Dimensional Analysis Quiz

Name: Key

Question 1

Convert the value 80.0 (3 S.F.) $\frac{miles}{h}$ to units of $^{m}/_{s}$

$$\frac{80.0\ miles}{1\ h}\left|\frac{1\ h}{60\ min}\right|\frac{1\ min}{60\ s}\left|\frac{1.609\ km}{1\ mile}\right|\frac{1000\ m}{1\ km} = 35.75556\ ^{m}/_{s} \rightarrow 35.8\ ^{m}/_{s}$$

Question 2

Light travels at a speed of $2.998 \times 10^{8}\ ^{m}/_{s}$

- How many s does it take for light to travel from the surface of the earth to the moon and back ($478,000\ miles$)?

$$\frac{478{,}000\ miles}{1\ mile}\left|\frac{1.609\ km}{1\ km}\right|\frac{1000\ m}{2.998\cdot10^{8}\ m}\left|\frac{1\ s}{1\ s}\right. = 2.56538\ s \rightarrow 2.57\ s$$

- How far does light travel in one minute?

$$\frac{1\ min}{1\ min}\left|\frac{60\ s}{1\ s}\right|\frac{2.998\cdot10^{8}\ m}{1\ s} = 1.7988\cdot10^{10}\ m \rightarrow 1.799\cdot10^{10}\ m$$

Question 3

A cup of water is about 237 g. How much energy is required to bring one cup of water from 25.0 °C to 100.0 °C?

$q = mC\Delta T \quad q = 237\ g \cdot 4.184\ ^{J}/_{g\,^{\circ}C} \cdot 75.0\ ^{\circ}C = 74{,}371\ J \rightarrow 74{,}400\ J$ -or- $74.4\ kJ$

Question 4

An adult male should consume about 2500 Cal each day. If 2500 Cal are added to 200.0 lb of water, how much would the water temperature change?

$$\frac{2500\ Cal}{1\ Cal}\left|\frac{1000\ cal}{1\ cal}\right|\frac{4.184\ J}{1\ cal} = 1.0\,(2\ S.F.)\,46\cdot10^{7}\ J$$

$$\frac{200.0\ lbs}{2.205\ lbs}\left|\frac{1\ kg}{1\ kg}\right|\frac{1000\ g}{1\ kg} = 90{,}703\ g\ (4\ S.F.)$$

$q = mC\Delta T \rightarrow \Delta T = \frac{q}{mC} \qquad \Delta T = \frac{1.046\cdot10^{7}\ J}{90{,}703\ g \cdot 4.184\ ^{J}/_{g\,^{\circ}C}} = 27.56\ ^{\circ}C \rightarrow 28\ ^{\circ}C$

Question 5

Convert the following temperatures from K to °C or from °C to K

25.0 °C	376.5 K	−12.3 °C	184.7 K
298.2 K	103.4 °C	260.9 K	−88.5 °C

Problem 6

Give the answer to the correct number of significant figures

- A person runs 1.00 *miles* in 7.46 minutes. Give her speed in $\frac{m}{s}$

$$\frac{1.00 \text{ miles}}{7.46 \text{ min}} \left| \frac{1 \text{ min}}{60 \text{ s}} \right| \frac{1.609 \text{ km}}{1 \text{ mile}} \left| \frac{1000 \text{ m}}{1 \text{ km}} \right| = 3.5947 \text{ m/s} \rightarrow 3.59 \text{ m/s}$$

- A metal sample weighs 2.576 kg and has $V = 0.954\ L$. Give the density in $\frac{g}{ml}$

$$\frac{2.576 \text{ kg}}{0.954 \text{ L}} \left| \frac{1000 \text{ g}}{1 \text{ kg}} \right| \frac{1 \text{ L}}{1000 \text{ ml}} = 2.7002 \text{ g/ml} \rightarrow 2.70 \text{ g/ml}$$

Problem 7

Based on Table 1.7 in your textbook, guess which metal is described in the problem above

Aluminum