Identifying patterns – cooling.

Background:

Everyone knows that 'hot objects cool down', but does this *always* happen?

This depends what we mean by 'hot'. An object that is *at a higher temperature* (hot*ter*) than its surroundings will cool down unless it is being heated actively.

So if an object is heated, such that it is at a higher temperature than the ambient temperature, when heating stops there will be a net flow of heat away from the object, and its temperature will drop.

How cold does the object get? The object will only continue to cool as long as it is hotter than its surroundings. If the temperature of the object reaches that of its environment, it will not cool further.

For example, if you heat some water in a kettle, then carefully pour some hot water into a test tube, and clamp the tube in a room at a lower temperature, then the tube of water will cool.

***Make a prediction*:** how do you think the temperature will change during cooling?

Check out your prediction:

Can you identify a pattern in the way that the temperature of the water changes during cooling?

Can you suggest an ***explanation*** *for any pattern that you find?*

Identifying patterns – capacitor discharge.

Background:

A capacitor is an electrical component that is used in some circuits to store charge. The capacitor can be charged by connecting it to a suitable power supply. If the charged capacitor is then connected into a suitable circuit it will *dis*charge. The potential difference (p.d., voltage) across the capacitor 'plates' (ends) will generate a current through the circuit. As charge moves away from the capacitor plates the p.d. across the capacitor will drop. Eventually, if the capacitor becomes completely discharged, then it will no longer be able to provide a current.

The apparatus provided enables the capacitor to be charged quickly, and (by changing the position of the switch) to be discharged through a resistor. The voltmeter shows the p.d. across the capacitor at any time, and the ammeter shows the current during discharge.

Make a prediction: do you think the current will have a steady value during discharge?

Check out your prediction:

Can you identify a pattern in the current values during discharge?

Can you suggest an ***explanation*** *for any pattern that you find?*

Identifying patterns – water flowing downhill.

Background:

We all know that water flows downhill – but what determines how quickly water runs downhill?

You are provided with apparatus that enables you to *model* the effects of water flowing down hill. The two glass tubes are connected by flexible tubing, with a tap to stop or start water flow. You can change the difference in the height of the water in the two tubes by adjusting the clamps.

Make a prediction: What do you think will happen if you set up the apparatus so that the water in each tube is at the same height, and open the tap?

Check out your prediction:

Can you identify a pattern in the water flow rate?

Set up the apparatus to give as big a difference in water height as possible, and then open the tap to allow water to flow. See if you can identify a pattern in the rate at which the water flows from one tube to the other.

*Can you suggest an **explanation** for any pattern that you find?*