Review Questions

1. In what way is scientific thinking natural to all of us? How does modern science differ from this everyday type of thinking?
2. Why did ancient peoples study astronomy? Describe an astronomical achievement of at least three ancient cultures.
3. How are the names of the days of the week related to astronomical objects?
4. What is a lunar calendar? Are lunar calendars still used today?
5. What do we mean by a model in science? Briefly summarize the Greek geocentric model.
6. What do we mean by the Ptolemaic model? How did this model account for the apparent retrograde motion of planets in our sky?
7. What was the Copernican revolution, and how did it change the human view of the universe?
8. Why wasn’t the Copernican model immediately accepted? Describe the roles of Tycho, Kepler, and Galileo in the eventual triumph of the Sun-centered model.
9. What is an ellipse? Define the focus and the eccentricity of an ellipse. Why are ellipses important in astronomy?
10. State each of Kepler’s laws of planetary motion. Describe the meaning of each law in a way that anyone could understand.
11. Describe the three hallmarks of science and explain how we can see them in the Copernican revolution. What is Ockham’s razor? Why doesn’t science accept personal testimony as evidence?
12. What is the difference between a hypothesis and a theory in science?

Quick Quiz

Choose the best answer to each of the following. Explain your reasoning with one or more complete sentences.

20. Newton’s law of gravity works as well for explaining the orbits of planets around other stars as it does for explaining the orbits of planets in our own solar system.
21. God created the laws of motion that were discovered by Newton.

Test Your Understanding

Science or Nonsense?

Each of the following statements makes some type of claim. Decide in each case whether the claim could be evaluated scientifically or whether it falls into the realm of nonscience. Explain clearly, not all of these have definitive answers, so your explanation is more important than your chosen answer.

13. The Yankees are the best baseball team of all time.
14. Several kilometers below its surface, Jupiter’s moon Europa has an ocean of liquid water.
15. My house is haunted by ghosts who make the creaking noises I hear each night.
16. There is no liquid water on the surface of Mars today.
17. Dogs are smarter than cats.
18. Children born when Jupiter is in the constellation Taurus are more likely to be musicians than other children.
19. Aliens can manipulate time so that they can abduct and perform experiments on people who never realize they were taken.

23. In the Greek geocentric model, the retrograde motion of a planet occurs when (a) Earth is about to pass the planet in its orbit around the Sun. (b) the planet actually goes backward in its orbit around Earth. (c) the planet is aligned with the Moon in our sky.
24. Which of the following was not a major advantage of Copernicus’s Sun-centered model over the Ptolemaic model? (a) It made significantly better predictions of planetary positions in our sky. (b) It offered a more natural explanation for the apparent retrograde motion of planets in our sky. (c) It allowed calculation of the orbital periods and distances of the planets.
25. When we say that a planet has a highly eccentric orbit, we mean that (a) it is spiraling in toward the Sun. (b) its orbit is an ellipse with the Sun at one focus. (c) in some parts of its orbit it is much closer to the Sun than in other parts.
26. Earth is closer to the Sun in January than in July. Therefore, in accord with Kepler’s second law, (a) Earth travels faster in its orbit around the Sun in July than in January. (b) Earth travels faster in its orbit around the Sun in January than in July. (c) it is summer in January and winter in July.
27. According to Kepler’s third law, (a) Mercury travels fastest in the part of its orbit in which it is closest to the Sun. (b) Jupiter orbits the Sun at a faster speed than Saturn. (c) all the planets have nearly circular orbits.
28. Tycho Brahe’s contribution to astronomy included (a) inventing the telescope. (b) proving that Earth orbits the Sun. (c) collecting data that enabled Kepler to discover the laws of planetary motion.
29. Galileo’s contribution to astronomy included (a) discovering the laws of planetary motion. (b) discovering the law of gravity. (c) making observations and conducting experiments that dispelled scientific objections to the Sun-centered model.
30. Which of the following is not true about scientific progress? (a) Science progresses through the creation and testing of models of nature. (b) Science advances only through the scientific method. (c) Science avoids explanations that invoke the supernatural.
31. Which of the following is not true about a scientific theory? (a) A theory must explain a wide range of observations or experiments.