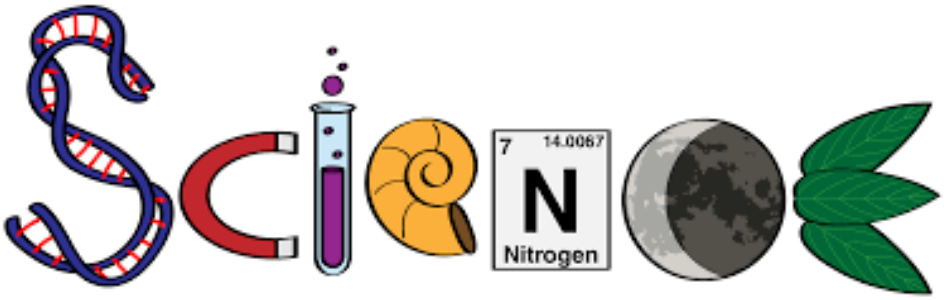
Meopham School



HOMEWORK BOOKLET

C6 Higher

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**

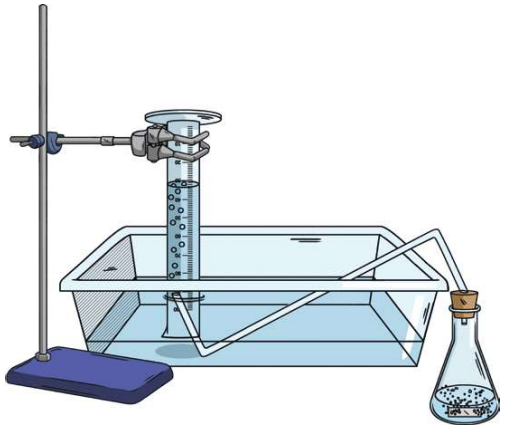
04

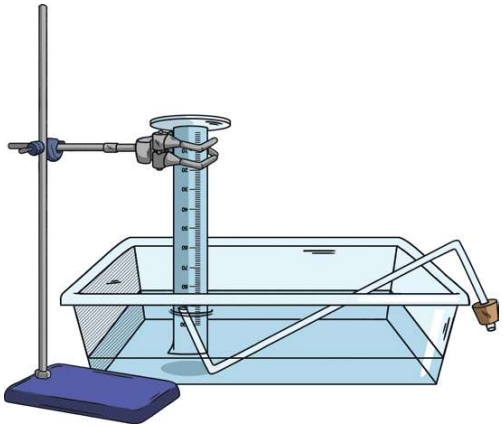
05

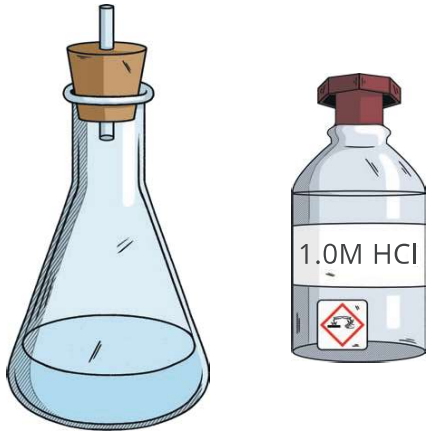
06

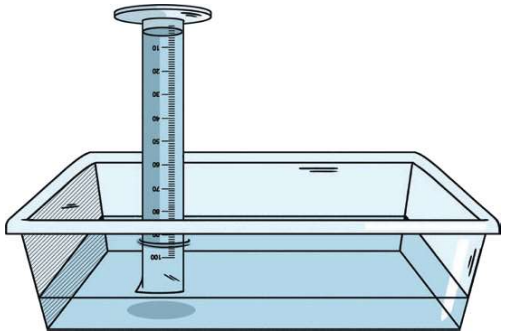
Homework 1

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.

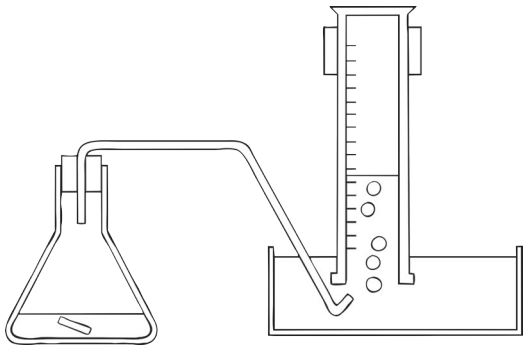
Homework 1

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.



