



30. The non-burning £5 note

Topic

Combustion, but this is essentially a 'fun' demonstration.

Timing

About 2 min.

Level

Any.

Description

A piece of paper or a £5 note is soaked in a mixture of ethanol and water. The alcohol burns but the paper does not.

Apparatus

- ▼ Bunsen burner.
- ▼ A pair of tongs.
- ▼ A heat proof mat.
- ▼ Three 250 cm³ beakers.

Chemicals

The quantities given are for one demonstration.

- ▼ 75 cm³ of **ethanol**.
- ▼ A few grams of sodium chloride (common salt).

Method

Before the demonstration

Prepare some pieces of paper about the size of a £5 note. Prepare three beakers – one containing about 50 cm³ of water; the second containing 50 cm³ of ethanol; and the third containing a mixture of 25 cm³ of water mixed with 25 cm³ of ethanol with a little sodium chloride dissolved in it.

The demonstration

Soak a piece of paper in water and try to ignite it by holding it with tongs in a yellow Bunsen flame. It will not ignite. Soak a second piece in ethanol. This will ignite easily. The alcohol will burn and ignite the paper, which will burn away. Soak a third piece in the alcohol-water mixture and hold it in the Bunsen flame. This time the alcohol will ignite and burn away, but the paper will not.

Visual tips

The pure alcohol flame is easily visible, but the alcohol-water one is almost invisible. The salt is added to colour the flame so that it can be seen. Some demonstrators may wish to explain this to the audience, others may prefer not to mention it. Alternatively the presence of the colourless flame may be shown by lighting a taper from it. The demonstration will look more impressive in subdued lighting.



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Theory

The water in the alcohol-water mixture evaporates and keeps the temperature below the ignition temperature of paper (approximately 230 °C, but science fiction fans might remember this as 'Fahrenheit 451' – the temperature conversion could be an exercise for students). The paper will still be wet with water after the alcohol has burned away. Sodium chloride gives the flame the characteristic orange colour of sodium, which looks like a normal yellow flame.

Extensions

Different proportions of water and alcohol could be tried as could other alcohols.

Further details

The rich and/or confident may wish to try this with a £5 (or bigger!) note. The imaginative will be able to dream up some suitable patter to introduce the demonstration while the silver-tongued may be able to persuade a member of the audience to supply a note for 'burning'.

Safety

Wear eye protection.

A fire extinguisher should be available.

It is the responsibility of teachers doing this demonstration to carry out an appropriate risk assessment.