

Speaker one

Minus 273 degrees is the lowest possible temperature.

It's called absolute zero. Any object with a temperature above this will emit and absorb infrared radiation, even the Earth.

Speaker two

That's right, and the rate at which infrared radiation is absorbed and emitted by the Earth's surface and atmosphere is one of the factors which determines the Earth's temperature.

Speaker one

We're going to investigate emissions of infrared radiation first and then absorption by completing two short experiments. We're going to use a Leslie cube to investigate emissions. This has four surfaces. A shiny black surface, a shiny metallic surface, a white surface, and a matte black surface, which means it's not shiny.

Speaker two

Now this is the equipment you'll need for our first experiment. Now pause and take a look. Boiling water may scald, so use a funnel when pouring. And avoid touching the Leslie cube until it's completely cooled.

Speaker one

Yeah. We're going to fill our Leslie cube with hot water from a kettle to increase its temperature. Make sure the lid is on to minimise heat loss through convection.

We'll then point our infrared thermometer at the four surfaces and record the amount of infrared radiation that is emitted.

Speaker two

So, we need to make sure the Leslie cube and the infrared detector have the same distance and angle between them each time to make sure the results are valid. We'll be using 10 centimetres, and pointing the sensor at a right angle to the cube's surface.

Speaker one

We'll use our results to create a bar chart.

So, in conclusion, from our emissions practical, the darker the colour and the more matte the surface the better emitter of infrared radiation. Now we'll look at the absorption of infrared radiation by different surfaces.

Speaker two

This is the equipment you'll need, so pause and take a look. Remember, the bulb will get hot. So, to avoid burns, we'll be careful not to touch that.

Speaker one

We're going to use a filament bulb with a shiny metal plate on one side and a matte black plate on the other.

Note that both plates are an equal distance from the bulb. This is one of our control variables.

Speaker two

On the other side of the plates we have drawing pins stuck to the plate with petroleum jelly.

We're going to switch the bulb on at the start and start our stopwatch.

As the plates absorb infrared radiation they will increase in temperature.

At a certain temperature the petroleum jelly will melt and the drawing pin will fall off. This will be the surface which is the best absorber of infrared radiation.

So, we can see that the drawing pin on the matte black plate fell off in 3 minutes and 48 seconds, while the pin attached to the shiny plate took over 11 minutes. This shows that the darker and more matte a surface is, the greater the absorption of infrared radiation.

Speaker one

So, we have learnt that dark, matte surfaces which are good emitters of infrared radiation are also good absorbers.

Speaker two

Equally, pale-coloured, shiny surfaces which are poor emitters of infrared are poor absorbers too.

This is because they reflect the infrared radiation back away from the surface.