Speaker one

Have you ever wondered how your take-away hot drinks stay hot? Or how some take-away cups are less effective? Let's look at thermal insulation!

Speaker two

Yeah, all right. Now, thermal insulation is essential for reducing heat transfer in all sorts of places.

For example, between the interior and exterior of buildings and in insulated cups and drinks flasks. Right, now, insulators work in two main ways. They keep things hot by reducing heat loss from a hot object And they keep things cool by reducing heat transfer to a cold object from its surroundings.

Speaker one

We're going to test the thermal conductivity of different materials to check their effectiveness at reducing heat loss or gain.

Materials with high thermal conductivity have a high energy transfer rate, so they are poor insulators. If they have a low conductivity they are effective insulators. Now, for this experiment you'll need the following things.

Do pause and take a look.

Now, don't sit down to perform this experiment just in case you spill the hot water.

Speaker two

All right, so control variables are the ones we keep the same.

So that's the volume of water, the starting temperature of the water, and the thickness of insulating material.

Speaker one

Let's get started. We need 80 cubic centimetres of hot water.

Speaker two

Okay, so that's about here.

Speaker one

So I'm going to transfer that

into this smaller beaker. And this is our constant volume of hot water.

For the control we're going to put that into the beaker with no insulation. Whoops, there we go.

Speaker two

There you go.

Speaker one

But I want to put this on top,
and then the thermometer so we can measure the temperature. Now as I put this in, we measure it at the right temperature. To achieve a consistent starting temperature we will wait until the temperature drops to 70 degrees C before starting the experiment.

When that's ready we're going to start our stopwatch and record the temperature of the water every 2 minutes for 10 minutes. That's 70, and start the stopclock.

BEEP

Speaker two

So where are we at?

Speaker one

OK, another 2 minutes, so I'll take another reading. What have we got now? Try to keep it in the water. Okay, yeah. Lovely. Wait another 2 minutes.

Speaker two

Another 2 minutes to go.

Now we're going to repeat

the experiment, but we're going to add our first insulating material.

We'll insert it between the two beakers...like this.

Speaker one

We need to get the lid on again. The thermometer. And start the stopclock.

BEEP

Speaker two

Next repeat the experiment with cotton wool, and finally, bubble wrap.

After recording our results we're going to plot our cooling curves, which is the temperature in degrees celcius on the y-axis against the time in minutes on the x-axis. The water will cool down at the slowest rate with the most effective insulator. We can see on our graph

that this has the shallowest gradient, therefore has the lowest rate

of energy transfer. In this case it looks like it was the cotton wool. This has the lowest thermal conductivity of all the materials.

Speaker two

Now, most insulators work by trapping a layer of air.

Speaker one

Yes.

Speaker two

The thermal conductivity of air is low as long as it's not free to move.So, the more that we can trap within our insulator, the less heat transfer will occur.

Speaker one

Insulators reduce heat transfer between objects or places which are at different temperatures. The higher the final line position, the more effective the insulator.