

Energy content of natural gas

Introduction

Many homes in the UK have gas fired central heating. Gas is a widely used fuel because it has a high energy content, is easy to distribute and can be used directly for heating and cooking. However, how much energy is there in natural gas and how does it compare to coal or oil? In this experiment you will try to work out a value for the energy content of natural gas.

What you need

- A Bunsen burner
- A 250 ml glass beaker
- Tripod, gauze and bench mat
- Thermometer
- Stop watch
- Safety goggles and lab coat or apron

Before you start

You will need to know how much gas you burn. Your teacher will need to first test the class gas taps to check how much gas is let out per second when they are fully open. They will write this value up on the class whiteboard for you.

Safety

This experiment involves boiling water and other hot pieces of equipment. Ensure that all pieces of apparatus are cool before you touch them and use safety precautions when dealing with the boiling water.

Finding the energy content of natural gas

Put 100 ml into your glass beaker. Use an accurate balance to measure the mass of the water. Then place your beaker onto the gauze on top of the tripod. Put the thermometer into the water and record the temperature. Light the Bunsen, making sure the gas tap is fully open and that the Bunsen is burning with a blue flame. As soon as you place the Bunsen is under the tripod, start the stop watch. Time how long it takes to until the water is just starting to boil.

The calculation

1. Total amount of gas used = time taken for water to boil (sec) x rate of flow of gas (litres per sec)
2. Temperature change = 100°C - starting temperature of water ($^{\circ}\text{C}$)
3. Energy needed to boil water = mass of water (kg) x specific heat capacity for water ($4200 \text{ joules/kg/}^{\circ}\text{C}$) x temperature change ($^{\circ}\text{C}$)
4. Energy content per litre of gas = Energy needed to boil the water \div time taken to boil the water.

Extension tasks

- Find the 'official' result for the energy content of natural gas and see how your result compares. You may need to do some internet research for this.
- Why might there be differences between the 'official' result and yours?
- How might you make your experiment more accurate?
- Re-do the experiment with the Bunsen burning on a yellow flame and see what effect it has on your results. Check with your teacher before you do this as it will produce a lot of soot.