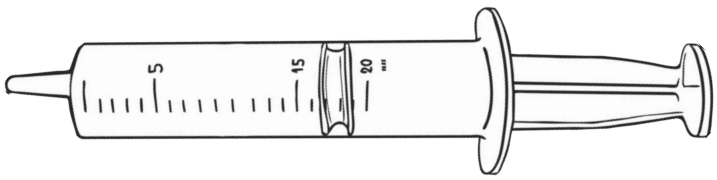
Write a plan for Omar to follow, using magnesium ribbon and dilute hydrochloric acid to investigate the rate of reaction. You may want to consider the following:

- 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?

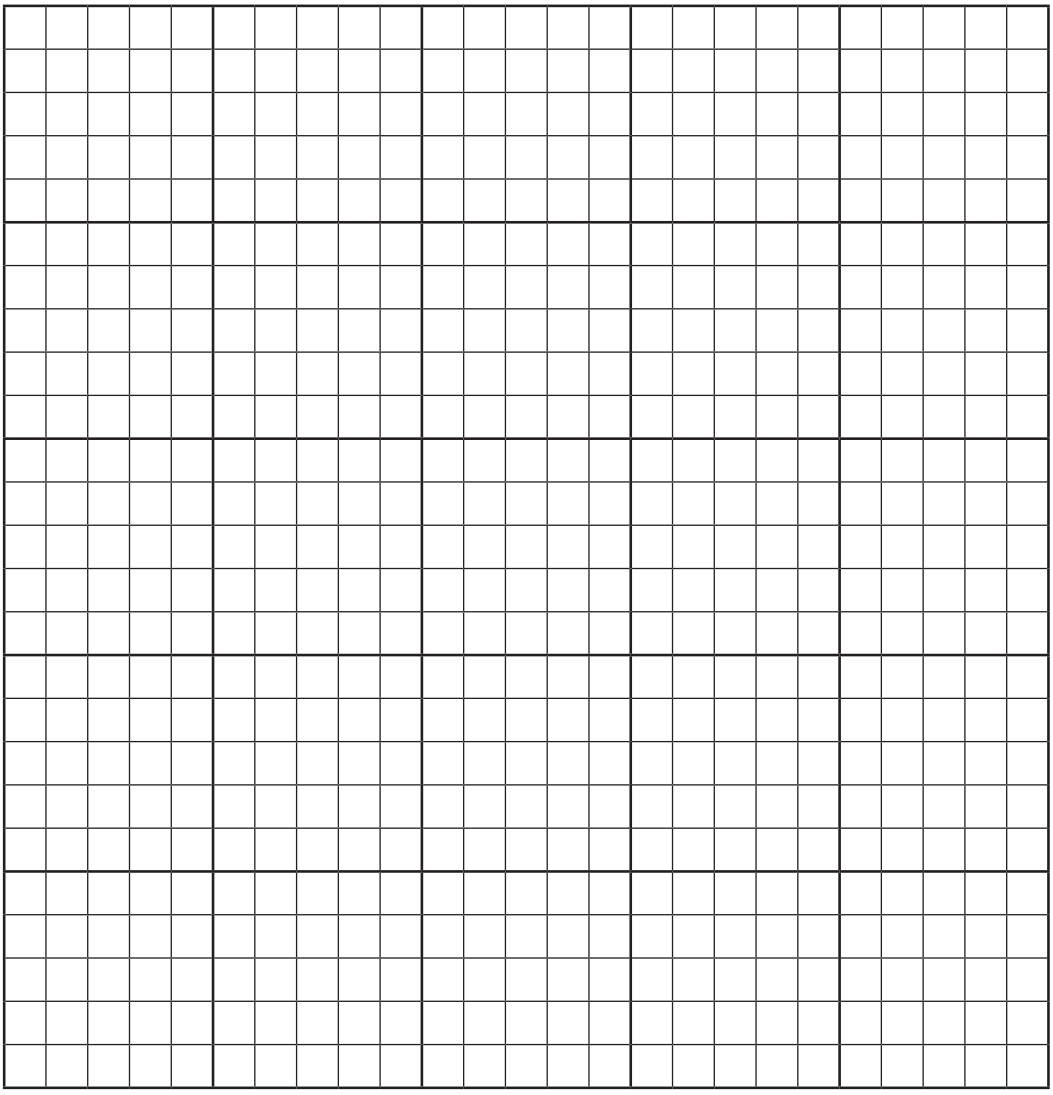


- 15.5cm^3 ☐
- 16.5cm^3 ☐
- 17cm^3 ☐
- 18cm^3 ☐

Question 3

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)**

Rates of Reaction: Gas Production Sequencing

Homework 2

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.	

