

## Announcements

Monday, January 26, 2009

Ch 2 MC assignment is due this Wed, Jan 28.

See me in my office (E224) if you have any trouble logging in to MasteringChemistry or D2L.

**Quiz 1** on names and symbols of common elements is on Monday, Feb 2. See the course webpage for the handout of elements you need to have memorized.

**Experiment 1** in lab this week. Have the prelab done before you come to lab!

# Dimensional analysis

43.2 m = ? cm

$$43.2 \cancel{\text{m}} \times \frac{100 \text{ cm}}{1 \cancel{\text{m}}} = 4320 \text{ cm}$$

remember...  
 $k = 10^3$   
 $c = 10^{-2}$   
 $m = 10^{-3}$

1 km = 1000 m  
 100 cm = 1 m  
 1000 mm = 1 m

217 in = ? km (start with a roadmap)  
 Give the answer with the correct number of sig figs and in scientific notation.

→ in → cm → m → km  
 in → ft → m → km  
 in → ft → mi → km

$c = 10^{-2}$   
 $k = 10^3$

$$217 \cancel{\text{in}} \times \frac{2.540 \cancel{\text{cm}}}{1 \cancel{\text{in}}} \times \frac{1 \cancel{\text{m}}}{100 \cancel{\text{cm}}} \times \frac{1 \cancel{\text{km}}}{1000 \cancel{\text{m}}} =$$

$$217 \times 2.540 \div 100 \div 1000 = 0.00551 \text{ km}$$

$$= 5.51 \times 10^{-3} \text{ km}$$

Monday, January 26, 2009  
10:18 AM

$$4.15 \text{ cm}^3 = ? \text{ in}^3$$

$$(1 \text{ in} = 2.540 \text{ cm})$$

$$4.15 \text{ cm}^3 \times \frac{(1 \text{ in})^3}{(2.540 \text{ cm})^3}$$

$$4.15 \cancel{\text{ cm}^3} \times \frac{1 \text{ in}^3}{2.540^3 \cancel{\text{ cm}^3}}$$

$$0.253 \text{ in}^3$$

$$4.15 \div 2.540^3 =$$

$$4.15 \div 2.540 \div 2.540 \div 2.540 =$$

## Density

**Density** is the amount of mass per unit volume

$$D = \frac{\text{mass}}{\text{volume}}$$

An object has a mass of 14.3 g and a volume of 9.8 mL. What is its density? in  $\text{g/cm}^3$

$$D = \frac{m}{V} = \frac{14.3 \text{ g}}{9.8 \text{ cm}^3} = 1.5 \text{ g/cm}^3$$

$$9.8 \text{ mL} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} = 9.8 \text{ cm}^3 \quad (1 \text{ mL} = 1 \text{ cm}^3)$$

Density is an **intensive property** (it does not depend on quantity.) So, it can be used to identify substances.

<u>Substance</u>	<u>Density</u>
gold	19.3 g/mL
mercury	13.6 g/mL
water	0.997 g/mL
air	0.00130 g/mL = 1.30 g/L

An obj has  $m = 2.8 \text{ oz}$  and  
 $V = 1.32 \text{ in}^3$ . What is  $D$  in  $\text{g/mL}$ ?

$$\text{oz} \rightarrow \text{g}$$

$$\text{in}^3 \rightarrow \text{mL}$$

Convert units first before  
doing  $D = \frac{m}{V}$

$$2.8 \text{ oz} \times \frac{28.35 \text{ g}}{1 \text{ oz}} = \underline{79.38 \text{ g}}$$

$$1.32 \text{ in}^3 \times \frac{2.54^3 \text{ cm}^3}{1 \text{ in}^3} \times \frac{1 \text{ mL}}{1 \text{ cm}^3} = \underline{21.630 \text{ mL}}$$

$$D = \frac{m}{V} = \frac{\underline{79.38 \text{ g}}}{\underline{21.630 \text{ mL}}} = \boxed{3.7 \text{ g/mL}}$$

## Density as a conversion factor

Density is **THE** conversion factor between mass and volume.

What volume Hg has a mass of 4.86 g?  
The density of Hg is 13.6 g/mL.

*in mL*

$$4.86 \text{ g Hg} \times \frac{1 \text{ mL Hg}}{13.6 \text{ g Hg}} = 0.357 \text{ mL Hg}$$

$13.6 \text{ g Hg} = 1 \text{ mL Hg}$

$$D(\text{Hg}) = 13.6 \text{ g/mL}$$

If you have 9.48 L Hg, what is its mass in grams?

$$\text{L} \rightarrow \text{mL} \rightarrow \text{g}$$

$$9.48 \text{ L Hg} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{13.6 \text{ g Hg}}{1 \text{ mL Hg}} =$$

$$\frac{1 \text{ cm}^3}{1 \text{ mL}}$$

$$1.29 \times 10^5 \text{ g Hg}$$

## Conversion practice

An object has a mass of 12.1 kilograms and a density of 4.5 g/mL. What is the volume of this object in fl ounces? (1 fl oz = 29.57 mL)

start

end

kg → g → mL → fl oz

$$12.1 \cancel{\text{kg}} \times \frac{1000 \cancel{\text{g}}}{1 \cancel{\text{kg}}} \times \frac{1 \cancel{\text{mL}}}{4.5 \cancel{\text{g}}} \times \frac{1 \text{ fl oz}}{29.57 \cancel{\text{mL}}} =$$

$$\boxed{91 \text{ fl oz}}$$

Unit Conversion worksheet on webpage