**Chapter 1: The Water Planet**

**Answers to Study Problems**

1. Earth’s mean radius can be defined as the radius of a sphere having the same volume as Earth. This is called the volumetric radius (Rv) and it is easily calculated from the equatorial radius (Re) and the polar radius (Rp) using:

Rv = cube root (Re 2 × Rp)

Using the values given in figure 1.8 for the lengths of Earth’s equatorial and polar radii, calculate Earth’s volumetric radius, or mean radius, in kilometers and miles.

Solution:

Re = 6378.1 km and Rp = 6356.8 km

Rv = cube root [(6378.1) 2 × 6356.8] = 6371 km (3959 mi)

1. If it is 2:30 P.M. at your location when it is noon along the Prime Meridian, what is your longitude?

Solution:

First calculate the difference in time = (12:00 – 14:30) = −(2 hours and 30 minutes)

Difference in longitude for 2 hours = 2 hr × (15°/hr) = 30°

Difference in longitude for 30 minutes = 30 min × (15’/min) = 450’ = 7° 30’ = 7.5°

Total difference in longitude is = 37.5°

Since the original time difference was negative, longitude is West.

Answer: 37.5° West

1. If it is 8:40 A.M. at your location when it is noon along the Prime Meridian, what is your longitude?

Solution:

First calculate the difference in time = (12:00 – 08:40) = +(3 hours and 20 minutes)

Difference in longitude for 3 hours = 3 hr × (15°/hr) = 45°

Difference in longitude for 20 minutes = 20 min × (15’/min) = 300’ = 5°

Total difference in longitude is = 50°

Since the original time difference was positive, longitude is East.

Answer: 50° East

1. Use Table 1.3 to determine the volume of water held in the atmosphere. Use Figure 1.16 to determine how much water is removed from the atmosphere by precipitation over the oceans and the land each year. Using these two estimates, calculate how many times the water in the atmosphere is replaced in a year.

Solution: (380,000 km3/yr) / (13,000 km3) = 29 times / yr

1. The mean depth of the ocean can be calculated by knowing the average depth of each individual ocean and the percent of the five ocean basins, and the percent of the total world ocean area they cover. Use estimates of these values given in table 1.4 to verify the average depth of the world ocean in meters and feet.

Solution:

Pacific(3972 m × 50.1%) + Atlantic(3646 m × 23.3%) + Indian(3741 m × 19.8%) + Southern(3270 m × 5.4%) + Arctic(1205 × 1.4%) = 3774 m or 12,381 ft

1. Determine the distance between two locations: 110°W, 38.5°N and 110°W, 45°N. Express this distance in nautical miles and kilometers.

Solution:

Because the longitudes of the two points are the same, the distance between the points is based on the change in latitude only. Students need to recall that 1° of latitude equals 60 nautical miles and that 1° of latitude is divided into 60 minutes.

45.0° N - 38.5° N = 6.5° of latitude,

6.5° × (60 nm/° latitude) = 390 nm = 722.3 km

1 km = .540 nm; therefore, 1 nm = 1.852 km

1. Use the volume of the oceans and Earth’s surface area to calculate the depth of a hypothetical ocean covering the entire globe. Express this depth in meters and feet.

Solution:

Volume of the oceans is ~1.335 × 109 km3; surface area of Earth is ~5.098 × 108 km2.

Single ocean depth = volume / surface area

(~1.335 × 109 km3 ) / (~5.098 × 108 km2 ) = 2.619 km = 2619 m = 8593 ft