Rate of Reaction Worksheet

Combined Science - Chemistry - Key Stage 4
The Rate and Extent of Chemical Change

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1. Which is the correct definition for a chemical reaction?

A. A system where none of the reactants or products are allowed to escape

B. Atoms rearrange to form new products

C. Atoms rearrange themselves so they become further apart

D. The output, or result of a chemical reaction

2. Which of the following is NOT a chemical reaction?

A. Thermal decomposition

B. Photosynthesis

C. Ice melting

D. Neutralisation

3. Which of the following is NOT a sign that a reaction has taken place?

A. Fizzing / effervescence

B. Decrease in mass

C. Colour change / turbidity

D. Evaporation

4. Which of the following is a possible unit for rate of reaction?

A. g/s

B. dm^3/g

C. g/cm^3

D. m/s

5. How could we measure the rate of reaction if the reaction produces a gas?

A. Time how long it takes from start until you cannot see any gas

B. Time how long the reaction takes from start to when a colour change is observed

C. Count the number of bubbles produced from start to stop

D. Time how long the reaction takes and record the volume of gas produced

Question 1

A student investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.

The student had collected 30 cm^3 of gas produced after 15 seconds. Calculate the mean rate of reaction from 0 to 15 seconds.

Question 2

A student investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.

The student had recorded an initial reactant mass of 27 g. The mass of the product recorded was 24.9 g after 30 seconds. Calculate the mean rate of reaction from 0 to 30 seconds.

