

## Chapter 1

# About Science

- 1.1 [What Is Life?](#)
- 1.2 [The Scientific Method](#)
- 1.3 [Science and Technology](#)
- 1.4 [Facts, Laws, and Theories](#)
- 1.5 [Working with Numbers](#)



## End of Chapter Questions

### Simple Review Questions

#### 1.1 What Is Life?

1. What are some of the characteristics of living organisms?
  
  
  
  
  
  
  
  
  
  
2. Describe what it means to say that living things are parts of populations that evolve.

#### 1.2 The Scientific Method

3. What do we mean when we say that a scientific hypothesis must be testable?

4. Is any hypothesis that is not scientific necessarily unreasonable? Explain.

#### 1.3 Science and Technology

5. Clearly distinguish between science and technology.



6. Is technology beneficial to society, harmful to society, or both?

#### **1.4 Facts, Laws, and Theories**

7. Distinguish among a scientific fact, a hypothesis, a law, and a theory.

8. How does the definition of the word *theory* differ in science versus in everyday life?

#### **1.5 Working with Numbers**

9. What is scientific notation, and why do people use this notation?

10. What is the metric system?

**(CLICK TO CHECK YOUR ANSWERS)**



## Challenging Review Questions

### 1.1 What Is Life?

11. How can you tell a plant is alive even though it doesn't talk or run around?
12. What are some features of living organisms? Describe how human beings show each of these features.
13. Bacteria reproduce by dividing in two. Is this an example of asexual reproduction or sexual reproduction? Defend your answer.

### 1.2 The Scientific Method

14. Which of the following are scientific hypotheses? (a) Chlorophyll makes grass green. (b) Pandas are the cutest mammals. (c) The leaves of maple trees will turn red in the autumn even if temperatures stay high.
15. Horned lizards have sharp spikes, or "horns" on their heads and bodies, as you can see in the photo. Can you formulate a hypothesis for why horned lizards have their horns? How would you test your hypothesis?



### 1.3 Science and Technology

16. Forensic scientists collect skin and hair samples from crime scenes and use these samples to collect information about the DNA of the people at the scene. They can then compare this DNA to the DNA of potential suspects. Explain how this is an example of technology.

17. Is a vaccine, such as the flu vaccine or Covid-19 vaccine, an example of technology? Why or why not?

### 1.4 Facts, Laws, and Theories

18. Zebras have black and white stripes on their coats. Is this a fact, a law, or a theory?

19. "Living things can reproduce." Is this a scientific law?

### 1.5 Working with Numbers

20. The typical adult human body has about  $3 \times 10^{10}$  cells. How would you write out this number, currently in scientific notation, with normal notation?

21. How many centimeters are there in a meter? How many millimeters are there in a meter?

22. The human egg is 0.1 millimeters in diameter. How many meters is this? Express your answer in regular notation as well as scientific notation.

**(CLICK TO CHECK YOUR ANSWERS)**



### Apply & Discuss Questions

23. Discuss a technology based on advances in biology. How has this technology been helpful? Has it also been harmful in any way? You may choose one of the following topics, or you may come up with your own: lab-grown “meat,” the Covid-19 vaccine, cancer screening techniques, the antibiotic penicillin, animal cloning.

24. Consider again the topic you discussed in the previous question. Can you think of any guidelines or laws that would help prevent the harmful effects you identified?

25. In what sense is science grand and breathtaking? In what sense is it dull and painstaking?

**(CLICK TO CHECK YOUR ANSWERS)**



## End of Chapter Solutions

### Simple Review Solutions

1. Living things share certain characteristics. For one thing, they use energy. Living things take energy from the environment and convert it to other forms of energy for their own use. Another characteristic of living things is that they develop and grow. Living things maintain themselves. They generate structures, such as stems and leaves or skin and bones, and they repair damage done to those structures. Living things have the capacity to reproduce. Finally, living things are parts of populations that evolve. Populations do not remain constant from one generation to the next but change over time.
3. The cardinal rule in science is that all hypotheses must be testable—in other words, they must, at least in principle, be capable of being shown wrong.
5. Science is concerned with gathering knowledge about the natural world. When we apply this knowledge for practical purposes, we have what we call technology.
7. When a scientific hypothesis has been tested over and over again and has not been contradicted, it may become known as a law or principle. A scientific fact, on the other hand, is generally something that competent observers can observe and agree to be true. In science, a theory is a synthesis of facts and well-tested hypotheses.
9. Scientific notation is a different way of writing numbers. You know that one million is 1,000,000 and that one billion is 1,000,000,000. Pretty quickly, it becomes cumbersome to write out all those digits. This is where scientific notation comes in. Scientific notation is especially useful for very big numbers and very small numbers, but it can be used for just regular numbers as well.

### Challenging Review Solutions

11. Plants show all the characteristics of life—they use energy, which they obtain from the Sun. They develop and grow, maintain their bodies. Plants also reproduce, for example when they produce seeds that grow into new plants. Finally, plant populations evolve over time.
13. This is an example of asexual reproduction, because a bacteria that divides in two is reproducing all by itself.
15. One hypothesis is that the horns of these lizards help protect them from predators. One way a scientist might test this hypothesis is by observing interactions between lizards and potential predators. A possible prediction is that lizards might actively use their horns in defense, by attacking potential predators. Or, predators might be unable to grab the lizards because of their horns. (In fact, biologists have observed lizards jerking their heads at potential predators in order to stab them with their horns.) Another way to test this hypothesis is by comparing lizards that were caught by predators to ones that had not, in order to see if there is any difference between the horns of these two groups. Scientists might predict that horned lizards that escape predation could have more horns or larger horns. (In fact, this has been done, and scientists did find that horned lizards who were caught by bird predators had shorter horns than those who were not caught by birds.)



17. Yes, a vaccine uses scientific knowledge to address the practical problem of reducing the impact of epidemics such as the flu and covid epidemics.

19. A scientific law is a hypothesis that has been tested over and over again and that has not been contradicted. Although the statement above describes a general characteristic of living things, it falls short of being a law because not every living thing can reproduce. Some organisms might be too young or too old to reproduce, for example. We also saw that the mule, though clearly living, is unable to reproduce.

21. There are 100 centimeters in a meter. There are 1000 millimeters in a meter.

### Apply & Discuss Solutions

23. Answers will vary!

25. Science is grand and breathtaking in its ability to tell us about the natural world around us. The process of building knowledge in science can be dull and painstaking, though, as scientists test their hypotheses repeatedly and with utmost care.

