11. **a.** 2×10^2 mm
b. 7.8×10^3 s
c. 1.6×10^7 μg
d. 7.5×10^4 cm
e. 6.75×10^{-4} g
f. 4.62×10^{-2} cm
g. 9.7 m/s

12. **a.** 1 dekaration
b. 2 kilomockingbirds
c. 1 microphone
d. 1 nanogoat
e. 1 examiner

13. 1.08×10^9 km

14. 11 people

15. Yes, a set of measurements could be precise (have a high number of significant figures) but not close to the true value due to an error with the measuring instrument.

16. **a.** 1
b. 3
c. 5
d. 4
e. 4
f. 6

17. No, the number of significant figures is not consistent between the two values in each example.

18. **a.** 3.00×10^8 m/s
b. 2.9979×10^8 m/s
c. $2.997\,925 \times 10^8$ m/s

19. **a.** 3
b. 4
c. 3
d. 2

20. **a.** 797 g
b. 0.90 m/s
c. 17.8 mm
d. 23.7 s

21. 228.8 cm

22. 115.9 m

Practice Problems

For problems 11–14, see Sample Problem A.

11. Express each of the following as indicated:
a. 2 dm expressed in millimeters
b. 2 h 10 min expressed in seconds
c. 16 g expressed in micrograms
d. 0.75 km expressed in centimeters
e. 0.675 mg expressed in grams
f. 462 μm expressed in centimeters
g. 35 km/h expressed in meters per second

12. Use the SI prefixes in **Table 3** of this chapter to convert these *hypothetical* units of measure into appropriate quantities:
a. 10 rations
b. 2000 mockingbirds
c. 10^{-6} phones
d. 10^{-9} goats
e. 10^{18} miners

13. Use the fact that the speed of light in a vacuum is about 3.00×10^8 m/s to determine how many kilometers a pulse from a laser beam travels in exactly one hour.

14. If a metric ton is 1.000×10^3 kg, how many 85 kg people can safely occupy an elevator that can hold a maximum mass of exactly 1 metric ton?

ACCURACY, PRECISION, AND SIGNIFICANT FIGURES

Review Questions

15. Can a set of measurements be precise but not accurate? Explain.

16. How many significant figures are in the following measurements?
a. 300 000 000 m/s
b. 3.00×10^8 m/s
c. 25.030°C
d. 0.006 070°C
e. 1.004 J
f. 1.305 20 MHz

17. The photographs below show unit conversions on the labels of some grocery-store items. Check the accuracy of these conversions. Are the manufacturers using significant figures correctly?

(a)


(b)


(c)


(d)


18. The value of the speed of light is now known to be $2.997\,924\,58 \times 10^8$ m/s. Express the speed of light in the following ways:
a. with three significant figures
b. with five significant figures
c. with seven significant figures

19. How many significant figures are there in the following measurements?
a. 78.9 ± 0.2 m
b. 3.788×10^9 s
c. 2.46×10^6 kg
d. 0.0032 mm

20. Carry out the following arithmetic operations:
a. find the sum of the measurements 756 g, 37.2 g, 0.83 g, and 2.5 g
b. find the quotient of 3.2 m/3.563 s
c. find the product of 5.67 mm $\times \pi$
d. find the difference of 27.54 s and 3.8 s

21. A fisherman catches two sturgeons. The smaller of the two has a measured length of 93.46 cm (two decimal places and four significant figures), and the larger fish has a measured length of 135.3 cm (one decimal place and four significant figures). What is the total length of the two fish?

22. A farmer measures the distance around a rectangular field. The length of each long side of the rectangle is found to be 38.44 m, and the length of each short side is found to be 19.5 m. What is the total distance around the field?