An investigation into the heat output of some alcohol

Problem

To design a fair experiment to find out which of the three alcohol gives the most heat output.
We have methanol, Ethanol and propane.

Hypothesis

I think Propanol would give the most heat output, because it has more carbon and hydrogen than other two alcohols.

Apparatus

- Small beaker containing 20 cm^3
- Weight scale, to weight each alcohol
- Thermometer, to measure the temperature of water every 30 seconds
- Stand, to hold the beaker above the alcohol
- Use the timer to measure the time taken for each alcohol to boil

Safety

- Wear goggles at all time during experiment
- If there were any spillage, wipe it off with a paper towel.
- At end of each experiment, pour the mixture away in the fume cupboard sink.

Accuracy

- Use a Wind shield to prevent draught in the lab from affecting the results.
- Use a measure cylinder to measure exactly 20 cm^3 of water.

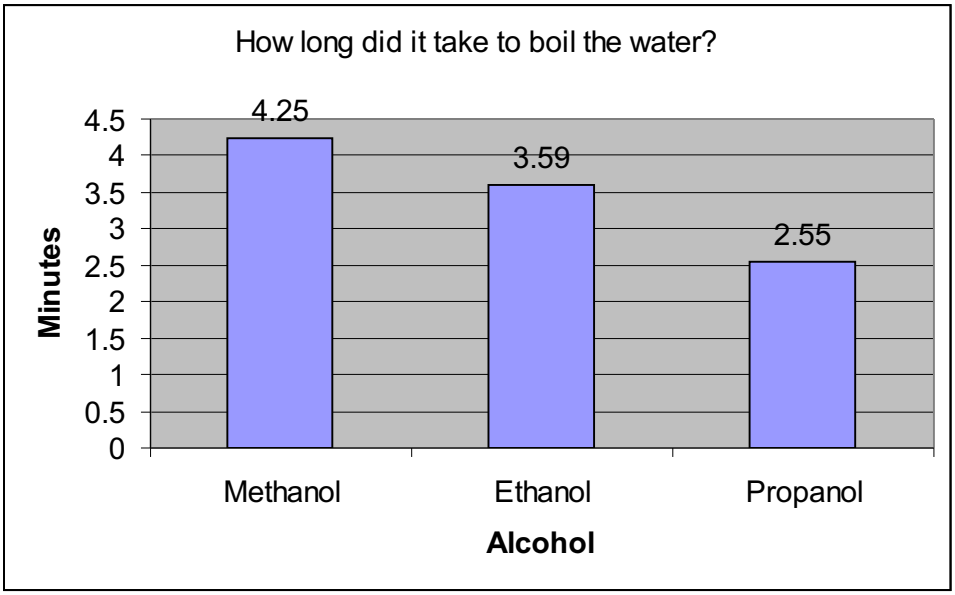
Method

I would suspend a small beaker containing 20 cm^3 of water above the alcohol and then I will ignite the alcohol.
I will use a stopwatch to measure the temperature of water every 30 second and how long it would take to boil.

1. The Independent variable-the variable that can be changed, in this experiment is the alcohol.
2. The Dependent variable- the variable that can't be changed, the amount of water.
3. The control variable-the variable that is kept the same, the distance of flame from beaker containing water and the temperature

Results

Temperature	Methanol	Ethanol	Propanol
At 0 sec	22 ºc	24 ºc	20 ºc
1st 30 sec	30 ºc	34 ºc	30 ºc
2nd 30 sec	44 ºc	49 ºc	42 ºc
3rd 30 sec	56 ºc	60 ºc	56 ºc
4th 30 sec	65 ºc	70 ºc	64 ºc
5th 30 sec	74 ºc	82 ºc	75 ºc
6th 30 sec	82 ºc	100 ºc	85 ºc
7th 30 sec	90 ºc		94 ºc
8th 30 sec	97 ºc		
Boiling at 100 ºc	**4.25 minutes**	**3.59 minutes**	**2.55 minutes**
Weight of alcohol before use	159 grams	176 grams	182 grams
Weight of alcohol after use	158 grams	174 grams	178 grams
How much alcohol used	1grams	2 gram	4 grams

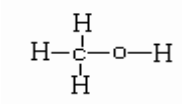


Conclusion

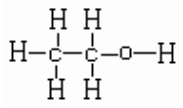
According to my results Propanol gives the most heat output as it boils the water in just 2.55 minutes.

Ethanol boils the water in 3.59 minutes and Methanol boils the water in 4.25 minutes, Methanol is more than 1.5 slower than Propanol.

