Anodising aluminium

1 Cut and clean the piece of aluminium (to be done by the teacher) that is to be the anode.

2 Prepare the cathode by cleaning it thoroughly.

3 Without touching the anode with your hands, hang the two electrodes near to each other in a beaker. Ensure they cannot touch each other.

4 Carefully fill the beaker almost to the top of the electrodes with 1.5 M sulfuric acid.

5 Connect the leads to the power pack. Ask the teacher to check your circuit before proceeding.

6 Cover the beaker lightly with a paper towel to stop acid spray and switch on. Adjust the voltage to 15 V and allow to electrolyse for about 30 minutes to create a hard layer of aluminium oxide on the metal.

7 Turn off the power. Lift out the anode strip without touching it. Wash it with distilled water and store it in a beaker of distilled water.

8 Place the strip in a beaker containing the dye you want to use and leave for about 10 minutes.

9 Remove the strip from the dye and wash it with tap water.

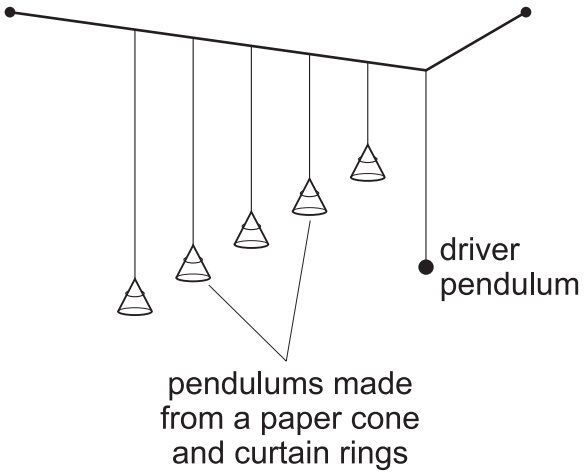
10 Place the strip in a beaker of boiled water from a kettle for about 15 minutes.

The strip will now have absorbed the dye into the layer of aluminium oxide.

Resonance

1 Barton's pendulums

Make a set of Barton's pendulums from paper cones as shown in the diagram. The driver pendulum should be a heavy mass. All the pendulums are suspended from the same string. One of the paper pendulums should be exactly the same length as the driver. The others should be shorter or longer as shown.



Set the driver oscillating and keep it oscillating with a constant amplitude. Note carefully what happens to each of the other pendulums.

Note the amplitude of each pendulum bob. Note whether each bob is in phase or out of phase with the driver. If it is out of phase, by how much?

Which of the pendulums is oscillating at its natural resonant frequency. What are the others doing?

2 Damping Barton's pendulums

Remove the curtain ring masses. This will dampen the pendulums by making air resistance more effective. Repeat the experiment and note the differences.

3 The Tacoma Narrows bridge collapse

Preparation work before the lesson

Download from the Internet a copy of the film of the Tacoma Narrows bridge collapse in 1942. This is on many engineering sites and can be located with any Internet search engine, such as www.google.com. Find out how many frames were taken per second by a 16 mm camera. This can be found on the Internet at a website such as www.howstuffworks.com.

Work in the lesson

Play the film, frame by frame. Note how many frames there are per oscillation of the bridge.

Work out how many seconds one bridge oscillation takes. Calculate the resonant frequency of the bridge (in hertz).

Resource 12.3

The fate of stars

You will be assigned one of these three topics:

- the decay of stars into white dwarfs;
- the production of neutron stars in a supernova explosion;
- the formation of a stellar black hole in a supernova explosion.

You should study all topics in outline but focus on the one you have been allocated.

Study your topic by finding information on the Internet or from other library resources.

Prepare a 5-minute presentation on your topic, preferably involving display software. Include visuals in your presentation.

Your presentation should include, but not be limited to, the following elements:

- the importance of stellar mass in determining the fate of a star;
- the role of the force of gravity in determining the nature, size and density of the ultimate product;
- energy changes involved in the decay process and the sources of such energy;
- evidence for the existence of the three kinds of stellar decay product.

Keep track of the sources you have used for your facts so that other interested classmates can go back to them for further information. Acknowledge the sources in your presentation.