

Science Observation & Evidence: Notice, Measure, Claim

6 complete activities from Science Observation & Evidence, each with a worked answer.



Trial	cm
1	21
2	25
3	24

HOW TO USE

1. Read the situation and the evidence first.
2. Show your thinking in the work boxes, not only an answer.
3. Explain how you know your answer makes sense.
4. Try the new problem at the bottom of the page.

6 activities • 3 answer pages • From the 30-activity collection

10 US Letter pages • Print at 100% / Actual Size

Original Bobotemp educational printable • Fictional names, places and prices

Name _____ Date _____

Park Detective: Observation or Inference?

LEVEL 1



Read each statement. Decide whether it is an observation or an inference.

Maya walked through a park one morning and wrote five statements in her notebook (practice notes). An observation is something you notice directly with your senses or measure with a tool. An inference is an explanation or conclusion about why something is the way it is. Sort all five statements. Then find the one statement that is an observation AND includes a measurement with a unit.

MAYA'S PRACTICE NOTES (NOT A REAL PARK)

- | | | |
|--|--|--|
| A
The bench has water drops on it. | B
It rained last night. | C
The puddle by the slide is 40 cm across. |
| D
A dog left the muddy paw prints. | E
Someone forgot the red umbrella. | |

1. Label each statement O (observation) or I (inference).

2. Circle the observation that includes a measurement with a unit.

3. Rewrite inference B as an observation that could support it.

TRY IT • Is 'The slide is 2 meters tall' an observation or an inference? Is 'Kids played on the slide yesterday' an observation or an inference?

Name _____ Date _____

Upgrade a Vague Description

LEVEL 1



Use the three clues to find the most precise description of the leaf.

A student wrote, 'The leaf is big.' That description is vague. Five classmates tried to upgrade it. A precise description uses exact qualitative words (shape, color, texture) and a quantitative measurement with a unit. It also describes only what is observed, not an explanation. Clue 1: It includes a number with a unit. Clue 2: It uses a precise shape or edge word. Clue 3: It contains only observations. Find the upgrade that passes all three clues.

UPGRADES OF 'THE LEAF IS BIG.'

Vague

The leaf is big.

A

The leaf is really, really big.

B

The leaf is 14 cm long.

C

The oval leaf is 14 cm long with jagged edges.

D

The leaf is huge because it gets lots of sun.

E

The oval leaf has jagged edges.

1. Write which descriptions pass each clue.

2. Name the best upgrade and underline its qualitative and quantitative parts.

3. Upgrade this description yourself: 'The rock is heavy.'

TRY IT • Upgrade 'The rock is heavy' so it has one qualitative word and one measurement with a unit. Then label each part.

Name _____ Date _____

Fix the Unfair Bean Test

LEVEL 2



Find the factor that makes the plan unfair. Then fix the plan.

Lee wants to answer this question: Does the amount of water affect how tall bean plants grow? Lee's plan is described below. In a fair test, only one factor changes on purpose, everything else stays the same, and one result is measured. Clue 1: The factor is different for Pot 1 and Pot 2. Clue 2: The factor is NOT the one Lee wants to test. Find the factor that makes Lee's plan unfair.

LEE'S PLAN

	Pot 1	Pot 2
Water	50 mL each day	100 mL each day
Where	sunny windowsill	inside a closet
Seed	same type of bean seed	same type of bean seed
Pot and soil	same 10 cm pot, same soil	same 10 cm pot, same soil
Measured	plant height in cm after 14 days	plant height in cm after 14 days

EVIDENCE TO USE

- Pot 1: 50 mL of water each day, on a sunny windowsill
- Pot 2: 100 mL of water each day, inside a closet
- Both: same type of bean seed
- Both: same 10 cm pot and same potting soil
- Measured: plant height in cm after 14 days

1. List every factor that is different between the two pots.

2. Circle the factor that makes the test unfair.

3. Rewrite the plan so that only one factor changes.

TRY IT • Testing whether ramp height affects how far a toy car rolls: Ramp 1 is 20 cm high and ends on tile. Ramp 2 is 40 cm high and ends on carpet. What must be fixed?

Name _____ Date _____

Paper Airplane Trials: Median and Range

LEVEL 2



Order the trial data. Then find the median and the range.

