The ‘whoosh’ bottle experiment

This experiment shows the power of the reaction that can take place when an alcohol burns.

Here is a method used by a teacher to show this experiment:

* Use an empty polycarbonate water bottle of
volume 20 dm3.

Source: Adrian Guy

* Add approximately 10cm3 of methanol into the bottle.
* Swirl the methanol inside the bottle.
* Then decant the excess methanol from the bottle.
* Place a rubber stopper or bung into the top of the bottle.
* Connect a wooden splint to the end of a metre rule, and light the end of the splint with a match.
* Carefully place the lighted splint (now at arm’s length) above the stopper on the bottle, and remove the stopper with the other hand.
* A spectacular reaction should now take place. Watch the reaction at <https://youtu.be/yl89heCsBpQ>.

Answer the questions below.

1. Explain why the methanol is swirled within the bottle before it is ignited.

1. Define the following terms used in this method:
2. Decant

1. Excess

1. State the molecular formula of methanol.

1. Draw the structure of a methanol molecule in which all bonds are shown.

1. In the reaction in the bottle, methanol is burning to form carbon dioxide and water.

Write a chemical equation to show this reaction.

1. Explain why this reaction produces a ‘whoosh’ when it takes place within a bottle.

1. The internal volume of the bottle was 20 dm3.

Write this volume in the following units:

1. cm3

1. m3

1. The mass of methanol vapour remaining in the bottle before ignition was 5.2 g.

Calculate the concentration of the methanol vapour in:

1. g / dm3
2. mol / dm3, and writing this answer in standard form.

RAM data: C = 12, H = 1, O = 16.

1. Calculate the mass of carbon dioxide formed when 5.2 g of methanol vapour is ignited.

You will need to use your chemical equation from question 5 to help you.

Show your working clearly.

1. After the reaction in a different bottle had taken place, it was allowed to cool.

A colourless liquid, A, is observed at the base of the bottle.

1. Name liquid A.

1. If the volume of liquid A was 4.50 cm3, calculate the mass of methanol that was burnt in the bottle.

Assume that the density of liquid A = 1 g / cm3.