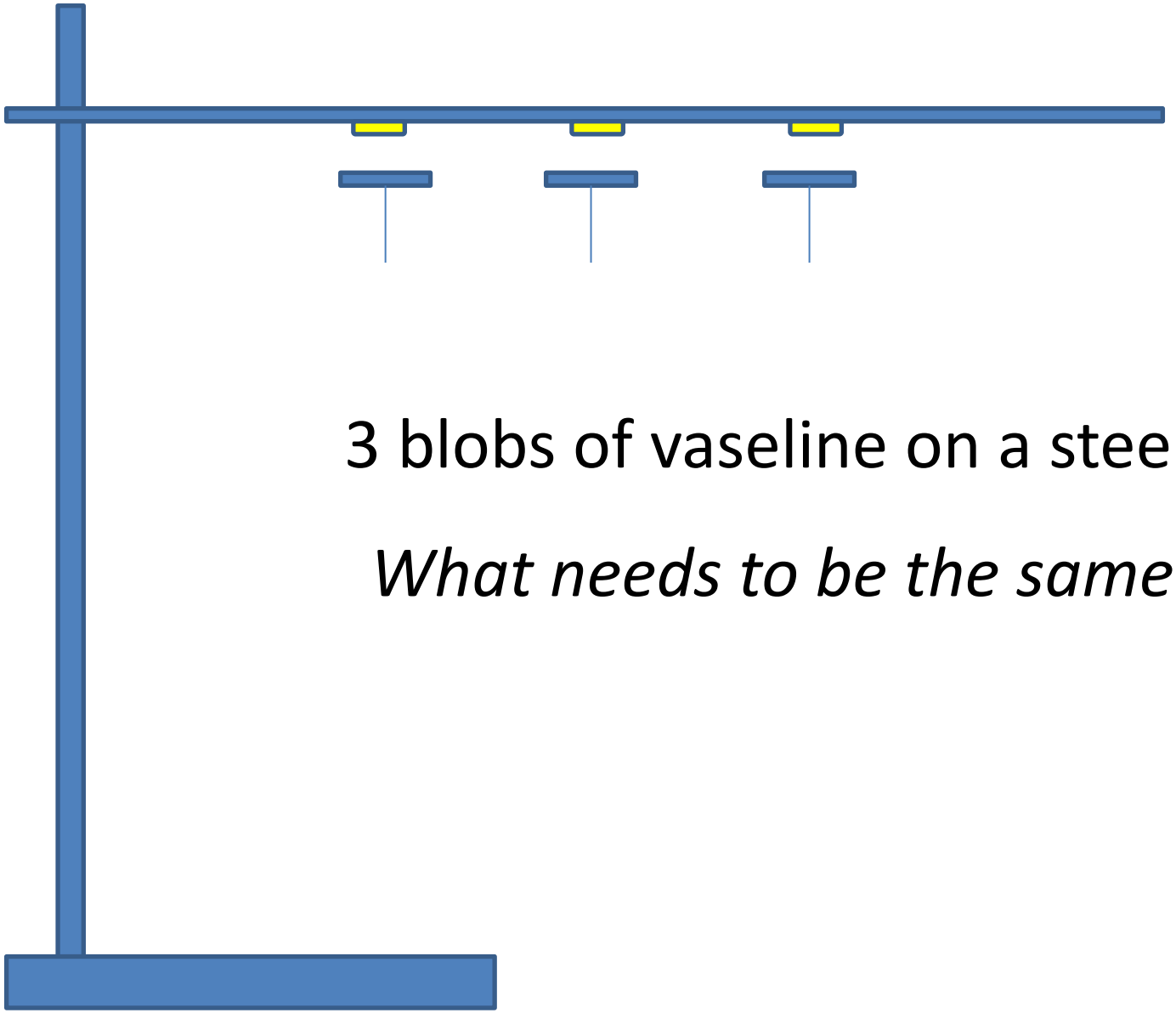
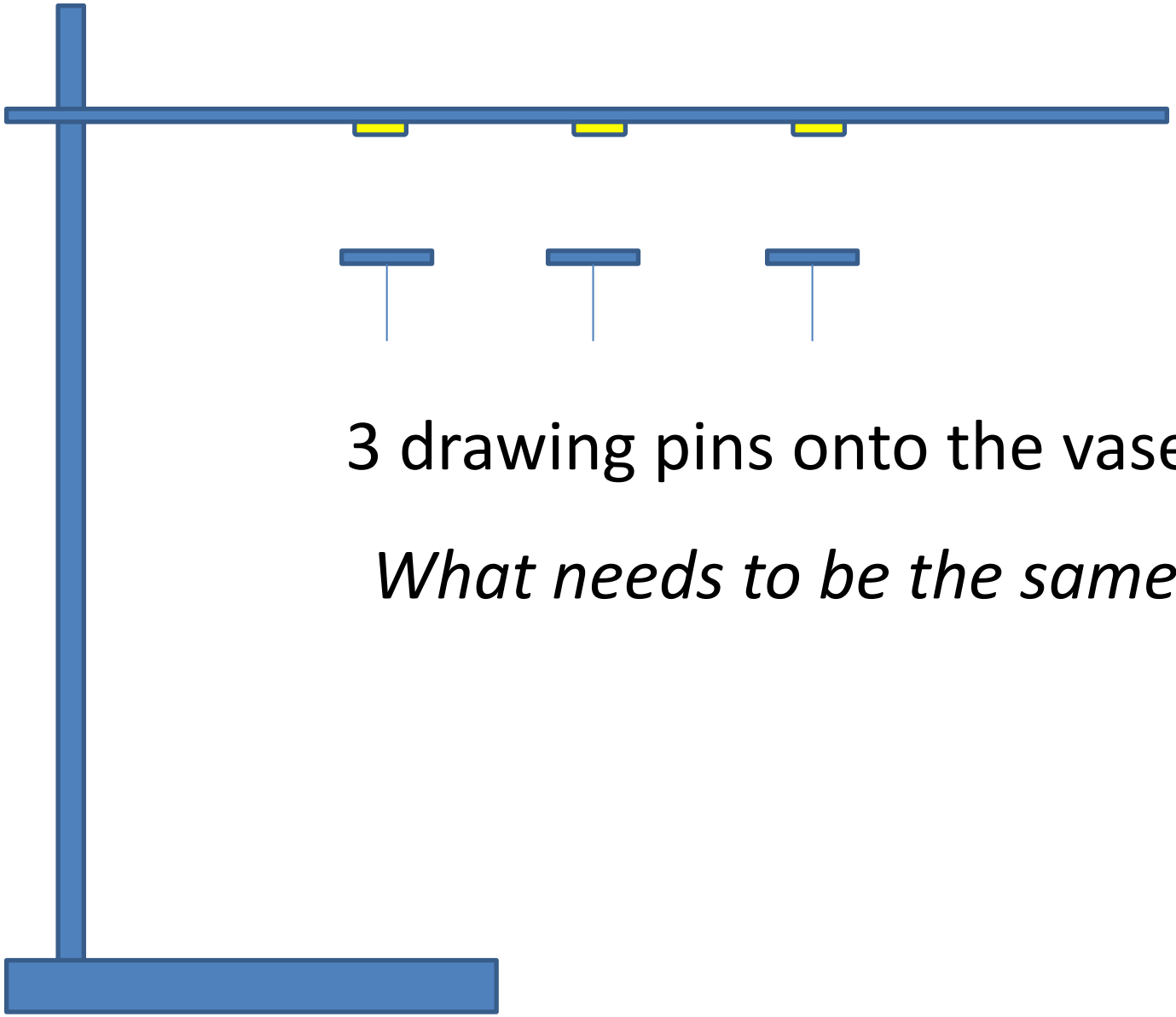
Target - **Demonstrate** conduction



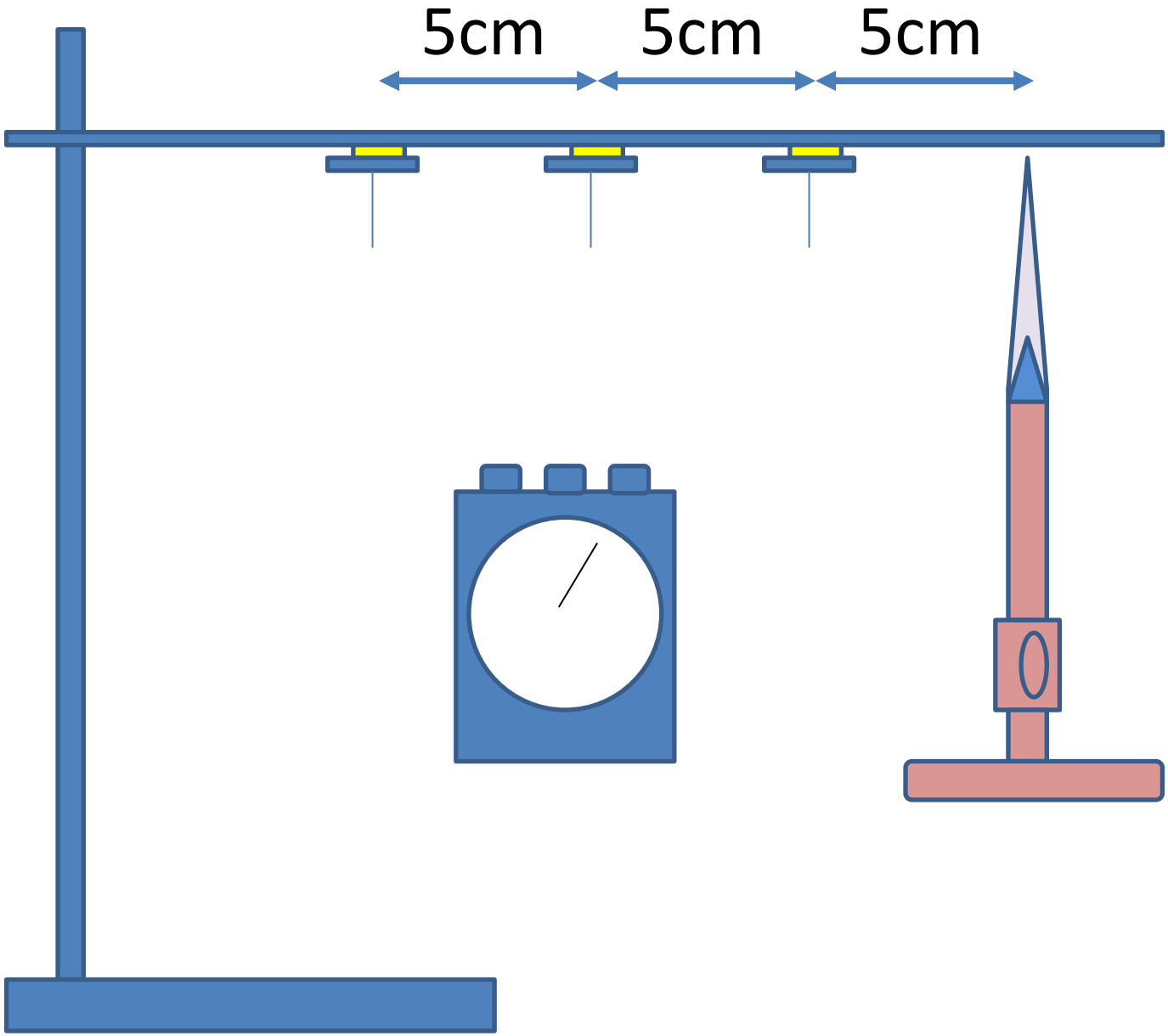
3 blobs of vaseline on a steel rod

What needs to be the same?



3 drawing pins onto the vaseline

What needs to be the same?


5cm
5cm
5cm

Measuring the speed of conduction

Distance from heating point (cm)	Time for drawing Pin to fall (s)
5	
10	
15	

Measuring the speed of conduction

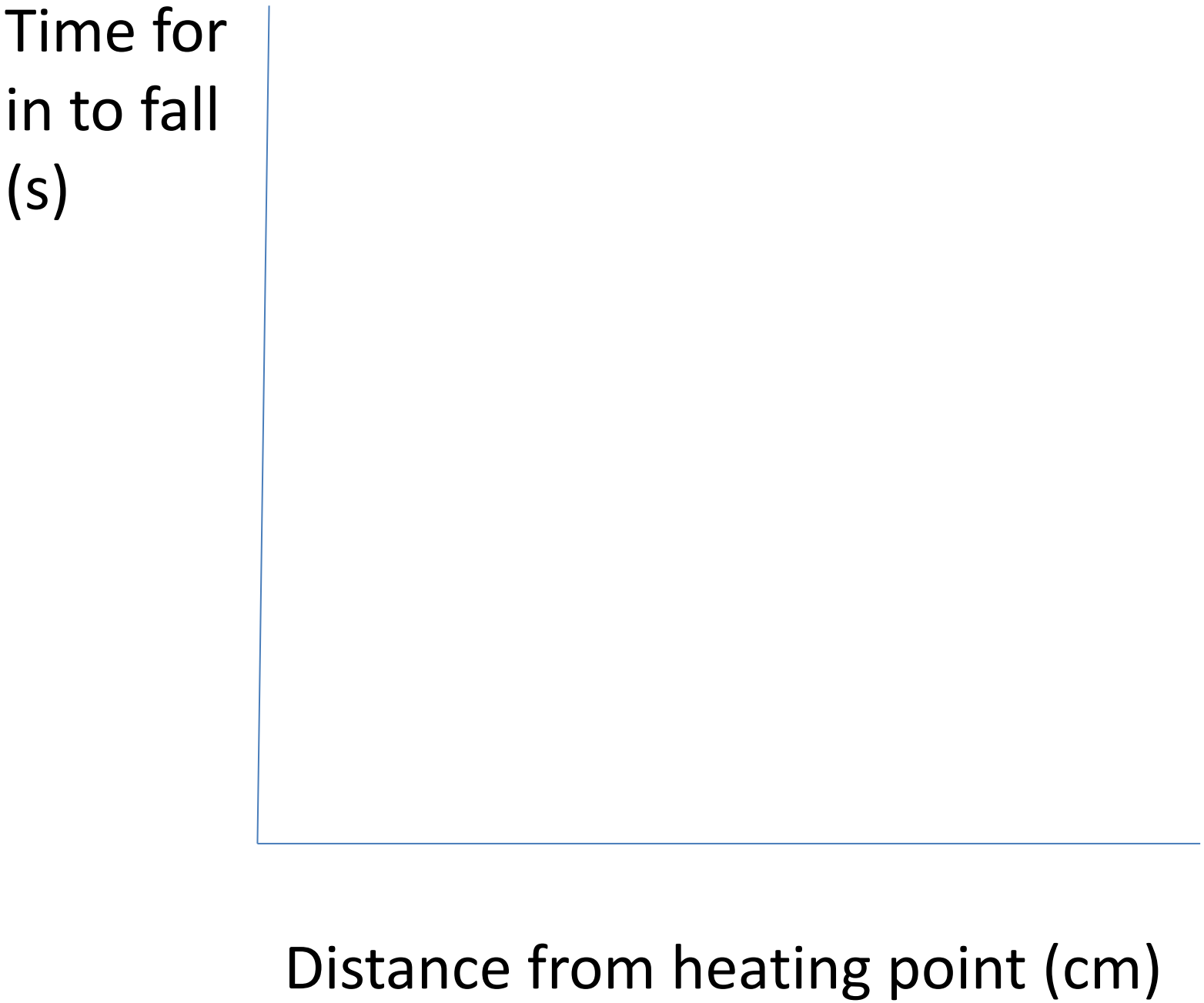
Distance from heating point (cm)	***Average*** Time for drawing Pin to fall (s)
5	
10	
15	

Graphing my results –

What type of graph?

Which way round?

What scales do I need ?


Time for in to fall (s)
Distance from heating point (cm)

Conclusion *(what my results mean)*

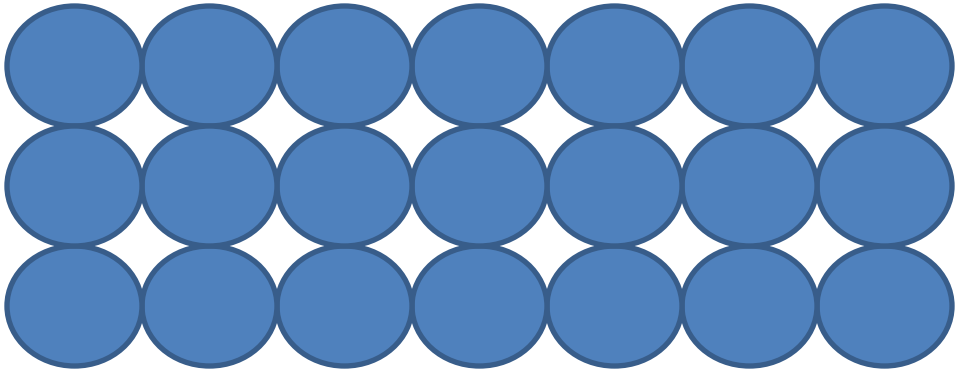
As the distance from the heating point increases, the time for the pins to fall .....

