UNIT 1 REVIEW: METRICS, MEASUREMENT, AND SIGNIFICANT FIGURES ANSWER KEY

***INSTRUCTIONS**: Answer each question thoroughly. Use complete sentences where appropriate and remember to use units and significant figure rules in each question! This unit corresponds to Chapters 1-2 in your textbook.*

1. Name the fundamental units (name *and* abbreviation) for each of the following measurements:
   a. Length: **meter (m)**
   b. Time: **second (s)**
   c. Mass: **kilogram (kg)**

2. What determines the precision of a measurement?
   The precision of the measurement tool is the determining factor. For example, we can be precise to 0.01 cm with a meter stick and 0.001 cm with a micrometer.

3. How are base units and derived units related?
   Derived units are a combination of 2+ fundamental (base) units.

4. Define the following:
   a. Accuracy of a Data Set
      Accuracy is an indication of how close a data set/result is to the accepted (true) value.

   b. Precision of a Data Set
      Precision is an indication of how consistent a data set is relative to itself (how close together is a set of data).

5. Four students measured the mass of a block of wood for an experiment. Determine the average mass from their measurements:

   1.20 kg 1125 g (↓ 1.125 kg) 1.1 kg 1201.2 g (↓ 1.2012 kg)

   $$Average = \frac{1.20\ kg + 1.125\ kg + 1.1\ kg + 1.2012\ kg}{4} = \frac{4.6\ kg}{4} = \boxed{1.2\ kg}$$

   ← Addition Rule! Sig Fig

6. Re-write the following in standard notation:
   a. 1.75×10^4 g = **17,500 g**
   b. 4.68×10^{-6} m = **0.00000468 m**

7. Rewrite the following in scientific notation:
   a. 1500 mL = **1.5×10^3 mL**
   b. 197,400 m = **1.974×10^5 m**
   c. 0.00000520 kg = **5.20×10^{-6} kg**
   d. 0.006001 g = **6.001×10^{-3} g**

8. How many significant figures are in each of the following measurements?
   a. 23.456 **5**
   b. 0.00200 **3**
   c. 1000.01 **6**
   d. 1000 **1**
   e. 100. **3**
   f. 100.0 **4**

9. Determine the answers for the following addition & subtraction problems, reporting your answer to the appropriate number of sig figs: ***Smallest level of precision (decimal places)***

   a. 263.36 + **236** = 499
   c. **568** – 236.23 = 332
   b. **258** + .0123 = 258
   d. 255.55 + **20.0** = 275.6

10. Determine the answers for the following Multiplication & division problems, reporting your answer to the appropriate number of sig figs: ***Smallest number of sig figs***

   a. 50.5 x **0.15** = 7.6
   c. 250.00 ÷ **25.00** = 10.00
   b. 135.90 x **0.1250** = 16.99
   d. **0.305** ÷ 0.1050 = 2.90

11. Record the following conversion factors:

   a. 1 km = 100,000 cm
   c. 1 W = 0.001 kW
   b. 1 s = 1000 ms
   d. 1MV = 1,000,000 V

12. Complete the following metric conversions. Report your answers in scientific notation.

   a. 0.0145 s = $14.5 = 1.45 \times 10^{1}$ ms
   c. 15.07 g = $0.01507 = 1.507 \times 10^{-2}$ kg
   b. 537000 cm = $5.37 = 5.37 \times 10^{0}$ km
   d. 0.540 MW = $540{,}000 = 5.40 \times 10^{5}$ W

13. A school bus full of students weighs 10638 lbs. What is the mass of this bus in kg?

5 s.f.

$$\frac{10{,}638\ \text{lb}}{} \left| \frac{1\ \text{kg}}{2.2\ \text{lb}} \right. = \boxed{4{,}835.5\ \text{kg}}$$

14. Washington State covers a land area of 66544 mi². What is this land area in square kilometers?

5 s.f.

$$\frac{66{,}544\ \text{mi}^2}{} \left| \frac{(1609)^2\ \text{m}^2}{1\ \text{mi}^2} \right| \frac{1\ \text{km}^2}{(1000)^2\ \text{m}^2} = \boxed{172{,}270\ \text{km}^2}$$

15. You have been told that the highway speed of a car was 1.5 m/s. Is this a reasonable speed, or has someone done a conversion wrong? Show a conversion from 1.5 m/s to miles per hour using the factor label method to justify your answer.

2 s.f.

$$\frac{1.5\ \text{m}}{\text{s}} \left| \frac{1\ \text{mi}}{1609\ \text{m}} \right| \frac{3600\ \text{s}}{1\ \text{hr}} = \boxed{3.4\ \text{mi/hr}}$$

This is NOT an appropriate highway speed!