Dimensional Analysis Problems

1.) $\frac{125\ \text{campers}}{1} \times \frac{2\ \text{sandwiches}}{1\ \text{camper}} \times \frac{75\ \text{seconds}}{1\ \text{sandwich}} \times \frac{1\ \text{minute}}{60\ \text{seconds}} \times \frac{1\ \text{hour}}{60\ \text{minutes}}$

= 5.2 hours

2.) Facts: $\frac{100.0\ \text{mg cef.}}{1\ \text{kg b.w.}}$ $\frac{40.0\ \text{mg cef.}}{1\ \text{mL soln.}}$

$\frac{39.6\ \text{lbs}}{1} \times \frac{454\ \text{g}}{1\ \text{lb}} \times \frac{1\ \text{kg}}{1000\ \text{g}} \times \frac{100.0\ \text{mg cef.}}{1\ \text{kg b.w.}} \times \frac{1\ \text{mL soln}}{40.0\ \text{mg cef.}} =$ **44.9 mL of soln**

3.) Fact: $\frac{3.00 \times 10^8\ \text{m}}{1\ \text{s}}$

$\frac{8.0\ \text{min}}{1} \times \frac{60\ \text{s}}{1\ \text{min}} \times \frac{3.00 \times 10^8\ \text{m}}{1\ \text{s}} \times \frac{1\ \text{km}}{1000\ \text{m}} \times \frac{1\ \text{mi}}{1.61\ \text{km}} =$ **8.9×10^7 mi**

4.) Facts: $\frac{1\ \text{tank}}{10.5\ \text{gal}}$ $\frac{33\ \text{mi}}{1\ \text{gal}}$

a) $\frac{1\ \text{tank}}{1} \times \frac{10.5\ \text{gal}}{1\ \text{tank}} \times \frac{4\ \text{qt}}{1\ \text{gal}} \times \frac{1\ \text{L}}{1.06\ \text{qt}} =$ **39.6 L**

b) $\frac{.5\ \text{tank}}{1} \times \frac{10.5\ \text{gal}}{1\ \text{tank}} \times \frac{33\ \text{mi}}{1\ \text{gal}} \times \frac{1.61\ \text{km}}{1\ \text{mi}} = 278.9\ \text{mi}$

280 mi

→ Do need to Stop for gas.

5.) Facts: $\frac{2\ \text{doses}}{1\ \text{day}}$ $\frac{40.0\ \text{mg amox.}}{1\ \text{kg bw}}$

$\frac{40.0\ \text{mg amox.}}{1\ \text{day}}$ $\frac{400.0\ \text{mg amox}}{5.0\ \text{mL susp.}}$

$\frac{22.25\ \text{lb}}{1} \times \frac{454\ \text{g}}{1\ \text{lb}} \times \frac{1\ \text{kg}}{1000\ \text{g}} \times \frac{40.0\ \text{mg amox.}}{1\ \text{kg bw.}} \times \frac{5.00\ \text{mL susp.}}{400.0\ \text{mg amox}}$

$= 5.05\ \text{mL susp} \div 2 =$ **2.53 mL suspension per dose**

6.) $\frac{130\ km}{1\ hr} \times \frac{1\ mi}{1.61\ km} = 80.7 = \boxed{81\ mi/hr}$

$\frac{130\ km}{1\ hr} \times \frac{1000\ m}{1\ km} \times \frac{1\ hr}{3600\ s} = \boxed{36\ m/s}$

7.) Facts: $\frac{1\ owl}{5.56\ km^2}$ $\frac{4.356 \times 10^4\ ft^2}{1\ acre}$ $5280\ ft = 1\ mi$

$2.79 \times 10^7\ ft^2 = 1\ mi^2$

$1\ mi = 1.61\ km$

$1\ mi^2 = 2.59\ km^2$

$\frac{3000.\ acres}{1} \times \frac{4.356 \times 10^4\ ft^2}{1\ acre} \times \frac{2.59\ km^2}{2.79 \times 10^7\ ft^2} \times \frac{1\ owl}{5.56\ km^2} = \boxed{2.18\ owls}$

8.) Facts: $\frac{1\ drop}{2\ s}$ $\frac{1\ drop}{2.0\ mL}$

$\frac{1\ day}{1} \times \frac{24\ hr}{1\ day} \times \frac{60\ min}{1\ hr} \times \frac{60\ s}{1\ min} \times \frac{1\ drop}{2\ s} \times \frac{2.0\ mL}{1\ drop} \times \frac{1\ L}{1000\ mL}$

$\times \frac{1.06\ qt}{1\ L} \times \frac{1\ gal}{4\ qt} = \boxed{23\ gallons}$

9.) Facts: $\frac{1\ canister}{10.50\ L\ O_2}$ $\frac{1\ canister}{3\ passengers}$ $\frac{290\ cm^3\ O_2}{1\ min}$

