WKS 2-9 - Honors
Extra Conversions Practice
Using Factor Label Method

Name Answer Key
Date_______
Period_________

Directions: Answer the following questions. All calculations must be done using ***dimensional analysis*** (even if you prefer a different method). **Show all work**. Every number written must have **units**. Write answers with the correct **number of significant digits**.

1) You are in France at a nice restaurant. Wanting to try a French delicacy, you contemplate ordering an escargot appetizer, but you are worried that it will be too expensive. The price for the appetizer is 12.00 euros (€). What is the price of the appetizer in US dollars?
\$1.0000 = €0.85359 as of Oct. 3, 2020

$$\cancel{€}12.00 \times \frac{\$1.0000}{\cancel{€}0.85359} = \$14.058 = \boxed{\$14.06}$$

2) A bottle contains 25 fluid ounces. How many cups is this?
128 fluid ounces = 1 gallon 1 gallon = 4 quarts 1 quart = 2 pints 1 pint = 2 cups

$$25\ \cancel{\text{fl. oz.}} \times \frac{1\ \cancel{\text{gal}}}{128\ \cancel{\text{fl. oz.}}} \times \frac{4\ \cancel{\text{qt}}}{1\ \cancel{\text{gal}}} \times \frac{2\ \cancel{\text{pt}}}{1\ \cancel{\text{qt}}} \times \frac{2\ \text{cups}}{1\ \cancel{\text{pt}}} = 3.125\ \text{cups} = \boxed{3.1\ \text{cups}}$$

3) Cesium atoms are the largest of the naturally occurring elements. They have a diameter of 5.30×10^{-10} m. Express the diameter of a cesium atom in nanometers, **nm**.

$$5.30\times10^{-10}\ \cancel{\text{m}} \times \frac{1\ \text{nm}}{1\times10^{-9}\ \cancel{\text{m}}} = \boxed{5.30\times10^{-1}\ \text{nm} = 0.530\ \text{nm}}$$

4) 15 μL= ? L

$$15\ \cancel{\mu\text{L}} \times \frac{1\times10^{-6}\ \text{L}}{1\ \cancel{\mu\text{L}}} = \boxed{1.5\times10^{-5}\ \text{L}}$$

5) The mass of the sun is 1.989×10^{30} kg. Express this mass in Tg.

$$\underbrace{1.989\times10^{30}\ \cancel{\text{kg}} \times \frac{1\times10^{3}\ \cancel{\text{g}}}{1\ \cancel{\text{kg}}}}_{1.989\times10^{33}\ \text{g}} \times \frac{1\ \text{Tg}}{1\times10^{12}\ \cancel{\text{g}}} = \boxed{1.989\times10^{21}\ \text{Tg}}$$

6) 1.5 karat diamond = ? mg *(1 karat = 0.200 g)*

$$\underbrace{1.5\ \cancel{\text{karat}} \times \frac{0.200\ \cancel{\text{g}}}{1\ \cancel{\text{karat}}}}_{0.300\ \text{g}} \times \frac{1\ \text{mg}}{1\times10^{-3}\ \cancel{\text{g}}} = 300\ \text{mg} = \boxed{3.0\times10^{2}\ \text{mg}}$$

7) 582 cm^3 = ? L

$$582\ \cancel{\text{cm}^3} \times \frac{1\ \cancel{\text{mL}}}{1\ \cancel{\text{cm}^3}} \times \frac{1\times10^{-3}\ \text{L}}{1\ \cancel{\text{mL}}} = \boxed{0.582\ \text{L}}$$

8) How many **minutes** will it take you to travel 25 km if you are driving at a speed of 85 km/hr.

$$25\ \cancel{\text{km}} \times \frac{1\ \cancel{\text{hr}}}{85\ \cancel{\text{km}}} \times \frac{60\ \text{min}}{1\ \cancel{\text{hr}}} = 17.64 \Rightarrow \boxed{18\ \text{min}}$$

9) $\boxed{\text{197.0 grams of gold contain } 6.022 \times 10^{23} \text{ atoms of gold.}}$ How many gold atoms are in 4.00 g of gold?

$$4.00\ \cancel{\text{g Au}} \times \frac{6.022\times10^{23}\ \text{atoms Au}}{197.0\ \cancel{\text{g Au}}} = 1.2227\times10^{22}\ \text{atoms Au} = \boxed{1.22\times10^{22}\ \text{atoms Au}}$$

What is the volume in mL of a 4.5 g slug of zinc? Density = 7.14 g/mL

Do not use D= M/V. Instead, start with the 4.5g and use the density as the conversion factor.

$$4.5\ \cancel{g} \times \frac{1\ \text{mL}}{7.14\ \cancel{g}} = 0.6303\ \text{mL} = \boxed{0.63\ \text{mL}}$$

10) Suppose right now it costs $2.50 for a gallon of gasoline in the US. In Germany, the prices of gasoline are listed in euros per liter. Suppose the price of gasoline was exactly the same in Germany as it is right now in the US. How would this US price be listed in Germany?

