CLASS 9 SCIENCE

CHAPTER 13

EXPLORATION: INTRODUCING SCIENTIFIC INVESTIGATION

NCERT QUESTIONS & ANSWERS

Chapter focus: Scientific investigation, asking questions, forming hypotheses, planning investigations, observing and measuring, analysing evidence, drawing conclusions, communicating findings, and applying scientific thinking.

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CHAPTER-END QUESTIONS & ANSWERS

Revise • Reflect • Refine — Chapter 13

1. What is the first step in a scientific investigation?

Answer: The first step is to **identify and clearly state a question or problem** that can be investigated. A good scientific question should be specific, observable or measurable, and suitable for investigation.

2. Why is observation important in scientific investigation?

Answer: Observation provides the **evidence and information** from which scientists identify patterns, ask questions and develop explanations. Careful observations can be qualitative or quantitative and help make an investigation systematic and reliable.

3. What is a hypothesis? How is it different from a scientific question?

Answer: A **hypothesis** is a testable proposed explanation or prediction based on observations or existing knowledge. A scientific question asks *what* or *how* something happens, whereas a hypothesis proposes an explanation that can be tested using evidence.

4. Why should a hypothesis be testable?

Answer: A hypothesis must be testable so that observations or measurements can provide evidence that supports or does not support it. If no possible investigation can check the prediction, it cannot be evaluated scientifically.

5. What is the difference between a qualitative and a quantitative observation?

Answer: A **qualitative observation** describes qualities or characteristics, such as colour, texture or appearance. A **quantitative observation** involves numerical measurements, such as length, mass, temperature, time or volume. Quantitative observations are especially useful when precise comparisons are needed.

Exam Tip: In an investigation, always distinguish the **question, hypothesis, variables, observations/measurements, evidence and conclusion**.

6. Why are measurements important in scientific investigations?

Answer: Measurements make observations **more precise, comparable and reproducible**. They allow scientists to record changes numerically, compare results between trials and communicate findings clearly. Using appropriate standard units also reduces ambiguity.

7. Why should variables be identified while planning an investigation?

Answer: Identifying variables helps the investigator determine what is being changed, what is being measured and what should be kept the same. This makes the investigation fair and helps establish whether a change in one factor is associated with a change in the outcome.

8. What is meant by a fair test?

Answer: A fair test is an investigation in which the factor being tested is changed deliberately while other relevant conditions are kept as constant as possible. The measured outcome can then be compared meaningfully.

9. Why are repeated trials useful?

Answer: Repeated trials help identify random variation and increase confidence in the results. If similar results are obtained repeatedly under the same conditions, the conclusion is more reliable than one based on a single observation.

10. Why is it important to record observations during an investigation?

Answer: Records provide a permanent evidence trail. They allow observations and measurements to be **checked, compared, analysed and communicated**. Accurate records also help another person understand how the investigation was carried out.

Exam Tip: In an investigation, always distinguish the **question, hypothesis, variables, observations/measurements, evidence and conclusion**.

11. How can tables and graphs help in analysing scientific data?

Answer: Tables organise raw observations and measurements systematically. Graphs make patterns, trends, comparisons and relationships easier to see. They can help an investigator decide whether the evidence supports a hypothesis and identify unusual results.

12. What should a scientist do if the results do not support the hypothesis?

Answer: The scientist should not change the results simply to fit the hypothesis. The evidence should be examined honestly, possible sources of error should be considered, and the hypothesis may be **modified or rejected**. A result that does not support a prediction can still provide useful scientific knowledge.

13. Why is evidence more important than personal belief in science?

Answer: Scientific explanations are expected to be supported by **observations, measurements and reproducible evidence**. Personal beliefs may influence what someone expects, but conclusions in science must be based on evidence that can be examined and tested by others.

14. Why should scientific findings be communicated to others?

Answer: Communication allows scientists to share methods, observations, evidence and conclusions. Other people can evaluate the work, repeat the investigation, identify limitations and build new investigations on the findings. Scientific knowledge therefore develops through shared evidence and discussion.

15. A student wants to investigate whether the amount of sunlight affects the growth of a plant. Write a suitable scientific question, hypothesis, variables and a simple investigation plan.

Answer:
Scientific question: Does the amount of sunlight received by a plant affect its growth?
Hypothesis: Plants receiving an appropriate greater amount of sunlight will show greater growth, provided other conditions remain suitable.
Independent variable: Amount of sunlight received.
Dependent variable: Plant growth, measured for example by height over a fixed period.
Controlled variables: Plant type and age, soil, pot size, amount of water, nutrients and duration of the investigation.
Plan: Use similar plants, expose groups to different controlled amounts of sunlight, keep other conditions as similar as possible, measure plant height at regular intervals, record the data in a table, compare the results using a graph, and draw a conclusion based on the evidence.

Exam Tip: In an investigation, always distinguish the **question, hypothesis, variables, observations/measurements, evidence and conclusion**.

QUICK REVISION — CHAPTER 13

Scientific investigation at a glance

Scientific investigation cycle: Observe → Ask a question → Form a testable hypothesis → Plan the investigation → Collect observations/measurements → Analyse data → Draw a conclusion → Communicate findings → Refine or investigate further.

Qualitative: Describes qualities. **Quantitative:** Uses numbers and measurements. Quantitative evidence is useful for precise comparison and identifying trends.

Variables: Independent variable = factor deliberately changed. Dependent variable = outcome measured. Controlled variables = relevant conditions kept the same.

Fair test: Change one relevant factor deliberately while controlling other important conditions, so the effect on the measured outcome can be evaluated.

Reliable evidence: Use careful measurements, accurate records and repeated trials. Do not alter data simply because it disagrees with a prediction.

Conclusion: A conclusion should answer the scientific question and be based on the evidence collected. A hypothesis may be supported, modified or not supported.