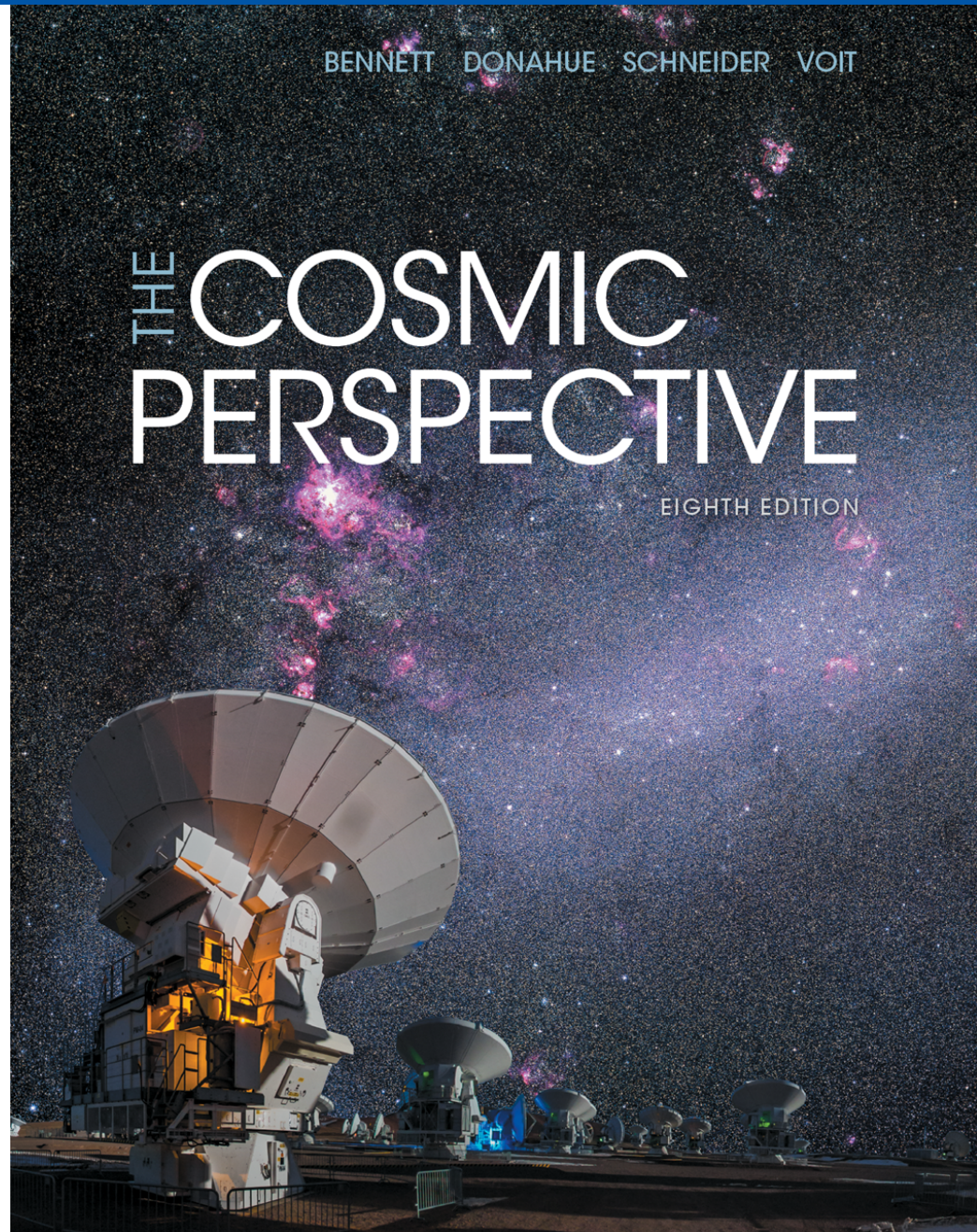


Chapter 3: The Science of Astronomy



BENNETT DONAHUE SCHNEIDER VOIT

THE COSMIC PERSPECTIVE

EIGHTH EDITION

3.1 The Ancient Roots of Science

- In what ways do all humans use scientific thinking?
- How is modern science rooted in ancient astronomy?

Scientific thinking is

- a) making predictions about future events based on past observations and experiences.
- b) a gradual process of learning how the world works.
- c) a willingness to give up preconceived notions if those ideas are inconsistent with an experiment or observation.
- d) all of the above

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Which of the following is not an example of measurements of ancient astronomers?

- a) marking the day of summer solstice
- b) measuring the 18.6 year cycle of lunar phases due to precession of its orbit
- c) measuring the orientation of the crescent Moon
- d) measuring the time for eclipse seasons to repeat
- e) All of the above were measurements made by ancient astronomers.

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Which is longer, a solar year or a lunar year?

