3. Express each of the following quantities in seconds: ~~form:~~ (a) 10.0 ms; (b) 1000 μs; (c) 10.000 ks; (d) 100 Ms; (e) 1000 ns. (Don't worry about significant figures in this problem.)

4. [I] Express each of the following quantities in micrograms: (a) 10.0 mg; (b) 10^4 g; (c) 10.000 kg; (d) 100×10^3 g; (e) 1000 ng. (Don't worry about significant figures.)

5. [I] How many millimeters are in 10.0 km?

SOLUTION: There are 1000 mm in 1 m, so first convert 10.0 km to meters and then to millimeters. (10.0 km)(1000 m/km) = 10.0×10^3 m and $(10.0 \times 10^3$ m)(1000 mm/m) = 1.00×10^7 mm.

6. [I] A U.S. nickel coin has a diameter of 2.1 cm; how much is that in inches?

7. [I] The *Titanic* (1912-1912) was 882 feet long; how long is that in meters?

8. [I] A red blood cell lives for about four months and travels roughly 1.0×10^3 mi through the body. How far is that in kilometers?

9. [I] How many millimeters are in 3.00 in.? [*Hint: Change inches to centimeters using 1 in. = 2.54 cm. Then change centimeters to millimeters.*]

10. [I] What is the equivalent in millimeters of 1.00 ft?

11. [I] How many inches are the equal of 200.0 mm?

12. [I] The unit known as an angstrom (Å), exactly equal to 0.1 nm, is still widely used. It's named after the nineteenth-century physicist Anders J. Ångstrom (Å is the letter that comes after Z in the Swedish alphabet). Given that an atom is about 1 Å in diameter, how much is that in centimeters?

13. [I] The length of a lightwave is about 5×10^3 Å (see previous problem). How much is that in nanometers?

SOLUTION: 1.0 Å equals 0.1 nm. Therefore the number of nanometers is 5×10^3 Å = $(5 \times 10^3$ Å)(0.1 nm/Å) and to one significant figure 5×10^3 Å = 0.5×10^3 nm.

14. [I] About how many centimeters tall is a stack of 25 CDs without their cases?

15. [I] The distance light travels in a year is called a *light-year* (ly). Given that 1.00 ly = 5.88×10^{12} mi, how far is that in meters? [*Hint: We first need to find the number of meters to 1 mile. The most rudimentary way to do this is to use 1 mi = 5280 ft. Then there are 5280 × 12 inches per mile and 5280 × 12 × 2.54 centimeters per mile.*]

16. [I] The Moon is, on average, 2.39×10^5 miles away. How much is that in meters?

17. [I] The nearest star beyond the Sun is Alpha Centauri. It's 4.2 light-years away (1 ly = 5.88×10^{12} mi). How far is that in kilometers?

18. [I] By what number would you multiply a given number of centimeters to convert it to millimeters?

19. [I] There are an average of 32 million bacteria on each square inch of the human body. Given a total skin area of 1.7 m^2, how many bacteria are you carrying around (exclude the bacteria that are internal)?

20. [I] How many square centimeters are in a square inch?

21. [I] A nickel (U.S. 5-cent coin) has a mass of about 5 g. How many nickels correspond to a kilogram? [*Hint: We need to determine how many 5-g objects are equivalent to 1 kilogram, which equals 1000 g.*]

22. [I] A stack of 4.00-g buttons is placed on one pan of a balance and a standard 1.00-kg mass is placed on the other pan. How many buttons will it take to balance the scale?

23. [I] Suppose that you have a bag of identical marbles each of which has a mass of 20.0 g. How many marbles will it take to match the mass of an exactly 1/2-kg banana?

24. [I] In a human nose, the total area of the region that detects odors is about 3/4 $in.^2$. Compare that to the sensory organ of a hunting dog, whose nose has an active area of about 65 cm^2.

25. [I] It takes your brain about one five-hundredth of a second to recognize a familiar object once the light from that object enters your eye. Express that time interval in milliseconds, microseconds, and nanoseconds, each to one significant figure.

26. [I] How many seconds are there in an exactly 24-h day?

27. [I] Each second the human brain undergoes 1×10^5 different chemical reactions. At that rate, how many will it experience in 10 h?

28. [II] A GM diesel locomotive pulling 40 to 50 loaded freight cars at 70 mi/h uses 1.0 gallon of fuel every 632 yd. How many meters can it travel on 10 gallons of fuel?

29. [II] By what number would you multiply a given number of centimeters to convert it into inches? Give the answer to four significant figures and show your work.

SOLUTION: There are exactly 2.54 cm per inch and we want the number of inches per centimeter, which is one over that:

$$\frac{1}{2.54 \text{ cm/in.}} = 0.393\,7 \text{ in./cm}$$

30. [II] THIS PROBLEM DEALS WITH UNIT CONVERSIONS. A Boeing 747 jumbo jet carrying 385 people while cruising at 39 000 ft travels 280 yd on a gallon of aviation fuel. We want to find out how many gallons it will need to travel 2000 km. a) How many meters does 280 yd equal? b) How many meters does 2000 km equal? c) How many meters does the plane travel per gallon of fuel? d) How many gallons will the plane need to travel 2000 km?

31. [II] Most people lose about 45 hairs per day out of a typical headful of 125 000. Suppose each hair averages 10-cm long. If you placed a year's lost hairs end-to-end, how far would they extend?

32. [II] What's the SI equivalent of 1.000 $in.^2$?

33. [II] Express the equivalent of 1.000 ft^2 in SI units.

34. [II] In an average lifetime, a human inhales roughly 5.0×10^5 yd^3 of air. How many cubic meters is that?

35. [II] A one-cup measure is equivalent to 237 milliliters. How much is that in the preferred SI unit of cubic meters? [*Hint: There are 1000 cm^3 to a liter, so each 1 cm^3 is a milliliter. Moreover, (p. 8) there are 10^6 cm^3 per 1 m^3.*]

36. [II] How many liters of water would fill a cube-shaped tank whose inner dimensions are 1.00 m on each side?

37. [II] Considering the tank in the previous problem, if it contained 20.0 liters of water, how deep would the liquid be?

38. [II] Roughly what size cube of water would have a mass of 1.0 kg? [*Hint: 1 cm^3 of water has a mass of 1 g.*]

39. [II] Each hour a large man sheds about 6×10^5 particles of skin. In a year, that amounts to about 1.5 lb (on Earth). Roughly how much is the mass of each such particle? What mass of skin will be shed in 50 years of adulthood?