Answer in **sentences** in your jotter –

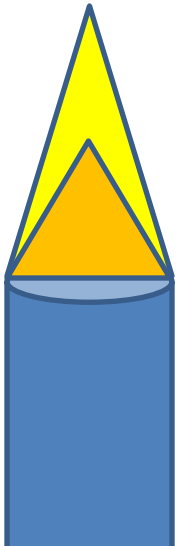
- *Why did your mean horrible teacher insist on using the **class averages** to plot the graph?*

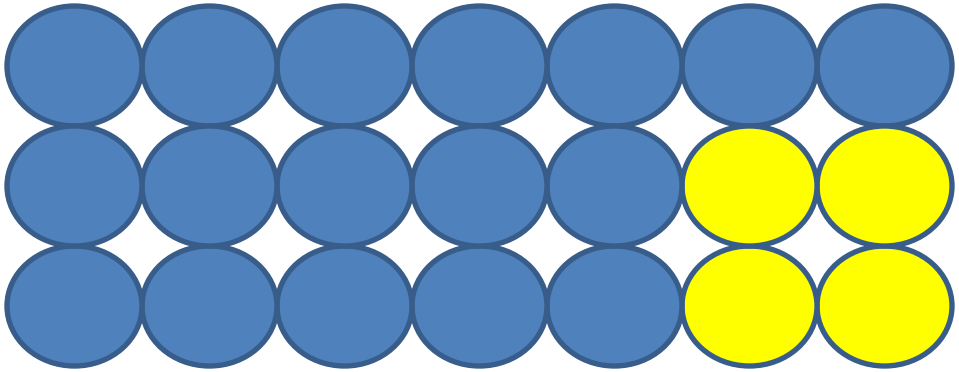
- ***Predict** how long the pin would have stayed on if it was 20cm from the point of heating.*

- ***List** 2 changes you could make to the experiment to make the results more reliable.*

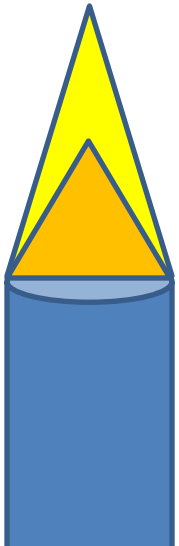


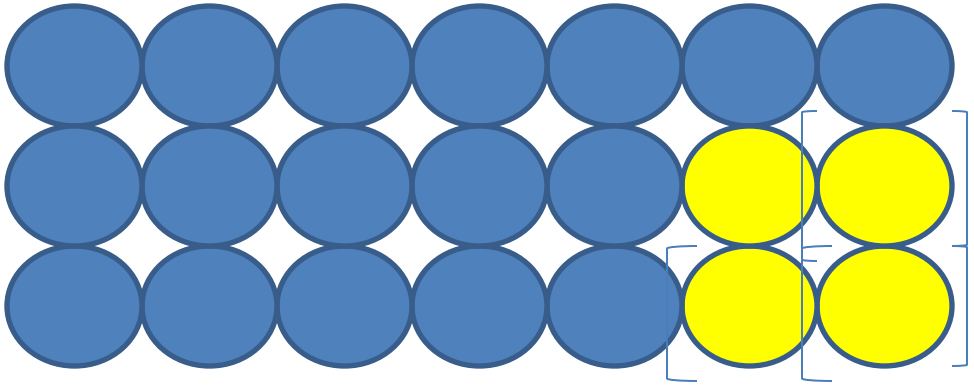
If you heat the solid here …



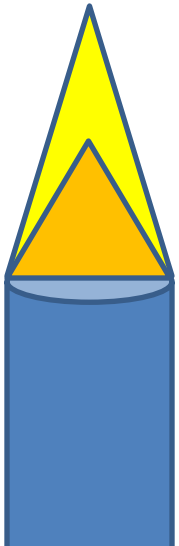


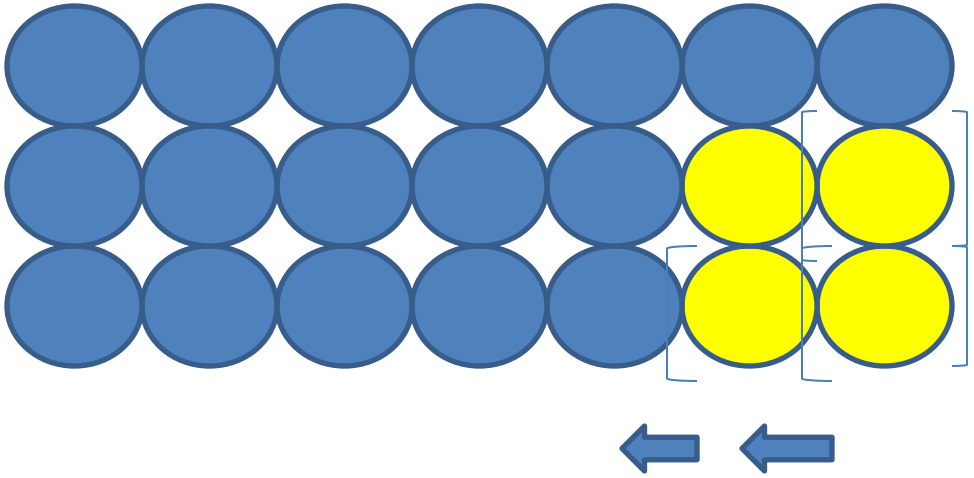
The particles get more heat energy…



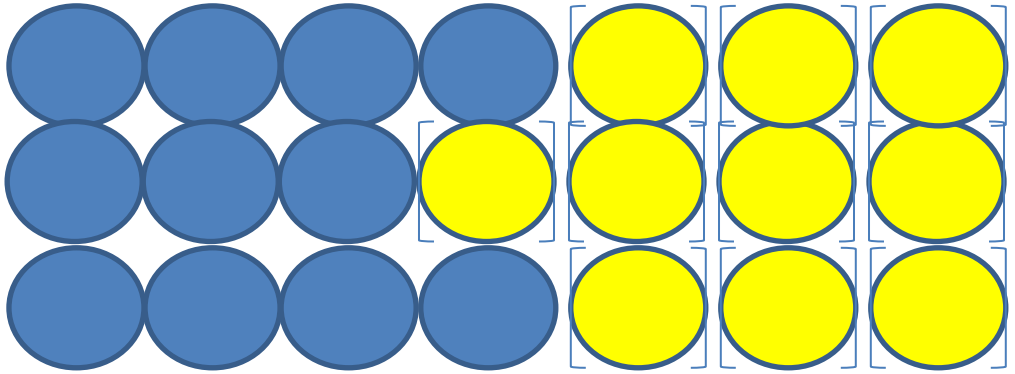


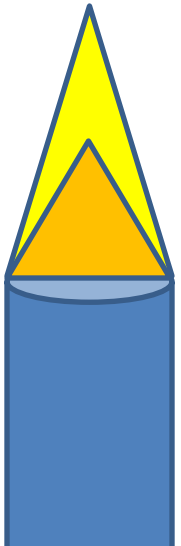
This makes them move around more by vibrating …



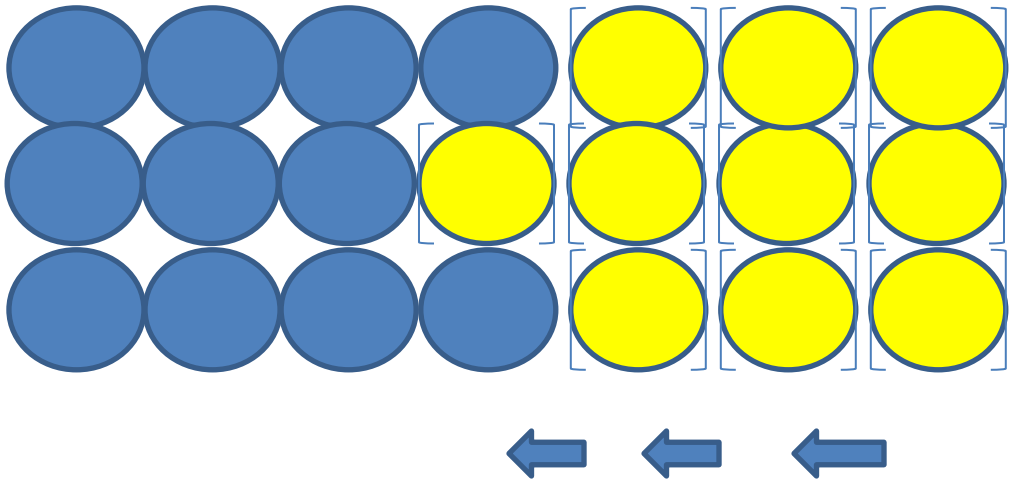


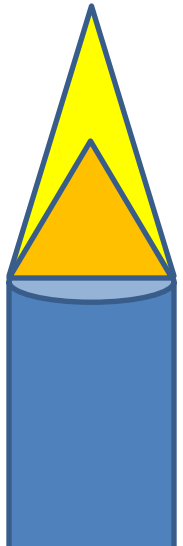
So they bump into the particles next to them and push them away…





As each the particles are heated more, the vibrations are passed from one particle to the next.





This means that heat always moves from the hottest area to cooler areas.

Recording conduction

- Each group gets a sheet of A3 (big) paper and some felt pens.
- Your task is to produce a story board of 3 or 4 diagrams to show how particles carry heat in a solid.
- Your story board should be made up of diagrams with notes below each to describe what is taking place.

Heat moving in solids

The way heat moves in solids is called _____. This only works on solids because he particles cannot _____.
As the particles are heated they start to _____. The vibrations are passed from one particle to the _____. This means that heat moves from the warmest places to the _____.

Heat moving in solids

The way heat moves in solids is called **conduction**. This only works on solids because he particles cannot **move**.
As the particles are heated they start to **vibrate**. The vibrations are passed from one particle to the **next**. This means that heat moves from the warmest places to the **coldest**.

Target - Design an investigation

Aim – *to compare conduction rates in different materials*

Design an investigation –

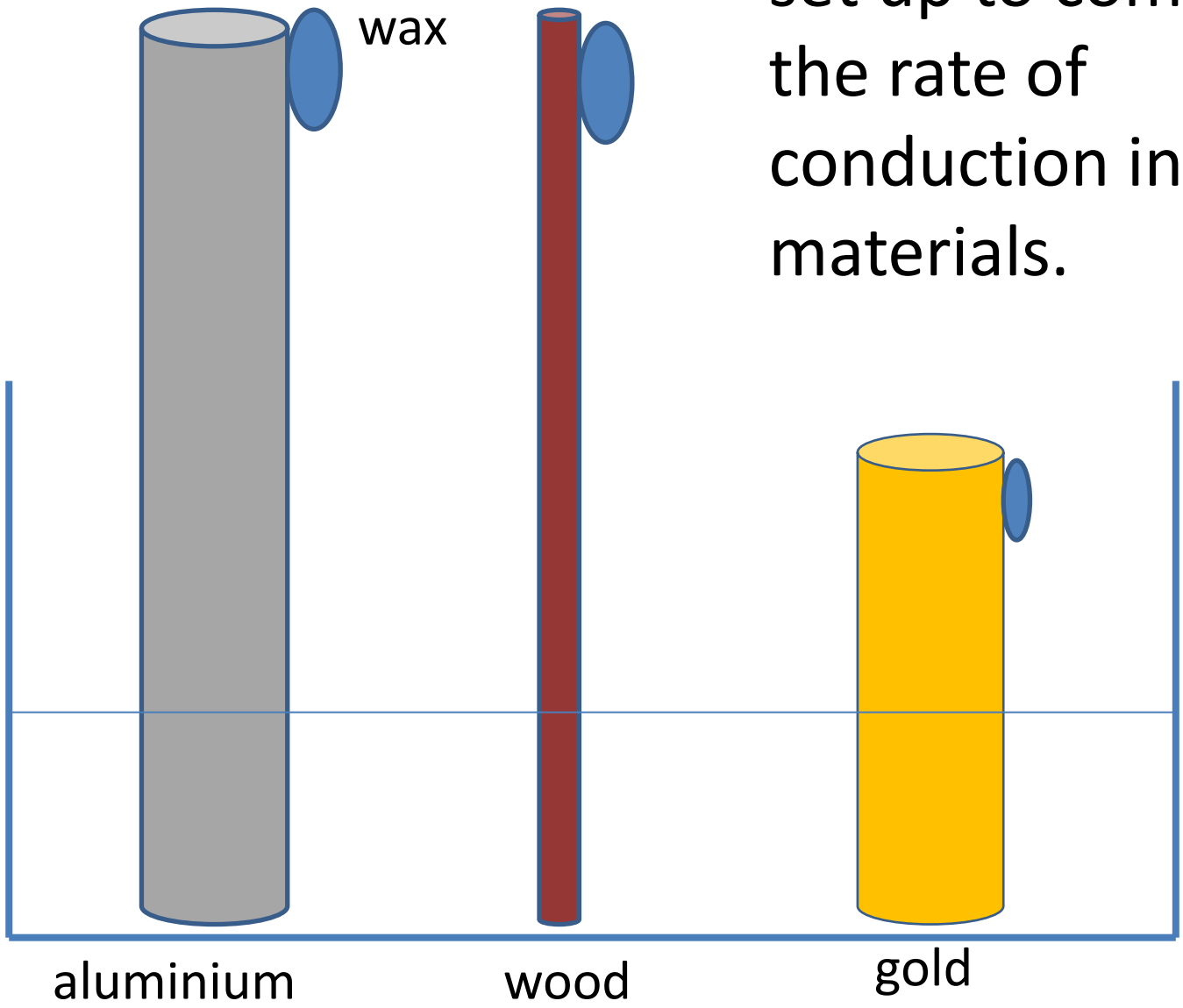
Aim – to compare conduction in different materials

You are supplied with –

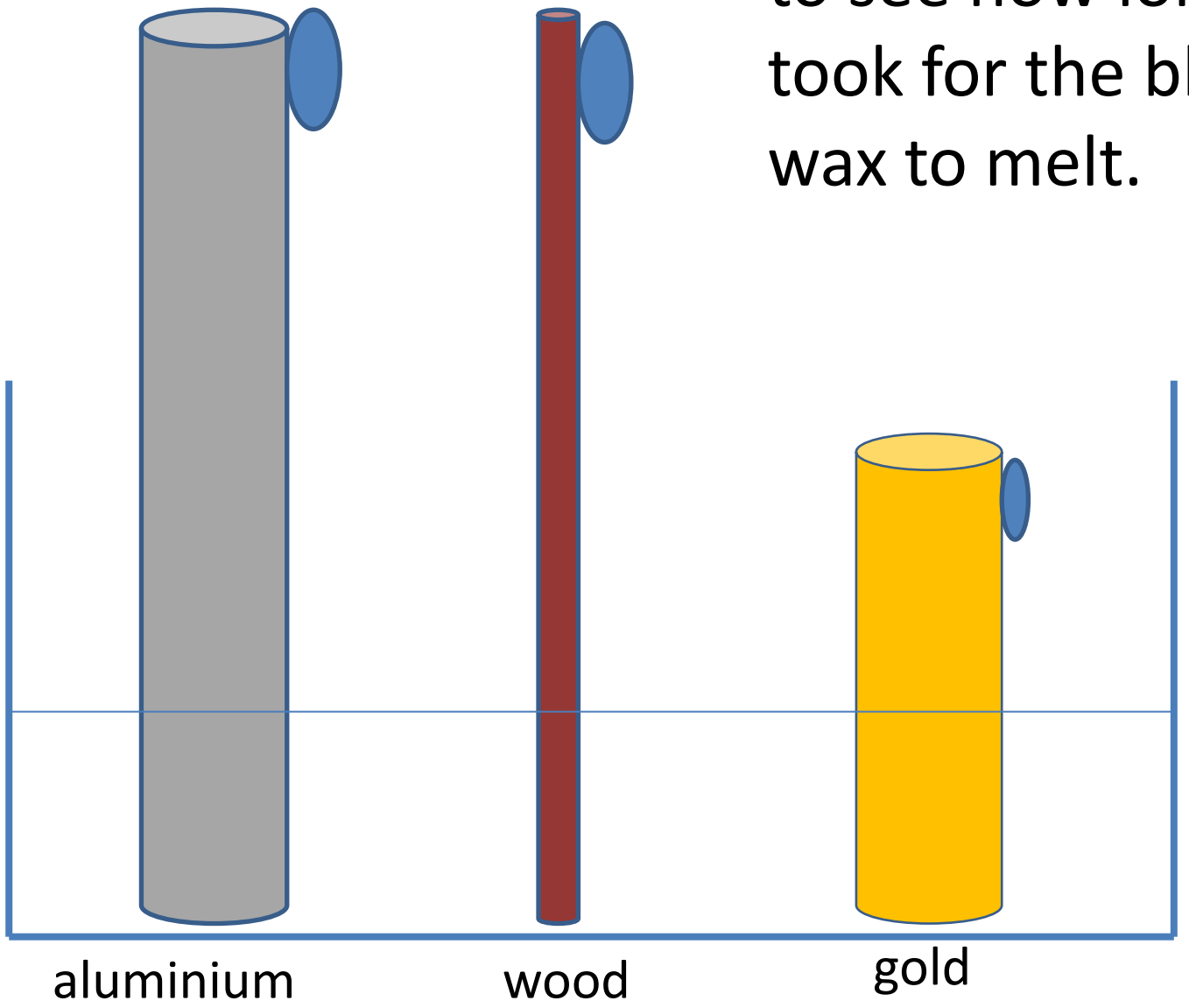
- Rods of different materials
- Vaseline
- Drawing pins
- Bunsen burner
- Clamp stand
- Stop watch

Use **notes** and **diagrams** to describe how you would set up an experiment to **compare** conduction in iron and copper

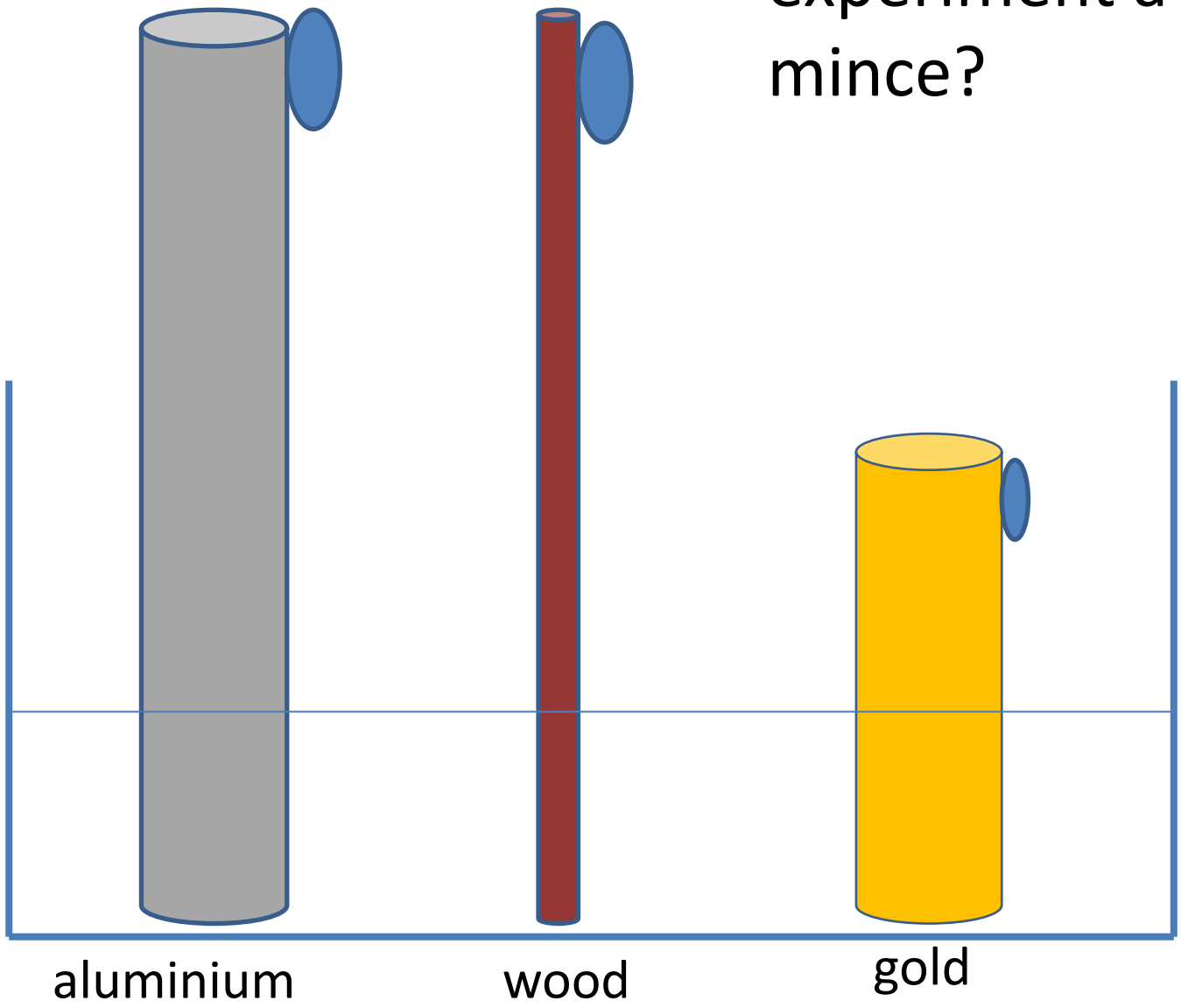
This experiment was set up to compare the rate of conduction in 3 materials.



