Changing state - melting ice and heating water

Why do this?

This procedure has often been used as an introduction to Yr 7 science. A beaker of water is placed on a tripod and gauze and the Bunsen adjusted to deliver a very hot flame. There have been instances of water "bumping" and scalding students. Students have been burned moving tripods and gauzes. This is usually used as an introductory procedure in early stages of science courses. Emphasis should be made on the on the safe use of using retort stands, bosses and clamps, safe use of the Bunsen Burner and dealing with hot materials in science.

Many teachers find that the skills necessary in this procedure, are overwhelming to many students who are just entering a secondary school. Other introductory procedures may well be more suitable. For instance, the Bunsen burner procedure is better suited to observing different flame colours, from splints soaked in Group 1 metal salt solutions.

Possible curriculum links: introduction to separation techniques as distillation is a further application

This *Practical Procedure* draws on safety information from the following guidance.

- *Student Safety Sheet SSS093; SSS094 and SSS095*

Suitability

Year 7

Method with control measures (including PPE)

Wear eye protection.

Tie any long hair back to avoid it catching fire.

Make sure your clothing does not get in the way of the flame and don't lean over a flame to reach other apparatus.

Procedure

Using Bunsen burner:

- Place the Bunsen burner on a heat-resistant mat 20 to 30cm from the edge of the bench
- Make sure the air hole is closed (unless you are lighting the gas with a piezo-electric lighter, in which case air hole should be half open)
- Attach the gas tubing to the gas tap
- Light a match or a wooden splint from a central flame
- Turn on the gas tap
- Keeping well away from the Bunsen burner, use the match or lighted splint to light the gas coming up the Bunsen burner chimney

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Melting ice and heating water:

- Use a wide-diameter test tube (usually called a boiling tube)
- Do not have the boiling tube more than 10mL full (it is much less likely to boil over)
- Measure 10mL of crushed ice/water mixture in the 25mL measuring cylinder
- Transfer the mixture to the boiling tube
- Add an anti-bumping granule ('boiling chip') before starting to heat (but never add one when it is already warm, which might result in it frothing up)
- Record the initial temperature of the water or ice
- Using a suitable holder, which is in good condition, keep the test tube at an angle (Fig.2)
- Take care that the test tube is not pointing directly at yourself or anybody else
- Hold the test tube so that the bottom is just at the tip of the flame and the top is well clear of the flame
- Start with a gentle flame (see CLEAPSS Student Safety Sheet 92), and increase it only if necessary.
- Show the pupils how to flick your wrist continuously but gently, so that the liquid is shaken all the time it is being heated
- Working in pairs record the temperature of the water or ice every 10 seconds (record your readings and observations). You may want students to put the test tube back into the rack before taking any readings.
- Place a test tube rack onto the heat resistant mat and let the boiling tube stand till it cooled down
- Make sure the air hole is closed and the flame is yellow
- Switch the gas off
- Remove the tubing by putting your fingers on the tubing around the gas tap nozzle and pulling. Don't pull the tubing off by stretching it

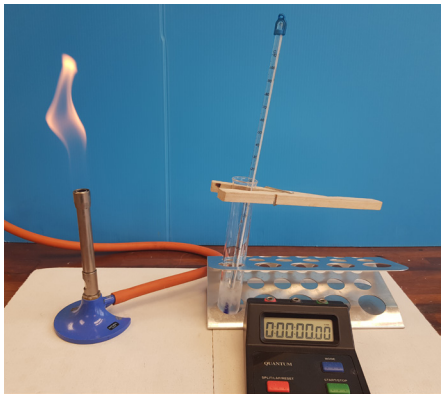


Fig.1 Set of equipment

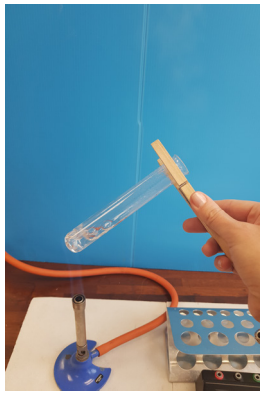


Fig.2 Keep the test tube at an angle.

Extension tasks:

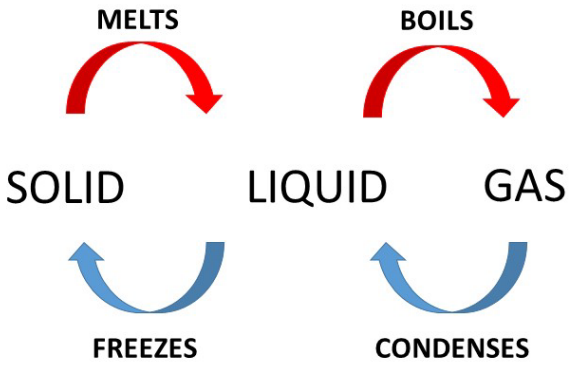
Try this activity with different Bunsen burner set up e.g. gentle flame (gas tap half open and the air hole partly closed) or medium flame (gas tap fully open and the air hole partly closed).

Disposal

Before emptying the content of the boiling tube to the sink make sure it has cooled down

Chemistry notes

Students learn changes of sate based on below diagram.



Suggested apparatus and materials

- Bunsen burner
- Boiling tube
- Test tube holder
- Thermometer -10°C to 110°C
- Heat-resistant mat 30 to 40cm
- 25mL measuring cylinder
- Anti-bumping granule
- Ice
- Water