SCIENCE FOUNDATIONS

Independent, dependent, and controlled variables

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you set up a fair baking test, by changing only the oven temperature while keeping the recipe and baking time the same and measuring how high the cake rises. The temperature is the thing you change on purpose, the height is the result you measure, and everything else stays fixed so it cannot muddy the answer. A gardener testing fertilizer does the same thing with two identical beds and one different feeding. Knowing these three kinds of variables tells you how to run a test that actually proves what caused the change.



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Rule

Variables: the independent variable is what you change on purpose. The dependent variable is what you measure. Controlled variables are everything else, kept the same.

Find what is changed first, then what is measured, then list what stays the same so it cannot muddy the answer.

Worked examples

EXAMPLE 1

Q **A plant growth experiment: name the variables.**

Changed on purpose	
Measured	
Kept the same	

SOLUTION

Find what is changed on purpose: the amount of light each day.

Find what is measured: the height of each plant in centimetres.

List what stays the same: plant type, soil, water, and pot size.

The result is independent light, dependent height, rest controlled.

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EXAMPLE 2

Q A dissolving experiment: name the variables.

Changed on purpose	
Measured	
Kept the same	

SOLUTION

Find what is changed on purpose: the temperature of the water.

Find what is measured: the time for the sugar to dissolve.

List what stays the same: amount of sugar, amount of water, stirring.

The result is independent temperature, dependent time, rest controlled.

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Practice questions

1 **A baking experiment: some cakes are baked at different oven temperatures, and the height of each cake is measured in centimetres. Name the independent variable, the dependent variable, and the controlled variables.**

- **A** Independent: oven temperature, dependent: cake height, controlled: recipe, baking time, pan size
- **B** Independent: cake height, dependent: oven temperature, controlled: recipe, baking time, pan size
- **C** Independent: oven temperature, dependent: baking time, controlled: cake height, recipe, pan size
- **D** Independent: pan size, dependent: cake height, controlled: oven temperature, recipe, baking time

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2 **In a dissolving test, the amount of salt is changed and the time for the salt to dissolve is measured. What is the independent variable, and what is the dependent variable?**

- **A** Independent: amount of salt, dependent: time to dissolve
- **B** Independent: time to dissolve, dependent: amount of salt
- **C** Independent: amount of water, dependent: time to dissolve
- **D** Independent: amount of salt, dependent: amount of water

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3 In a fair test, how many variables should you change at a time?

- **A** One
- **B** Two
- **C** As many as you like
- **D** None

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4 A student writes in her plan: 'Independent variable: plant growth. Dependent variable: fertilizer type.' What is wrong with her plan?

- **A** The two are swapped
- **B** Nothing is wrong
- **C** Fertilizer is a controlled variable
- **D** Plant growth cannot be measured

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5

A student changes both light and water in one test. What is wrong?

- A Two factors changed, so the cause is unclear
- B Nothing is wrong, changing two factors is faster
- C Only the plant type changed
- D The student measured the wrong variable

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6

Which variable goes on the x-axis of a graph?

- A The independent variable
- B The dependent variable
- C The controlled variable
- D The measured variable

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7 Which variable is measured?

A The dependent variable

B The independent variable

C The controlled variable

D The x-axis variable

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8 What does controlled mean?

A Kept the same in every trial

B Changed on purpose

C Measured at the end

D Written in the results table

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9 Name one controlled variable in the plant light experiment.

- A Soil type
- B Amount of light
- C Plant height
- D Number of trials

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10 Why keep the plant type the same in the light experiment?

- A So plant type cannot explain the difference
- B So the plants grow faster
- C So the light changes more
- D So the height is easier to measure

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ANSWER KEY

1. Independent: oven temperature, dependent: cake height, controlled: recipe, baking time, pan size
2. Independent: amount of salt, dependent: time to dissolve
3. One
4. The two are swapped
5. Two factors changed, so the cause is unclear
6. The independent variable
7. The dependent variable
8. Kept the same in every trial
9. Soil type
10. So plant type cannot explain the difference

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