LITTLE BIG FUTURES

Activity 3 worksheet

Name

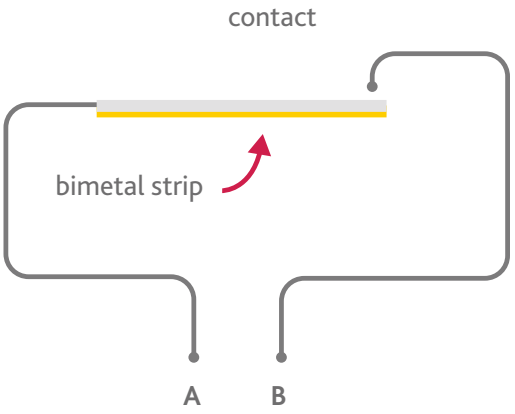
Investigation 1 - bimetal strip demo

Q. What did you observe when you heated the bimetal strip?

Q. When hot, did the strip bend towards the brass or towards the iron?

Q. Which of the two metals expands most when heated, brass or iron?

Q. How might the circuit shown be used by a computer control system that needs to sense a change in temperature?



Research question

Q. How are bimetal strips used, find as many examples as you can?

Investigation 2 - thermistor

Thermistor	Resistance (ohms)
1. In air	
2. In cold water	
3. In warm water	
4. In hot water	

Q. What happens to the resistance of the thermistor as the temperature increases?

Q. Can you spot a relationship between the temperature and the resistance?

Q. How could the data on the graph (printed on the instructions) be used in a program for a computer control system so that is triggers at a specific temperature?

The sensitivity of a thermistor based temperature sensor can be adjusted so that it will trigger an alarm at a range of different threshold temperatures. Delicate electrical circuits can be damaged by high temperatures.

In which of the following situations might the thermistor be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	

Investigation 3 - a flashing filament lamp

My sketch of the lamp

Q. Giving as much detail as possible, describe what happens inside the lamp when the switch is closed.

The sensitivity of a bimetal strip based temperature sensor can be adjusted so that it will trigger an alarm at a range of different threshold temperatures.

In which of the following situations might the bimetal strip be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	

Investigation 4 - melting wire

Q. Why must you keep the two crocodile clips apart?

Q. Record and explain your observations when you heated the wire.

Q. In a fire alarm system, which of the algorithms on the instructions would you use to process the input from the melting wire, Option 1 or Option 2?

Research questions

Q. What is the melting point of lead free solder?

Q. Would this fire detection system be more or less sensitive if you used a length of aluminium wire in place of the solder? Circle your answer below.

More **Less**

The sensitivity of a melting wire based temperature sensor cannot be adjusted. It will only trigger an alarm when it reaches its melting point, the threshold temperature.

In which of the following situations might the melting wire be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	

Investigation 5 - melting wax

Record your observations.

Q. Explain why the lamp came on when the ends of the nails were heated?

Research questions

Q. What is the melting point of paraffin wax?

Q. Is paraffin wax a conductor or an insulator?

Q. Suggest another substance that might be placed between the ends of the nails?

Q. How might the sensitivity of this fire detection method be adapted to make it sensitive to a smaller temperature rise?

Q. How might the sensitivity of this fire detection method be adapted to be less sensitive - so that a larger temperature change is needed to trigger it?

The sensitivity of a melting wax based temperature sensor cannot easily be adjusted. It will only trigger an alarm when it reaches its melting point, the threshold temperature.

In which of the following situations might the melting wax be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	

Investigation 6 - expanding water

Record your observations – what was the distance between the two marks?

_____ mm.

Q. How could you adapt this apparatus to trigger a fire alarm? Can you think of a way of using the rising water level in the tube as an input into an electronic control system?

Q. Suppose that the water were replaced by the liquid metal mercury. Can you think of a way of using the rising mercury level in the tube as an input into an electronic control system?

Research questions

Q. How is the expansion of a liquid used to trigger sprinkler systems?

Q. Why might you NOT want to use mercury in a fire detection system?

The sensitivity of an expanding water based temperature sensor cannot easily be adjusted. It will only trigger an alarm when it reaches the threshold temperature.

In which of the following situations might expanding water be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	

Investigation 7 - expanding air

Syringe temperature	Volume of air (ml)
Iced water	
Hot water	
Change in volume	

Q. Did the movement of the syringe plunger close the circuit? _____

Q. How did you make the system more sensitive?

Q. How did you make it less sensitive?

Q. How could you calibrate your sensor so that it triggers an alarm at a specific temperature?

Research question

Q. Why do substances expand when they are heated?

The sensitivity of an expanding air based temperature sensor can be calibrated to be triggered through a range of different temperatures because the volume of air is proportional to the temperature.

In which of the following situations might the expanding air based sensor be applicable:

Situation	Normal temperature range	Threshold temperature to trigger alarm	Applicable (Y/N)
An outside garage	0°C - 15°C	Above 20°C	
Bedroom	18°C - 25°C	Above 20°C	
Drying room	30°C - 50°C	Above 80°C	
Gas boiler	100°C - 150°C	Above 200°C	