

Asking Good Scientific Questions

Questions are an essential part of science. What makes a good scientific question is that it can be answered by direct observations or with scientific tools. Examples of questions that are not scientific are based on values or opinions like what people believe is right or wrong, or beautiful or ugly.

Scientists may start with a broad question such as “What makes a seed grow?” Next, they break the question down into smaller questions: What are the essential factors necessary for seed germination? What factors are necessary for radish seed germination? They state the final question in a way that can be answered by investigation or experiment. A good scientific question is: “What effect does the pH of water have on radish seed germination?”

Good scientific questions are defined, measurable, and controllable.

Tips on Asking Good Scientific Questions

1. Begin by asking several questions about a topic.
2. Eliminate questions that cannot be answered by direct observation or by gathering evidence.
3. Break broad questions into smaller questions that can be investigated one at a time.
4. Word questions in a way that allows them to be answered by an experiment.

Here are some good ways to begin scientific questions:

“What is the relationship between . . . ?”

“What factors cause . . . ?”

“What is the effect of . . . ?”

Directions:

1. Read each question 1 – 10 below and write yes if the question is a good scientific question. Write no if it is a poorly worded question.
2. Then, for each item to which you answered no, explain the limitations of the question and/or rewrite the question in the form of a valid scientific question. **Avoid binary (yes/no) questions.**

Questions 1 – 10:

1. Do excessively high temperatures cause people to behave immorally?
2. What is the function of spines on cacti?
3. What is the sequence of the human genome?
4. Does salt negatively affect the rate of radish seed germination?
5. How does light intensity affect invertebrate activity?

6. Why do birds fly to warmer regions during the winter months?
7. What is the relationship between smoking and lung cancer?
8. Does exposure to ultraviolet radiation cause increased risk of skin cancer?
9. Do enzymes increase the rate of hydrogen peroxide degeneration?
10. Is genetically modified corn safe to eat?

Define the Variables

There should be three categories of **variables** in every experiment: dependent, independent, and controlled.

Independent -- what is changed during the experiment; it is what the investigator thinks might affect the dependent variable.

State our independent variable:

Dependent -- what will be measured; it's what the investigator thinks will be affected during the experiment.

State our dependent variable:

Controlled -- variables held constant (that means they are measured and CONTROLLED). Since the investigator wants to study the effect of one particular independent variable, the possibility that other factors are affecting the outcome must be eliminated.

State our controlled variables (at least 4):