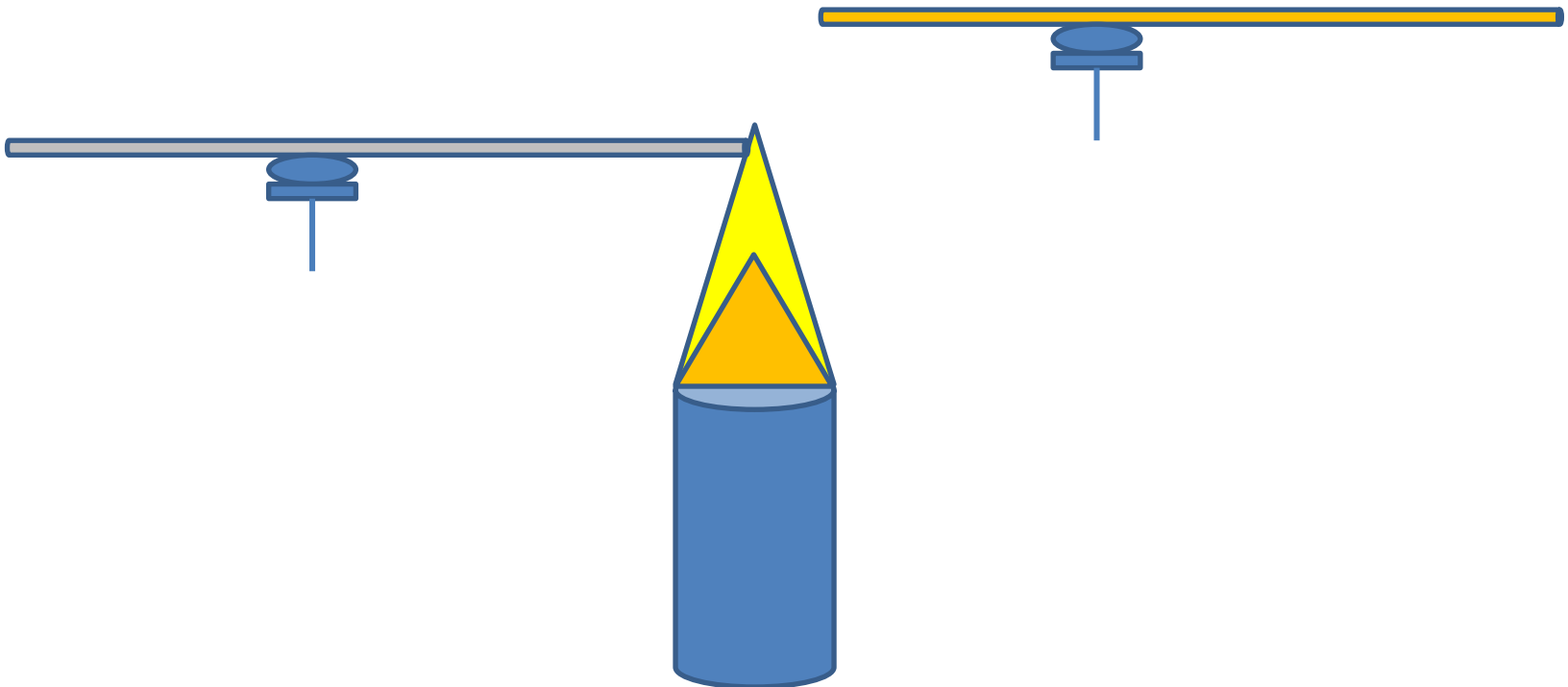
The time was taken to see how long it took for the blobs of wax to melt.



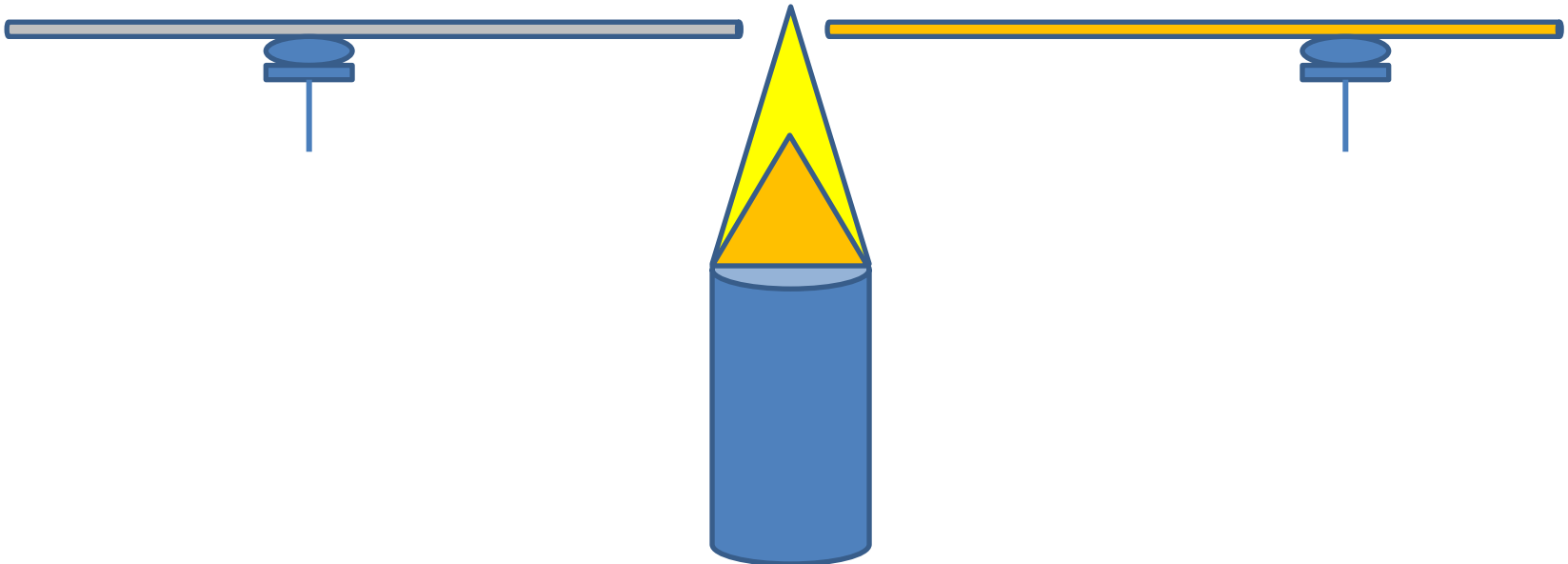
Why is this experiment a load of mince?



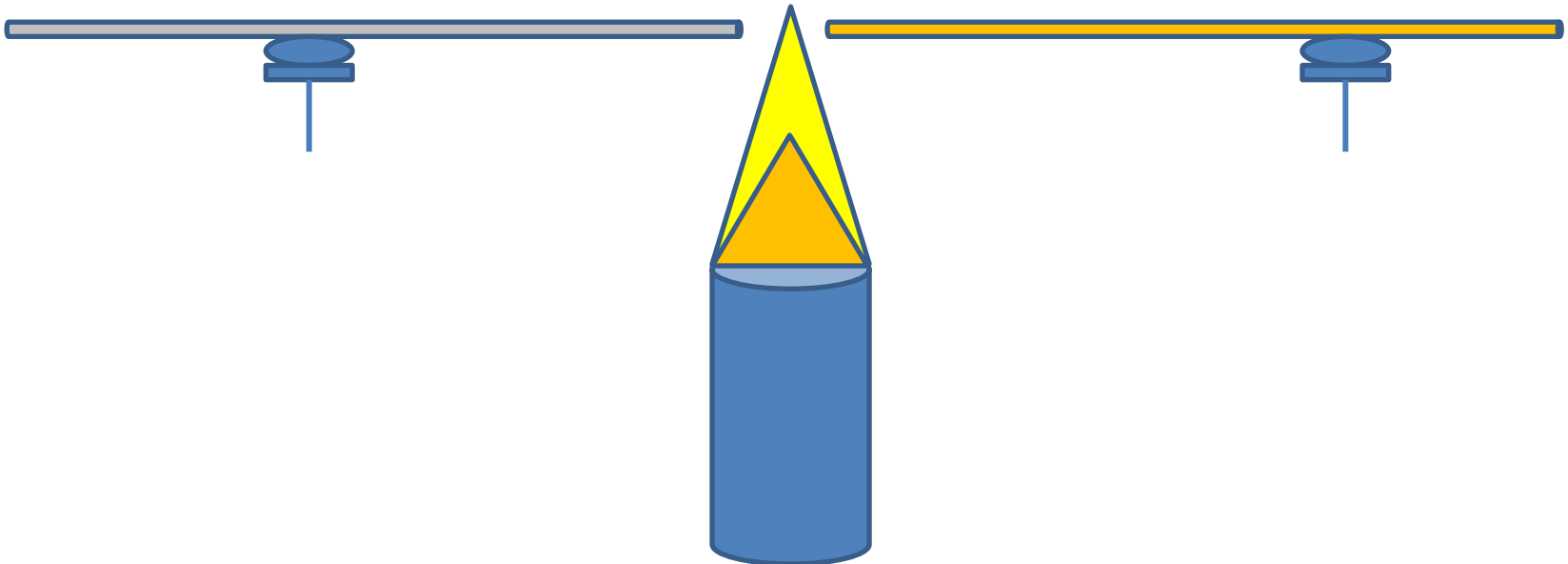
What would you need to ***keep the same*** to make the experiment ***fair***?



What would you ***measure*** to get the ***results*** for the experiment?



How would you make sure that each bar got exactly the ***same quantity of heat***?



Comparing conduction in different materials

Material	time for pin to fall (s)

Conclusion -

Target – ***Describe*** conduction in context

- I can explain how conduction is considered in the design of some common items. I can explain how the choice of material makes it good for its job.
- I can describe how conduction is used in the design of some common items. I can identify conductor and insulator parts.
- I can identify conductor and insulator parts in some common household items.

Conduction

Conduction is how heat travels through _____. This works because the particles are so _____ that they touch. Heat energy makes the particles _____. These _____ are passed from one particle to the next. This makes heat move from the _____ areas to the _____.
Materials which let heat through easily are called _____.
Materials which do not let heat through easily are called _____.
Metals are all good _____ of heat.

Conduction

Conduction is how heat travels through **solids**. This works because the particles are so **close** that they touch. Heat energy makes the particles **vibrate**. These **vibrations** are passed from one particle to the next. This makes heat move from the **hottest** areas to the **coldest**.

Materials which let heat through easily are called **insulators**.

Materials which do not let heat through easily are called **conductors**.

Metals are all good **conductors** of heat.

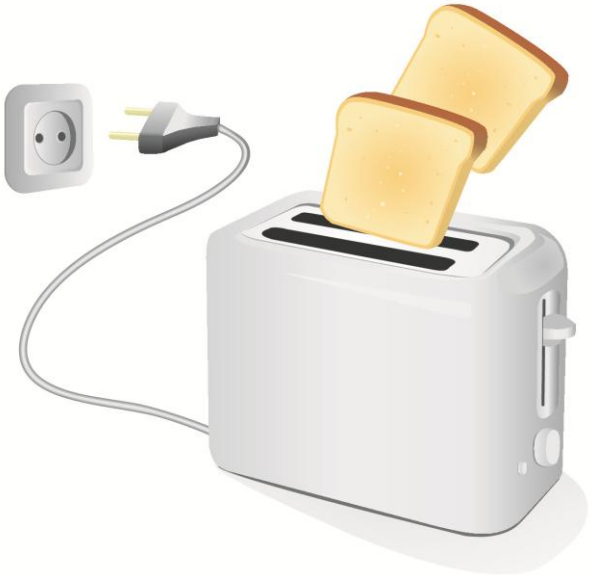
Conduction in action

Materials which *let heat travel* through them easily are called **conductors**. Materials which *resist* the flow of heat are called **insulators**.
Some common items are designed with some parts which **conduct** heat and others which act as **insulators**.

- For each of these items **describe** which parts are conductors and which are insulators
- **Explain** how different materials have been used as conductors and as insulators.

*This could be done as a **table** or a series of **diagrams and notes***


morphy richards

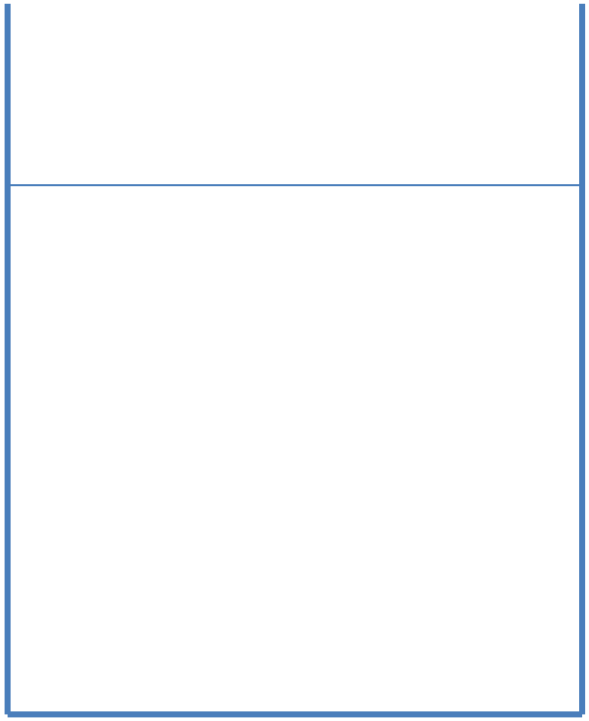


Pick one object **of your own** to show how different areas of conductors and insulators are used as part of the job of the object.

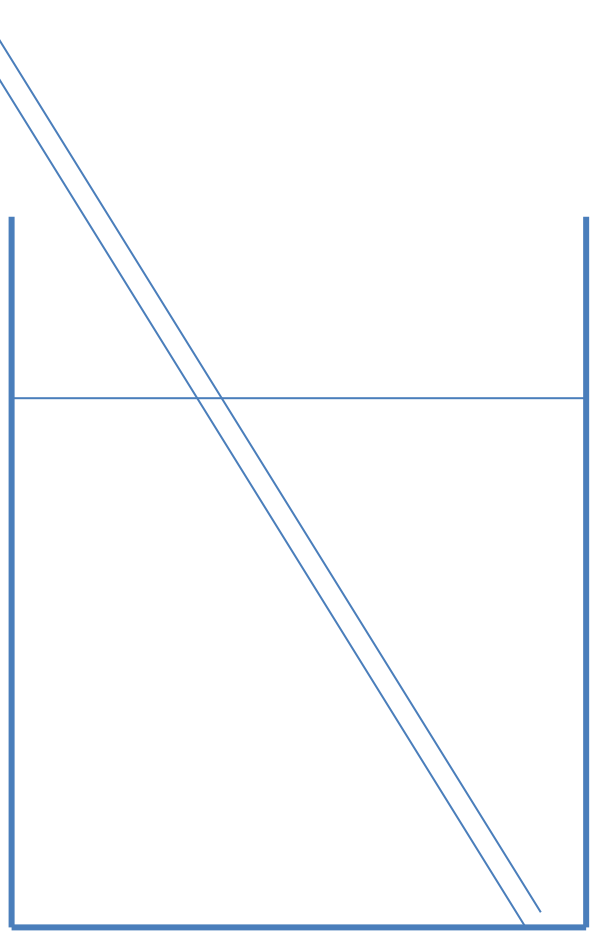
Draw a **sketch diagram** and **write a sentence or two to explain** how the ideas of conduction and insulation are used in the *design* of the object

Target – Exemplify convection

How does heat travel in **liquids**?

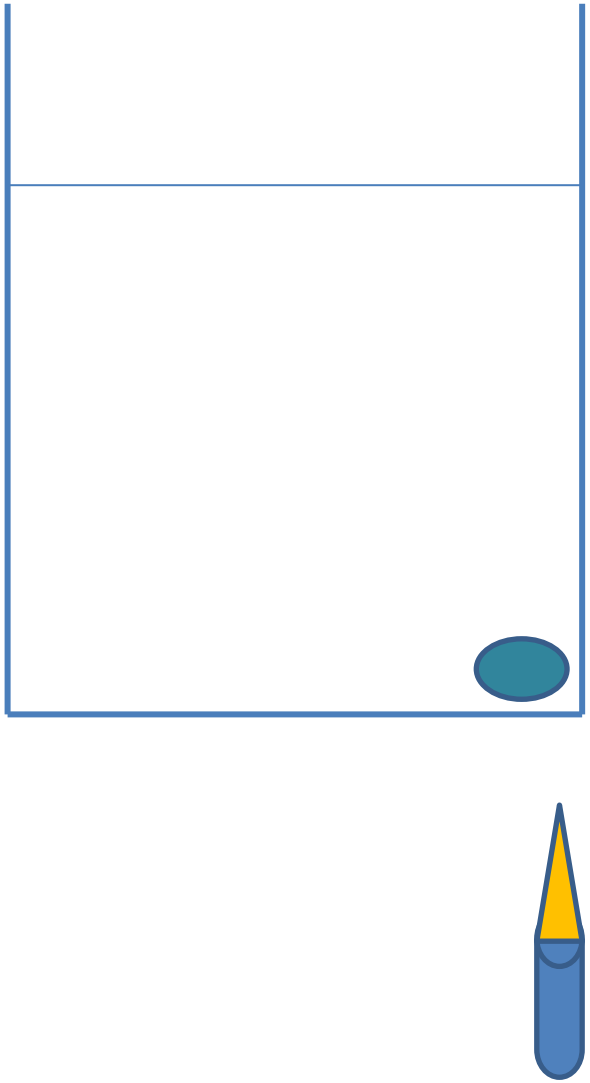


How does heat travel in **liquids**?

