WKS
Dimensional Analysis Complete

NAME Answer Key
Period _____ **Date** _____

Use any conversion factors needed (some are given) to perform the following conversions. You MUST use dimensional analysis, show ALL STEPS, use units on ALL numbers and express your answer to the correct number of SIGNIFICANT FIGURES.

Prefixes Used with SI Units Can be used with *any unit* (m, L, g, etc.)		
Prefix	**Meaning**	**Origin**
tera- (T)	1×10^{12}	**Examples (with meters)**
giga- (G)	1×10^{9}	1 Tm = 10^{12} m
mega- (M)	1×10^{6}	1 Gm = 10^{9} m
kilo- (k)	1×10^{3}	**1 Mm = 10^{6} m**
–	1×10^{0}	**1 km = 10^{3} m (1000 m)**
deci- (d)	1×10^{-1}	***(1 m = 1 m)***
centi- (c)	1×10^{-2}	1 dm = 10^{-1} m *(10 dm = 1 m)*
milli- (m)	1×10^{-3}	**1 cm = 10^{-2} m *(10^{2} cm = 1 m)***
micro- (µ)	1×10^{-6}	**1 mm = 10^{-3} m *(10^{3} mm = 1 m)***
nano- (n)	1×10^{-9}	**1 µm = 10^{-6} m *(10^{6} µm = 1 m)***
pico- (p)	1×10^{-12}	**1 nm = 10^{-9} m *(10^{9} nm = 1 m)***
femto- (f)	1×10^{-15}	1 pm = 10^{-12} m *(10^{12}pm = 1 m)*

1. How many kg are in 261 g?

$$?\ \text{kg} = 261\ \text{g} \times \frac{1\ \text{kg}}{1\times10^{3}\ \text{g}} = \boxed{0.261\ \text{kg}}$$

2. Convert 9,474 mm to cm.

$$?\ \text{cm} = \frac{9{,}474\ \text{mm} \mid 1\times10^{-3}\ \text{m} \mid 1\ \text{cm}}{1\ \text{mm} \mid 1\times10^{-2}\ \text{m}} = \boxed{947.4\ \text{cm}}$$

3. How many L is 0.73 nL?

$$?\ \text{L} = 0.73\ \text{nL} \times \frac{1\times10^{-9}\ \text{L}}{1\ \text{nL}} = \boxed{7.3\times10^{-10}\ \text{L}}$$

4. Convert 498.82 kW to MW.

$$?\ \text{MW} = \frac{498.82\ \text{kW} \mid 1\times10^{3}\ \text{W} \mid 1\ \text{MW}}{1\ \text{kW} \mid 1\times10^{6}\ \text{W}} = \boxed{0.49882\ \text{MW}}$$

5. Convert 4.65×10^{2} µm to m

$$?\ \text{m} = 4.65\times10^{2}\ \mu\text{m} \times \frac{1\times10^{-6}\ \text{m}}{1\ \mu\text{m}} = \boxed{4.65\times10^{-4}\ \text{m}}$$

6. Convert 22.4 kg/L to µg/mL (remember to make into full fractions!).

$$?\ \frac{\mu\text{g}}{\text{mL}} = \frac{22.4\ \text{kg} \mid 1\times10^{-3}\ \text{L} \mid 1\times10^{3}\ \text{g} \mid 1\ \mu\text{g}}{1\ \text{L} \mid 1\ \text{mL} \mid 1\ \text{kg} \mid 1\times10^{-6}\ \text{g}} = \boxed{\frac{2.24\times10^{7}\ \mu\text{g}}{1\ \text{mL}} = 2.24\times10^{7}\ \mu\text{g/mL}}$$

7. How many seconds (s) are in 3.00 days?

$$?\ \text{s} = 3.00\ \text{days} \times \frac{24\ \text{hr}}{1\ \text{day}} \times \frac{60\ \text{min}}{1\ \text{hr}} \times \frac{60\ \text{s}}{1\ \text{min}} = \boxed{259{,}000\ \text{s} = 2.59\times10^{5}\ \text{s}}$$

8. Convert the heating rate of 0.74 KJ/min to J/s

$$?\ \frac{\text{J}}{\text{s}} = \frac{0.74\ \text{kJ}}{1\ \text{min}} \times \frac{1\times10^{3}\ \text{J}}{1\ \text{kJ}} \times \frac{1\ \text{min}}{60\ \text{s}} = \boxed{\frac{12\ \text{J}}{1\ \text{s}} = 12\ \text{J/s}}$$