The Rate and Extent of Chemical Change

Multiple Choice Questions

Homework 2

Set 4 (HT)

Tick **one** box.

The thermal decomposition of hydrogen peroxide is shown in **Equation 1**.

Equation 1

$$2H_2O_2(l) \longrightarrow 2H_2O(l) + O_2(g)$$

A group of students carried out an investigation to find a suitable catalyst for this reaction. They measured the rate of reaction by recording the volume of oxygen gas produced after 30 seconds. Their results are shown in **Table 1**.

Table 1

Substance Added to Reaction	Volume of Oxygen Produced in 30 Seconds (cm^3)
A	11
B	10
C	21
D	8

1. Which substance in **Table 1** is the most suitable catalyst for the reaction shown by **Equation 1**.

   A. A ☐
   B. B ☐
   C. C ☐
   D. D ☐

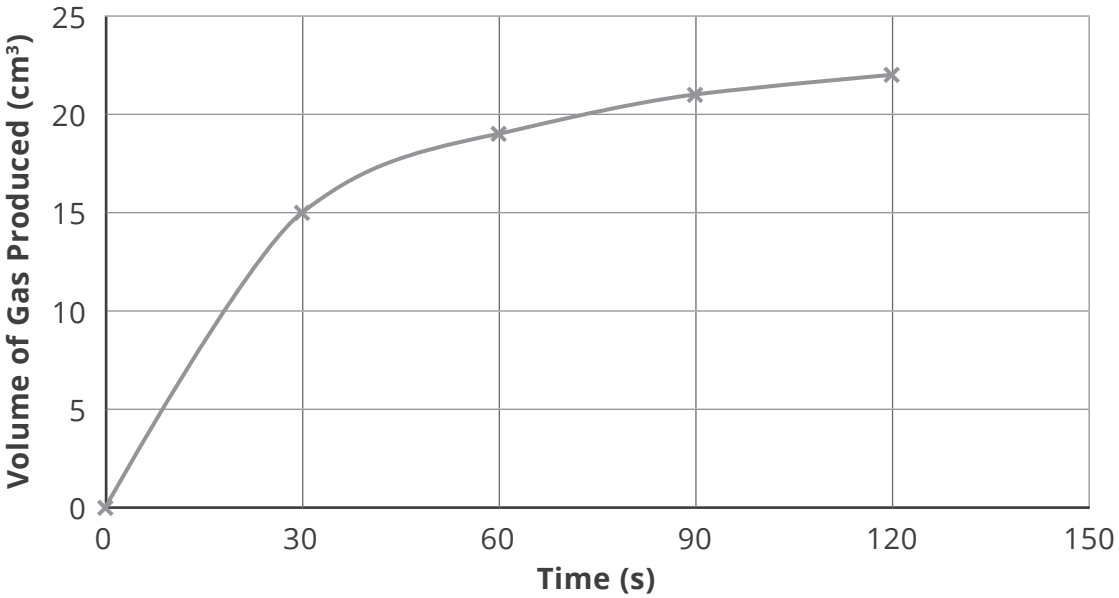
2. In addition to using a catalyst, how else could the rate of reaction in **Equation 1** be increased?

   A. by increasing the pressure ☐
   B. by increasing the surface area ☐
   C. by increasing the temperature ☐
   D. all of the above ☐

3. Which of the following is **not** a unit for measuring the rate of a chemical reaction?
   A. cm^3/s
   B. g/s
   C. m/s
   D. mol/s

Figure 1 is a graph showing the volume of gas produced in a chemical reaction over time.

Figure 1



4. What was the rate of reaction in the first 30 seconds?
   A. $0.5cm^3/s$
   B. $1.5cm^3/s$
   C. $2.0cm^3/s$
   D. $15cm^3/s$

5. Why does the rate of reaction decrease over time?
   A. because the activation energy increases
   B. because the concentration of the reactants decreases
   C. because the particles have less energy
   D. because the temperature decreases

6. What is used to predict the effect of changing conditions in a system at equilibrium?
   A. Atomic Theory
   B. Collision Theory
   C. Haber Process
   D. Le Chatelier's Principle

Equation 2 shows how sulfur trioxide can be made from sulfur dioxide and oxygen.