A class threw the same paper airplane five times across the gym and measured each glide distance (practice data from a described class demonstration). Scientists repeat trials so that one odd result does not fool them. Summarize the trials with the median and the range, and look for an unusual value.

PRACTICE DATA: GLIDE DISTANCE (CM)

Trial	Distance (cm)	Note
Trial 1	412	
Trial 2	398	
Trial 3	455	a door opened
Trial 4	403	
Trial 5	401	

1. Order the distances from least to greatest and find the median.

2. Find the range.

3. Why does the class repeat trials? Which value is unusual?

TRY IT • New practice trials: 210, 225, 218, 214, 290 cm. Find the median and the range.

Name _____ Date _____

Paper Helicopter: Which Trials Count?

LEVEL 3



Decide which trials are fair evidence. Then find the mean.

A teacher dropped one paper helicopter from the same stairwell landing four times while the class timed each fall to the nearest second (practice data from a described demonstration). The class notes say something went wrong in one trial. Decide which trials give fair evidence. Find the mean fall time of those trials, and explain why your choice matters.

PRACTICE DATA: FALL TIME (SECONDS, TO THE NEAREST SECOND)

Trial	Fall time	Note
Trial 1	6 s	
Trial 2	8 s	
Trial 3	3 s	hit a stair railing
Trial 4	7 s	

1. Decide whether any trial should be left out, and give a reason from the notes.

2. Find the mean of the trials you keep.

3. Find the mean of all four trials. Which mean is a better summary?

TRY IT • A second helicopter design had these practice trials: 9, 11, 10, and 4 s (note: hit a wall). Find the mean of the trials that should be kept.

Name _____ Date _____

Evidence Ranking: Marble Rolls

LEVEL 3



Use the clues to find the strongest evidence. Then rank the evidence.

Claim: A marble rolls farther on a smooth wood floor than on carpet. Four students offered evidence from a class demonstration (practice data). Clue 1: The evidence is based on watching or measuring the marble, not on what someone thinks. Clue 2: The evidence includes numbers with units. Clue 3: The evidence gives data for both surfaces. Find the evidence that passes all three clues.

EVIDENCE OFFERED**E1**

The marble rolled really far on the wood floor.

E2

Over 3 trials each, the marble rolled a median of 245 cm on wood and 60 cm on carpet.

E3

My friend thinks carpet slows marbles down.

E4

On the wood floor, the marble rolled 245 cm.

1. Cross out any evidence that is opinion.

2. Rank the remaining evidence from strongest to weakest.

3. Explain why E2 is stronger than E4.

TRY IT • Claim: Bean plants grow taller with more light. Which evidence is stronger: (a) 'The window plant grew a lot,' or (b) 'In 14 days, the window plant grew 9 cm and the cupboard plant grew 1 cm'? Explain.

1. Park Detective: Observation or Inference?

LEVEL 1

C. 'The puddle by the slide is 40 cm across' is the only observation with a measurement and unit. A and C are observations. B, D, and E are inferences.

WORKED REASONING • Ask about each statement: could Maya see it or measure it right now? A: Yes, she can see the drops, so it is an observation. B: She did not see rain fall; she is explaining the wet things, so it is an inference. C: She can measure the puddle, so it is an observation with 40 cm. D: She sees prints but did not see a dog, so it is an inference. E: She sees an umbrella but does not know that someone forgot it, so it is an inference. The observations are A and C. Only C has a number and a unit. Sample rewrite of B: 'There is a puddle, and the bench has water drops.'

WATCH FOR • Students often label B an observation because it sounds like a fact. Maya did not watch the rain fall. She is explaining what she sees, so B is an inference.

TRANSFER • 'The slide is 2 meters tall' is an observation because it can be measured now. 'Kids played on the slide yesterday' is an inference because it explains past events that were not seen.

2. Upgrade a Vague Description

LEVEL 1

C: 'The oval leaf is 14 cm long with jagged edges.'

