Question 1: Starting with Observations

A student notices that bean seedlings on a windowsill look taller and greener than seedlings placed on a bookshelf across the room.

What is the difference between making an observation and forming a scientific question from it?

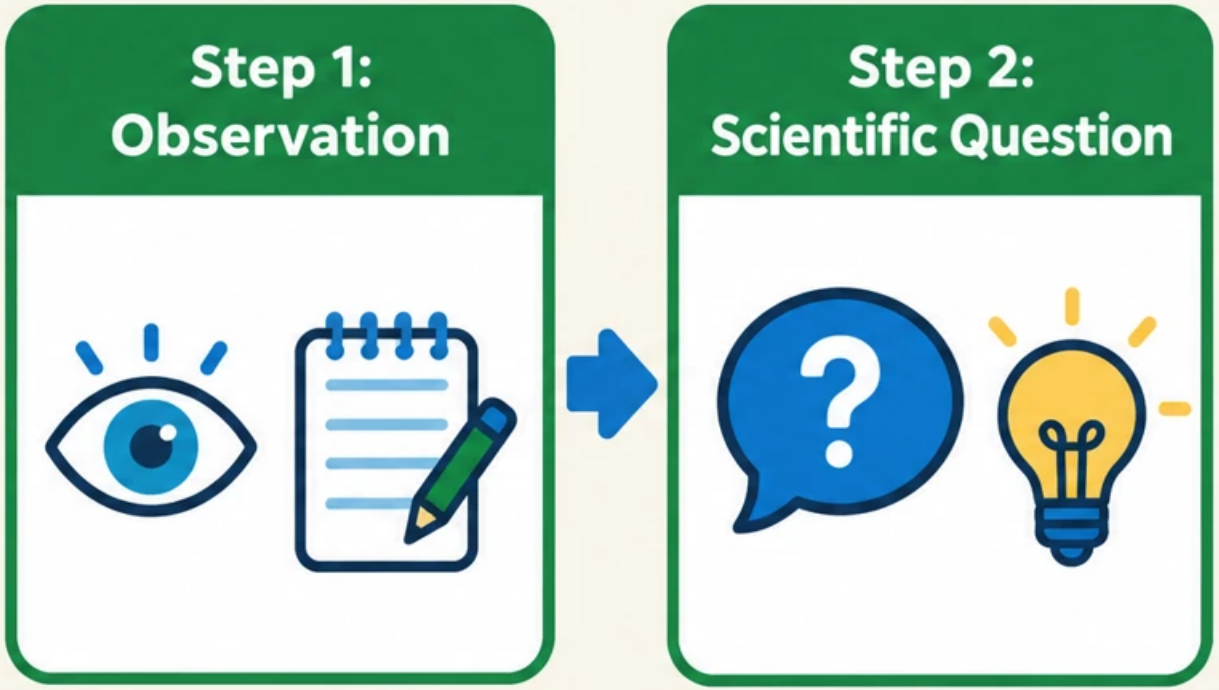


Question 1 Answer

An observation is noticing and recording details using your senses or tools. A scientific question asks how or why something happens based on those observations, leading to a testable investigation.

Observation: Window seedlings grew taller and greener than bookshelf seedlings.

Scientific Question: Does the amount of daily sunlight change how fast bean plants grow?



Question 2: Crafting a Testable Hypothesis

The student wants to investigate how sunlight affects bean plant growth.

Which statement is a testable scientific hypothesis, and why?

A. Plants are happier and prettier when they get natural sunlight.

B. If bean plants receive more hours of sunlight each day, then they will grow taller over two weeks.



Answer 2: Crafting a Testable Hypothesis

Statement B is a testable hypothesis.

A scientific hypothesis must be specific and measurable. Statement B uses an 'If... then...' structure that links a specific change (hours of sunlight) to an observable, measurable outcome (plant height in centimeters).

Statement A cannot be tested scientifically because 'happier' and 'prettier' are personal opinions, not measurable data.

Statement A

"If plants get more sunlight, then they will be happier and prettier."

