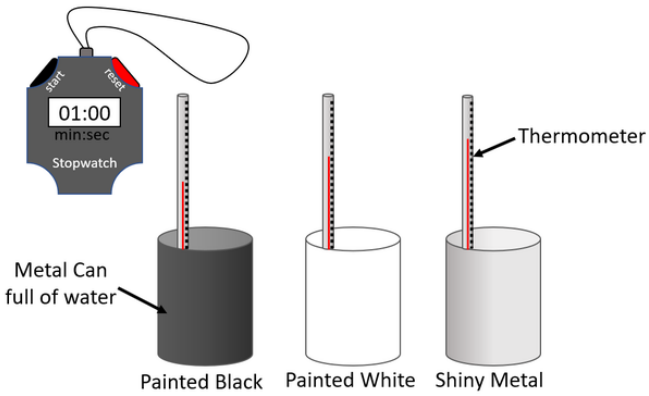
Radiation

Introduction:

Both conduction and convection need a material for the heat to travel. However, there must be another way for heat to travel since heat arrives from the Sun, which is almost 150 million km away, mostly through the vacuum of empty space. Heat can, therefore, travel through a vacuum. In other words, it does not need a material or particles to travel through. This method of heat travel is called Radiation. Heat energy is transferred as infrared radiation. Infrared radiation is part of the electromagnetic spectrum. This means that it is a wave that travels at the speed of light: $3x10^8$ m/s.

- Hot objects emit infrared radiation. (The hotter an object is the more infrared radiation it emits.)
- All objects absorb infrared radiation.



Materials:

- Two drinks cans of equal size (aluminium)
- Black paint (shiny/polished)
- Black paint (matt/dull)
- Infrared heater
- Hot water
- Thermometers
- 2 marbles or 2 rubber stoppers
- Wax or bluetack

Experiment 1: Which surfaces are best at emitting infrared radiation?

Procedure:

1. Fill each can with equal amounts of hot water
2. Put a thermometer in each one.
3. Let the cans cool down, side by side, stirring them occasionally.
4. Record the temperature every minute or two, over a time period of 10 to 15 minutes.

Time in minutes	Temperature of water in shiny can in ^{0}C	Temperature of water in dull black can in ^{0}C

5. Answer the following Questions:

Q1. Which can cools down more quickly?

_____
_____
_____

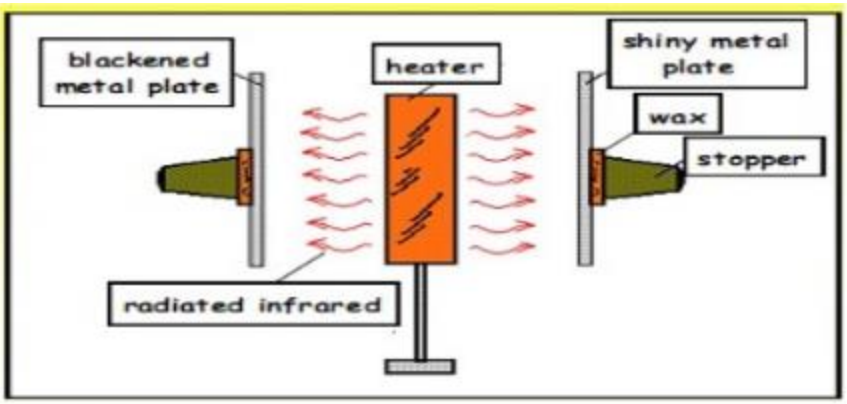
Q2. Which can is radiating heat energy more quickly?

_____
_____
_____

Experiment 2: Which surfaces are best at absorbing infrared radiation?

Procedure:

1. Remove the top and bottom of the drinks can. Open out the material t ocreat two identical plates of metal.
2. Place the two metal plates equal distances from an infrared heater. One should be painted black and one left shiny.
3. On the back of each plate a marble is stuck using wax (see diagram 1)



Digram 1: When the heater is switched on, both plates receive the same amount of radiated heat (infrared radiation).

4. Answer the following questions

Q1. Which marble/stopper dropped from what plate first?

_____
_____

Q2. Which plate is better at absorbing radiated heat?

