

How fast? The rate of chemical change · supported focus

Supported focus · SL

## Supported scope

- Supported SL focus. First assessment 2025; current brief acquired; full Chemistry guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

## Rates · 1.1

### Reasoning

A faster reaction finishes sooner, but it need not make more product. Rate and final yield answer different questions. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

## Rates · 2.1

### Reasoning

Reaction rate describes reactant used or product formed per time. Higher temperature increases the fraction of collisions with enough energy. A catalyst provides an alternative pathway with lower activation energy. activation energy: The energy barrier for a reaction pathway; rate: Change in a measured quantity per unit time.

## Rates · 3.1

### Reasoning

A product-time graph has a steeper gradient where rate is larger. A tangent estimates instantaneous rate; a secant gives average rate over an interval. The final plateau reflects the total collected product under the stated conditions. For gas production, check apparatus for leaks, start timing consistently and record volume at regular intervals. Keep concentration, reactant amount and surface area controlled when changing temperature.

## Rates · 4.1

### Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: gas volume increases from 10 to 34 cubic centimetres between 20 and 60 s. Average rate = change in volume/change in time. Rate =  $(34 - 10)/(60 - 20) = 0.60$  cubic centimetres per second. This is not necessarily the instantaneous rate at 40 s.

## Rates · 4.2

### Reasoning

A reaction makes 24 cubic centimetres of gas in 40 s. Find average rate. Use the same sequence: known quantities  $\rightarrow$  model  $\rightarrow$  relation  $\rightarrow$  substitution  $\rightarrow$  unit and interpretation.

## Rates · 5.1

### Reasoning

A catalyst does not change the equilibrium constant at a fixed temperature. A mass-loss method cannot detect all reactions, and losing gas through a leak biases a collection experiment. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

## Rates · 5.2

### Reasoning

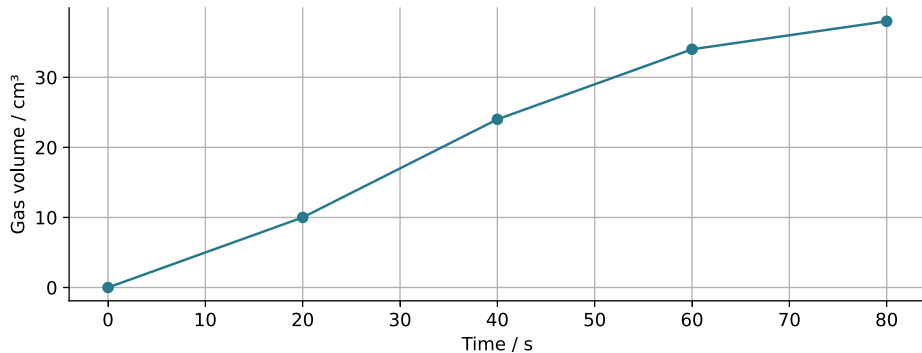
A faster reaction always produces a larger final amount of product. This claim is false:  
A catalyst does not change the equilibrium constant at a fixed temperature. A mass-loss method cannot detect all reactions, and losing gas through a leak biases a collection experiment.

## Rates · 5.3

### Reasoning

Rates, catalysts and reliable endpoints: A product-time graph has a steeper gradient where rate is larger. A tangent estimates instantaneous rate; a secant gives average rate over an interval. The final plateau reflects the total collected product under the stated conditions.

## Rates · diagram



- Original teaching diagram: Rates, catalysts and reliable endpoints
- Use the labels and the stated model together.

## Rates · original transfer

### Your turn

Fictional gas volumes at 0, 20, 40 s are 0, 18, 24 cm<sup>3</sup>. Compare interval rates. Can the 0–40 s average be called the instantaneous rate at 20 s?

## Rates · transfer reasoning

### Method and interpretation

0.90 then 0.30 cm<sup>3</sup>/s; overall 0.60. A secant does not in general give the tangent at 20s. More closely spaced data are needed for the instantaneous estimate.

## Check yourself

- Explain rate using the stated model.
- Explain activation energy using the stated model.
- Change one value in the original transfer; explain which assumption still matters.