Not Testable (Subjective Opinion)

Statement B

"If plants get more hours of sunlight, then they will grow taller (in centimeters)."

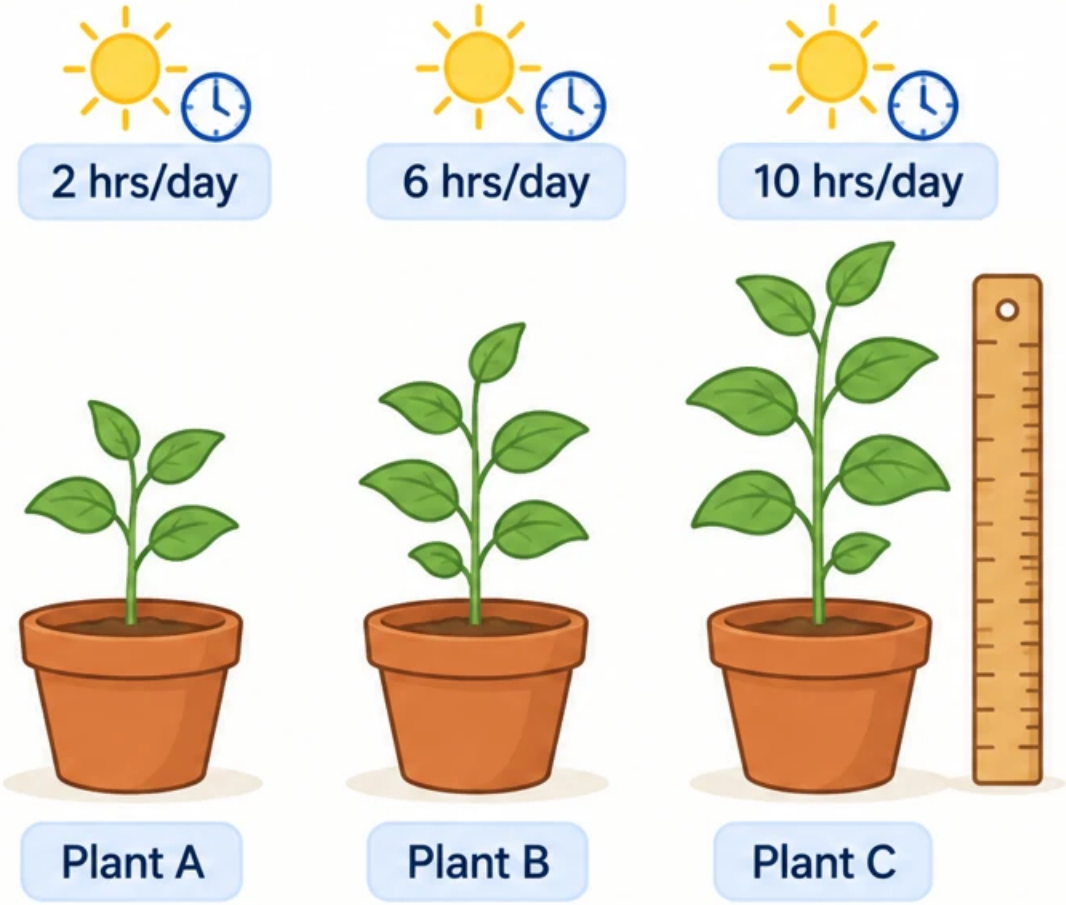
If [Condition]

Then [Measurable Result]

Question 3: Identifying the Variables

To test the hypothesis, the student sets up three bean plants: Plant A gets 2 hours of light per day, Plant B gets 6 hours, and Plant C gets 10 hours. After two weeks, the student measures each plant's height in centimeters.

In this investigation, which factor is the independent variable, and which factor is the dependent variable?