9. What is the density 8.41 g/mL converted to kg/L?

$$? \ \frac{\text{kg}}{\text{L}} = \frac{8.41 \ \text{g}}{1 \ \text{mL}} \left| \begin{array}{l} 1 \ \text{kg} \\ \hline 1\times10^{3} \ \text{g} \end{array} \right. \left| \begin{array}{l} 1 \ \text{mL} \\ \hline 1\times10^{-3} \ \text{L} \end{array} \right. = \boxed{\frac{8.41 \ \text{kg}}{1 \ \text{L}} = 8.41 \ \text{kg/L}}$$

10. What is the speed of 3.8 km/sec in m/year (use 1 yr = 365.25 day)?

$$? \ \frac{\text{m}}{\text{yr}} = \frac{3.8 \ \text{km}}{1 \ \text{s}} \times \frac{1\times10^{3} \ \text{m}}{1 \ \text{km}} \times \frac{60 \ \text{s}}{1 \ \text{min}} \times \frac{60 \ \text{min}}{1 \ \text{hr}} \times \frac{24 \ \text{hr}}{1 \ \text{day}} \times \frac{365.25 \ \text{day}}{1 \ \text{yr}} = \boxed{\frac{1.2\times10^{11} \ \text{m}}{1 \ \text{yr}} = 1.2\times10^{11} \ \text{m/yr}}$$

11. At a speed of 25.0 m/s, how far, in km, will a car travel in 55.0 min?

$$? \ \text{km} = 55.0 \ \text{min} \times \frac{60 \ \text{s}}{1 \ \text{min}} \times \frac{25.0 \ \text{m}}{1 \ \text{s}} \times \frac{1 \ \text{km}}{1\times10^{3} \ \text{m}} = \boxed{82.5 \ \text{km}}$$

12. Traveling at 105 km/hour, how many minutes will it take to drive 345 km to Washington, DC?

$$? \ \text{min} = 345 \ \text{km} \times \frac{1 \ \text{hr}}{105 \ \text{km}} \times \frac{60 \ \text{min}}{1 \ \text{hr}} = \boxed{197 \ \text{min}}$$

13. It takes 8.35 J of heat to raise the temperature of a block of iron (Fe) 1°C (8.35 J/°C). How much energy, in kJ, are needed to raise the temperature 315°C?

$$? \ \text{kJ} = \frac{315 \ ^{\circ}\text{C}}{1 \ ^{\circ}\text{C}} \left| \begin{array}{l} 8.35 \ \text{J} \\ \hline 1\times10^{3} \ \text{J} \end{array} \right. \left| \begin{array}{l} 1 \ \text{kJ} \\ \hline \end{array} \right. = \boxed{2.63 \ \text{kJ}}$$

14. Sally Leadfoot was pulled over on her way from Syracuse to Ithaca by an officer claiming she was speeding. The speed limit is 65 mi/hr and Sally had traveled 97.0 km in 102 minutes. How fast was Sally's average speed in mi/hr? (1 mi = 1609 m) Does she deserve a ticket?

$$? \ \frac{\text{mi}}{\text{hr}} = \frac{97.0 \ \text{km}}{102 \ \text{min}} \times \frac{1\times10^{3} \ \text{m}}{1 \ \text{km}} \times \frac{1 \ \text{mi}}{1609 \ \text{m}} \times \frac{60 \ \text{min}}{1 \ \text{hr}} = \boxed{\frac{35.5 \ \text{mi}}{1 \ \text{hr}} = 35.5 \ \text{mi/hr; No}}$$

15. In Raiders of the Lost Ark, Indiana Jones tried to remove a gold idol from a booby-trapped pedestal. He replaces the idol with a bag of sand. The idol has a mass of 2.00 kg. How many litres of sand must he place on the pedestal to keep the mass sensitive booby-trap from activating? (Use the density of sand = 3.00 g/cm^3 as a conversion factor; remember that 1 cm^3 = 1 mL)

$$? \ \text{L} = 2.00 \ \text{kg} \times \frac{1\times10^{3} \ \text{g}}{1 \ \text{kg}} \times \frac{1 \ \text{cm}^3}{3.00 \ \text{g}} \times \frac{1 \ \text{mL}}{1 \ \text{cm}^3} \times \frac{1\times10^{-3} \ \text{L}}{1 \ \text{mL}} = \boxed{0.667 \ \text{L}}$$