Essential Question

How does a graph show how fast something changes?

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Slope: Rise Over Run

- Rise: change in y (Δy)
- Run: change in x (Δx)
- Slope = rise ÷ run

The **slope** of a line measures how steep it is.

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Choosing Your Two Points

- Use points on the line
- Pick points far apart
- Skip data points off the line

Lab data usually scatters a little, so scientists draw a best-fit line and find the slope of that line.

Units of Slope

- Slope unit: y unit over x unit
- Read units from the axis labels
- A slope without units is unfinished

In science, a slope always has units.

What Slope Means in Science

- Slope is a rate: how fast y changes
- Ask: what is y per x?

A slope is a **rate**: it tells how fast the y variable changes for each unit of x.

Steep, Flat, and Negative

- Steeper line: faster change
- Flat line: slope 0, no change
- Negative slope: y is decreasing

The steeper the line, the bigger the slope and the faster the change.

Example: Rolling Cart

Try it first!

A cart rolls down a track. Use the graph of its position over time to find the cart’s speed.

Diagram: A position-time graph with position in meters on the y-axis from 0 to 20 and time in seconds on the x-axis from 0 to 8. A green straight line starts at 2 meters at 0 seconds and rises to 18 meters at 8 seconds.

Example: Reaction Rate

Try it first!

The graph shows the concentration of a reactant over time. Find the slope. What does its sign tell you?

Diagram: A graph of concentration in molarity versus time in seconds. A red straight line starts at 0.80 M at 0 seconds and falls to 0.20 M at 60 seconds. Gridlines are every 10 seconds and every 0.10 M.

Example: Oxygen from Pondweed

Try it first!

Pondweed in light makes oxygen gas. Use the best-fit line to find the rate of oxygen production.

Diagram: A graph of volume of oxygen in milliliters versus time in minutes, from 0 to 10 minutes. Seven black data points scatter slightly above and below a blue best-fit line that starts at 5 milliliters and rises to 30 milliliters at 10 minutes.

Big Ideas

- Slope = rise ÷ run = $\Delta y/\Delta x$
- Two far-apart points on the line
- Units: y unit per x unit
- Steeper = faster; negative = down