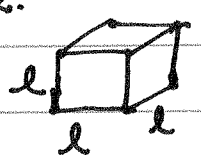
Problem Set 1 Key

1. a) $833\ \text{MHz}\left(\frac{1\times10^{6}\ \text{Hz}}{1\ \text{MHz}}\right) = \boxed{8.33\times10^{8}\ \text{Hz}}$

b) $2525\ \text{cm}^3\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)^3 = \boxed{2.525\times10^{-3}\ \text{m}^3}$

c) $372\ \frac{\mu\text{g}}{\text{L}}\left(\frac{1\ \text{L}}{1000\ \text{cm}^3}\right)\left(\frac{1\ \text{g}}{1\times10^{6}\ \mu\text{g}}\right)\left(\frac{1\times10^{12}\ \text{pg}}{1\ \text{g}}\right) = \boxed{3.72\times10^{5}\ \frac{\text{pg}}{\text{cm}^3}}$

Forgot #1(d). Answer: 18 km/hr

2. 

$m_{Al} = 7.6\ \text{g}$

$d_{Al} = 2.698\ \text{g/cm}^3$

$d = \frac{m}{V}$

$V_{cube} = l^3$

Find volume of cube; then, solve for length.

$V = \frac{m}{d} = \frac{7.6\ \text{g}}{2.698\ \text{g/cm}^3}$ $\quad V = 2.8169\ \text{cm}^3$

$V = l^3$

$l = \sqrt[3]{V}$ (or $V^{1/3}$)

$l = \sqrt[3]{2.8169\ \text{cm}^3} = \boxed{1.4\ \text{cm}}$

3. 

1 kernel
$m = 0.125\ \text{g}$

1 lb of popcorn
total wt. = 1 lb
(mass)

How many kernels per pound?

$1\ \text{lb}\left(\frac{1\ \text{kg}}{2.205\ \text{lb}}\right)\left(\frac{1000\ \text{g}}{1\ \text{kg}}\right) = 453.515\ \text{g}$ total mass

Total mass = (mass per kernel)(number of kernels)

$\#\text{ of kernels} = \frac{453.515\ \text{g}}{0.125\ \text{g/kernel}} = \boxed{3.63\times10^{3}\ \text{kernels}}$

4.

$V_{oil} = 1\ tsp = 5\ cm^3$

Area = $A_{oil} = 0.5$ acre

$1.0 \times 10^4\ m^2 = 2.47$ acres

a) $V = lwh \quad A = lw \longrightarrow V = A * h \ ; \ h = \frac{V}{A}$

V_{oil} and A_{oil} are given; you just need to convert into compatible units.

Convert $\overset{0.5}{\text{acre}} \rightarrow cm^2$:

$$0.5\ \text{acre}\left(\frac{1.0\times10^4\ m^2}{2.47\ \text{acres}}\right)\left(\frac{100\ cm}{1\ m}\right)^2 = 2.02429\times10^7\ cm^2$$

Solve for h:

$$h = \frac{V}{A} = \frac{5\ cm^3}{2.02429\times10^7\ cm^2} = 2.47\times10^{-7}\ cm$$

thickness = 2×10^{-7} cm
or 2×10^{-9} m

b) $V_{oil} = 1$ barrel $= 42$ gal $\qquad V = Ah \qquad A = \frac{V}{h}$

$h = 2\times10^{-9}\ m = 2\times10^{-7}\ cm$

Convert volume in gallons to cm^3:

$$1\ \text{barrel}\left(\frac{42\ \text{gal}}{1\ \text{barrel}}\right)\left(\frac{3.785\ L}{1\ \text{gal}}\right)\left(\frac{1000\ cm^3}{1\ L}\right) = 1.5897\times10^5\ cm^3$$

Solve for area:

$$A = \frac{V}{h} = \frac{1.5897\times10^5\ cm^3}{2\times10^{-7}\ cm} = 7.9\times10^{11}\ cm^2$$

$8\times10^{11}\ cm^2$
one sig fig

$$7.9\times10^{11}\ cm^2\left(\frac{1\ m}{100\ cm}\right)^2 = 8\times10^7\ m^2$$

$$8\times10^7\ m^2\left(\frac{2.47\ \text{acres}}{1.0\times10^4\ m^2}\right) = 2\times10^4\ \text{acres}$$

5.  $m_{Cu} = 57\ kg$ $d_{Cu} = 8.96\ g/cm^3$

 $diam_{wire} = 9.50\ mm$

Cu wire

1) Find volume of copper.

$d = \frac{m}{V}$; $V = \frac{m}{d}$ $\quad 57\ kg \left(\frac{1000\ g}{1\ kg}\right) = 5.7 \times 10^4\ g$

$V = \frac{5.7 \times 10^4\ g}{8.96\ g/cm^3} = 6.3616 \times 10^3\ cm^3$

$V_{cylinder} = \pi r^2 h$ $\quad (V = A_{circle} * h)$ $\quad A_{circle} = \pi r^2$

$r = \frac{diameter}{2} = \frac{9.50\ mm}{2}\left(\frac{1\ cm}{10\ mm}\right) = 0.475\ cm$

Convert to cm

Solve for h (length of wire):

$V = \pi r^2 h$; $h = \frac{V}{\pi r^2}$

$h = \frac{6.3616 \times 10^3\ cm^3}{\pi (0.475\ cm)^2}$

$h = 8.975 \times 10^3\ cm \left(\frac{1\ m}{100\ cm}\right) = \boxed{9.0 \times 10^1\ m}$