Unit 1 – Chapter 1: Matter, Energy and Measurement KEY

Students should be able to:

1. Identify the number of significant figures in a given measurement.
2. Perform calculations involving significant figures.
3. Convert from one metric unit to another (know the following prefixes: kilo, deci, centi, milli, micro, nano, pico).
4. Differentiate between measurements which are accurate and precise.
5. State the uncertainty in a measurement.
6. Determine the density of solids and liquids and calculate volumes or masses using the given density.
7. Convert between Celsius and Kelvin units of temperature.
8. Explain absolute zero.
9. Identify the characteristics of the states of matter: solids, liquids and gases.
10. Identify substances as elements, compounds, or mixtures.
11. Explain methods of separation of mixtures (distillation, chromatography, filtration, centrifugation).
12. Identify changes as being physical or chemical (or both).
13. Distinguish between potential and kinetic energy.
14. Calculate the kinetic energy of an object.
15. Calculate percent error.
16. Solve simple unit analysis problems.
17. Other vocabulary to know: joule, pure substance, homogeneous matter, heterogeneous matter, Law of Definite Proportions, intensive properties, extensive properties

Chapter One Practice *(Answer key is on the website under Resources. Check your work.)*

1. Write the following measurements (units) in scientific notation.
   - A. 369 g — 3.69×10^2 g
   - B. 540,000 mL (3 sig figs) — 5.40×10^5 mL
   - C. 0.4560 mi — 4.560×10^{-1} mi
   - D. 0.000000060 — 6.0×10^{-8}

2. Express the following as whole numbers or decimals.
   - A. 2.85×10^{-3} — .00285
   - B. 1.5×10^{8} — 150000000
   - C. 4.00×10^{-2} — .0400

3. How many significant figures are there in each of the following values?
   - A. 0.01359456 — 7
   - B. 12.0000 — 6
   - C. 133.45 — 5
   - D. 120.3 — 4
   - E. 2200 — 2
   - F. 0.0040 — 2
   - G. 45.006 — 5

4. Perform the indicated calculations on the following **measured values**. Give the answer with the correct number of significant figures and units.

A. 16.81 m + 3.226 m = 20.04 m

B. 326.8 N x 4.4 m = 1400 Nm A Nm is a joule. J

C. 7.442 s – 7.52 s = −.08 s

D. 91 g ÷ 1.86 cm³ = 49 g/cm³

↳ when a force of 1 Newton act on an object thr a distance of 1m

5. Using conversion factors, convert 4.1 liters to:

$\frac{4.1\,L}{1} \left| \frac{1\,kL}{1000\,L} \right. =$

A. kiloliters .0041 kL

B. milliliters 4100 mL (4.1×10^3 mL)

C. microliters 4100000 µL (4.1×10^6 µL)

D. cubic centimeters 4100 cm³

µ micro

6. A velocity is 9.21×10^4 cm per minute. Use unit analysis (dimensional analysis) to calculate the velocity in meters per second.

$$\frac{9.21 \times 10^4\,cm}{1\,min} \left| \frac{1\,min}{60\,s} \right| \frac{1\,m}{100\,cm} = 15.35 = 15.4\ m/s$$

$15.4\ ms^{-1}$

7. A team of students determined the density of a sample of wood to be 0.62 grams per centimeter³. A handbook of tree physiology reported the density to be 0.631 for the same type of wood. What is the percent error of the student's value?

$\left| \frac{exp - accepted}{accepted} \right| \times 100 = \%\ Error$

$$\left| \frac{.62 - .631}{.631} \right| \times 100 = 1.7\%$$

8. A leaky faucet drips at a rate of 1 drop/s. If one drop of water is 0.1 mL, how many gallons of water will be wasted in one day?

s.f.

gal/day

$$\frac{1\,dr}{1\,s} \left| \frac{.1\,mL}{1\,dr} \right| \frac{1\,L}{1000\,mL} \left| \frac{1.06\,qt}{1\,L} \right| \frac{1\,gal}{4\,qt} \left| \frac{60\,s}{1\,min} \right| \frac{60\,min}{1\,hr} \left| \frac{24\,hr}{1\,day} \right. = 2.29 = 2\ gal/d$$

9. An aluminum bar is 5.0 cm x 4.0 cm x 10.4 mm and has a mass of 54.000 g. Find the density of the bar in lb/ft³.

2 s.f.

↳ 1.04 cm

$$D = \frac{mass}{volume} = \frac{54.000\,g}{21\,cm^3} \left| \frac{16.4\,cm^3}{1\,in^3} \right| \frac{1728\,in^3}{1\,ft^3} \left| \frac{1\,lb}{454\,g} \right. = 160\ \frac{lb}{ft^3}$$

(length) $2.54\,cm = 1\,in$

(volume) $16.4\,cm^3 = 1\,in^3$

$(12\,in)^3 = (1\,ft)^3$

$1728\,in^3 = 1\,ft^3$

10. What is the diameter, in Angstroms, of an atom of element X, if 6.89×10^7 atoms laid side by side is 1.8000 inches in length?

$$\frac{1.8000\,in}{6.89 \times 10^7\,atoms} \left| \frac{2.54\,cm}{1\,in} \right| \frac{1 \times 10^8\,Å}{1\,cm} = 6.64\ \frac{Å}{atom}$$

• 1 degree temp. change on Celsius scale equals 1 degree temp. change on Kelvin scale.

11. A. Compare and contrast the Kelvin scale and the Celsius scale.

• Kelvin → absolute zero
(no neg. temps.
• 0°C = 273K

B. Convert 450. Kelvin to Celsius $450 - 273 = 177°C$

C. Convert 200.78 Celsius to Kelvin $200.78 + 273 = 473\ K$

D. Convert -230.1 Celsius to Kelvin $-230.1 + 273 = 43\ K$

Try some of the odd-numbered problems at the end of Chapter 1. The answers to these are in the back of your book.