$\frac{1\ passenger}{1} \times \frac{1\ can}{3\ pass} \times \frac{10.50\ L\ O_2}{1\ can} \times \frac{1000\ mL}{1\ L} \times \frac{1\ cm^3}{1\ mL} \times \frac{1\ min}{290\ cm^3\ O_2} = \boxed{12\ min}$

10.) $15\ ft \times 33\ ft \times 6\ ft = 2970\ ft^3$

$\frac{2970\ ft^3}{1} \times \frac{1728\ in^3}{1\ ft^3} \times \frac{16.4\ cm^3}{1\ in^3} \times \frac{1\ mL}{1\ cm^3} \times \frac{1\ L}{1000\ mL} \times \frac{1.06\ qt}{1\ L} \times \frac{1\ gal}{4\ qt}$

$= \boxed{2.2 \times 10^4\ gal}$

$1\ ft = 12\ in$

$1\ ft^3 = 1728\ in^3$

$1\ in = 2.54\ cm$

$1\ in^3 = 16.4\ cm^3$

← How exactly would this be measured?

11.) $\frac{100\text{ yds}}{10.9\text{ s}} \times \frac{1\text{ mi}}{1760\text{ yd}} \times \frac{3600\text{ s}}{1\text{ hr}} = \boxed{18.8\text{ mi/hr}}$

12.) Fact: $\frac{1\text{ atom}}{10.0\text{ nm}}$

$\frac{2.0\text{ in}}{1} \times \frac{2.54\text{ cm}}{1\text{ in}} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\times10^{9}\text{ nm}}{1\text{ m}} \times \frac{1\text{ atom}}{10.0\text{ nm}} = \boxed{5.1\times10^{6}\text{ atoms}}$

13.) Fact: $\frac{4.82\times10^{7}\text{ atoms}}{1.800\text{ in}}$ an atom = 1 atom

$\frac{1\text{ atom}}{1} \times \frac{1.800\text{ in}}{4.82\times10^{7}\text{ atoms}} \times \frac{2.54\text{ cm}}{1\text{ in}} \times \frac{1\times10^{8}\text{ Å}}{1\text{ cm}} = \boxed{9.49\text{ Å}}$

14.) Fact: $\frac{2.1\times10^{7}\text{ atoms}}{.085\text{ ft}}$

$\frac{1\text{ atom}}{1} \times \frac{.085\text{ ft}}{2.1\times10^{7}\text{ atoms}} \times \frac{12\text{ in}}{1\text{ ft}} \times \frac{2.54\text{ cm}}{1\text{ in}} \times \frac{1\times10^{8}\text{ Å}}{1\text{ cm}} = \boxed{12\text{ Å}}$

15.) $\frac{35\text{ people}}{1} \times \frac{2\text{ slices}}{1\text{ person}} \times \frac{1\text{ pizza}}{8\text{ slices}} = 8.75$ pizzas → Buy 9 pizzas!

$9 \times \$14.78 = \boxed{\$133.02}$

16.) $\frac{75\text{ acres}}{1} \times \frac{4.356\times10^{4}\text{ ft}^2}{1\text{ acre}} \times \frac{32.0\text{ fl.oz.}}{6000.0\text{ ft}^2} \times \frac{1\text{ gal}}{128\text{ fl.oz}} \times \frac{4\text{ qt}}{1\text{ gal}} \times \frac{1\text{ L}}{1.06\text{ qt}}$

$= 513.68\text{ L} = \boxed{520\text{ L}}$

17.) Facts: $\frac{1 \text{ pallet}}{120 \text{ ft}^2}$ $\frac{1 \text{ pallet}}{1\frac{1}{2} \text{ metric tons}}$

$1 \text{ m} = 100 \text{ cm}$
$1 \text{ m}^2 = 1 \times 10^4 \text{ cm}^2$
$1 \text{ in} = 2.54 \text{ cm}$
$1 \text{ in}^2 = 6.45 \text{ cm}^2$

$3.0 \text{m} \times 5.0 \text{m} = 15.0 \text{m}^2$

A.) $\frac{15.0 \text{m}^2}{1} \times \frac{1 \times 10^4 \text{cm}^2}{1 \text{ m}^2} \times \frac{1 \text{ in}^2}{6.45 \text{cm}^2} \times \frac{1 \text{ft}^2}{144 \text{ in}^2} \times \frac{1 \text{ pallet}}{120 \text{ft}^2} = \boxed{1.3 \text{ pallets}}$

B.) $\frac{1.3 \text{ pallets}}{1} \times \frac{1.5 \text{ metric tons}}{1 \text{ pallet}} \times \frac{1000 \text{ Kg}}{1 \text{ metric ton}} \times \frac{2.2 \text{ lbs}}{1 \text{ kg}} = 4290$

$\boxed{4300 \text{ lbs}}$