(In other words, convert $2.50/gallon to €/liter.) $1.0000 = €0.85359   1 gallon = 3.785 Liters

$$\underbrace{\frac{\cancel{\$}2.50}{1\ \cancel{\text{gal}}} \times \frac{€0.85359}{\cancel{\$}1.0000}}_{2.1340\ €/\text{gal}} \times \frac{1\ \cancel{\text{gal}}}{3.785\ \text{L}} = €0.56379/\text{L} = \boxed{€0.564/\text{L}}$$

11) A heater gives off heat at a rate of 330.0 kJ/min. What is the rate of heat output in kcal/hr?

(1 cal = 4.184 J) It may help to have a road map first.

$$\underbrace{\frac{330.0\ \cancel{\text{kJ}}}{1\ \cancel{\text{min}}} \times \frac{1\times10^3\ \cancel{\text{J}}}{1\ \cancel{\text{kJ}}}}_{3.3300\times10^5\ \text{J/min}} \times \underbrace{\frac{1\ \cancel{\text{cal}}}{4.184\ \cancel{\text{J}}} \times \frac{1\ \text{kcal}}{1\times10^3\ \cancel{\text{cal}}}}_{78.872\ \text{kcal/min}} \times \frac{60\ \cancel{\text{min}}}{1\ \text{hr}} = 4732.31\ \text{kcal/hr} = \boxed{4732\ \text{kcal/hr}}$$

12) Express 3.5 m^2 in nm^2.

$$3.5\ \cancel{\text{m}^2} \times \underbrace{\left(\frac{1\ \text{nm}}{1\times10^{-9}\ \cancel{\text{m}}}\right)^2}_{1\ \text{nm}^2=1\times10^{-18}\ \text{m}^2} = \boxed{3.5\times10^{18}\ \text{nm}^2}$$

13) At standard conditions the density of helium is 1.786×10^{-4} g/cm^3. What is its density in kg/m^3?

$$\underbrace{\frac{1.786\times10^{-4}\ \cancel{g}}{1\ \cancel{\text{cm}^3}} \times \frac{1\ \text{kg}}{1\times10^3\ \cancel{g}}}_{1.786\times10^{-7}\ \text{kg/cm}^3} \times \underbrace{\left(\frac{1\ \cancel{\text{cm}}}{1\times10^{-2}\ \text{m}}\right)^3}_{1\ \text{cm}^3=1\times10^{-6}\ \text{m}^3} = \boxed{0.1786\ \text{kg/m}^3}$$

14) Vanillin, a flavoring used in ice cream, is the substance whose aroma the human nose detects in the smallest amount. The smallest amount of vanillin that can be detected is $\boxed{2.0 \times 10^{-11} \text{ grams per liter of air}}$. If the current price of $\boxed{\text{50 g of vanillin is \$112}}$, determine the cost to supply enough vanillin so that its aroma could be detected in a large aircraft hangar with a volume of 5.0×10^7 ft^3. *This is a long problem! Think first—a road map may be helpful.*   *Helpful info: 1 inch = 2.54 cm*

$ft^3 \rightarrow in^3 \rightarrow cm^3 \rightarrow mL \rightarrow L \rightarrow g \rightarrow \$$

$$\underbrace{5.0\times10^7\ \cancel{\text{ft}^3} \times \underbrace{\left(\frac{12\ \cancel{\text{in}}}{1\ \cancel{\text{ft}}}\right)^3}_{1728\ \text{in}^3=1\ \text{ft}^3} \times \underbrace{\left(\frac{2.54\ \cancel{\text{cm}}}{1\ \cancel{\text{in}}}\right)^3}_{16.39\ \text{cm}^3=1\ \text{in}^3} \times \frac{1\ \cancel{\text{mL}}}{1\ \cancel{\text{cm}^3}} \times \frac{1\times10^{-3}\ \cancel{\text{L}}}{1\ \cancel{\text{mL}}}}_{\text{First convert volume from ft}^3\text{ to L: }1.4158\times10^9\ \text{L}} \times \underbrace{\frac{2.0\times10^{-11}\ \cancel{g}}{\cancel{\text{L}}}}_{0.02832\ g} \times \frac{\$112}{50\ \cancel{g}} = \$0.06343 = \boxed{\$0.063\ (6.3¢)}$$