Investigation of the thermal conductivity of metals

Introduction

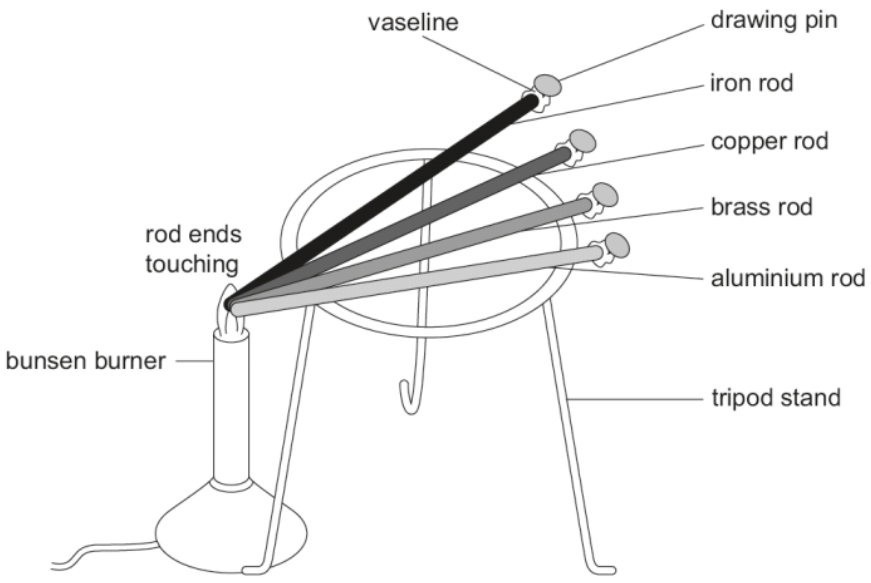
Metals are better conductors of heat than non-metals. However, some metals are much better conductors than others. In this investigation the thermal conductivity of 4 metals is compared and the metals can then be placed in order from the best conductor of heat to the poorest.

Apparatus

4 × metal rods (aluminium, brass, copper and iron)
4 × drawing pins
Vaseline
tripod
heat proof mat
stopwatch

Diagram of Apparatus

Metal Rods Experiment



Method

1. Set up the apparatus as shown in the diagram.
2. Attach a drawing pin to the end of each rod with a small blob of Vaseline.
3. The ends of the rods (without the drawing pins) should be brought together so that they can be heated equally (see diagram).
4. Heat the ends of the rods equally with a blue Bunsen flame.
5. Record the time taken for each rod to lose its drawing pin.

Analysis

1. Determine the order of conductivity of the metals.

Risk Assessment

Hazard	Risk	Control measure
Hot metal rods can burn	Burning fingers when moving rods	Allow the rods to cool thoroughly before attempting to move them from the tripod
Hot tripod can burn	Burning fingers when moving tripod	Allow the tripod to cool. Do not touch the top. Move by holding bottom of a leg
Aluminium melting can burn	Molten aluminium falling on back of hand causing burning/injury	Do not overheat aluminium. Observe aluminium for signs of melting and remove heat. Do not hold the Bunsen when it is directly beneath end of aluminium rod

Teacher / Technician Notes

The expected order is : **copper** **(best conductor),**
aluminium,
brass,
iron **(poorest conductor).**

Some groups may find aluminium to be the best conductor. It is often very close between copper and aluminium. Hopefully, a quick survey of each group's results will reveal more votes for copper than for aluminium as the best conductor.

The metal rods may roll off the tripod and onto the bench. Thick cloths should be available for the teacher to pick them up and place them onto the heat proof mat to avoid marking the benches.

The Vaseline makes this a potentially messy experiment. Students need access to soap and hot water to remove Vaseline from hands. A plentiful supply of paper towels should be available to wipe Vaseline from benches. Wooden splints may be used to transfer Vaseline from a small pot onto the drawing pin / metal rod. Students should be encouraged to use the smallest amount of Vaseline that is needed to attach each drawing pin to the rod.

The practical can be extended by adding four drawing pins to the underside of each rod and recording the time for each to fall.

Working scientifically skills covered

2. Experimental skills and strategies

Carry out experiments appropriately having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.

Make and record observations and measurements using a range of apparatus and methods.

3. Analysis and Evaluation

Interpret observations and other data including identifying patterns and trends, making inferences and drawing conclusions.

Evaluate data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.

4. Scientific vocabulary, quantities, units, symbols and nomenclature

Use scientific vocabulary, terminology and definitions.