Scientific Method and Experiment Design

Use this key to check answers and read the explanations.

1. Which lab note records quantitative data?
   - A. The spinner turned 18 times.
   - B. The paper looked glossy.
   - C. The spinner made a faint hum.
   - D. The air smelled smoky.

   Correct answer: A. The spinner turned 18 times.
   The turn count is a number measuring how often something happened. The other notes describe qualities.

2. Which idea can a class test by measuring salt dissolving in water?
   - A. Salt is the best material in science.
   - B. Warm water has the most beautiful color.
   - C. Salt dissolves faster in warmer water.
   - D. Dissolving salt looks more interesting than ice.

   Correct answer: C. Salt dissolves faster in warmer water.
   The class can change water temperature and compare how long equal amounts of salt take to dissolve.

3. A student changes the height of a ramp and records how far a toy car rolls past its end. What is the dependent variable?
   - A. Height of the ramp
   - B. Distance the car rolls
   - C. Type of toy car
   - D. Surface below the ramp

   Correct answer: B. Distance the car rolls
   The student changes ramp height and measures the resulting distance. That measured outcome is the dependent variable.

4. A group tests a flower preservative by adding it to the water for one set of identical cut flowers. What should the comparison flowers receive?
   - A. Preservative in warmer water
   - B. Preservative at double strength
   - C. Plain water in a much smaller vase
   - D. The same amount of plain water

   Correct answer: D. The same amount of plain water
   Plain water gives a baseline under the same conditions. The intended difference between groups is whether the preservative is present.

5. Which note reports an observation from a paper towel test without explaining why it happened?

A. Towel A absorbed more because its fibers were thicker.
B. Towel A absorbed 14 mL of water.
C. Towel A performed worse because it had fewer pores.
D. Towel A must have been more expensive to make.

Correct answer: B. Towel A absorbed 14 mL of water.
The volume is a direct measurement. The other statements propose explanations or infer something the test did not measure.

6. A team asks whether adding a paper clip changes how long a paper helicopter stays in the air. Which test isolates the clip?

A. Drop matching models with and without a clip from the same height.
B. Drop a clipped model from a higher shelf than an unclipped model.
C. Drop a clipped wide model and an unclipped narrow model from the same height.
D. Drop a clipped model indoors and an unclipped model outside.

Correct answer: A. Drop matching models with and without a clip from the same height.
Matching the models and drop conditions leaves the clip as the planned change. The other designs change another factor at the same time.

7. Three timed drops of an identical model take 1.9, 2.1 and 2.3 seconds. What can the three times show that the middle time alone cannot?

A. Which design would always finish first
B. How the model would fall outdoors
C. Whether the stopwatch read exactly right
D. How much the times varied

Correct answer: D. How much the times varied
The spread among repeated values shows trial-to-trial variation. One reading cannot show that spread.

8. A survey finds students who own binoculars report seeing more bird species. Which claim fits this evidence?

A. More species in an area always cause students to buy binoculars.
B. Buying binoculars will make every student see more species.
C. Binocular ownership and reported sightings were associated.
D. Time outdoors cannot affect the number of species seen.

Correct answer: C. Binocular ownership and reported sightings were associated.
The study found an association. Another factor, such as time spent outdoors, could help explain both the equipment and the sightings.

9. A museum tests two signs for the same exhibit. Which procedure randomly assigns visitors to the signs?

A. Use a random number to choose which sign each visitor sees.
B. Let visitors pick the sign they prefer.
C. Show one sign to everyone before noon and the other after noon.
D. Choose the sign according to the visitor’s age.

Correct answer: A. Use a random number to choose which sign each visitor sees.
Using a random number gives each visitor a chance of seeing either sign. Age, preference and arrival time no longer determine assignment.

10. Batter A is baked in a metal pan and batter B in a glass pan. The cakes rise to different heights. What makes the cause unclear?

A. The cooks measured both cakes.
B. The groups each had a pan.
C. Cake height was the outcome.
D. Batter recipe and pan material changed together.

Correct answer: D. Batter recipe and pan material changed together.
The two conditions pair each recipe with a different pan material. That setup cannot separate the effect of the recipe from the effect of the pan.

11. Judges score photos produced by two camera settings. Which step reduces the chance that expected results influence a judge’s score?

A. Ask each photographer to rate only their own pictures.
B. Show the judges which setting the team expects to win.
C. Label the photos with codes that hide the settings.
D. Give each judge photos from only the setting they favor.

Correct answer: C. Label the photos with codes that hide the settings.
Hidden settings keep judges from applying different expectations to the photos. The scores can still be matched to the settings afterward.

12. A 100 g reference mass gives readings of 104.9 g, 105.0 g and 105.1 g. How should those readings be described?

A. Accurate but imprecise
B. Precise but inaccurate
C. Both accurate and precise
D. Neither accurate nor precise

Correct answer: B. Precise but inaccurate
The readings cluster tightly, which shows precision. They cluster away from the known 100 g value, which shows poor accuracy.

13. A class reports that one wheel design rolls farther. Which follow-up is an independent replication attempt?

A. The authors publish a copy of their original data table.
B. A classmate recalculates the average using the original measurements.
C. A teacher redraws the original graph at a different scale.
D. Another class builds comparable wheels and gathers its own measurements.

Correct answer: D. Another class builds comparable wheels and gathers its own measurements.
The second class tests the same idea with newly collected data. Reusing the first class's numbers can check the calculation without independently testing the result.

14. A teacher recruits volunteers from one science club, then randomly assigns them to two study methods. Which limitation remains?

A. The volunteers may not represent all students.
B. Students chose which study method they received.
C. The two groups cannot be compared at all.
D. The volunteers must represent every school equally.

Correct answer: A. The volunteers may not represent all students.
Random assignment helps make the groups comparable within the experiment. Recruiting from one club still limits how far the findings can be generalized.

15. Identical water bowls are randomly assigned to be covered or uncovered. After a week in the same room, covered bowls have more water left on average. What conclusion fits best?

A. The experiment established that room temperature never affects water loss.
B. Covers prevent all water loss in every room.
C. The result supports an effect of the cover in this setup.
D. The result shows that each bowl lost the same amount of water.

Correct answer: C. The result supports an effect of the cover in this setup.
The bowls started under matching conditions, with covers assigned at random. The result supports a cover effect here. It says little about other covers or room temperatures.