Unit Fraction Method Worksheet

The unit fraction method is an excellent way to complete mathematical calculations that involve converting measurements of one unit type to another. For example, let's determine the number of meters in one mile.

$$(1mile)\left(\frac{5280\,ft}{mile}\right)\left(\frac{.3048meters}{1\,ft}\right)=1609meters$$

For the mile conversion, we needed to know how many feet are in a mile and how many meters are in one foot. This is a simple example because most of us know that there are approximately 1600 meters in a mile. However, other conversions can be more difficult.

Let's say we want to determine the amount of coal needed to heat a 500 ft^2 room. In order to do this we need to know a few things before we can complete the calculation. First, we need to know how much energy (in BTU's) is needed to heat 1 ft^2 of the room. Let's say that it takes 200 BTU's to heat 1 ft^2 of space. We can write this as $\left(\frac{200BTU}{1\,ft^2}\right)$. Then we need to know how much energy is contained in a set amount of coal. Let's say that 1 pound of coal produces 5,000 BTU's. We can write this as $\left(\frac{5,000BTU}{1pound}\right)$ or $\left(\frac{1pound}{5,000BTU}\right)$.

According to these simple conversions we can figure out the amount of coal need to heat the room by simply multiplying the two conversion factors by the size of the room.

$$\left(\frac{200BTU}{1\,ft^2}\right)\left(\frac{1pound}{5,000BTU}\right)\left(500\,ft^2\right)=20\,pounds$$

1. Use the Unit Fraction Method to determine the number of seconds in one decade. We've started the answer for you. Using scientific notation will be helpful.

$$(1decade)\left(\frac{10\,years}{decade)}\right)...$$

2. If there are 3.45 miles in a league and 0.00018 leagues per meter, how many meters would you travel if you covered one hundred miles?

3. If there are 270,512 drams in one cubic meter and $1.55*10^{-5}$ hogsheads in a dram, how many cubic meters of water are there in 10 hogsheads?

We will be using the unit fraction method as a way to keep track of the units in our energy conversion calculations. Use the following conversion factors to answer the questions on the back of this sheet.

1 gallon of water = 8 lbs. of water
1kWH = 3,400 BTU's
1BTU = the amount of energy to raise 1 lb. of water $1^{o}F$

1 calorie = the amount of energy to raise 1 ml of water $1^{o}C$.
1 liter = 0.2624 gallons
An average coal power plant produces 12 million kWH of electricity each day
An average solar power plant produces 10 million kWH of electricity each day.
1 lb. of coal can produce 5,000 BTU's.
Coal is 5% sulfur by mass.
Coal costs $35 per ton on average
1 ton = 2,000 lbs.
1 cubic foot of natural gas can produce 1,000 BTU's.
Natural gas is available at $5.00 per one thousand cubic feet.

1. How many pounds of coal are required to power an average electric plant each year?

2. Assume that a power plant uses $8*10^{6}$ lbs of coal each day. Coal fired power plants generate electricity by boiling water to create steam which spins a turbine. If the water source for a coal power plant has an in initial temperature of $60^{o}F$, how many pounds of water are used by a power plant in one day?

3. How much natural gas would be required to produce the same amount of energy as a single day at the coal power plant?

4. How much does the coal cost to run the coal power plant for one day?

5. How much sulfur is produced by the coal power plant each day?

6. If the efficiency of the coal plant was increased by 10%, how many pounds less of sulfur would be produced each year?