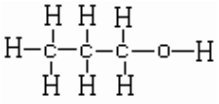
METHANOL CH_3OH



ETHANOL C_2H_5OH

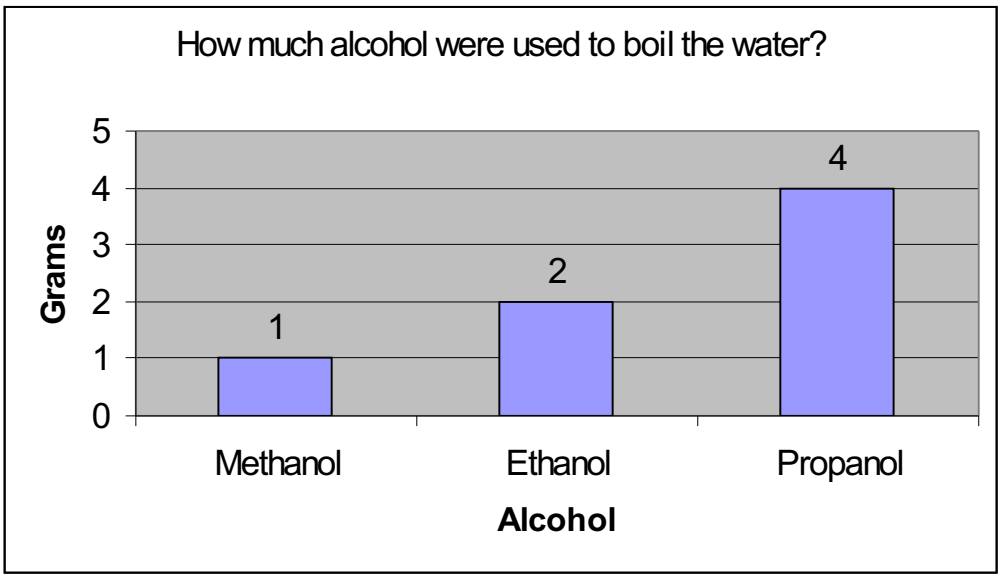


PROPANOL C_3H_7OH



As the number of carbon and hydrogen increase in the alcohol, the faster it could boil the water.

My prediction was right as I predict that Propanol would give the most heat output, because it has more carbon and hydrogen than other two alcohols.

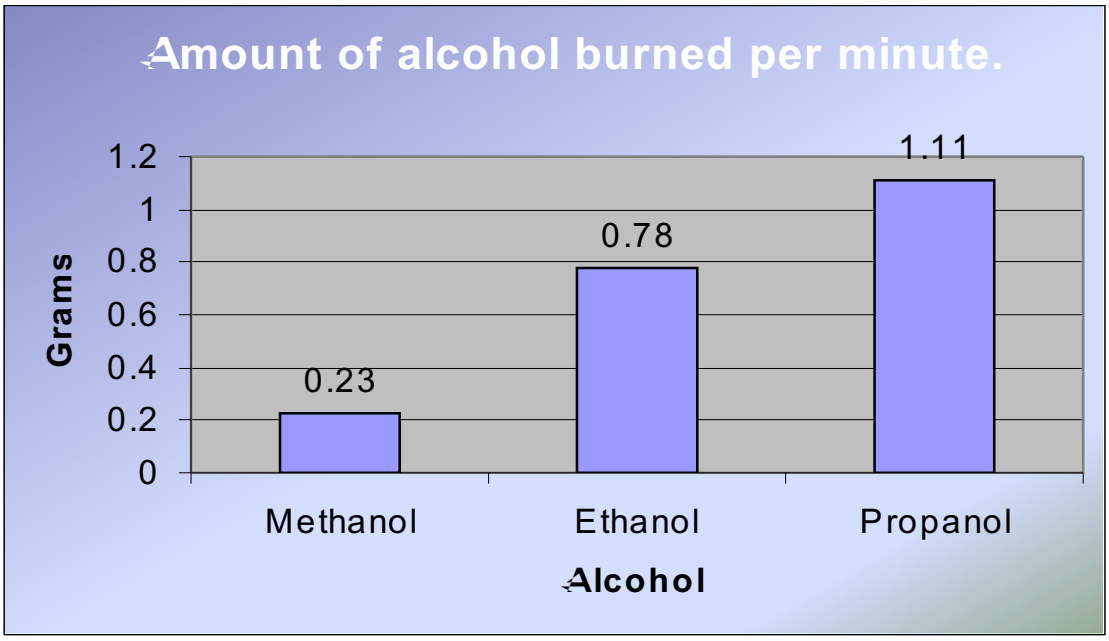


This graph shows how much alcohol was burned to boil the water.

1 gram of Methanol was burned in 4.25 minutes to boil the water. It takes too much time, but it is economy.

2 grams of Ethanol were burned in 3.59 minutes to boil the water.

4 grams of Propanol were burned in 2.55 minutes to boil the water I think this is the best fuel because it boils the water in minimum amount time.



This graph shows how much alcohol burns per minute.
Ethanol burns at 0.78 gram per minute, Methanol burns at 0.23 gram per minute and Propanol burns at 1.11 grams per minute.
Propanol burns at a faster rate.

Evaluation

I think my experiment was fair because I used a measure cylinder to measure exactly 20 cm^3 of water and there were no spillage of water so the beakers contained exactly 20 cm^3 of wate r.
I also stopped the time on 100 °c.
I didn't have any anomalous result and all the results were reasonably accurate.
I can make the experiment more accurate by measuring the water by pipette and repeating the experiment three times for each alcohol to get an average result.
We can't get an accurate result for how long it would take the alcohol to boil the water because some of the heat from alcohol merges into open air. If we carry the experiment in close area such as inside an oven the water would boil much quicker.