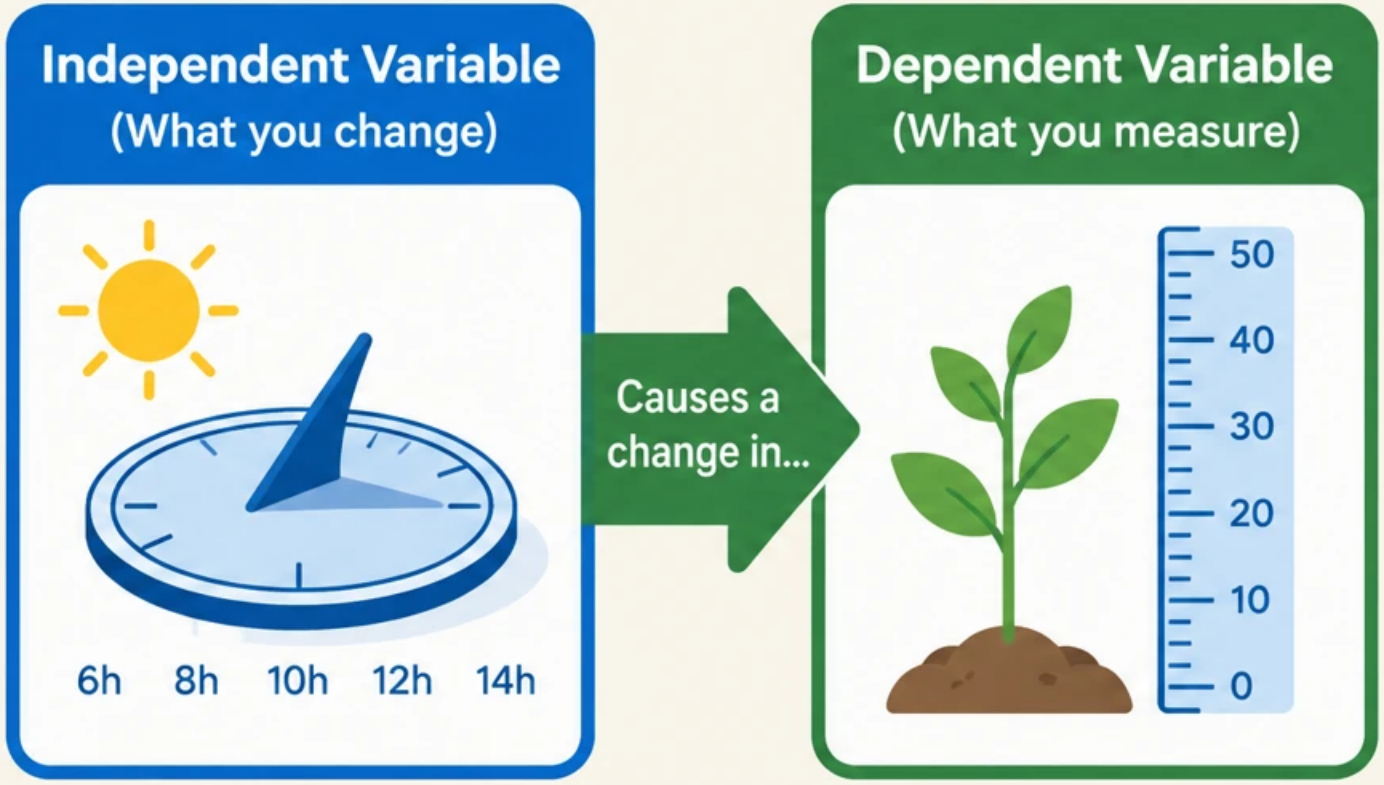


Answer 3: Independent vs. Dependent Variables

Independent Variable (IV):
The daily hours of light exposure (the variable deliberately changed by the scientist).

Dependent Variable (DV):
The final plant height in centimeters (the variable measured to see the effect).