Equation 2

$$SO_2(g) + O_2(g) \rightleftharpoons SO_3(g)$$

7. Which gas or gases are present in the equilibrium mixture of the reaction shown by **Equation 2**?
   A. O_2 only
   B. O_2 and SO_2
   C. SO_3 only
   D. SO_3, O_2 and SO_2

8. The reaction shown by **Equation 2** is exothermic in the forward direction. Which conditions would give the highest yield of SO_3?
   A. a high temperature and a high pressure
   B. a high temperature and a low pressure
   C. a low temperature and a high pressure
   D. a low temperature and a low pressure

9. Vanadium (V) oxide, V_2O_5, is used as a catalyst in the reaction shown by **Equation 2**. What effect does this catalyst have on the yield of SO_3?
   A. it decreases the yield
   B. it increases the yield
   C. it depends on the catalyst used
   D. it has no effect on the yield

10. Why does V_2O_5 **not** appear in **Equation 2**?
   A. including the catalyst in the equation would make it unbalanced
   B. the catalyst is a solid
   C. the catalyst has no effect on the rate of the chemical reaction
   D. the catalyst is not changed into something different during the chemical reaction

The Rate and Extent of Chemical Change

Multiple Choice Questions

Homework 2

Set 5 (HT)

Tick **one** box.

Equation 1 shows the reaction between sodium thiosulfate and hydrochloric acid.

Equation 1

$$2HCl(aq) + Na_2S_2O_3(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + SO_2(g) + S(s)$$

When the reactants are mixed in a flask, the reaction mixture becomes turbid (cloudy).

1. Which product is responsible for the increased turbidity of the mixture?
   - A. NaCl
   - B. H_2O
   - C. SO_2
   - D. S

A student investigated how the concentration of hydrochloric acid affected the rate of reaction of **Equation 1**. They timed how long it took the reaction mixture to obscure an 'X' on a piece of paper placed beneath the flask. Their results are shown in **Table 1**.

Table 1

Hydrochloric Acid Sample	Time Taken for 'X' to be Obscured (s)
W	34
X	63
Y	48
Z	15

2. Which sample of hydrochloric acid had the highest concentration?
   - A. W
   - B. X
   - C. Y
   - D. Z

Homework 2

Over many years, copper objects change from being a shiny, orange-pink colour to a dull, green-blue colour. This change in appearance is due to an oxidation reaction.

3. Why does this reaction take place over many years?
   A. the pressure on copper objects increases over time ☐
   B. the reactants were not all available until recently ☐
   C. the reaction has a very high activation energy ☐
   D. the reaction only occurs on hot days ☐

4. How does the size of the particles in a solid affect its rate of reaction?
   A. larger particles have a greater surface area to volume ratio which increases the rate of reaction ☐
   B. larger particles have a smaller surface area to volume ratio which increases the rate of reaction ☐
   C. smaller particles have a greater surface area to volume ratio which increases the rate of reaction ☐
   D. smaller particles have a smaller surface area to volume ratio which increases the rate of reaction ☐

5. What does Le Chatelier's Principle describe?
   A. a system at equilibrium responds to counteract any changes made to it ☐
   B. catalysts increase the rate of a reaction by lowering the activation energy ☐
   C. particles will only react if they collide with enough energy ☐
   D. reversible reactions are exothermic in one direction and endothermic in the opposite direction ☐

Equation 2 shows how hydrogen gas can be obtained by reacting methane with steam. This reaction is endothermic in the forward direction and will reach equilibrium in a closed system.

Equation 2

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

6. What effect would increasing the temperature have on the rate of the forward reaction in **Equation 2**?
   A. the rate would decrease ☐
   B. the rate would increase ☐
   C. the rate would stay the same ☐
   D. it is not possible to predict the effect on the rate ☐

7. What effect would increasing the temperature have on the yield of hydrogen in **Equation 2**?
   A. the yield would decrease ☐
   B. the yield would increase ☐
   C. the yield would stay the same ☐
   D. it is not possible to predict the effect on the yield ☐

8. What effect would increasing the pressure have on the rate of the forward reaction in **Equation 2**?
   A. the rate would decrease ☐
   B. the rate would increase ☐
   C. the rate would stay the same ☐
   D. it is not possible to predict the effect on the rate ☐

