Sample of a Student's Notebook for

Science and Sustainability, Revised Edition

Activity 31
Activity 31.1 Fueling Trade Offs

Prediction - kerosene will be better because they sell it in stores

Procedure
1. Fill soda can with exactly 100ml of HzO
2. Stick thermometer in can and take temp of HzO
3. Put kerosene under can holder and light it up with the matches
4. Time it for 5 minutes then take temp
5. Do 1-4 again but use ethanol burner

| Data Table |
|------------|------------|-----------|-----------|-----------|
| Burner     | Start Mass | Start Temp | End Temp  | End Mass  |
| Kerosene   | 251.1g     | 25.2°C     | 72.8      | 250.1     |
| Ethanol    | 221.6g     | 24.8       | 57.0      | 220.5     |

\[
\begin{align*}
\text{Kerosene} & \quad 72.8^\circ C \\
& \quad 25.2 \\
& \quad 47.6^\circ C \\
\text{Ethanol} & \quad 57^\circ C \\
& \quad 24.8 \\
& \quad 32.2^\circ C
\end{align*}
\]

Temp. ->

Mass ->

Good job!
3/15 31.1 Group Analysis

and temperature

1. Errors: weighing mistakes
   firing different sizes
   measuring water not the same
   burners not in exact same spot
   timing could be different

2. We don't all agree but I think
   energy per volume is useful because
   you fill up your tank in gallons
   and that is volume and mpg is
   important to know so you don't
   run out of gas.

Individual Analysis

3. Since we got a pretty big difference
   between temperature change using kerosene
   I would use pure gasoline unless it costs
   a lot more than ethanol gasoline

4. I would want to know the price of
   each one and the mpg of each one
   and also the pollution of each one
31.2 Fuels for the Future

1. Cheap to buy
   Easy to get whenever you need it
   High mpg
   Low pollution
   Lots of it for future

I think that either biomass or hydrogen are the best because the others don’t seem like they would work very well in a car.

2. For electricity you would want pretty much the same as for the car list I made except mpg isn’t important. I also think we use lots more electricity so you need a way to produce a lot all the time. Nuclear seems good except that it’s bad for the environment. All the others seem like they aren’t big enough or useful enough for some places if you don’t have lots of sun or wind or big rivers to dump up.

3. The trade-offs with nuclear are that you get a lot of energy from a little amount of fuel but the fuel is dangerous and so is the reactor if it meltdowns. Also the wastes stay radioactive for a very long time and are hard to get rid of safely. Nuclear plants don’t make any air pollution like fossil fuels do and should last a lot longer into the
future. Another bad thing about nuclear is that terrorists can steal the uranium to make bombs or they might try to blow up the reactor.

4. I think that solar is the most sustainable because it doesn't mess up the environment as much as the others do. And it can be used pretty much everywhere except maybe at the north and south poles in winter. The wind and the water can't be used everywhere and not geothermal either. Biomass and hydrogen still mean that fuel gets burned and that is not great. Solar is not used because it is still expensive and isn't good when the sun isn't shining a lot.

31.3 Combustion

Purpose: Model the chemical changes that occur when a hydrocarbon molecule reacts with oxygen and relate these changes to the energy released during combustion

Procedure

1) \( \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{energy} \)

2) Done

3) 3 \( \text{O}_2 \) used and 2 \( \text{CO}_2 \) and 3 \( \text{H}_2\text{O} \) made
4) \( \text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O} \)

5) a. benzene (\( \text{C}_6\text{H}_6 \))

\( 7\frac{1}{2} \text{ O}_2 \) used and \( 6 \text{ CO}_2 \) and \( 3\text{H}_2\text{O} \) made

\( \text{C}_6\text{H}_6 + 7\frac{1}{2}\text{O}_2 \rightarrow 6\text{CO}_2 + 3\text{H}_2\text{O} \)

b. hexane (\( \text{C}_6\text{H}_{14} \))

\( 9\frac{1}{2} \text{ O}_2 \) used and \( 6 \text{ CO}_2 \) and \( 7\text{H}_2\text{O} \) made

\( \text{C}_6\text{H}_{14} + 9\frac{1}{2}\text{O}_2 \rightarrow 6\text{CO}_2 + 7\text{H}_2\text{O} \)

Group Analysis

1) \( \text{C}_2\text{H}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \)

\( 3\text{CH}_4 + 5\text{O}_2 \rightarrow 2\text{CO} + \text{CO}_2 + 6\text{H}_2\text{O} \)