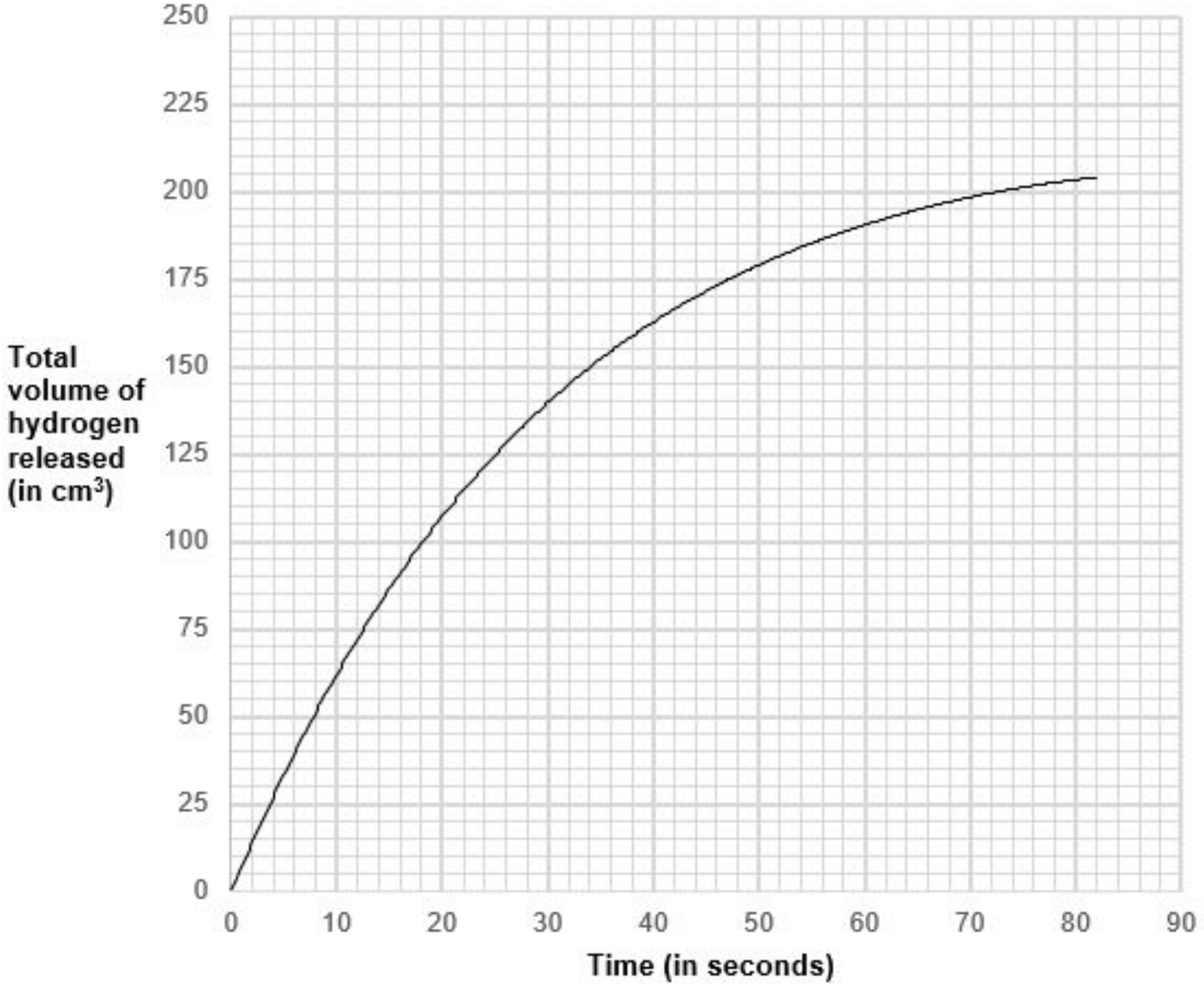
Question 3

Student A investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid. The student collected 7.5 cm^3 of gas produced after 15 seconds.

Student B investigated the rate of reaction between magnesium and hydrochloric acid. The student collected 17 cm^3 of gas produced after 10 seconds.

Which student's investigation had a faster rate of reaction?

Find mean rate of reaction in the first 20 seconds



Independent Practice Questions

1. State FOUR possible signs a chemical reaction has taken place.
2. State the equipment used to measure the following:
   - Volume of gas produced
   - Temperature change
   - Change in mass
   - Time
3. A student investigated the reaction between magnesium and hydrochloric acid. The reaction took 150 seconds to complete and the student recorded a mass lost of 9.85 g. Calculate the mean rate of reaction. Give your answer to two decimal places.

Answers to multiple choice quiz

1. Which is the correct definition for a chemical reaction?

B. Atoms rearrange to form new products

2. Which of the following is NOT a chemical reaction?

C. Ice melting

3. Which of the following is NOT a sign that a reaction has taken place?

D. Evaporation

4. Which of the following is a possible unit for rate of reaction?

A. g/s

5. How could we measure the rate of reaction if the reaction produces a gas?

D. Time how long the reaction takes and record the volume of gas produced

Question 1 answer

A student investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.
The student had collected 30 cm^3 of gas produced after 15 seconds. Calculate the mean rate of reaction from 0 to 15 seconds.

$$\text{Mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$

$$\text{Mean rate of reaction} = \frac{30}{15}$$

Mean rate of reaction = 2 cm^3/s

Question 2 answer

A student investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid.
The student had recorded an initial reactant mass of 27 g. The mass of the product recorded was 24.9 g after 30 seconds. Calculate the mean rate of reaction from 0 to 30 seconds.

$$\text{Mean rate of reaction} = \frac{\text{quantity of reactant used}}{\text{time taken}}$$

$$\text{Mean rate of reaction} = \frac{27 - 24.9}{30}$$

Mean rate of reaction = 0.07 g/s

Question 3 answer

Student A investigated the rate of reaction between calcium carbonate (marble chips) and hydrochloric acid. The student collected 7.5 cm^3 of gas produced after 15 seconds.

Student B investigated the rate of reaction between magnesium and hydrochloric acid. The student collected 17 cm^3 of gas produced after 10 seconds.

Which student's investigation had a faster rate of reaction?

Student A:

Mean rate of reaction = $\frac{\text{quantity of product formed}}{\text{time taken}}$

= $\frac{7.5\ cm^3}{15\ s}$

= 0.5 cm^3/s

Student B

Mean rate of reaction= $\frac{\text{quantity of product formed}}{\text{time taken}}$