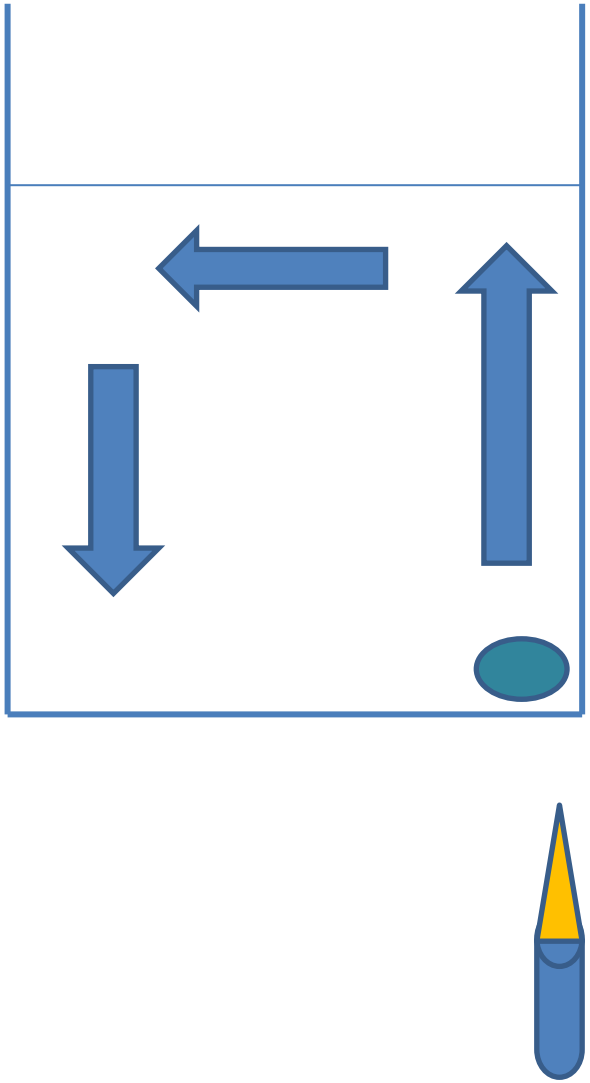


- purple crystal
- big tube

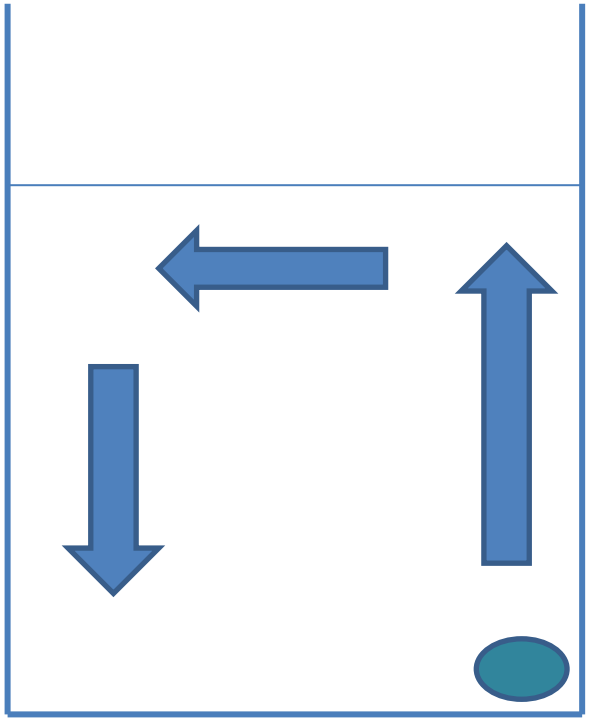
How does heat travel in **liquids**?



How does heat travel in **liquids**?



How does heat travel in **liquids**?



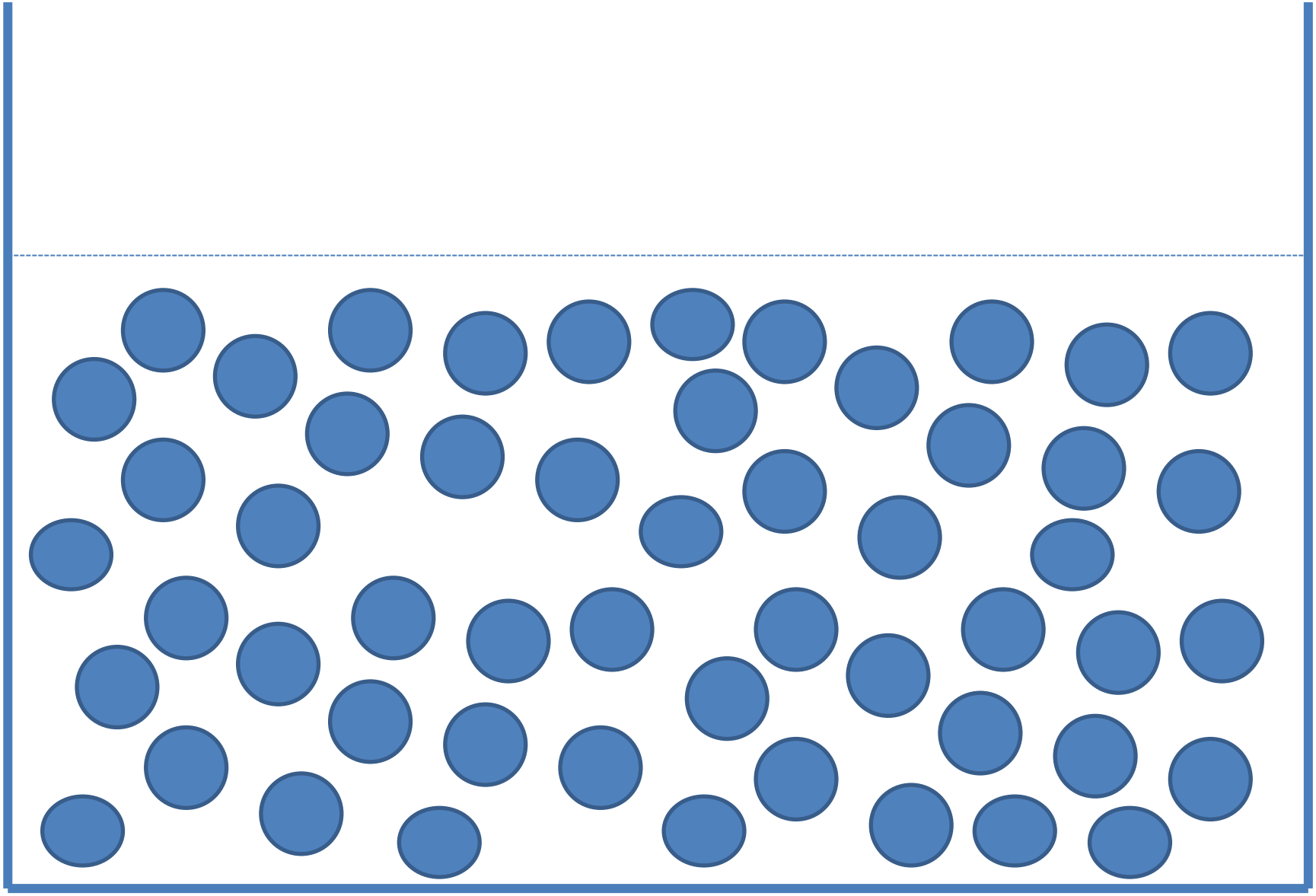
Heat travels in liquids by **convection**.

Convection makes hot liquids **rise**.

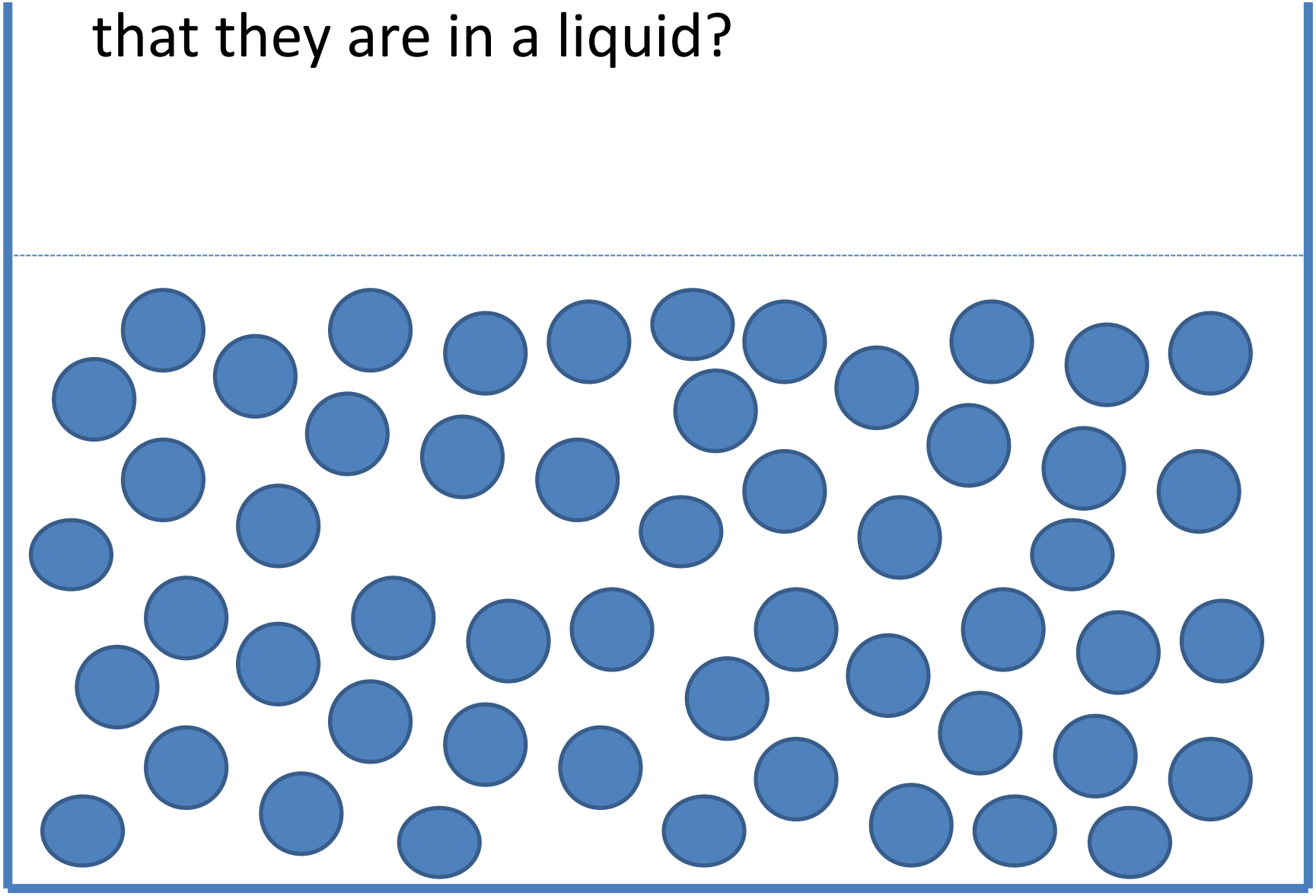
Colder liquids then flow in to replace them.

This creates a **convection current.**

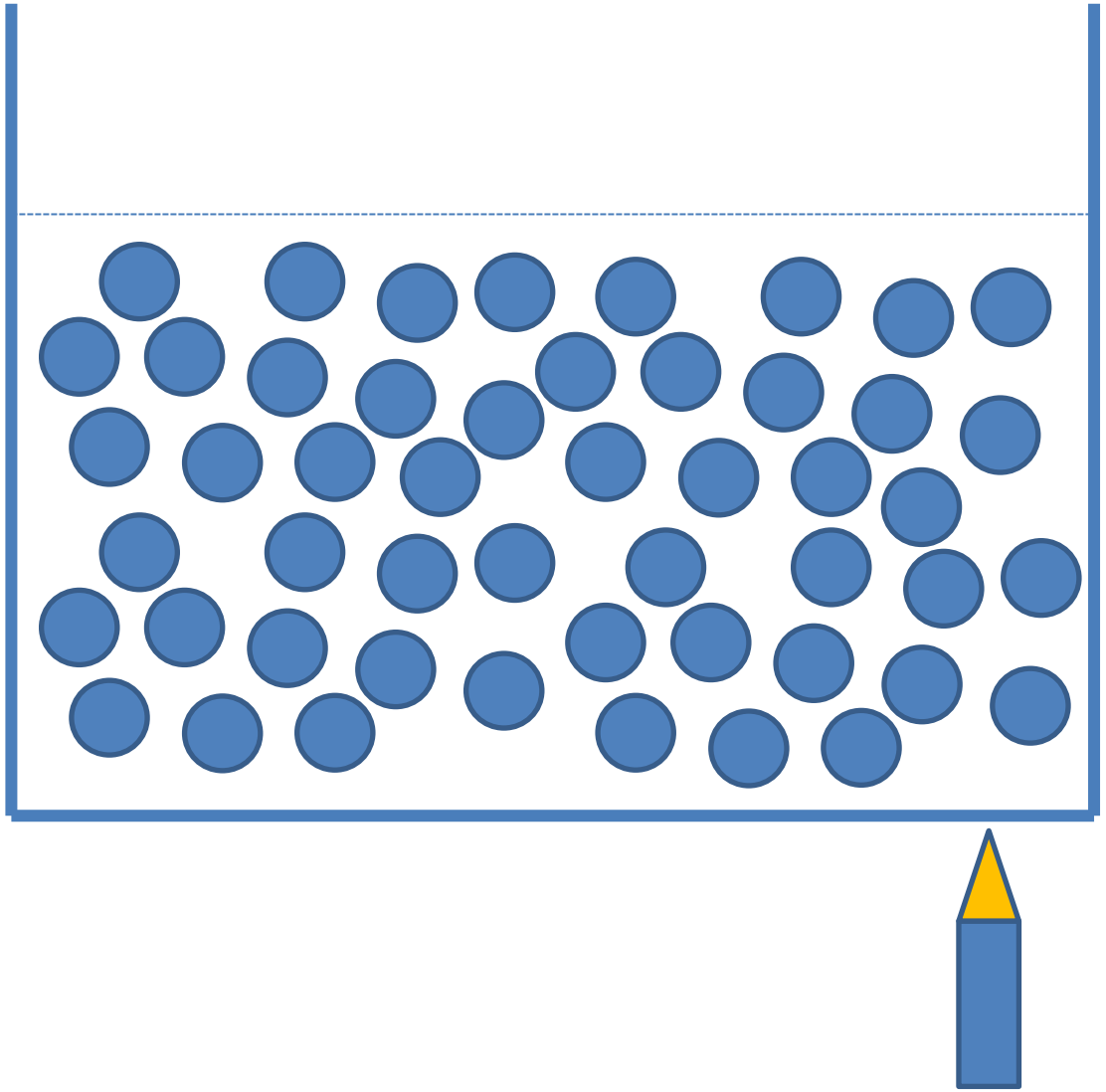
How does the particle model explain convection?



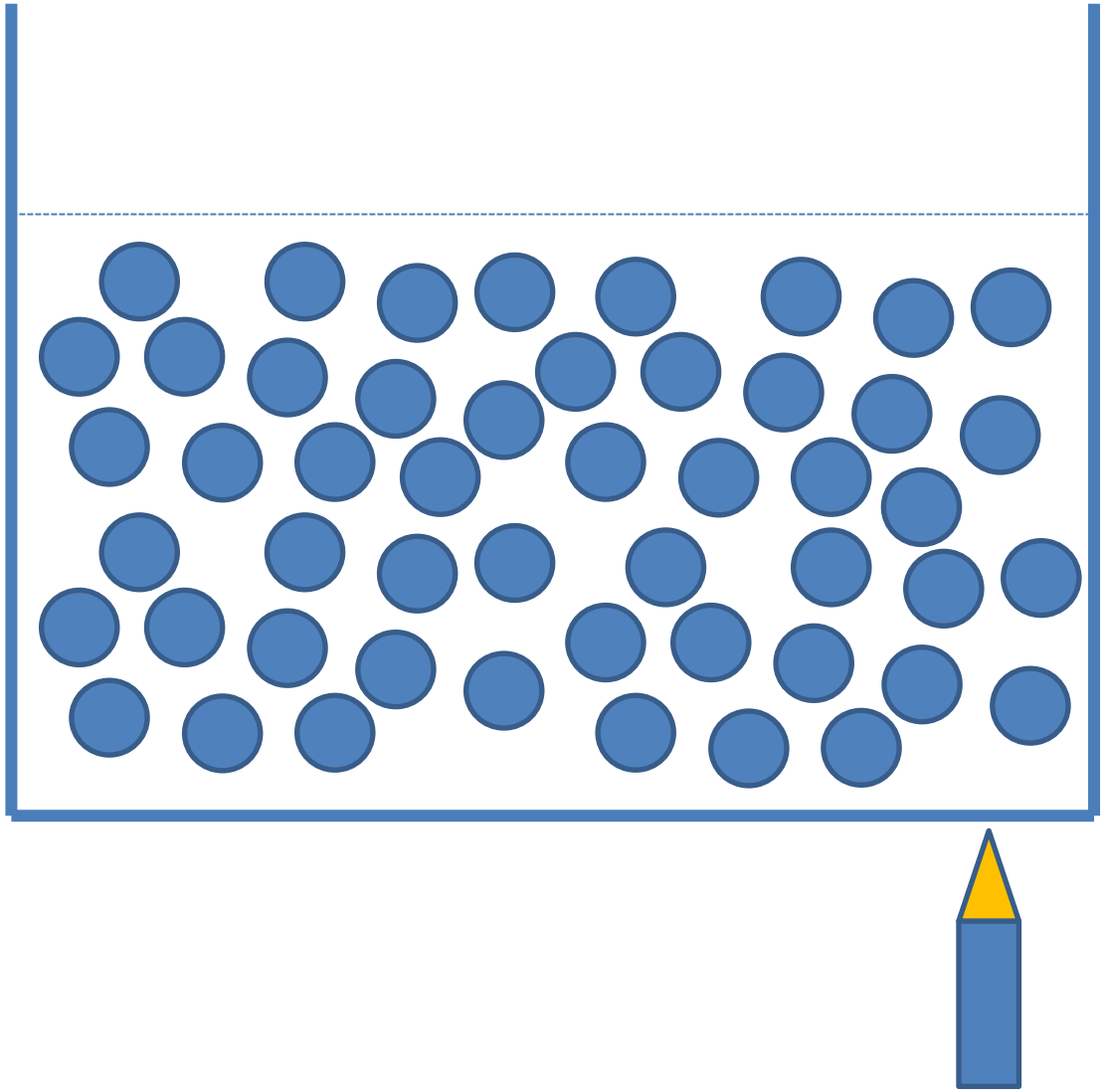
What features of the particles tell you that they are in a liquid?



