What Is Reaction Rate?

CHEMISTRY • WORKSHEET • REACTION RATES

Name: _____ Class: _____ Date: _____

Learning targets Define reaction rate; explain how it is measured; compare fast and slow reactions; identify factors affecting rate; interpret reaction-rate data.

Key formula Average reaction rate = change in a measured quantity ÷ time taken. For example, gas volume produced ÷ time (cm^3/s).

A | Understanding reaction rate

1. Complete the definition using the words below. Use each word once.

time reactants products change

Reaction rate describes how quickly _____ are used up or _____ are formed. It is measured by the _____ in a suitable quantity per unit _____.

2. Match each experiment to the most useful measurement. Write A, B, C or D beside each.

Measurements: A. Gas volume B. Mass lost C. Time for a cross to disappear D. Colour change

Experiment	Measurement
A reaction produces gas collected in a syringe.	_____
A cloudy sulfur precipitate forms in a solution.	_____
A reaction mixture changes from purple to colourless.	_____
A gas escapes from a flask on a balance.	_____

3. Circle the two correct units for a reaction rate.

A. cm^3/s B. cm^3 C. g/min D. s

B | Fast and slow reactions

4. Rank these processes from 1 (fastest) to 4 (slowest) under ordinary conditions.

Process	Rank (1–4)
Iron nail rusting	_____
Paper burning in a flame	_____
Effervescent tablet fizzing in water	_____
Silver jewellery tarnishing	_____

5. Give one observable sign that a chemical reaction is occurring, and explain why that sign alone does not tell you its exact rate.

_____

_____

What Is Reaction Rate?

C | Measuring and interpreting data

A student reacts magnesium with excess dilute acid and records the volume of hydrogen gas collected. The values are illustrative experimental data.

Time (s)	0	10	20	30	40	50	60
Gas volume (cm^3)	0	22	38	50	58	62	64

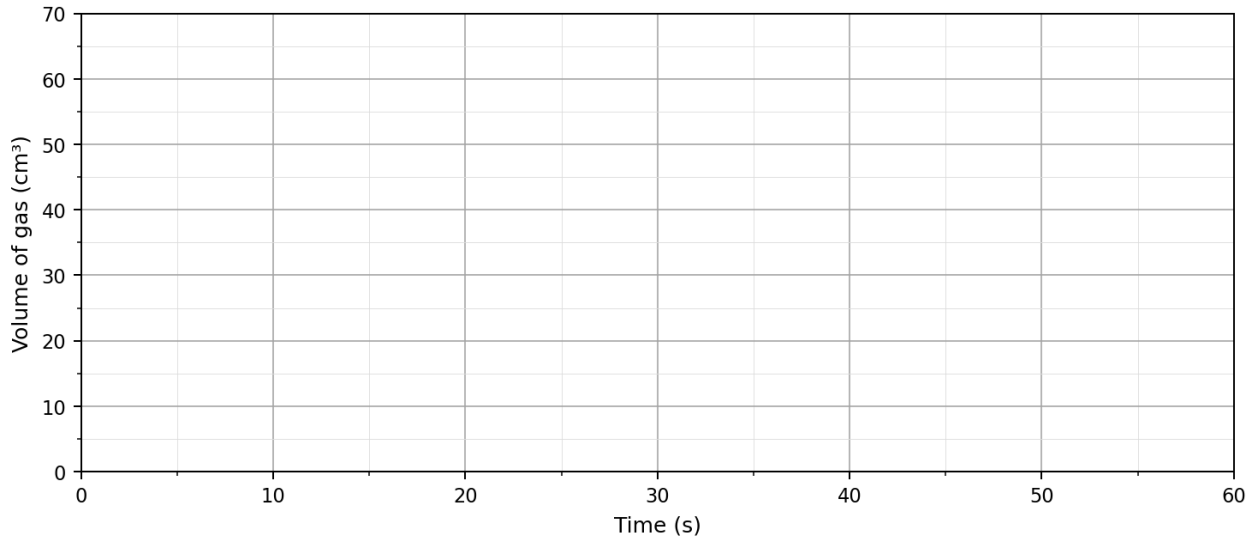
6. Calculate the average rate of gas production for each interval. Show your working and units.

a) 0–10 s: _____

b) 10–20 s: _____

c) 40–60 s: _____

7. Plot gas volume against time on the grid. Use a smooth curve through the points (do not join them with ruler-straight segments).



8. During which 10-second interval was gas formed fastest? How do the data show this?

_____

9. Explain why the curve becomes less steep as the reaction continues.

_____

_____

What Is Reaction Rate?

D | Factors affecting reaction rate

For each change below, predict whether the reaction is usually faster, slower, or unchanged. Assume all other relevant conditions remain the same.

Change	Prediction	Reason
Increase the temperature	_____	_____
Use a more concentrated acid	_____	_____
Crush a solid reactant into powder	_____	_____
Add a suitable catalyst	_____	_____
Dilute the acid with water	_____	_____

10. Explain what a catalyst does. Does a catalyst necessarily increase the amount of product obtained?

_____

_____

E | Designing a fair test

A student compares how quickly 2.0 g of calcium carbonate reacts with hydrochloric acid. The student wants to test the effect of particle size.

11. Complete this plan for a fair investigation.

Independent variable: _____

Dependent variable (what you measure): _____

Two variables to keep constant: 1. _____ 2. _____

12. The student uses 2.0 g of large chips in Trial A and 2.0 g of powder in Trial B. Both produce 80 cm^3 of gas eventually. Trial B produces the gas much sooner. Explain this result.

_____

_____

_____

F | Comparing experimental results

Two students carry out the same gas-producing reaction using different temperatures. Their results are shown below.

Time (s)	0	10	20	30	40
Experiment X: 20 °C (cm^3)	0	10	18	24	28
Experiment Y: 40 °C (cm^3)	0	20	32	39	42

13. Calculate the average rate from 0–20 s for X and for Y. Include units.

_____

_____

14. Which experiment is faster at the start? Give numerical evidence.

_____

What Is Reaction Rate?

G | Reasoning and application

15. A student says, “The reaction that makes the most gas must be the fastest.” Explain why this is not always correct.

_____

_____

_____

16. A graph of product volume against time becomes horizontal at 90 s. What does this tell you about the measured gas production? Give one possible chemical reason.

_____

_____

_____

17. A student measures the time for the same mass of magnesium to disappear in acid:

Acid concentration	Time to disappear
0.5 mol/L	90 s
1.0 mol/L	44 s
1.5 mol/L	29 s

a) Describe the pattern in the data. _____

_____

b) Estimate the average disappearance rate for 0.20 g magnesium at 1.0 mol/L in g/s.

Working: _____

c) Identify one limitation of using “time to disappear” instead of continuous gas-volume data.

_____

_____

18. Extension: Two gas-producing reactions each make 60 cm^3 of gas. Reaction P takes 30 s; reaction Q takes 50 s. Calculate each average rate and state how many times faster P is on average.

_____

_____

_____

Exit ticket

Complete the three statements:

- Reaction rate tells us _____.
- Two ways to measure reaction rate are _____.
- One factor that usually increases rate is _____.