Chapter 1 Answers

True/False
1) T   2) F   3) F   4) T   5) F   6) T   7) F   8) F   9) F   10)F   11) T   12) F   13) F   14) F   15) T

FIB
1) galaxy   2) distance   3) axis   4) celestial sphere   5) stars
6) eclipse   7) winter solstice, lowest   8) celestial equator   9) 1/60
10) quarter   11) lunar   12) angular size
13) distance from the sun or radius of orbit   14) angular size   15) Earth

1.   The sun is about 100 times the size of the Erth. A light year is about 10^{13} km and a typical galaxy is about 100,000 light years or 10^{18} km in diameter. This makes a galaxy about 10^{14} times larger than earth. Astronomers can see objects as distant as 10 billion light years.

2.   The "universe" is everything. All space, time, matter and energy

3.   A constellation is an imagined pattern of naked eye stars commonly associated with myths or common objects. Constellations are useful to designate specific sections of the sky.

4.   The sun appears to rise in the east and set in the west but it is much simpler (and easier) to consider the sun at (basically) rest and the Earth revolving around it. The Earth rotates from west to east giving rise to the apparent motion of the sun. The moon, stars and all other astronomical objects appear to do the same.

5.   Since the earth moves around the sun once in a year the number of times you have traveled around the sun equals your age in years.

6.   The seasons of the Earth are caused by the tilt of the Earths axis relative to its orbit around the sun. This results in the sun appearing higher in the sky during the spring and summer and much lower in the fall and winter. During the winter, the sun's light falling more at an angle to the earth's surface, heats the earth less.

7.   Due to the motion of the earth around the sun the earth "points" in the opposite direction in the summer as in the winter.

8.   The true rotation of the earth is measured with respect to the stars, the sidereal day. During one sidereal day the earth will have moved about 1° (365 days in a year, 360° in a circle) more for the sun to appear in the same location as it did on the previous day (solar day). This takes slightly longer than the sidereal day.

9.   As the moon orbits the earth different sides are illuminated by the sun. Our angle of view of the earth changes during its orbit around us but the part facing us is the same.

10.   A lunar eclipse is when the earth gets between the sun and the moon. A solar eclipse is when the moon gets between the sun and the earth.

11.   The moon's orbit is not exactly in the same plane as the earths, instead it more closely matches the tilt of the earth's axis so it is generally twice a year when all three can line up.

12.   Precession is a slow shift in the direction of the tilt of the earth's rotation axis. Over a period of about 26,000 years it will complete one circle, always keeping an angle of about 23.5°. It is caused by the gravitational pull of the moon, the sun and to a much smaller extent, the other planets.

13.   Parallax is the apparent change in position of a near object relative to a distant background. Example: "Aim your finger at a distant object with one eye closed. Keep your finger still but switch which eye is open. Your finger appears to change position.

14.   The amount of parallax is directly proportional to the length of the baseline and inversely proportional to the distance to the object. The larger the baseline the further distance that can be measured.

15.   Traveling to the outermost planet in the solar system the stars would appear the same. Traveling to another star at least some of the stars would appear to change positions. Traveling to another galaxy would cause all the stars to appear to change position much like traveling to the middle of a forest would make the trees appear to change position.

Problems.

1.   a) 1×10^3 1×10^{-6} 1.001×10^3 1×10^{15} 1.23×10^3 4.56×10^{-4}

        b) 31,600,000   299,800   0.0000000000667

        c) 2000.01   333,000 9.47×10^{12}

2.   a) 0.0017 s   b) 0.033 s   c) 1.3 s   d) 150 s   e) 3.3 years

4.   about 7 days (actually 7 days plus 7° or 7.14 days)

6.   a) in one hour about 0.5° or 30'

        b) in one minute 0.5' or 30"

        c) in one second about 0.5"   Because the Moon's diameter is about 30' it moves its own diameter in about one hour

7.   144 meters

8.   a) 57300 km   b) 3.44×10^6 km   c) 2.06×10^8 km

9.   3350 km

10.   If the earth was flat the sun would not have changed positions so there would be no measurement for the angle (or a measurement of zero).