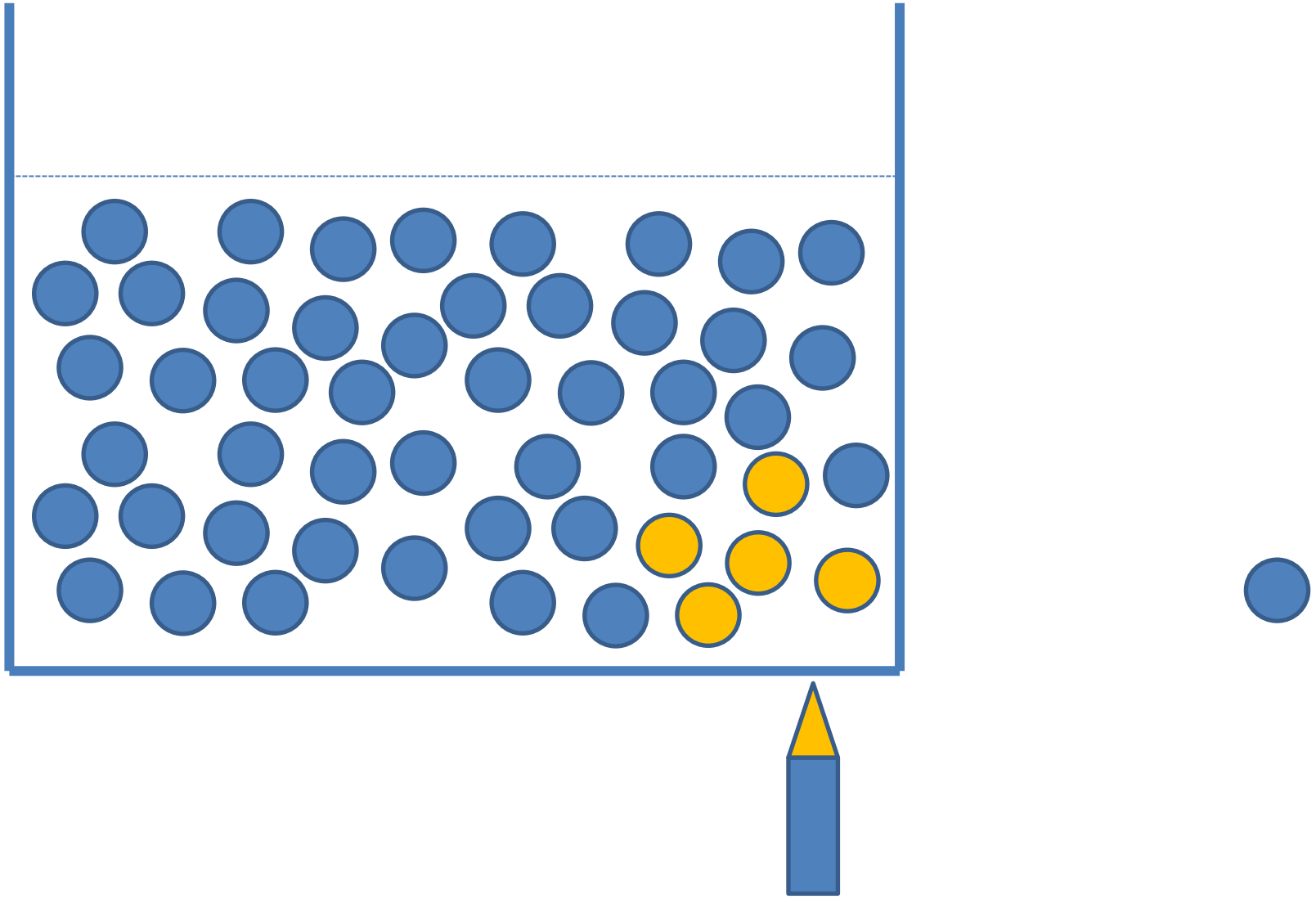
When you heat particles in a liquid, you give them more .... energy.



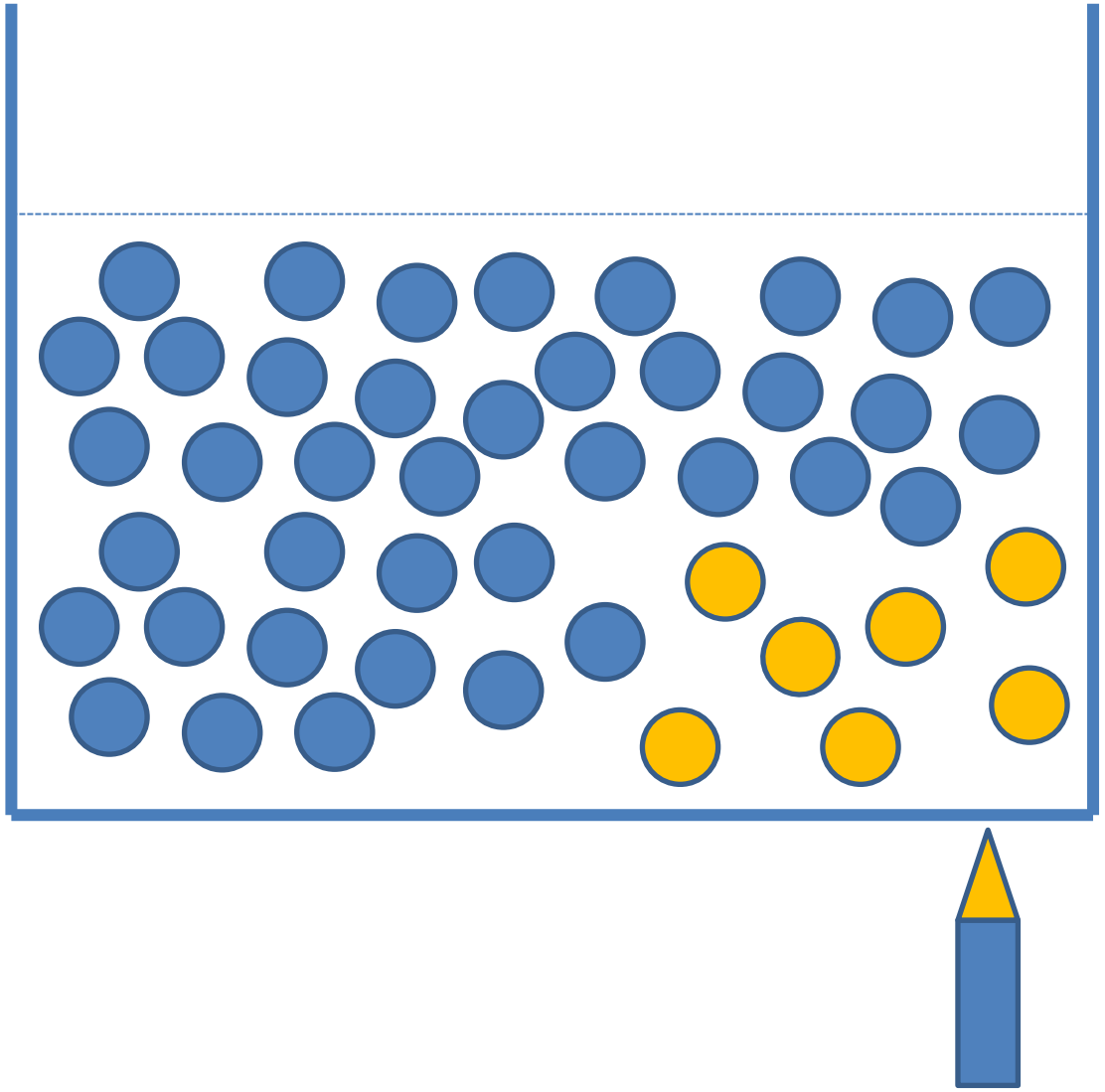
When the particles get more energy, they move around .... more .



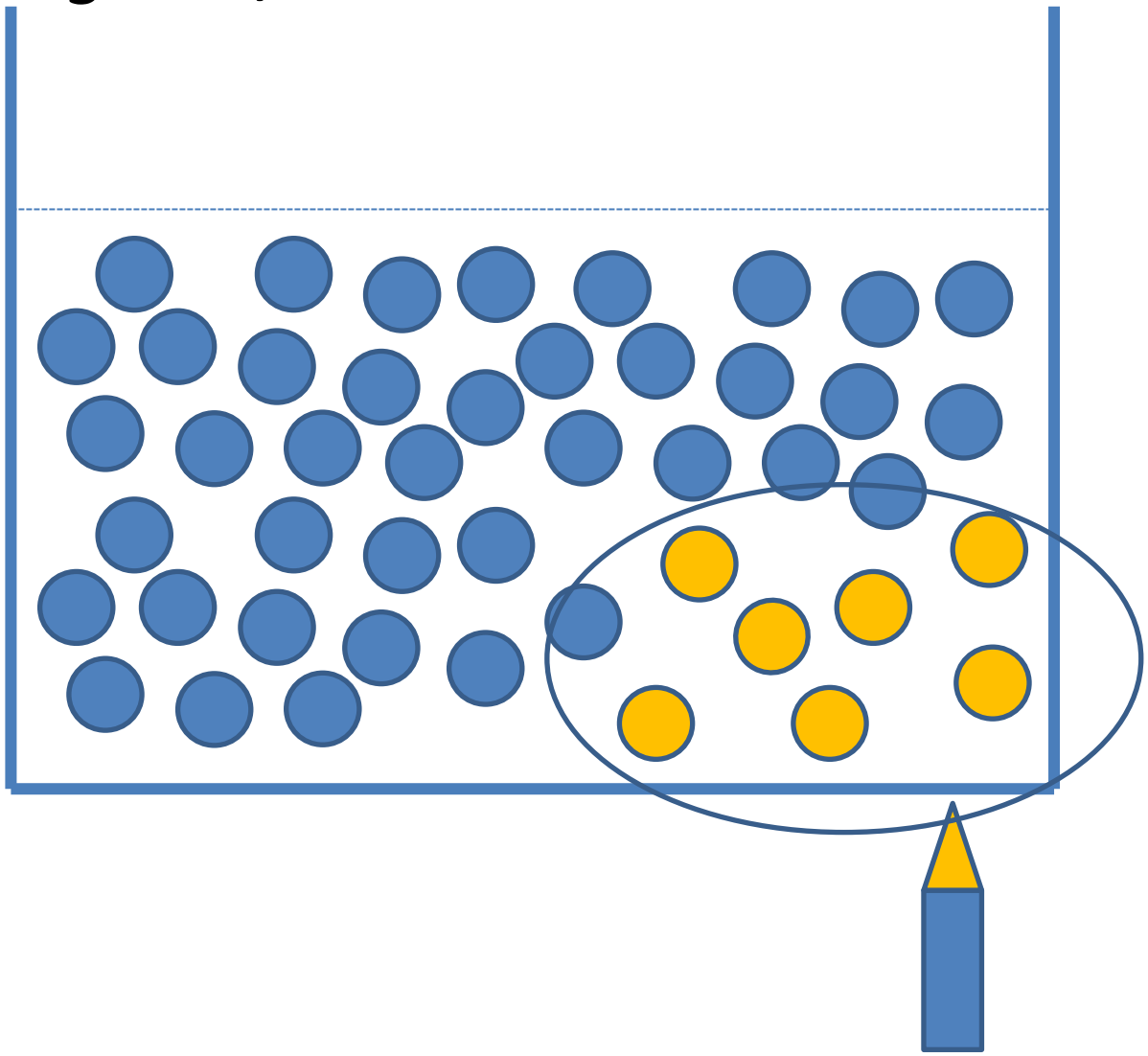
When the particles move around more, they bump into other particles .... more.



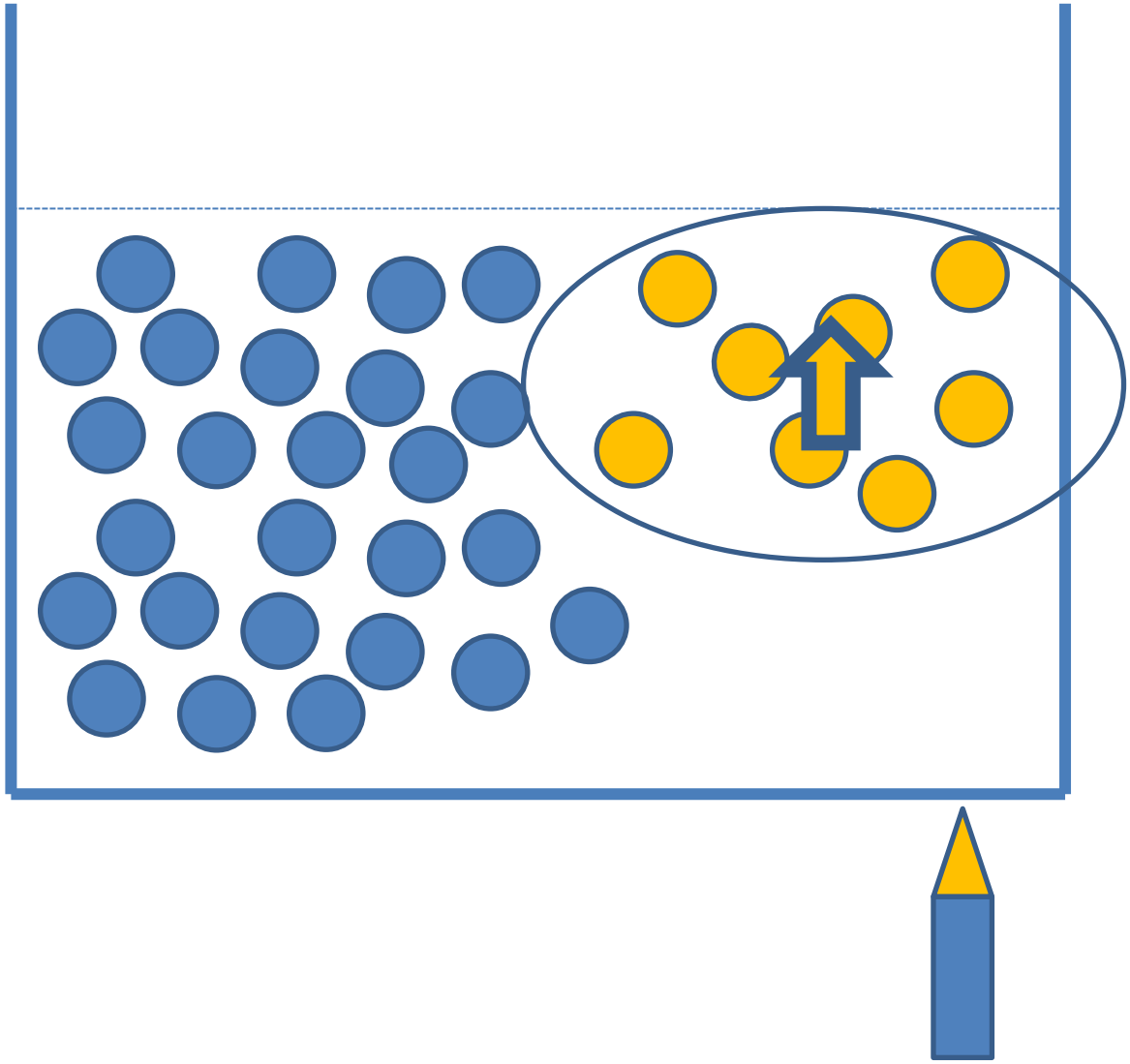
This constant colliding makes the spaces between particles .... bigger.



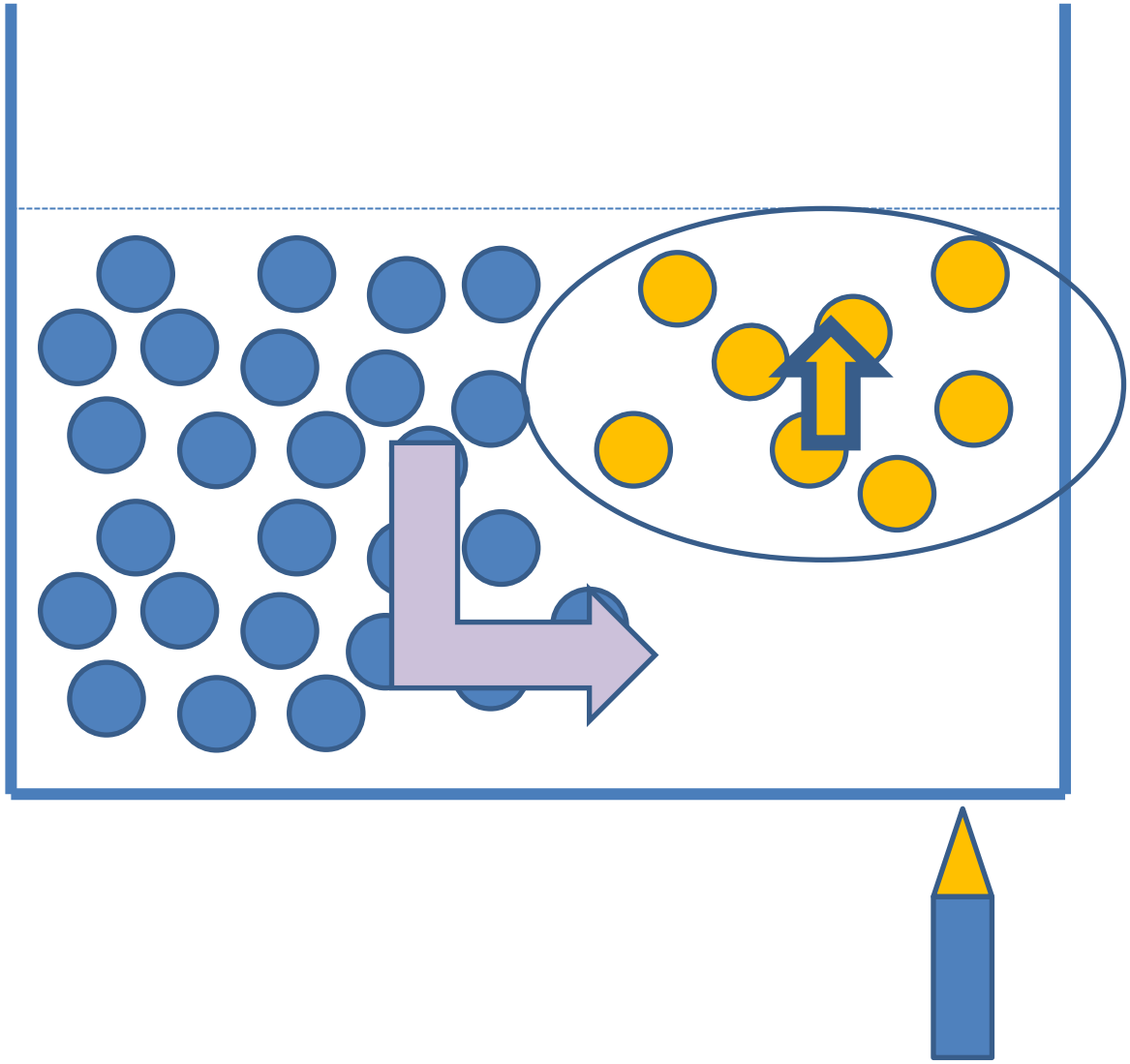
There is now an area with fewer particles and more space. This area is *lighter / heavier* than its surroundings..



