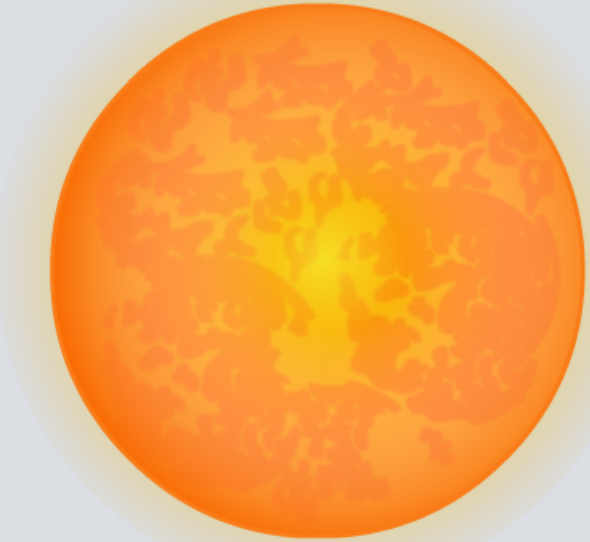
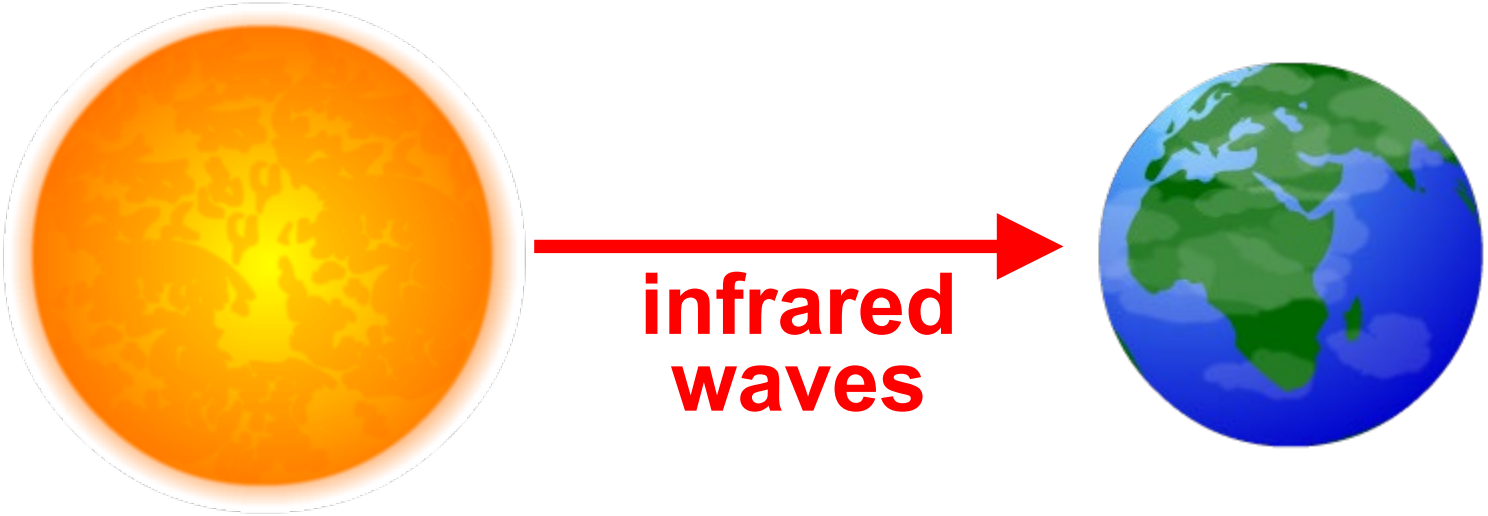
Radiation



How does heat travel through space?

The Earth is warmed by heat energy from the Sun.

How does this heat energy travel from the Sun to the Earth?