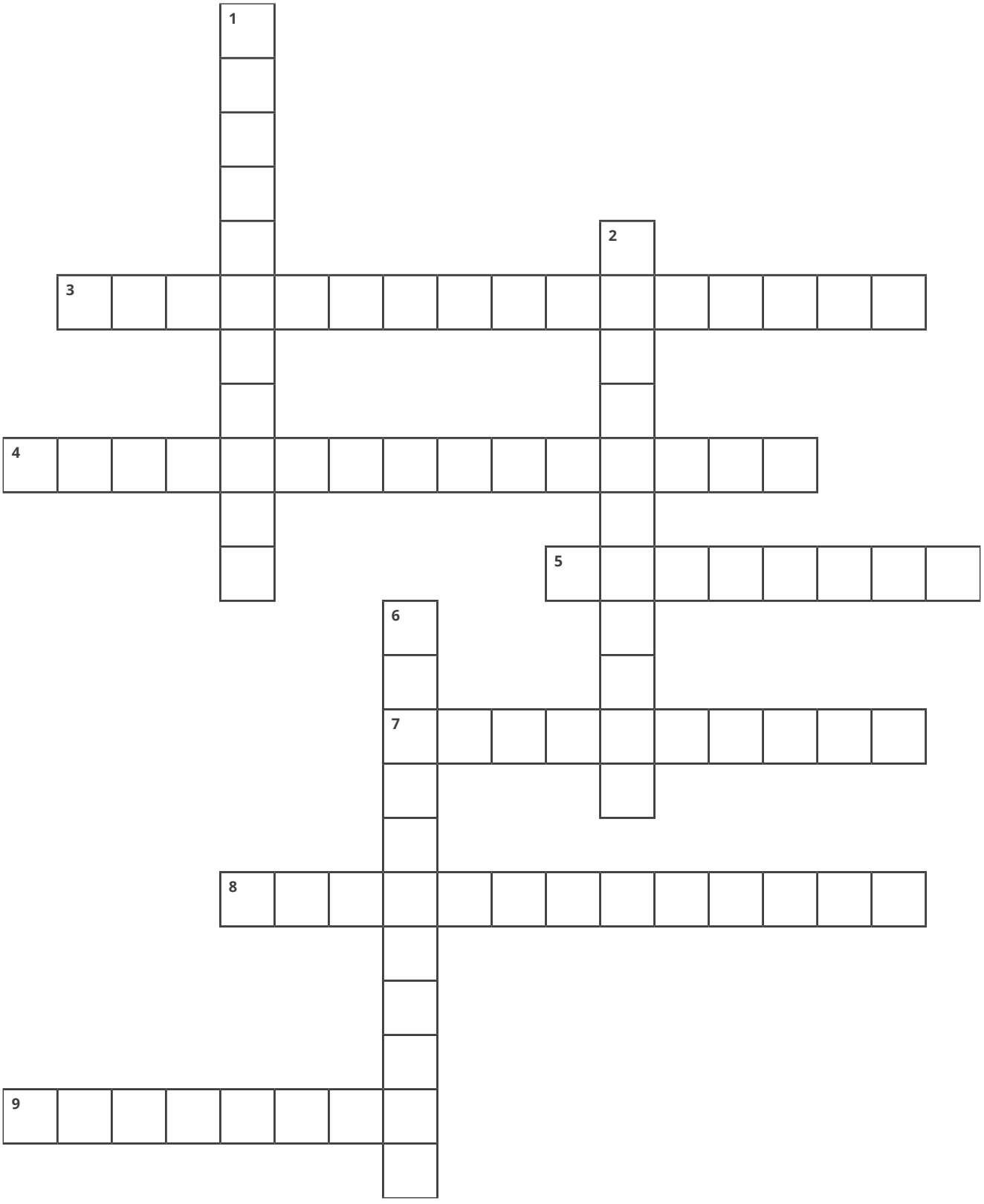
9. What effect would increasing the pressure have on the yield of hydrogen in **Equation 2**?
   A. the yield would decrease ☐
   B. the yield would increase ☐
   C. the yield would stay the same ☐
   D. it is not possible to predict the effect on the yield ☐

10. What effect would using a catalyst have on the rate of the reaction in **Equation 2**?
    A. the rate would decrease ☐
    B. the rate would increase ☐
    C. the rate would stay the same ☐
    D. it is not possible to predict the effect on the rate ☐

Homework 3

The Rate and Extent of Chemical Reactions
Crossword

Solve the clues to complete the crossword. Each of the answers to the clues relates to the rate and extent of chemical reactions. The number of letters in each word has been given to help you.



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. This substance has no effect on the position of equilibrium of a reversible 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)