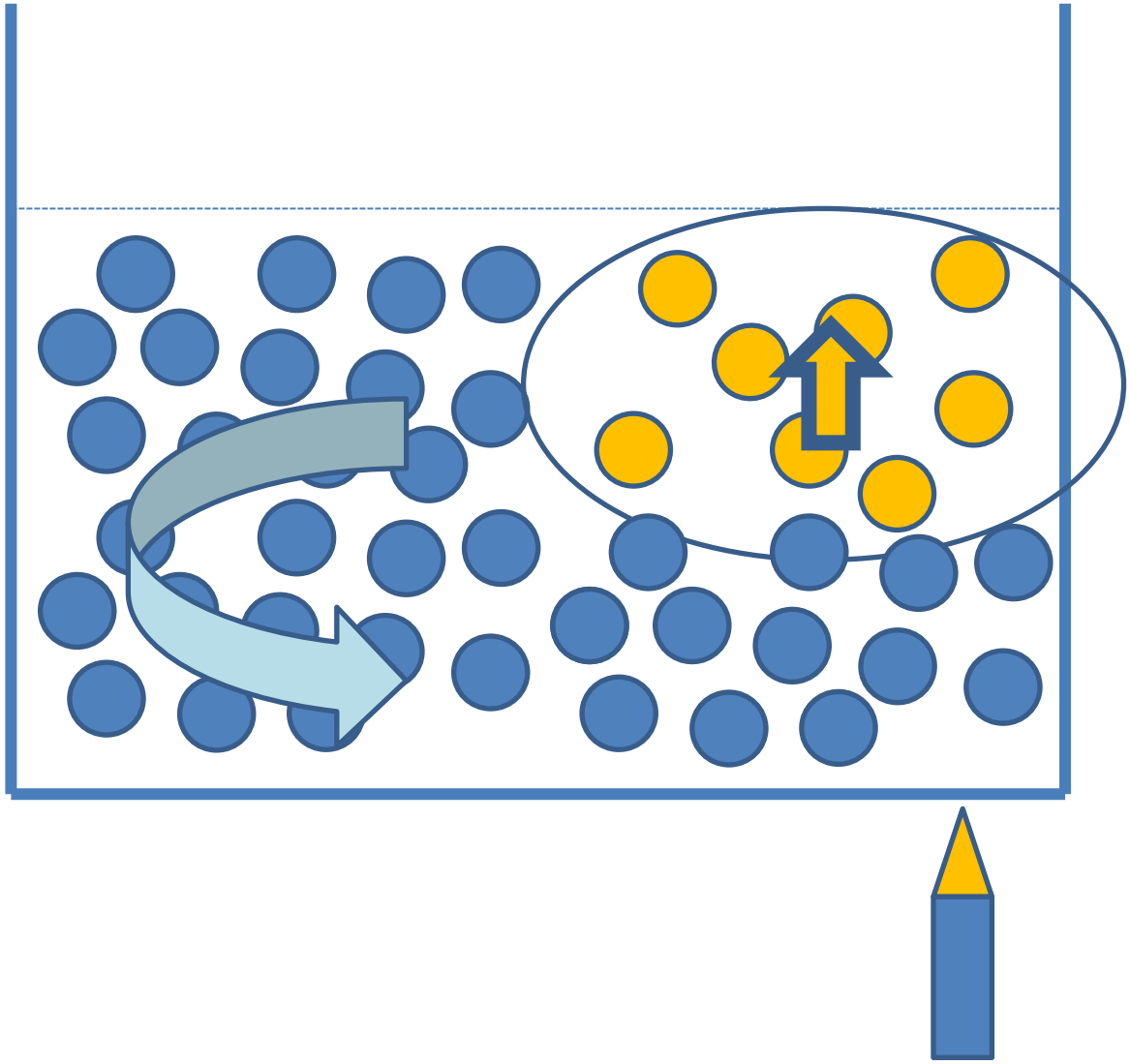
The lighter area moves up because it is lighter than its surroundings



There cannot be a space in the liquid, so colder, heavier liquid flows in to replace it.



The hotter, lighter area rising and the colder, heavier area sinking creates the convection current.



Recording – Title – <u>Convection in liquids</u>

Draw a **diagram** of the beaker, purple crystal and bunsen to show how the colour moved when the bottom corner was heated.

Write **two sentences** to **describe** what happened to the colour and to **explain why** this happened.

Write a sentence to state what you have learned about the **direction** that hot liquids move in.

Heat moving in liquids and gases

The way heat moves in liquids and gases is called _____. This works in liquids and gases because he particles can _____.
As the particles are heated they start to _____ out. This means there are fewer particles and more _____ in hot liquids and gases. If there is more space, the hot liquid or gas is lighter, so moves ___. Cold liquid moves in to replace it.
This creates a convection _____.

Heat moving in liquids and gases

The way heat moves in liquids and gases is called _____. This works in liquids and gases because he particles can _____.
As the particles are heated they start to _____ out. This means there are fewer particles and more _____ in hot liquids and gases. If there is more space, the hot liquid or gas is lighter, so moves ___. Cold liquid moves in to replace it.
This creates a convection _____.

Heat moving in liquids and gases

The way heat moves in liquids and gases is called **convection**. This works in liquids and gases because he particles can **move**.
As the particles are heated they start to **spread** out. This means there are fewer particles and more **space** in hot liquids and gases. If there is more space, the hot liquid or gas is lighter, so moves **up**. Cold liquid moves in to replace it. This creates a convection **current**.

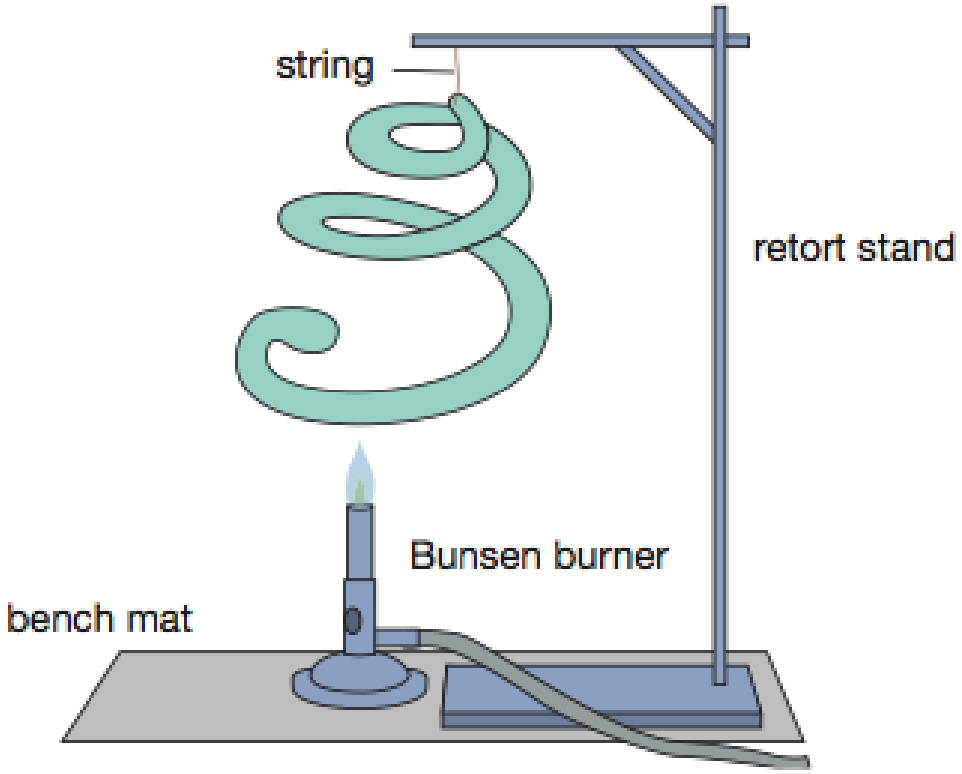
Convection is how heat is transferred in liquids. This works because the particles in a liquid are free to move, and move more when they are given heat energy.

Conduction is how heat is transferred in solids. This works because the particles are packed together and cannot move.

Which of these methods will be how heat is transferred in gases?

Recording –
Write a sentence to *describe* what happened to the paper spiral

Write a sentence to *explain* why this happened.



Give one example of when you see something similar happen

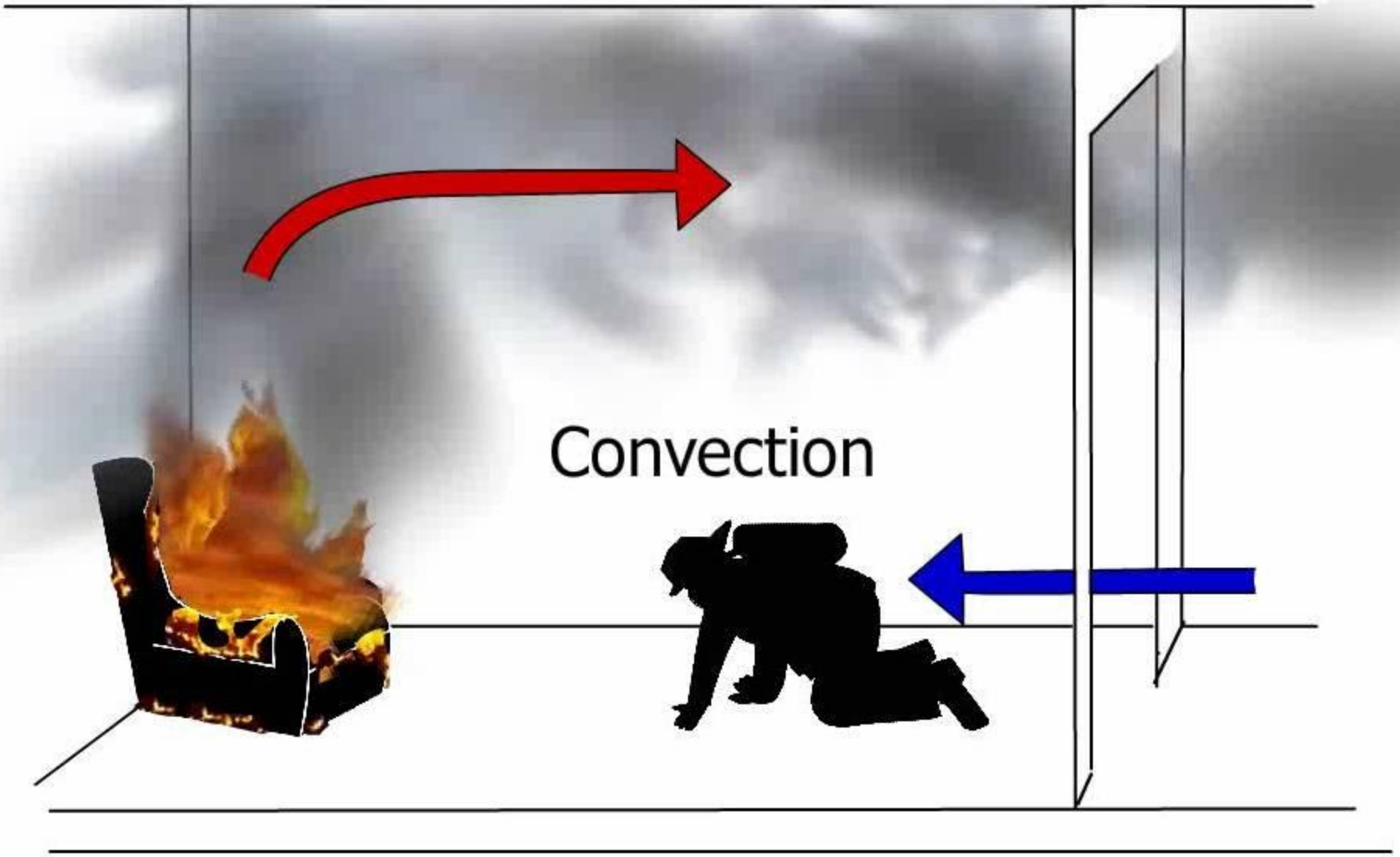
Target – **Exemplify** convection

- I can describe several situations where convection is used or is a problem. I can explain how the process is involved. I can suggest my own examples.

- I can describe a few situations where convection can be used or can be a problem. I can explain be convection is involved.

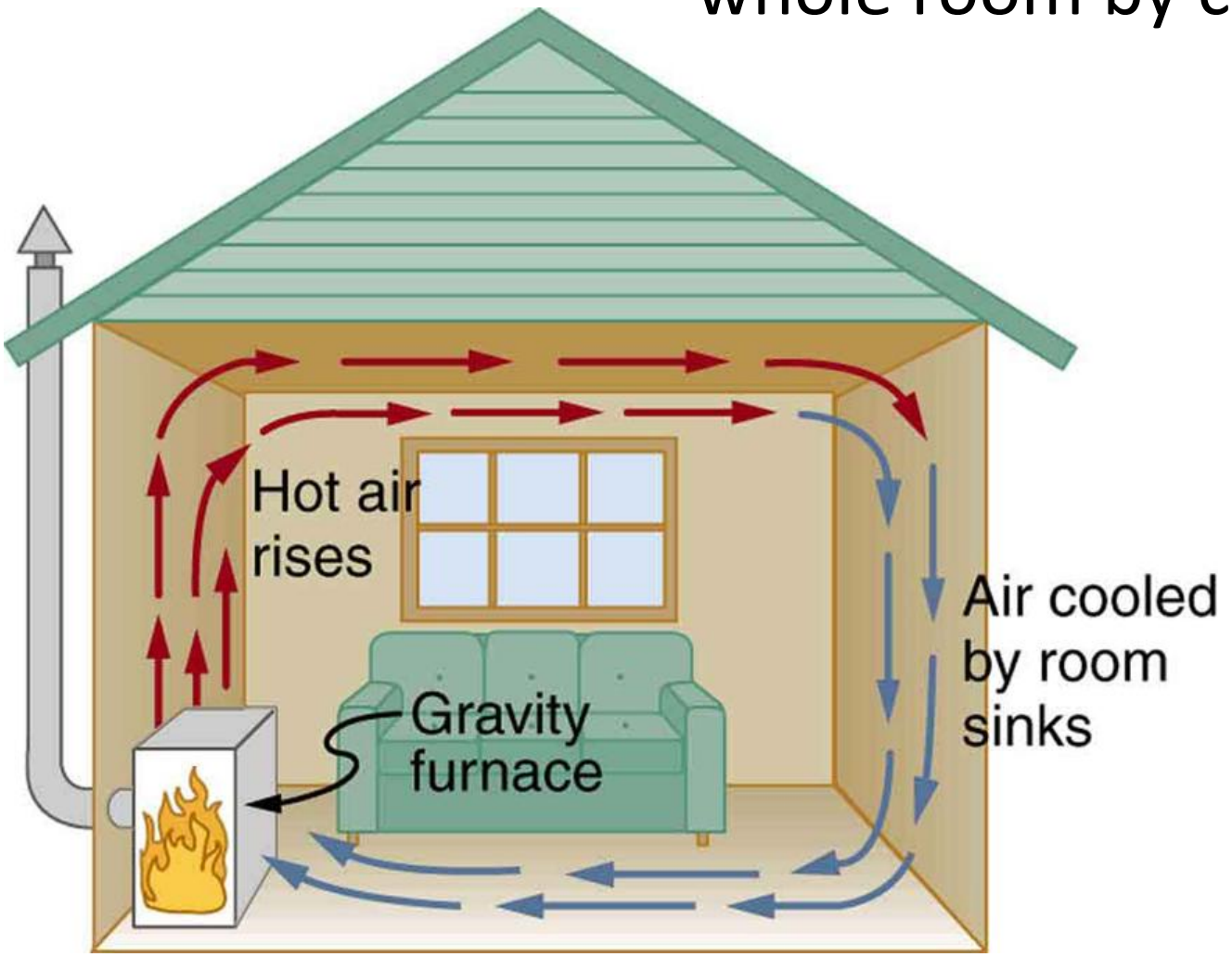
- I can describe a few situations where convection can be used or can be a problem.