- a) A lunar year, because it is based on 13 months that are 29–30 days long, which is longer than 365 days.
- b) A lunar year, because it is based on the time between total lunar eclipses, which is longer than 365 days.
- c) A solar year, because a lunar year is 12 lunar months that are 29–30 days long each, for a total of 354–355 days.
- d) A solar year, because a lunar year is based on 13 months that are 28 days long, which is 364 days.

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What does the 19-year Metonic cycle describe?

- a) the time it takes for phases of the Moon to repeat on the same dates
- b) the time it takes for eclipses to occur on the same dates
- c) the time it takes for Earth's axis to precess
- d) the time it takes for a series of lunar and solar eclipses to repeat, but not on exactly on the same dates

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3.2 Ancient Greek Science

- Why does modern science trace its roots to the Greeks?
- How did the Greeks explain planetary motion?

How did Ptolemy's model differ from Aristotle's model of the universe?

- a) Ptolemy's model placed the Sun at the center rather than Earth.
- b) Ptolemy's model involved spheres that were not perfectly circular.
- c) Ptolemy's model had the planets moving in smaller circles attached to the larger spheres.
- d) Ptolemy's model had a different ordering of spheres than Aristotle's.

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How was the great library of Alexandria destroyed?

- a) It was destroyed deliberately by people in the 5th century A.D.
- b) It was destroyed accidentally in a great fire in the 4th century A.D.
- c) It was destroyed when the Nile flooded in the 5th century A.D.
- d) It was abandoned after the death of Alexander the Great, and gradually fell into disrepair over a period of several centuries.

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3.3 The Copernican Revolution

- How did Copernicus, Tycho, and Kepler challenge the Earth-centered model?
- What are Kepler's three laws of planetary motion?
- How did Galileo solidify the Copernican revolution?

Why didn't scientific thinkers immediately accept the Copernican model of the solar system?

- a) They had irrefutable evidence that the Earth-centered model was correct.
- b) Copernicus's model did not make noticeably better predictions than the Earth-centered model.
- c) Copernicus was not respected in the science community.
- d) They were reluctant to throw out the Earth-centered model because it had been around for so many years.
- e) B and D

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Who observed a nova in 1572, showing that there could be changes in the realm of the heavens?

- a) Nicolas Copernicus
- b) Galileo Galilei
- c) Johannes Kepler
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Which of the following is not a contribution made by Tycho Brahe to the Copernican Revolution?

- a) He measured the parallax of a supernova and showed that it was further away than the Moon.
- b) He measured the parallax of a comet and showed that it was further away than the Moon.
- c) He measured the parallax of stars, showing that the Earth orbits the Sun.
- d) He measured the positions of the planets with unprecedented accuracy, making it possible for Kepler to determine their orbits.

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Which of the following is not one of Kepler's laws of planetary motion?

- a) The orbit of each planet around the Sun is an ellipse with the Sun at one focus.
- b) As a planet orbits the Sun it sweeps out equal areas in equal times.
- c) The rotation of a planet is always in sync with its orbital motion around the Sun.
- d) Planets with larger orbits orbit the Sun at slower average speeds than planets with smaller orbits.

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- a) the semi-major axis
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- b) He observed objects orbiting Jupiter.
- c) He observed the phases of Venus.
- d) He observed mountains on the Moon.

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3.4 The Nature of Science

- How can we distinguish between science and nonscience?
- What is a scientific theory?

A scientific model

- a) is a small physical representation of a real-world system.
- b) uses logic, and often math, to describe and predict the behavior of a real-world system.
- c) is a scientist who is photographed for advertisements.
- d) must be completely accurate or it is considered pseudoscience.
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The concept of a scientific model comes from

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- b) Galileo Galilei.
- c) Johannes Kepler.
- d) the Mayans.
- e) the ancient Chinese.

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If an experiment or observation contradicts a scientific theory, then

- a) it must not have been a scientific theory, but pseudoscience.
- b) the theory must be revised to account for the new data, or discarded.
- c) the theory is still considered correct as long as the vast majority of experiments still agree with the theory.
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Which of the following is not a hallmark of science?

- a) A scientific theory is built on logic and common sense to explain observed phenomena.
- b) Science seeks explanations for observable phenomena using natural causes.
- c) Science makes progress by testing models that explain observations as simply as possible.
- d) A scientific model makes testable predictions about natural phenomena and is revised or abandoned if the predictions do not agree with observations.

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3.5 Astrology

- How is astrology different from astronomy?
- Does astrology have any scientific validity?

Which of the following is an *astrological* prediction?

- a) Venus and Mars will be nearly aligned on a particular date.
- b) The Moon will eclipse the Sun at a particular time.
- c) When Saturn enters a particular constellation, the weather will improve.
- d) all of the above

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Astrology is

- a) a scientific study of human behavior.
- b) a scientific study of the effects of the Sun and other celestial objects on the Earth and people.
- c) not a scientific enterprise because scientists have overwhelmingly voted against it in favor of astronomy.
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