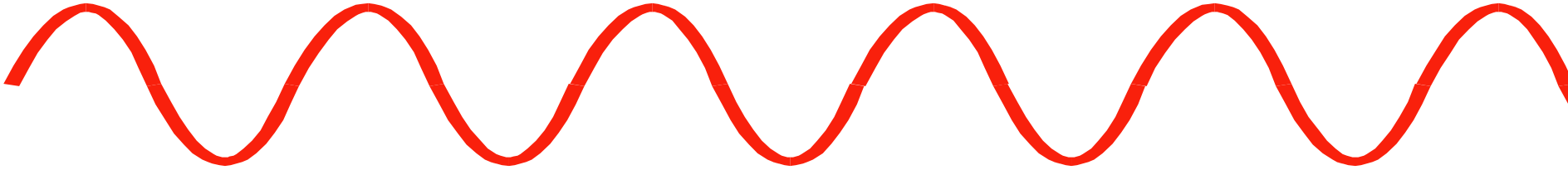
There are no particles between the Sun and the Earth, so the heat **cannot** travel by conduction or by convection.

The heat travels to Earth by **infrared waves**. These are similar to light waves and are able to travel through empty space.

What are infrared waves?

Heat can move by traveling as **infrared waves**.

These are electromagnetic waves, like light waves, but with a longer wavelength.



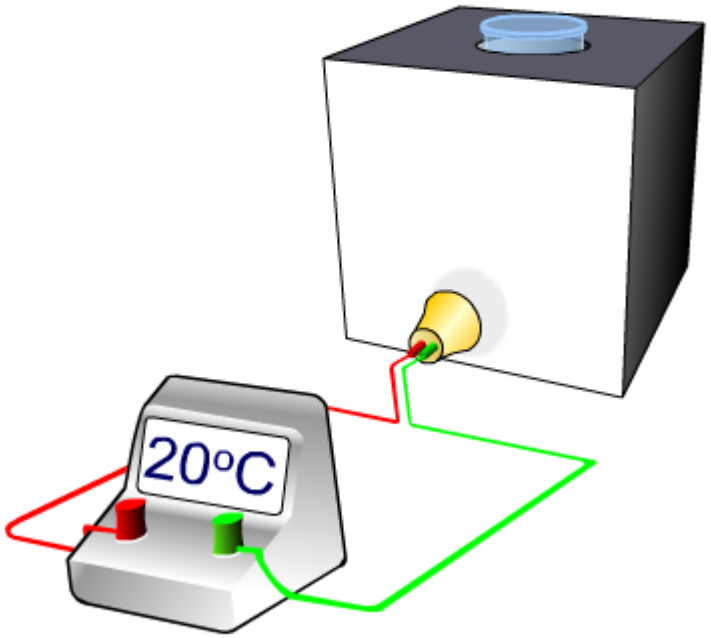
This means that infrared waves act like light waves:

- They can travel through a vacuum.
- They travel at the same speed as light – 300,000,000 m/s.
- They can be reflected and absorbed.

Infrared waves heat objects that **absorb** them and are also known as **thermal radiation**.

Investigating thermal emission

Do all surfaces emit the same amount of thermal radiation?



Surface of cube emitting thermal radiation	Final temp.
silver	°C
matte black	°C
white	°C
shiny black	°C

Emitting thermal radiation

All objects **emit** (give out) some thermal radiation.

Certain surfaces are better at **emitting** thermal radiation than others.

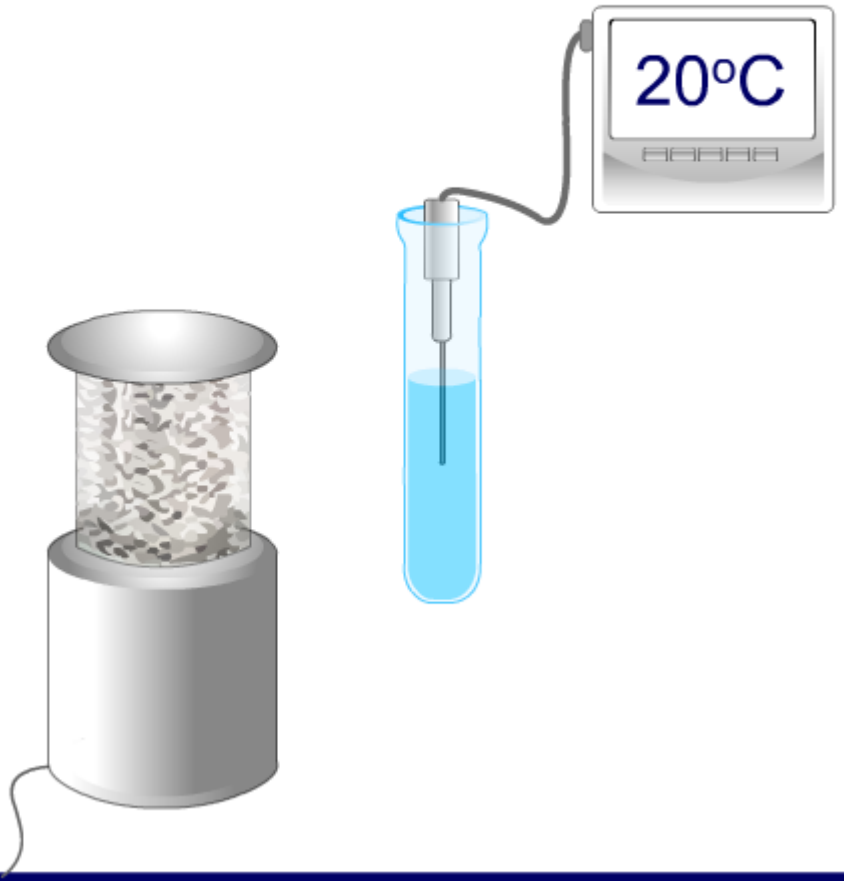
Matte black surfaces are the best emitters of radiation.

