Thinking Like a Scientist

Key Concepts

- What skills do scientists use to learn about the world?
- What attitudes are important in science?

Scientists use skills such as observing, inferring, predicting, classifying, and making models to learn more about the world. Observing means using one or more of your senses to gather information. Your senses include sight, hearing touch, taste, and smell. Observations can be either quantitative or qualitative. **Quantitative** observations deal with a number, or amount. Seeing that you have eight new e-mails in your inbox is a quantitative observation. **Qualitative** observations, on the other hand, deal with descriptions that cannot be expressed in numbers. Noticing that a bike is blue and that a grape tastes sour are qualitative observations.

When you explain or interpret the things you observe, you are **inferring,** or making an inference. Making an inference doesn't mean guessing wildly. Inferences are based on reasoning from what you already know. **Predicting** means making a forecast of what will happen in the future based on past experience or evidence. While inferences are attempts to explain what is happening or *has* happened, predictions are forecasts or what *will* happen.

Classifying is the process of grouping together items that are alike in some way. You classify objects and information all the time. Classifying things helps you to stay organized so you can easily find and use them later.

Making models involves creating representations of complex objects or processes. Models help people study and understand things that are complex or that can't be observed directly. Using a model allows scientists to share information that would otherwise be difficult to explain. Models include diagrams and physical objects, such as globes and movie sets. Some models are computer-generated, like the ones some architects use to design new buildings. Models are only representations of the real object or process. Therefore, some information may be missing from a model.

Science is a way of learning about the natural world. Science also includes all the knowledge gained from exploring the natural world. **Successful scientists possess certain important attitudes, or habits of mind, including curiosity, honesty, open-mindedness, skepticism, and creativity.** An important attitude that drives scientists is their curiosity. Successful scientists are eager to learn. Good scientists always report their observations and results truthfully. Scientists need to be open-minded, or capable of accepting new and different ideas. Open-mindedness should always be balanced by **skepticism,** which is having an attitude of doubt. When a problem arises in scientific studies, scientists use creativity to find a solution. Creativity means coming up with inventive ways to solve problems or produce new things.

Thinking Like a Scientist *(continued)*

Introduction (p. 6)

1. What are five skills scientists use to learn more about the world?

_____ _____

_____ _____

_____

Observing (p. 7)

2. What is observing?

_____

_____

_____

3. The senses a scientist uses in observing include sight, hearing, touch, taste, and _____.

4. In the spaces below, explain the differences between quantitative and qualitative observations.

Observations	
Quantitative Observations	**Qualitative Observations**

Inferring (p. 8)

5. What is inferring?

_____

_____

_____

6. Circle the letter of each item that is true about inferences.
   - **a.** Inferences are based on reasoning from what you already know.
   - **b.** Making an inference involves wild guessing.
   - **c.** An inference is an interpretation of observations.
   - **d.** People make inferences all the time.

Predicting (p. 9)

7. Making a forecast of what will happen in the future based on past experience or evidence is called _____.

8. How are inferring and predicting related?

_____

_____

_____

Classifying (p. 10)

9. What is classifying?

_____

_____

_____

10. Is the following sentence true or false? A drawback of classifying things is that objects and information stay disorganized. _____

Making Models (p. 11)

11. What does making models involve?

_____

_____

_____

_____

_____

_____

12. Circle the letter of each item that could be a model.
    - **a.** map
    - **b.** movie set
    - **c.** computer-generated illustration
    - **d.** notebook notes

Thinking Like a Scientist *(continued)*

13. Is the following sentence true or false? Models help people study things that cannot be observed directly. _____

14. Is the following sentence true or false? Some information about an object or process may be missing from a model. _____

Scientific Attitudes (p. 12)

15. What is science?

_____

_____

_____

16. What are five important attitudes that successful scientists possess?

_____ _____

_____ _____

_____

17. Circle the letter of the definition of skepticism.
    a. having an attitude of doubt
    b. being open-minded
    c. coming up with inventive ways to solve problems
    d. an eagerness to learn more about a topic

18. Is the following sentence true or false? Honesty is important when a scientist's results go against previous ideas. _____