

Chapter 12 Astronomy

Introduction

Chapter 12 begins with a discussion of Earth's motions, time, and seasons. The effects of **rotation** and **revolution** are described and related to the length of a day and year. Revolution and the tilt of Earth cause the sun's strongest, or vertical, rays to shift on Earth and cause changing seasons.

A physical description of the objects in the solar system is presented and includes the newly defined **planets**, **dwarf planets**, and **plutoids**. Characteristics of objects in the solar system are presented in this chapter. The description and relationship of the sun, **moon**, **meteors**, **asteroids**, and **comets** presents a complete picture of the **solar system**. The changing positions and motions of the sun, moon, and Earth are emphasized in the discussions about **moon phases**, **eclipses**, and **tides**.

The final section focuses on Earth's place in the universe. **Galaxies**, **stars**, and space distances (**light-years**, and **astronomical units**) present the big picture of the universe. The evolution of the solar system and stars provides a past and future view of the solar system, sun, and Earth.

Students Should Understand the Following Concepts

- Day and night are caused by the rotation of Earth on its axis. Earth completes one rotation every 24 hours (one day).
- The amount of time it takes Earth to make one complete revolution around the sun is 365.25 days (1 year).
- Earth's axis is tilted 23.5° to the plane of its orbit. This causes the sun's rays to strike Earth's surface at different angles at different times of the year. This tilt and Earth's revolution cause the seasons to change.

- The sun's vertical rays strike Earth farthest north (*Tropic of Cancer*) on June 21 (summer solstice) and farthest south (*Tropic of Capricorn*) on December 21 (winter solstice).
- There are eight planets in the solar system, as well as dwarf planets, plutoids, asteroids, comets, satellites, and meteoroids. The sun is located at the center of the solar system; its gravity keeps all solar system objects in orbit around it.
- Our sun is an average star. It is one of about 200 billion stars that make up the spiral galaxy called the Milky Way galaxy. The universe contains billions of galaxies separated by empty space.

Activities to Develop the Topic

Use one or more of the following activities to review this unit with your students.

Ask students how they know the Earth rotates. If the Earth rotates, why can't we feel it? Play devil's advocate and say, "When we ride in a car or train we can feel it moving, why can't we feel the Earth moving?" Remind students (Chapter 4) that a frame of reference is needed to see and feel movement. Use a series of questions to discuss rotation and its effects. Does the rotation of Earth have a frame of reference? Develop the concept of the apparent rising and setting sun, moon, and stars are our frame of reference. What else does rotation cause? How long does it take Earth to rotate once? Does the Earth rotate quickly or slowly? What would we see from space if we watched the Earth rotate? It would be difficult to see Earth rotating. It rotates slower than the hour hand on a clock.

Elicit from the students how the position of the sun and stars change during a year. Focus on the changing position of the sun during the year and the length of shadows. Ask some students to do the

Process Skill 1: Observing the Changing Position of the Noon Sun on pages 336–338. Using data gathered from this investigation relate the changing shadow to the changing position of the sun and to the changing seasons. Offer an extra credit question at the end of the lesson, “Explain why in winter, the Earth is closer to the sun than it is in summer.”

Since most of your students are probably familiar with the order of the planets, spend a little more time explaining the formation of the solar system. Have the students research each of the planets and have them report back some of the characteristics of each of the planets as well as some recent discoveries concerning each of the

planets. Astronomy is a rapidly evolving field of study, and new discoveries are constantly being made. You should try to incorporate them into your lessons if possible.

Night sky observations allow students to witness the awesomeness of the universe. Ask students to observe the night sky and see if they can determine the different colors of some stars. On a clear, dark night they can see about 2000 stars. These stars are a small part of the Milky Way galaxy that contains billions of stars. Encourage them to use star charts and locate constellations, named stars, the Milky Way galaxy, distant galaxies, meteors, planets, natural and artificial satellites, and of course, the moon.

Name _____

Date _____

Class _____

Review of Chapter 12

- The imaginary rod extending from North Pole to South Pole that represents the line Earth spins around is the
 - axis of rotation
 - equator
 - prime meridian
 - circle of revolution
- There is a 3-hour difference in time between Los Angeles and New York City; the number of degrees of longitude between the two cities is about
 - 15°
 - 30°
 - 45°
 - 60°
- The factors that cause seasons on Earth are
 - the amount of light and heat Earth radiates into space
 - the distance Earth is from the sun and revolution around the sun
 - the tilt of Earth's axis and revolution around the sun
 - the location of the continents and ocean currents
- Earth is closest to the sun in
 - September
 - July
 - April
 - January
- Changes in the number of hours of daylight at a particular area on Earth's surface are caused by the
 - angle of Earth's surface relative to the sun
 - position of the moon relative to Earth
 - distance of Earth from the sun
 - changes in the amount of energy the sun releases
- Australia is in the Southern Hemisphere. The first day of summer in Australia is
 - March 21
 - June 21
 - September 23
 - December 21
- The sun is highest in the sky at
 - dawn
 - noon
 - sunset
 - midnight

8. The first day of spring in the Northern Hemisphere occurs when the sun's vertical rays strike the
 - (1) Tropic of Capricorn
 - (2) equator
 - (3) Tropic of Cancer
 - (4) prime meridian

9. The planet that experiences the least effect of the sun's gravity is

(1) Jupiter	(3) Mars
(2) Neptune	(4) Mercury

10. Heat and light energy from the sun are produced by

(1) chemical reactions	(3) gravity
(2) nuclear reactions	(4) momentum

11. Planets are visible in the night sky because they
 - (1) reflect the sun's light
 - (2) create their own light
 - (3) create chemical reactions in their atmospheres
 - (4) have erupting volcanoes on their surface

12. If viewed from Mars the sun would appear

(1) larger	(3) the same size
(2) smaller	(4) to be invisible

13. Which of the following planets has the greatest orbital speed?

(1) Mercury	(3) Mars
(2) Jupiter	(4) Earth

14. Living organisms are *not* present on Earth's moon. This is because the moon
 - (1) lacks water and an atmosphere
 - (2) is too close to the sun
 - (3) lacks soil and oceans
 - (4) is too far away from the sun

15. The moon completes one revolution around Earth in about

(1) one a day	(3) one a month
(2) one a week	(4) one a year

16. When the moon passes through Earth's shadow, there is a
 - (1) lunar eclipse
 - (2) solar eclipse
 - (3) half moon eclipse
 - (4) new moon eclipse

17. Tides are produced on Earth by
- (1) the gravity of the moon and the sun
 - (2) the changing distance between earth and the moon
 - (3) the wind
 - (4) Earth's rotation
18. A loosely bound mass of rock, ice, dust, and gases that moves through space is called a(n)
- (1) meteoroid
 - (2) asteroid
 - (3) planet
 - (4) comet
19. Which of the following items is the largest?
- (1) the universe
 - (2) the solar system
 - (3) the Milky Way galaxy
 - (4) the asteroid belt
20. Our sun is classified a
- (1) planet
 - (2) star
 - (3) comet
 - (4) galaxy