Shiny surfaces are the worst emitters of radiation.

Which type of kettle would cool down faster: a black kettle or a shiny metallic kettle?

Investigating thermal absorption

Do all surfaces absorb the same amount of thermal radiation?

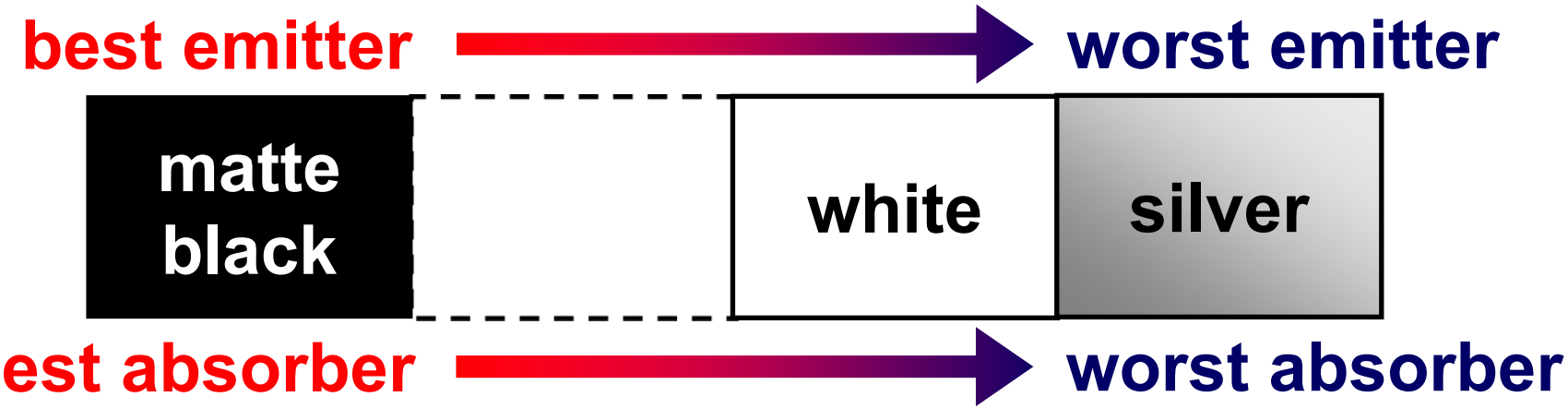


Surface on test tube absorbing thermal radiation	Final water temp.
silver	°C
matte black	°C
white	°C
shiny black	°C

Absorbing thermal radiation

Infrared waves heat objects that **absorb** (take in) them.

Certain surfaces are better at **absorbing** thermal radiation than others. Good emitters are also good absorbers.



Matte black surfaces are the best absorbers of radiation.

Shiny surfaces are the worst emitters because they reflect most of the radiation away.

Why are solar panels that are used for heating water covered in a black outer layer?

Infrared radiation – true or false?

Are these statements about infrared radiation true or false?

1.	Infrared radiation travels in straight lines.	
2.	Infrared radiation can travel through a vacuum.	
3.	Infrared radiation requires particles to travel.	
4.	Infrared radiation can travel through thick walls.	
5.	Matte surfaces are best at emitting infrared radiation.	
6.	Infrared radiation travels at the speed of light.	
7.	Shiny surfaces are best at emitting infrared radiation.	

true false

?

solve