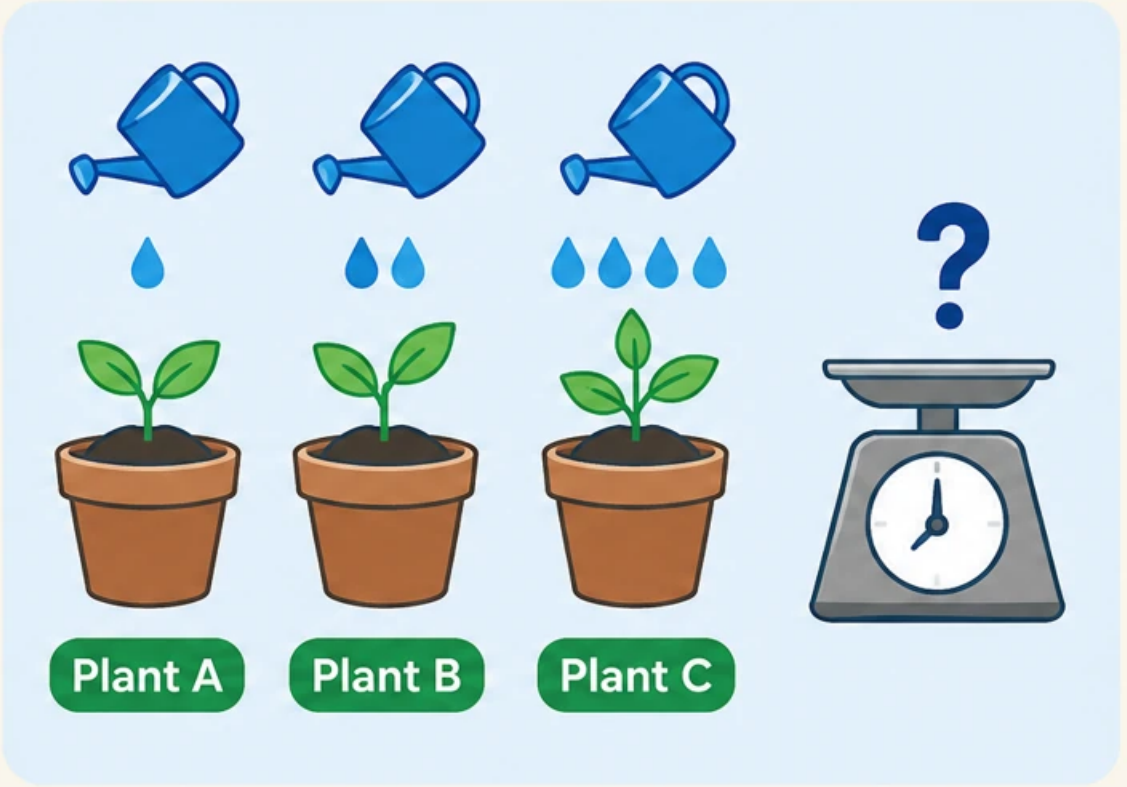
Memory Tip:
The Independent variable is what 'I' change; the Dependent variable is the Data collected.



Question 4: Conducting a Fair Test

A classmate suggests watering Plant A once a week, Plant B twice a week, and Plant C every day, while giving them different amounts of light.

Why would this ruin the experiment, and what must be done to keep the comparison fair?

