

In context

Subject area: Organic chemistry

Level: 14–16 years (Higher)

Topic: Alcohols

Source: rsc.li/3ntOcpM

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.
- 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/yI89heCsBpQ>.



Source: Adrian Guy

Answer the questions below.

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

2. Define the following terms used in this method:

a) Decant

b) Excess

3. State the molecular formula of methanol.

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

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

Write a chemical equation to show this reaction.

6. Explain why this reaction produces a 'whoosh' when it takes place within a bottle.

7. The internal volume of the bottle was 20 dm^3 .

Write this volume in the following units:

a) cm^3

b) m^3

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

Calculate the concentration of the methanol vapour in:

a) g / dm³

b) mol / dm³, and writing this answer in standard form.

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

c) 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.

9. 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.

a) Name liquid A.

- b) If the volume of liquid A was 4.50 cm^3 , calculate the mass of methanol that was burnt in the bottle.

Assume that the density of liquid A = 1 g / cm^3 .