_____
_____

Discussion:

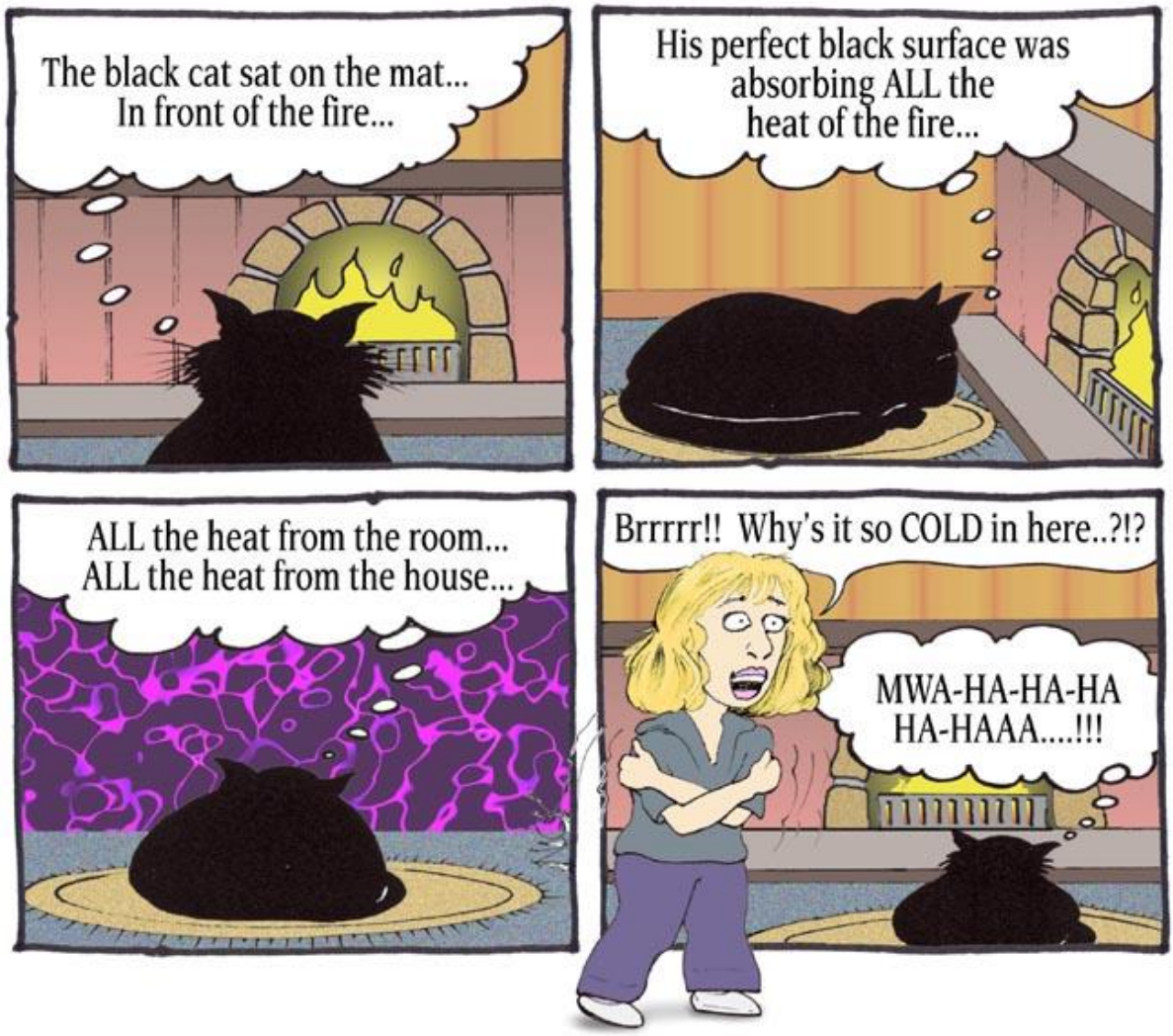
1. _____ surfaces are the best emitters of infrared radiation
2. _____ surfaces are the worst emitters of infrared radiation
3. _____ surfaces are the best absorbers of infrared radiation.
4. Shiny, white or silver surfaces are the _____absorbers of infrared radiation.
5. Why is it good for some fire-fighting suits to be bright and shiny?

_____
_____
_____

6. Should a teapot be bright and shiny or dull black? Explain your answer.

_____
_____
_____

7. Why is tarmac hotter in the summer than concrete?


The black cat sat on the mat...
In front of the fire...
His perfect black surface was absorbing ALL the heat of the fire...
ALL the heat from the room...
ALL the heat from the house...
Brrrrr!! Why's it so COLD in here..?!?
MWA-HA-HA-HA HA-HAAA.....!!!