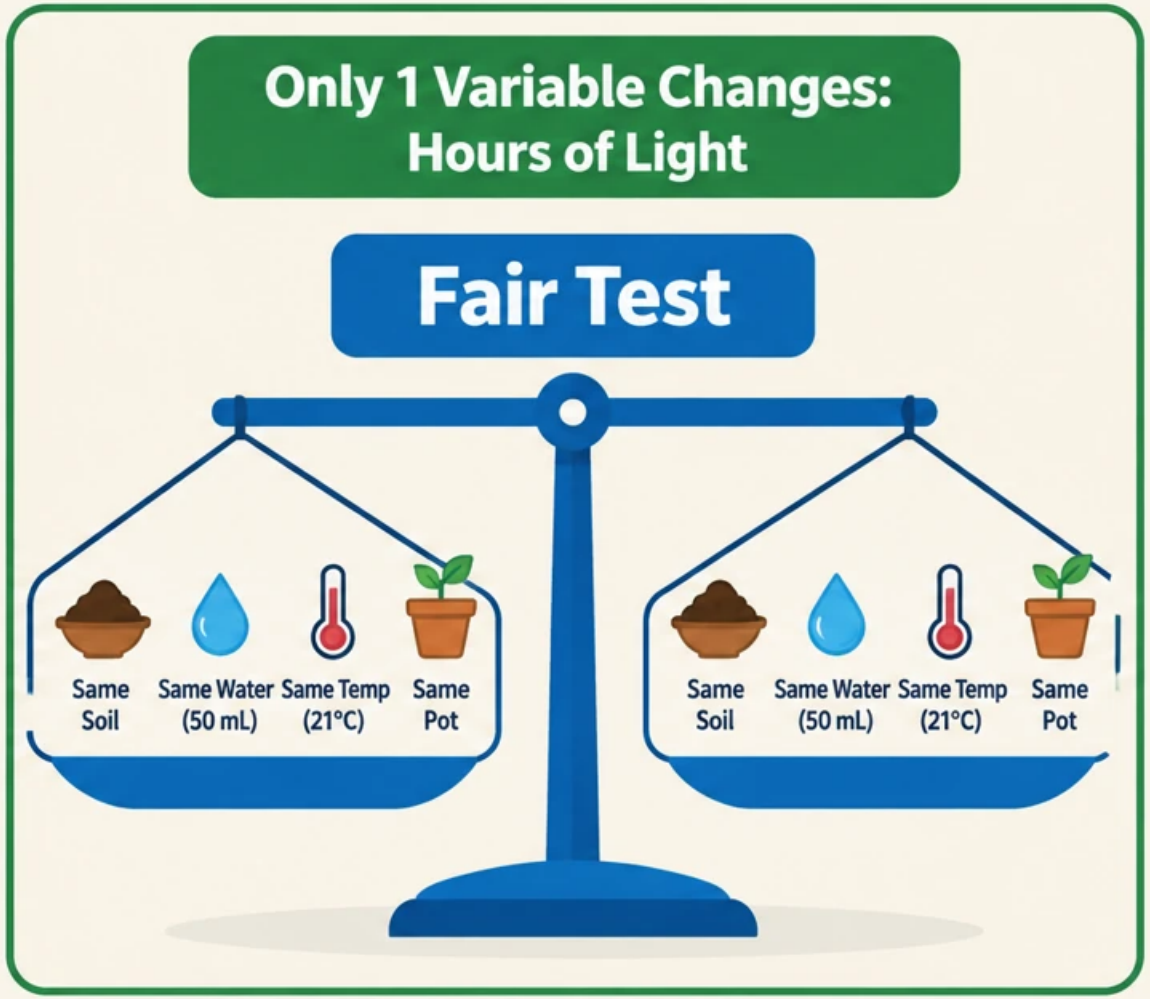


Answer 4: Conducting a Fair Test

Changing water and light at the same time creates confounding variables. If one plant grows taller, you cannot know whether extra light or extra water caused the growth.

To conduct a fair test, keep all controlled variables identical across all groups:

- Same type and starting size of bean plant
- Same soil and pot volume
- Same amount and schedule of water
- Same room temperature



Question 5: Interpreting Experimental Data

Look at the illustrative data table below collected from the two-week investigation:

Plant A (2 hours light/day): 6 cm final height

Plant B (6 hours light/day): 14 cm final height

Plant C (10 hours light/day): 22 cm final height

What pattern does this data show, and does it support the student's hypothesis?

Plant Group (Illustrative Example)	Light Exposure (Hours/Day)	Final Height (cm)
Plant A	2	6
Plant B	6	14
Plant C	10	22

Answer 5: Interpreting Experimental Data

The data shows a clear positive pattern: as daily sunlight hours increased, final plant height increased.

Conclusion: The evidence supports the hypothesis (If bean plants receive more hours of sunlight each day, then they will grow taller).

Scientific note: This illustrative result supports the hypothesis for this tested range, but further repeated trials are needed to confirm the conclusion across different plant species.

