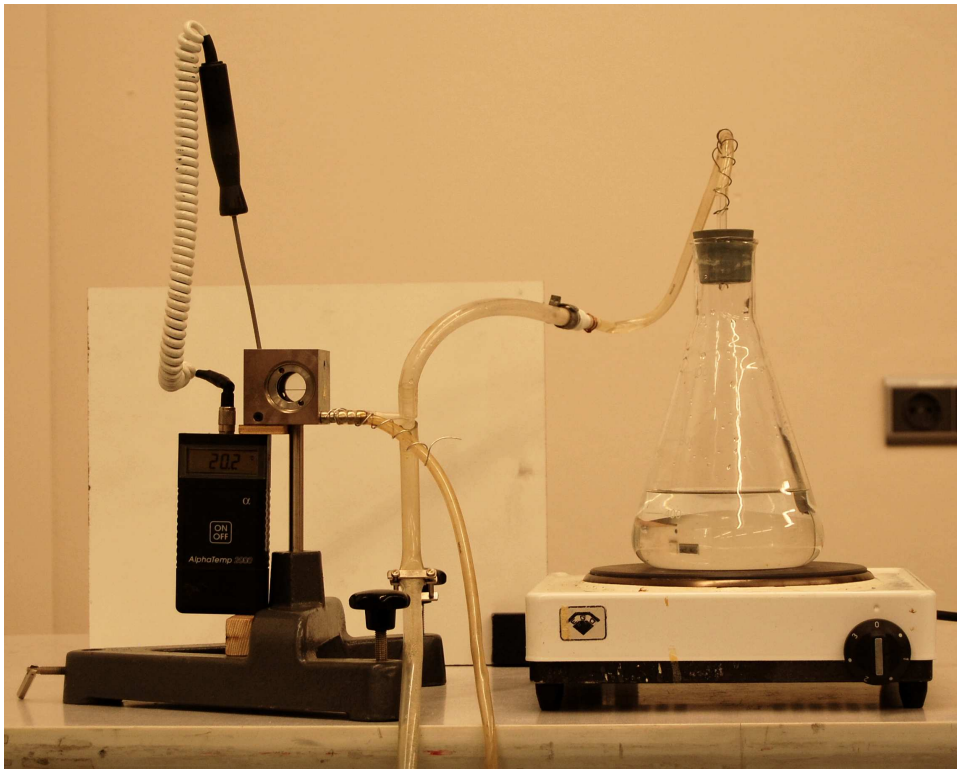
Critical point

Aim: To show the behaviour of a substance when it reaches the critical temperature

Subjects: 4C50 Critical Point

Diagram:



Equipment:

- Pressure chamber filled with sulphur hexafluoride (SF_6).
- Temperature probe fitted into a hole of the pressure chamber.
- Hot-plate.
- Conical flask, 1 litre, filled with a small amount of water.
- Clear acrylic tubing and tubing clamps.
- Beaker, 1 litre, to capture the out-flowing steam.
- Camera, that observes the liquid-vapour level inside the pressure chamber and the temperature-reading (see also Figure 1A). This image is projected to the audience.

Safety:

- Check the heating channel of the pressure chamber that there are no obstructions (blow air through it).
- Mind the steam heating the chamber. Take care that all tubing is sealed securely and capture the out-flowing steam in a beaker.
- Sulfur hexafluoride has no hazard indications. (This gas is even used in demonstrations where it is inhaled and causes the breather's voice to sound very deep [see YouTube], since sulphur hexafluoride is 5 times heavier than air.)
- It is a very potent greenhouse gas (a warming potential of 22,800 times that of CO_2.
- There is a high pressure inside the chamber. The manufacturer indicates a maximum temperature of 100ºC.

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Presentation:

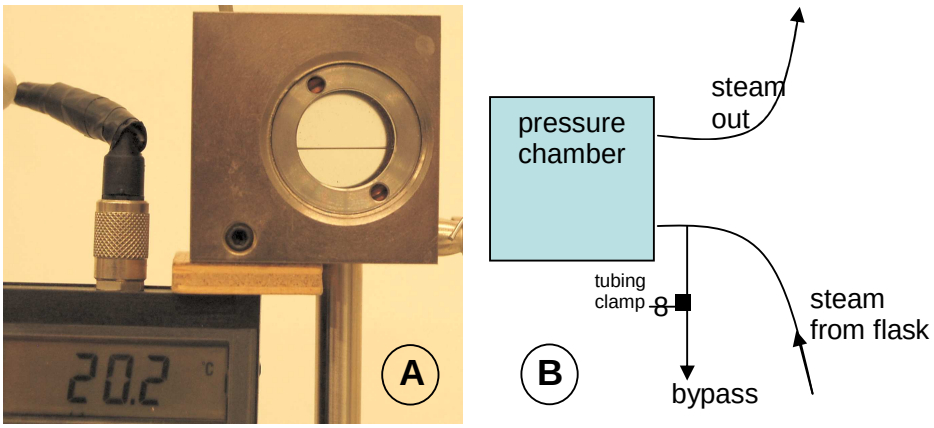

Figure 1

The hotplate is switched on, heating the water. When the water is boiling steam is blown through the pressure chamber, heating it.
Heating the chamber with steam, the temperature increases too quickly. That's why a there is a bypass for the steam that can be controlled by a tube clamping (see Figure 1B). Bypassing steam makes control of temperature rise at a slow rate possible.
Passing the 40ºC rise the temperature as slowly as possible.
While temperature rises slowly nothing is observed in the liquid-vapour. When the critical temperature (45.5ºC) is approaching warn the audience to watch carefully, because when the critical temperature is passed they might have missed the sudden disappearance of the phase boundary.
After that phase change, the steam flask is removed and the pressure chamber starts cooling down. This passes slowly, so that the phase-change can be observed at more ease.

Explanation:

Remarks:

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Sources:

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