WORKED REASONING • Clue 1 (number with a unit): B and C both say 14 cm. Clue 2 (precise shape or edge word): C and E use 'oval' and 'jagged.' Clue 3 (only observations): A, B, C, and E describe what is seen. D adds an explanation ('because it gets lots of sun'), so D is out. Only C passes all three clues. C is the best upgrade because it has qualitative parts (oval, jagged edges) and a quantitative part (14 cm long).

WATCH FOR • Students may think adding emphasis words like 'really, really' or 'huge' makes a description precise. Precise means exact: name the shape or texture, or give a measured value with a unit.

TRANSFER • Sample: 'The gray, rough rock has a mass of 350 g.' 'Gray' and 'rough' are qualitative. '350 g' is quantitative. Any color or texture word plus a mass with a unit is acceptable.

11. Fix the Unfair Bean Test

LEVEL 2

location. The pots are in different places (windowsill and closet), so the amount of light also changes. Fix: put both pots on the same sunny windowsill.

WORKED REASONING • Compare the pots one factor at a time. Water: 50 mL vs. 100 mL (different). Place: windowsill vs. closet (different). Seed type, pot size, and soil: the same. Lee is testing water, so the water amount is supposed to change. The location also changes, and that changes the light. Then we cannot tell whether water or light caused a height difference. Fix: keep both pots on the same windowsill, change only the water amount, and measure the height in cm.

WATCH FOR • Students may say the water amount makes the test unfair because it is different. The tested factor is supposed to differ. The problem is a second factor changing at the same time.

TRANSFER • The floor surface must be fixed. Both ramps should end on the same floor so that only the ramp height changes.

12. Paper Airplane Trials: Median and Range

LEVEL 2

Range = 57 cm (455 - 398). Median = 403 cm. Trial 3 (455 cm) is the unusual value.

WORKED REASONING • Sorted: 398, 401, 403, 412, 455. The middle value (3rd of 5) is 403, so the median is 403 cm. Range: $455 - 398 = 57$ cm. Trial 3 (455 cm) is far from the others, and the notes say a door opened, so moving air may have pushed the plane. Without Trial 3, the range would be $412 - 398 = 14$ cm. Repeating trials shows which values are typical and which are unusual.

WATCH FOR • Students may pick the middle value of the unsorted list, which is Trial 3 (455 cm). The data must be put in order before finding the median.

TRANSFER • Sorted: 210, 214, 218, 225, 290. The median is 218 cm. The range is $290 - 210 = 80$ cm.

21. Paper Helicopter: Which Trials Count?

LEVEL 3

The mean of the three kept trials is 7 s ($21 \div 3$). Trial 3 (3 s) is left out because the helicopter hit a stair railing.

WORKED REASONING • Trial 3 (3 s) is far below the others, and the notes say it hit a stair railing, so it does not measure a normal fall. Keep Trials 1, 2, and 4: $6 + 8 + 7 = 21$ s. Mean: $21 \div 3 = 7$ s. With all four trials: $6 + 8 + 3 + 7 = 24$ s, and $24 \div 4 = 6$ s. The 7 s mean is the better summary because the 6 s mean is pulled down by a trial with a known problem.

WATCH FOR • Students may drop any value they do not like. A value should be left out only when there is a recorded reason, such as the railing hit noted here. Otherwise, the trial should be repeated rather than ignored.

TRANSFER • Leave out 4 s. $9 + 11 + 10 = 30$, and $30 \div 3 = 10$ s.

22. Evidence Ranking: Marble Rolls

LEVEL 3

E2 is the strongest evidence. Ranking: E2, then E4, then E1. E3 is opinion, not evidence.

WORKED REASONING • Clue 1: E3 is what a friend thinks, so it is out. E1, E2, and E4 remain. Clue 2: Only E2 and E4 have numbers with units (245 cm, 60 cm). Clue 3: Only E2 gives data for both wood and carpet. E2 passes all three clues. Ranking: E2 (both surfaces, repeated trials, numbers), then E4 (one number, one surface), then E1 (vague). E2 is stronger than E4 because a claim that compares two surfaces needs data from both surfaces.

WATCH FOR • Students may think E4 is enough because it has a number. A comparison claim needs measurements for both things being compared. A single large number does not show which surface wins.

TRANSFER • (b) is stronger. It gives measured values with units for both conditions, so it shows the comparison. (a) is vague and gives data for only one plant.