when the forward and reverse reactions in a reversible reaction occur at exactly the same rate in a closed system. (11)

2. A factor, measured in degrees Celsius (°C), that can affect the rate of a reaction. Increasing this factor will favour the endothermic direction of a reversible reaction. (11)

6. A factor that can affect the rate of a reaction involving at least one solid reactant. (7,4)