SCIENCE FOUNDATIONS

Scientific method

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you test an idea fairly, like whether a new phone case really protects better, instead of just trusting a feeling or an advert. A phone case maker who drops both cases the same number of times from the same height has a real comparison. A student testing two plant foods the same way can say which one actually helped. Knowing the scientific method tells you how to turn a hunch, a testable prediction called a hypothesis, into a test you can trust, and how to change your mind when the test says you were wrong.



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Worked examples

EXAMPLE 1

Q Does light affect plant growth?



SOLUTION

Ask: do plants grow taller in bright light or in dim light?

Predict: if a plant gets bright light, then it will grow taller than one in dim light.

Test fairly, measure height each week, and compare the two groups at the end.

The result is bright-light plants grew taller, supporting the prediction.

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EXAMPLE 2

Q Does warm water dissolve sugar faster?



Warm water



Cold water

SOLUTION

Ask: does water temperature change how fast sugar dissolves?

Predict: if the water is warmer, then the sugar will dissolve faster.

Stir the same amount of sugar in warm and in cold water and time each one.

The result is sugar dissolved faster in warm water, supporting the prediction.

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Practice questions

1 **Does music affect how fast bean plants grow? Write a testable hypothesis and describe a fair test.**

- **A** Hypothesis: if a plant hears music, then it will grow taller; grow identical plants with and without music and measure height each week
- **B** Hypothesis: if a plant hears music, then it will grow shorter; water one plant and not the other
- **C** Hypothesis: music makes plants grow; grow one plant with music and measure it once
- **D** Hypothesis: if a plant gets more water, then it will grow taller; grow identical plants with different amounts of water and measure height each week

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2 A student tests whether fertilizer affects plant growth. She grows one group of plants with fertilizer and one group without. What is the independent variable in her test?

- **A** The height of the plants
- **B** The amount of fertilizer
- **C** The type of plant
- **D** The amount of water

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3 A student tests whether stirring makes salt dissolve faster. She stirs one sample in warm water and leaves another sample still in cold water. What is wrong with this test?

- **A** She should use more salt
- **B** Two things change at once, so she cannot tell which caused the result
- **C** She should not time the samples
- **D** She should use cold water for both

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4 **A student tests whether more water makes plants grow taller. She grows one group with more water and one group with the usual amount. Which group is the control?**

- **A** The group with more water
- **B** The group with the usual amount
- **C** Both groups together
- **D** There is no control

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5 **What is a hypothesis?**

- **A** A proven fact
- **B** A testable prediction
- **C** A list of results
- **D** A conclusion from data

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6 Why must a test be fair?

- **A** So only the tested factor can explain the result
- **B** So the test finishes quickly
- **C** So every plant gets a different treatment
- **D** So the hypothesis is always right

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7 After testing, what do you do with the results?

- **A** Throw them away
- **B** Change them to fit the hypothesis
- **C** Analyse them for a pattern
- **D** Keep them secret

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8 What does a conclusion state?

A What the evidence supports

B What you hoped would happen

C The first guess you made

D The equipment you used

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9 Put in order: conclusion, hypothesis, test.

A Conclusion, hypothesis, test

B Test, conclusion, hypothesis

C Hypothesis, conclusion, test

D Hypothesis, test, conclusion

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10

A student only tests one plant. What is the problem?

A One plant cannot show a reliable pattern

B One plant grows too slowly to measure

C One plant always proves the hypothesis

D One plant uses too much water

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ANSWER KEY

1. Hypothesis: if a plant hears music, then it will grow taller; grow identical plants with and without music and measure height each week
2. The amount of fertilizer
3. Two things change at once, so she cannot tell which caused the result
4. The group with the usual amount
5. A testable prediction
6. So only the tested factor can explain the result
7. Analyse them for a pattern
8. What the evidence supports
9. Hypothesis, test, conclusion
10. One plant cannot show a reliable pattern

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