= $\frac{17\ cm^3}{10\ s}$

= 1.7 cm^3/s

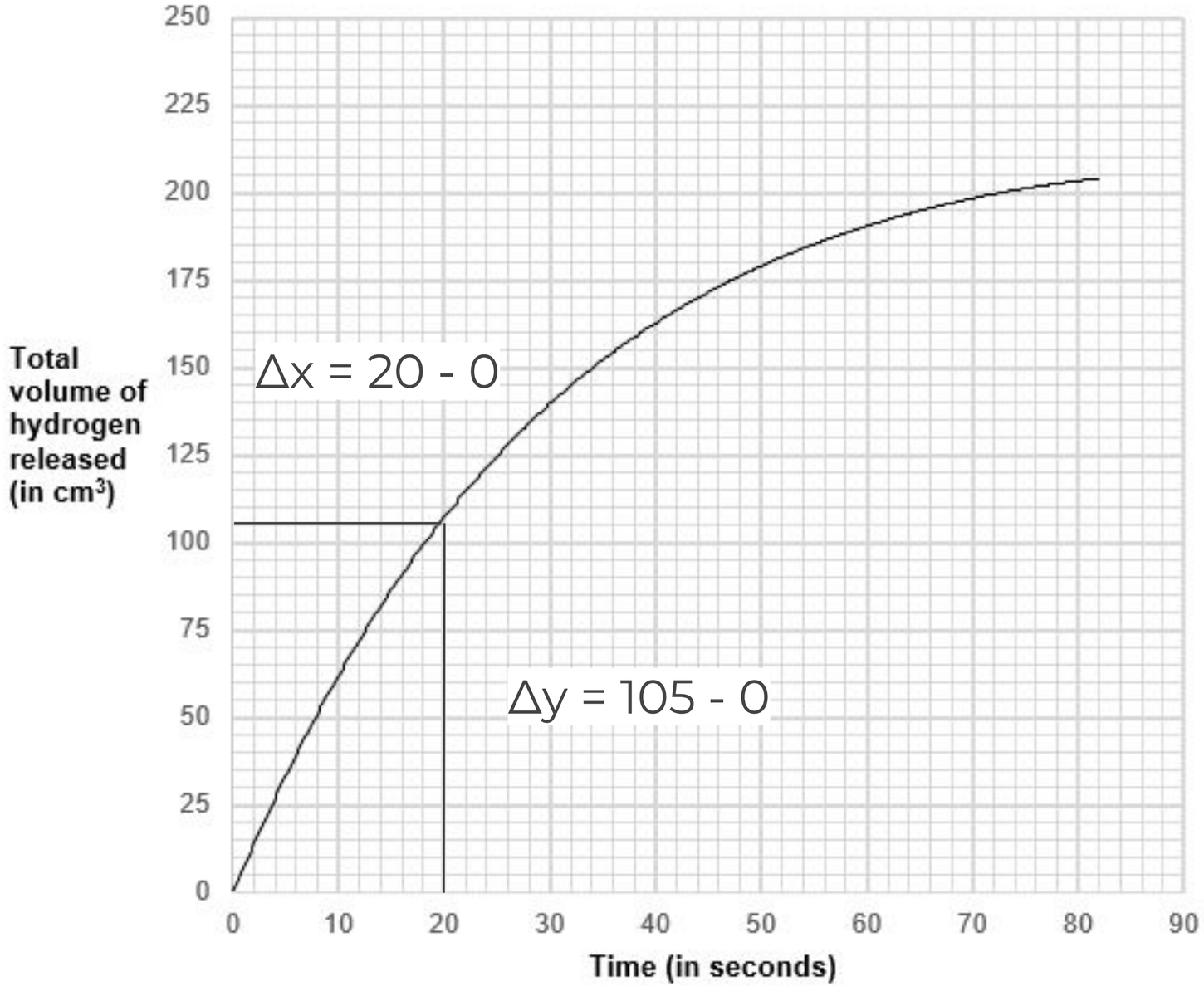
Student B's investigation had a faster rate of reaction.

Mean rate of reaction in the first 20 seconds

$$= \frac{\Delta y}{\Delta x}$$

$$= \frac{105}{20}$$

$$= 5.25 \text{ cm}^3/\text{s}$$



Independent Practice Answers

1. State FOUR possible signs a chemical reaction has taken place.
   (1) fizzing (2) change in mass (3) change in colour / turbidity
   (4) temperature change
2. State the equipment used to measure the following:
   - Volume of gas produced: gas syringe
   - Temperature change: thermometer
   - Change in mass: top pan balance
   - Time: digital stop clock
3. A student investigated the reaction between magnesium and hydrochloric acid. The reaction took 150 seconds to complete and the student recorded a mass lost of 9.85 g. Calculate the mean rate of reaction. Give your answer to two decimal places.

   Mean rate of reaction = quantity of reactant used / time taken
   = 9.85 / 150
   = 0.0656 = 0.07 g/s