

Name:..... Date:.....

# What sank the Kursk nuclear submarine?

## Which catalyst? Decomposing hydrogen peroxide

### Investigation

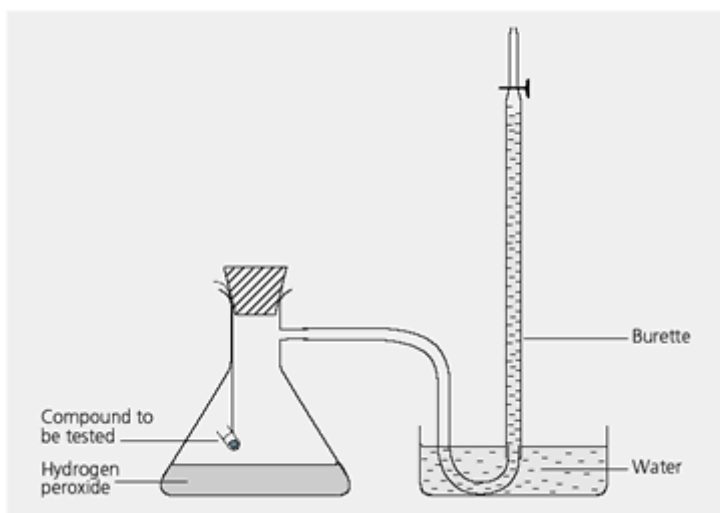
Investigate which compound is best at speeding up the decomposition reaction producing water and oxygen gas from hydrogen peroxide.

### What you need

- Trough
- 50 cm<sup>3</sup> burette
- 250 cm<sup>3</sup> conical flask with sidearm and bung fitted
- About 75 cm<sup>3</sup> of 20 volume hydrogen peroxide per test – **Irritant**
- Range of compounds to test - see list for suggestions
- Small test-tubes
- Rubber tubing to connect sidearm to mouth of burette
- Boss, clamp and stand
- Stopclock
- Cotton thread
- Funnel
- 100 cm<sup>3</sup> measuring cylinder
- Access to balance
- Eye protection.

Compounds to test: zinc oxide, iron(III) oxide, copper(II) oxide (**Harmful**), manganese(IV) oxide (**Harmful**).

Elements to test: powdered metals eg zinc, iron, copper.



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## What you do

The basic experiment

1. Take one of the prepared tubes of catalyst compound.
2. Tie cotton thread round the tube, leaving an end about 20 cm long.
3. Place the small tube in the flask.
4. Secure the long end of the thread with the bung.
5. Connect the rubber tubing to the side arm.
6. Fill the trough with water.
7. Fill the burette with water. Check the tap is closed.
8. Put a thumb or finger over the open end of the burette. Turn it upside down so the open end goes under the surface of the water in the trough.
9. Clamp the burette in position using the boss, clamp and stand.
10. Measure 50 cm<sup>3</sup> hydrogen peroxide.
11. Pour the hydrogen peroxide into the flask, taking care to make sure the tube does not tip over.
12. Secure the bung again.
13. Get ready to start timing.
14. When you are ready, remove the bung and replace it quickly, allowing the tube to tip over and the compound to meet the hydrogen peroxide.
15. Record the volume of oxygen produced every 20 seconds for a fixed amount of time – you will need to do a trial run to test this, but there is no need to record for any longer than 5 minutes.
16. Plot a graph of your results.

## Making the experiment into an investigation

Here are some ways you can develop the basic experiment:

- What can you change? Plan an investigation in which you change one variable at a time.
- How can you improve the equipment, for example measuring the volume of gas?
- How many readings will you need to be sure your results are accurate?
- What other compounds can be tested?

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## Questions

1. Which compound was the best catalyst?

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2. If you tested more than one compound, put the catalysts in order from most effective to least effective.

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3. What would happen if highly concentrated hydrogen peroxide were used with the most effective catalyst?

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Note: This procedure can be downloaded with a set of activities investigating the decomposition of hydrogen peroxide in the context of the Kursk submarine sinking (<https://rsc.li/34pd4X5>). Alternatively, it can also be downloaded as part of a lesson plan on this topic for 14–16 year olds (<https://rsc.li/2F4yphu>) or 16–18 year olds (<https://rsc.li/3hIEgo0>).