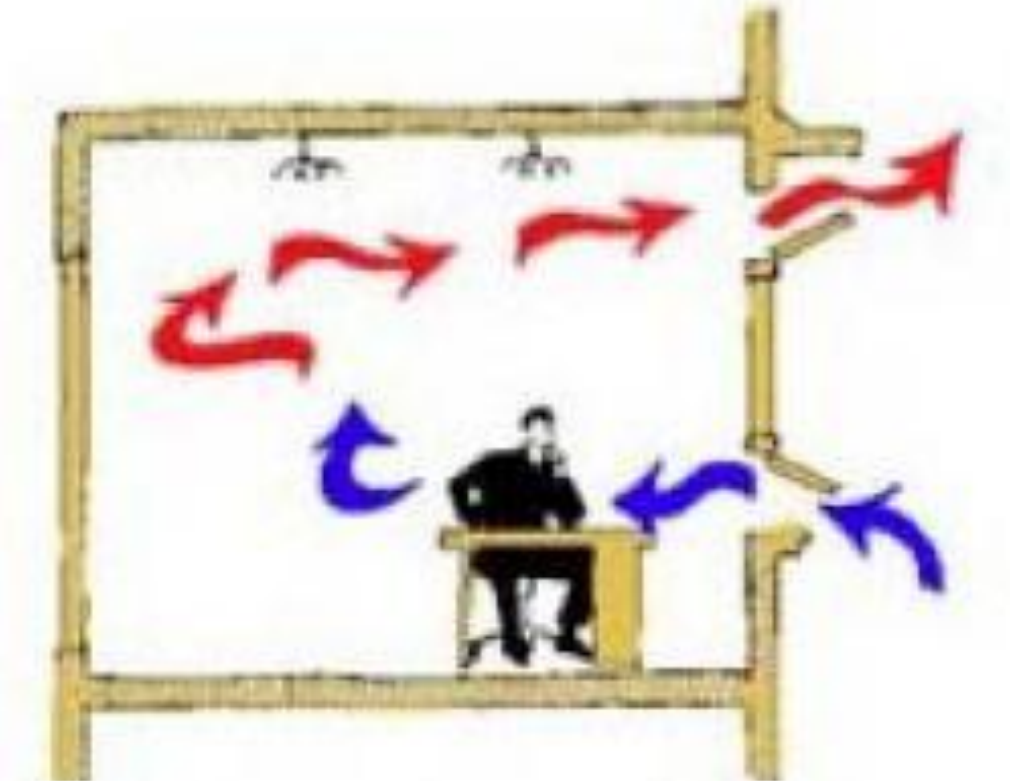

CastIronFires.Com



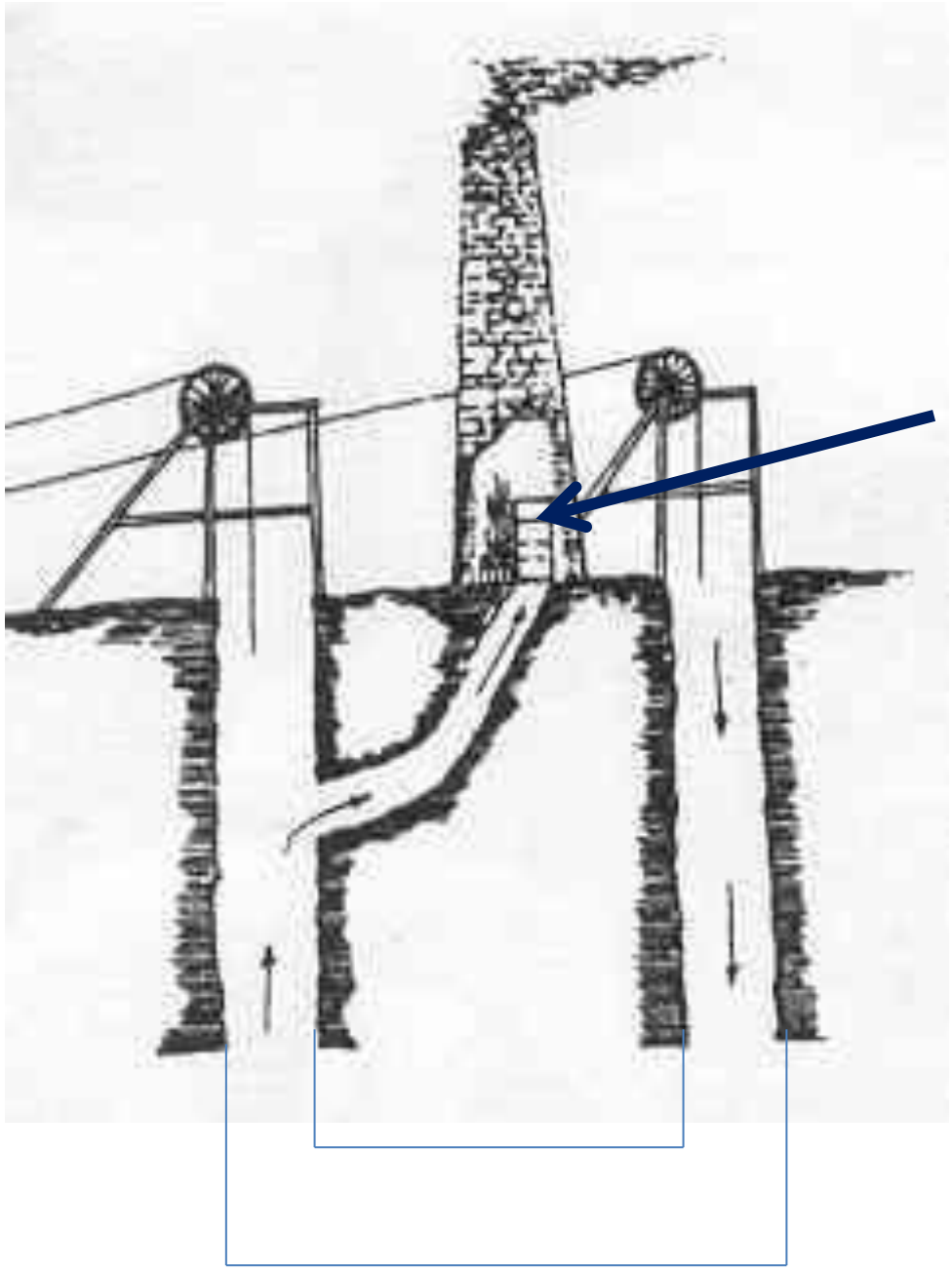
Write a few sentences to explain why the **two** convection currents make the fire dangerous.

Write a description of how a single radiator can heat the whole room by convection.

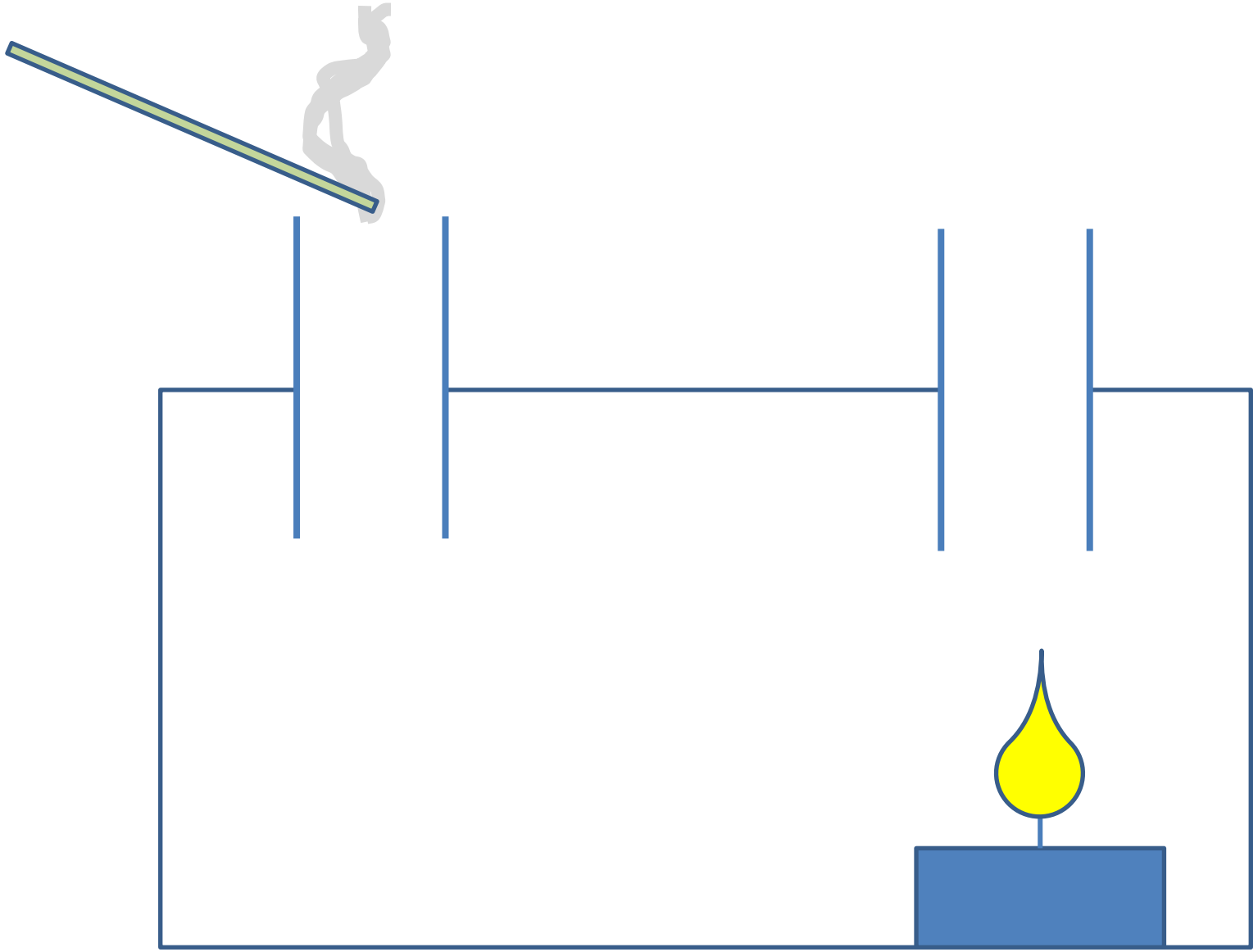




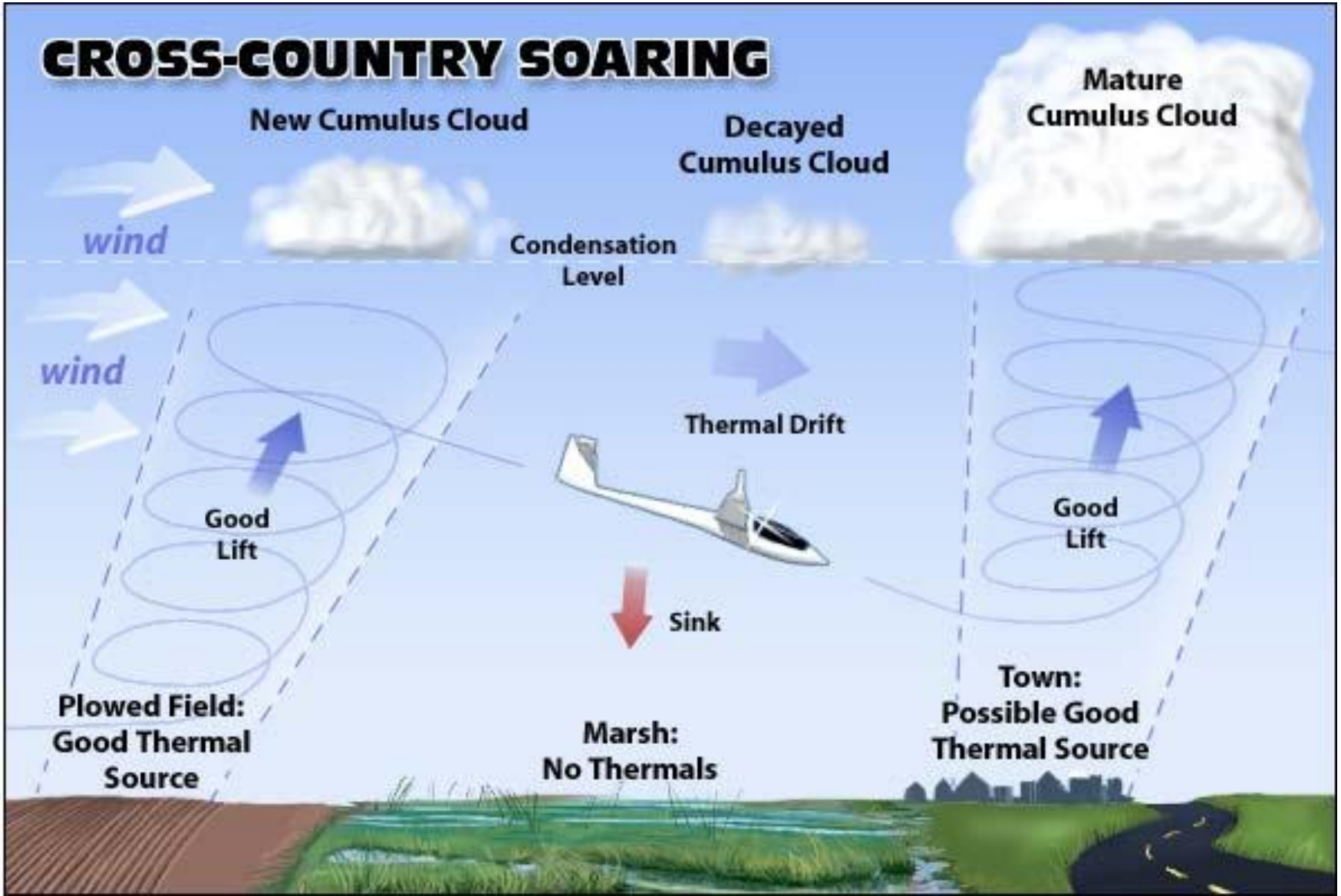
Write a sentence or two about why our Science labs have top *and* bottom windows.



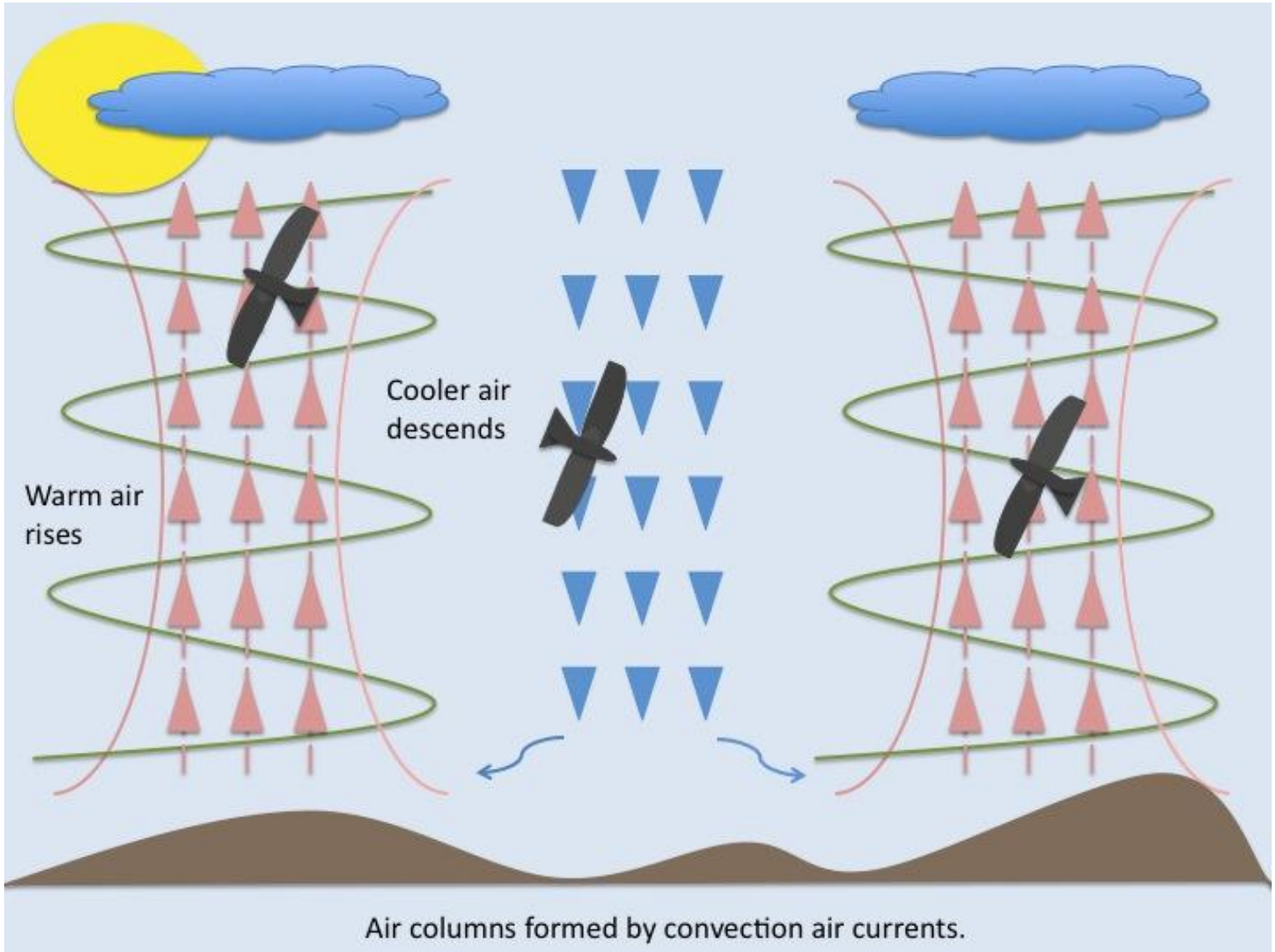
In the 1800s mine shafts were ventilated by keeping a fire burning.
Explain how this fire keeps fresh air flowing into the mine.



Explain how gliders can stay up so long with no engines.

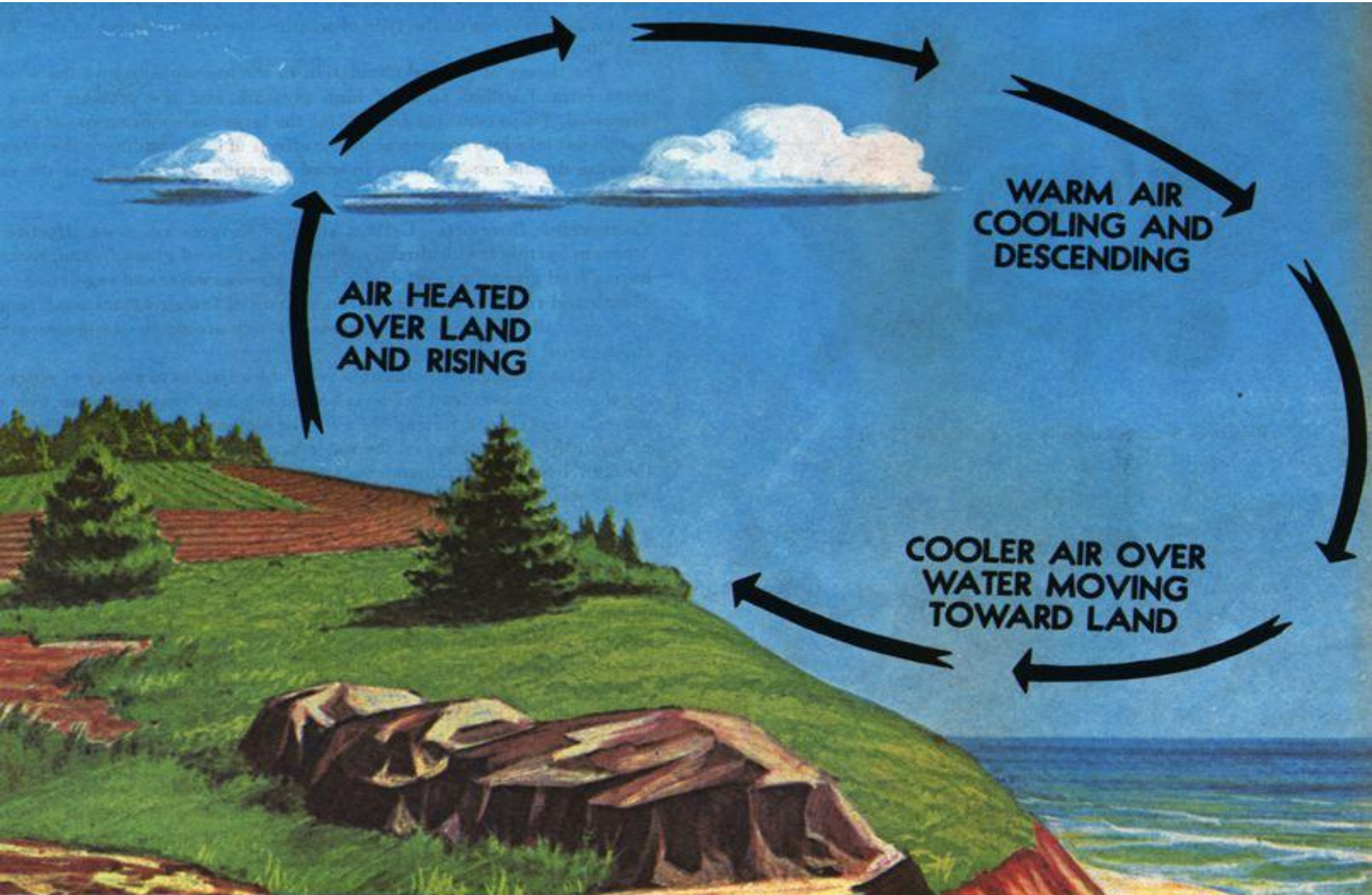


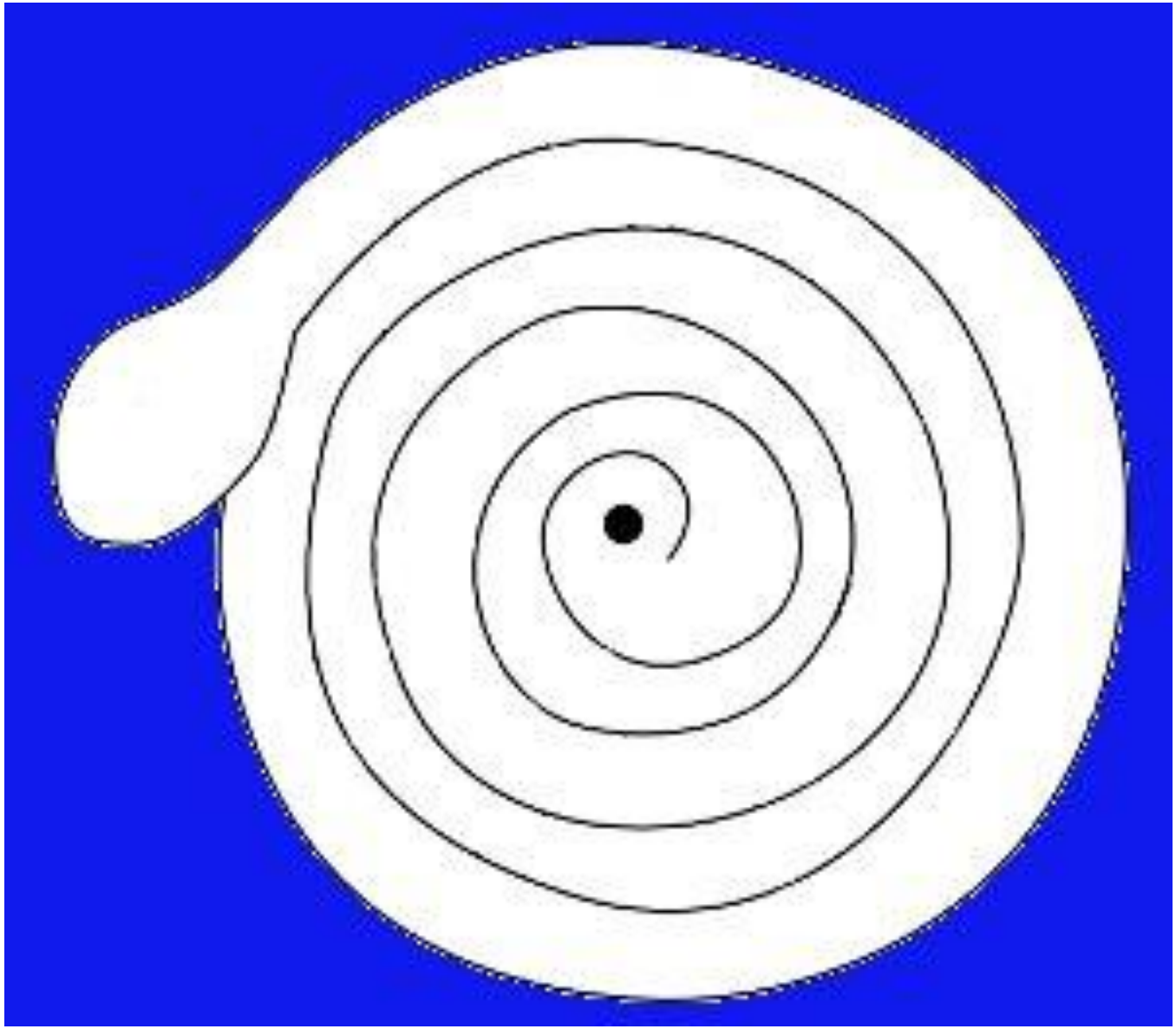
How do big birds of prey ‘soar’ without having to flap their wings very much?



Air columns formed by convection air currents.

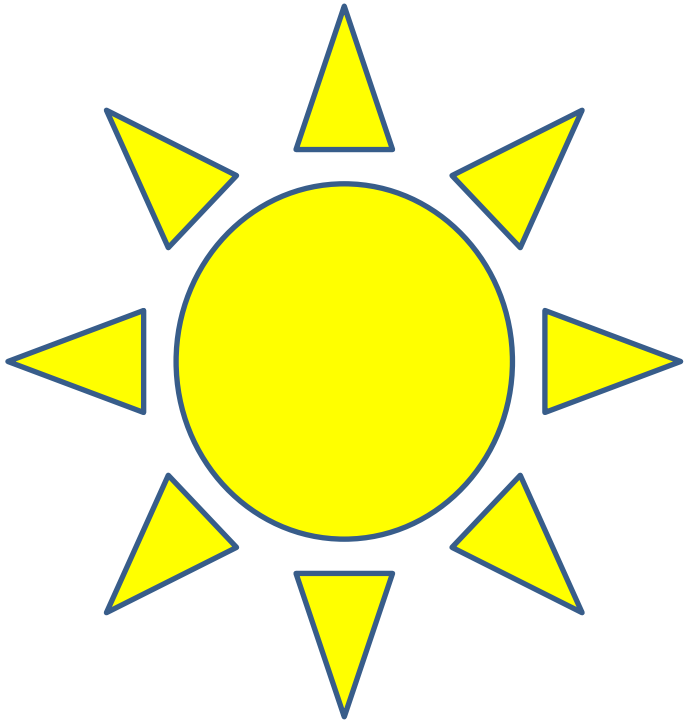
Why are there ‘sea breezes’?



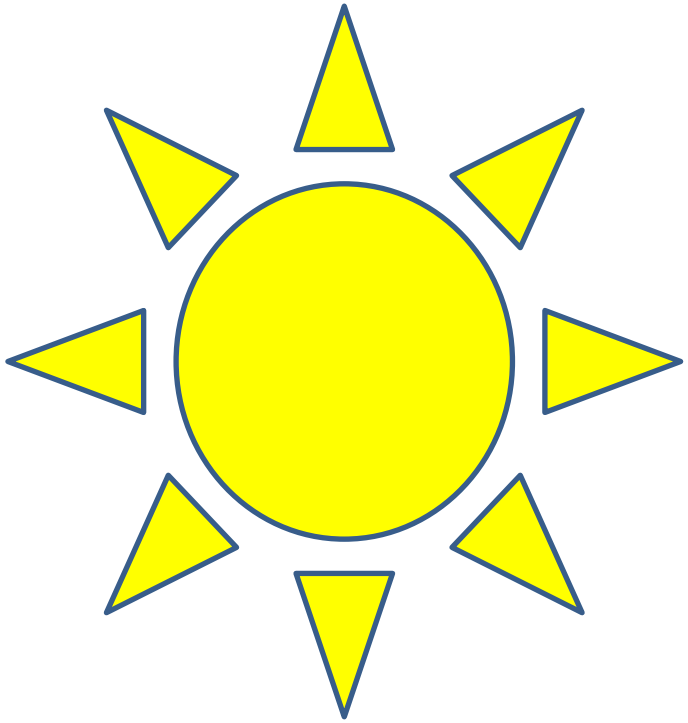


Target – **Investigate** radiation

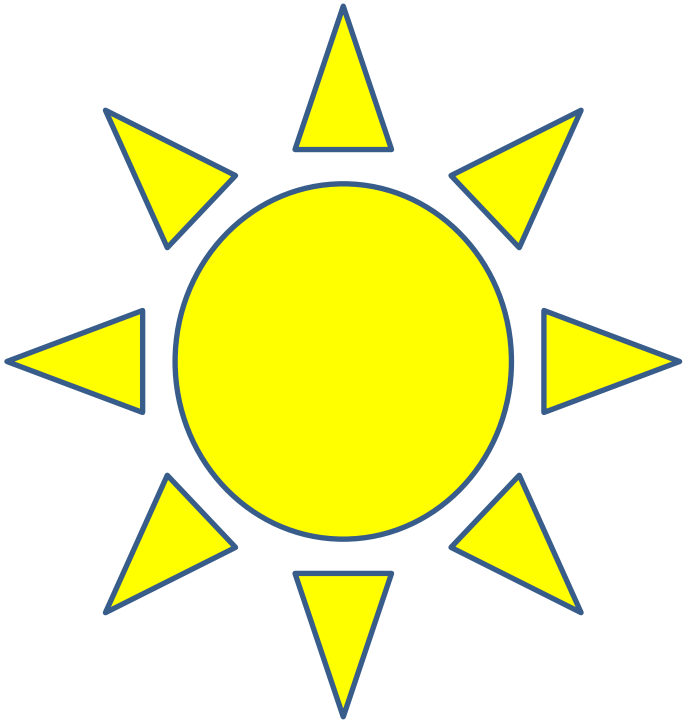
So, the bad news is that we are all dead.



All the heat energy that the Earth needs comes from the sun.

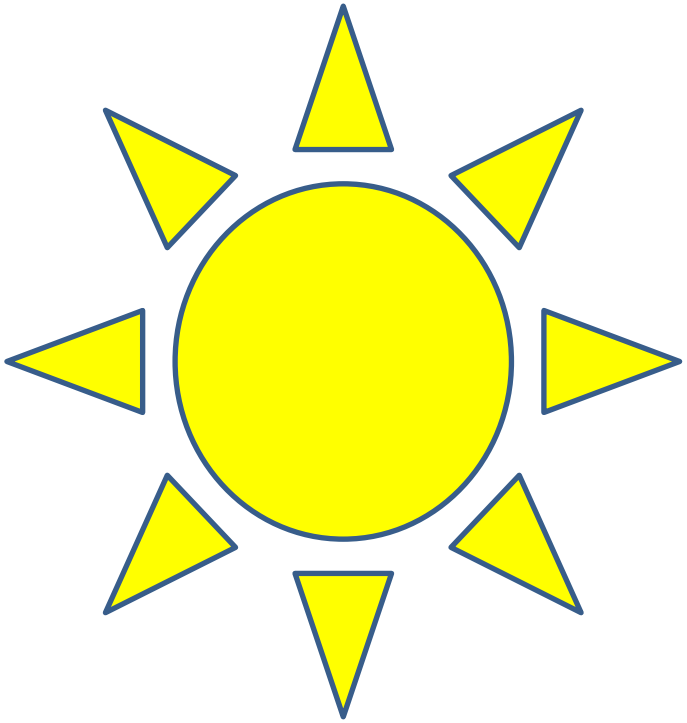


All the heat energy that the Earth needs comes from the sun.



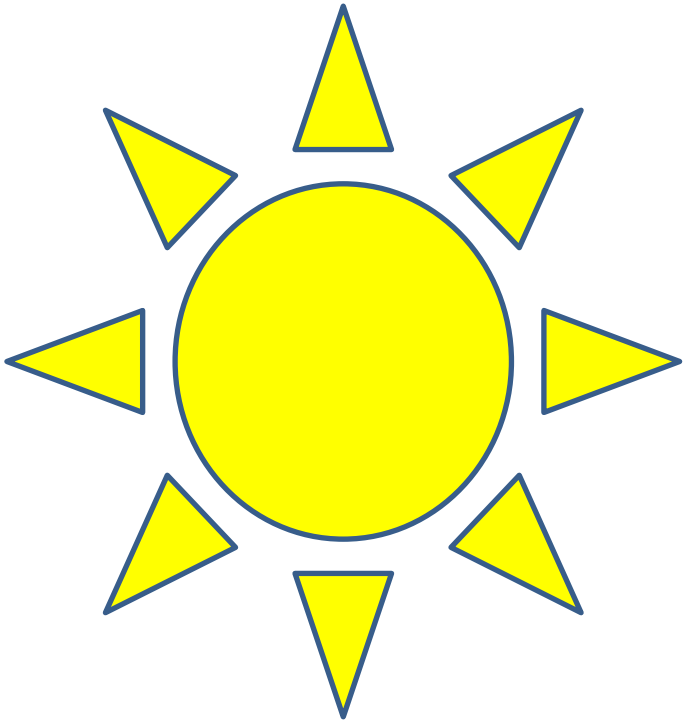
It cannot get to the Earth by conduction because .....

All the heat energy that the Earth needs comes from the sun.



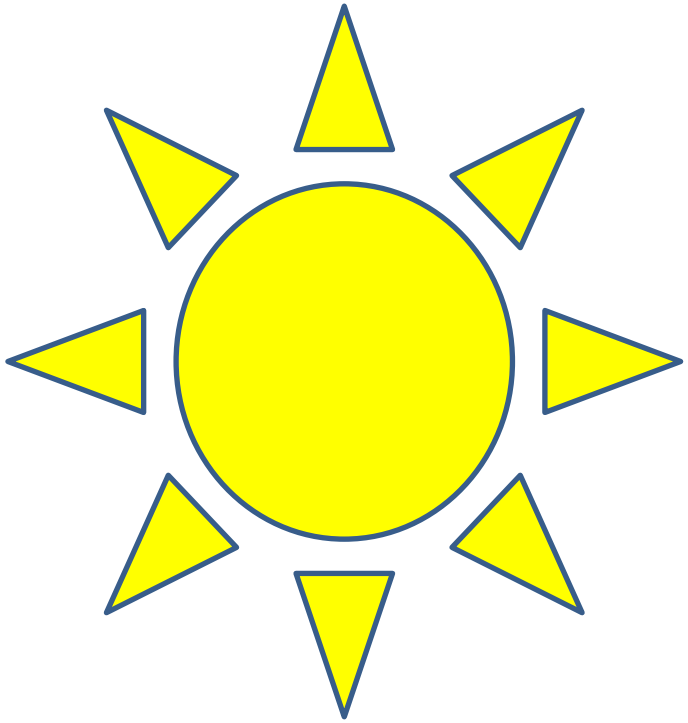
It cannot get to the Earth by convection because .....

Both conduction and convection require particles to work.



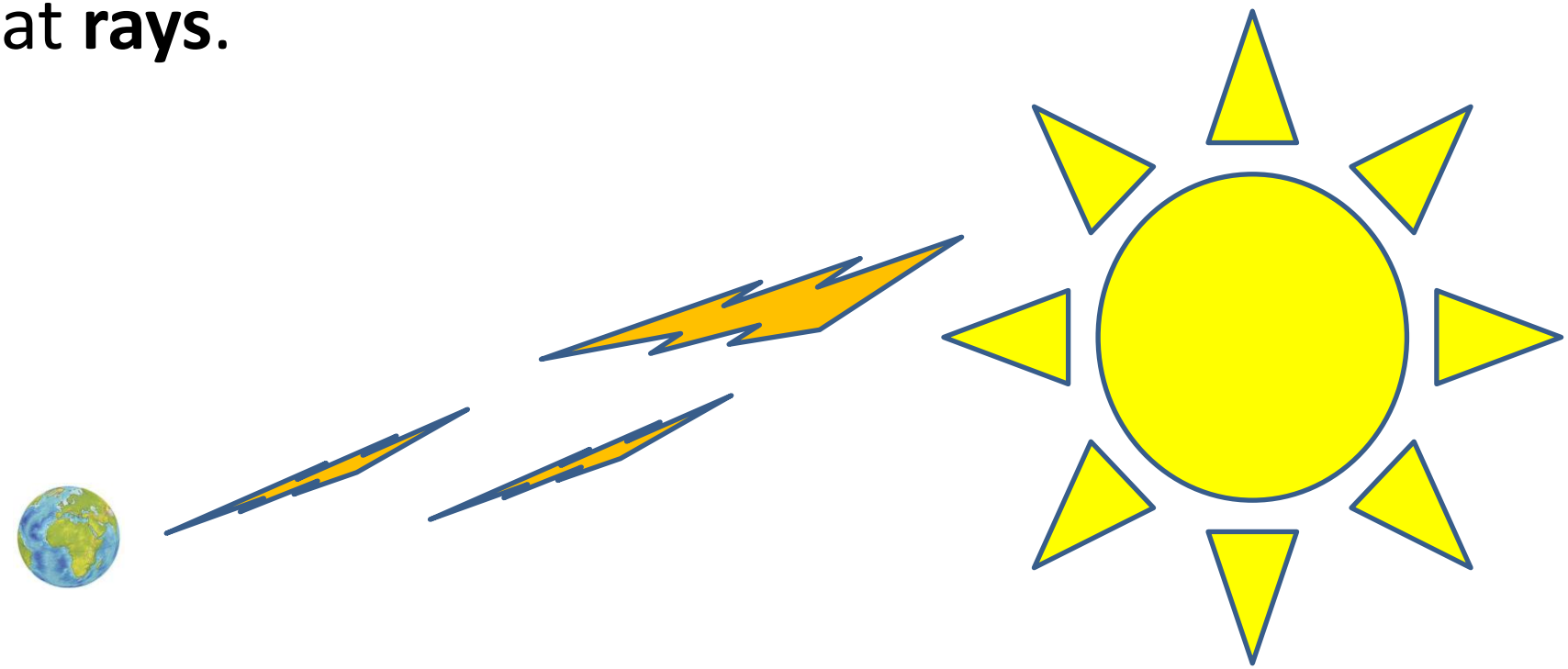
There is 96 million miles between the sun and the Earth, but not a single particle. In space, there are no particles – it is a vacuum.

There must be a third way that heat can travel.

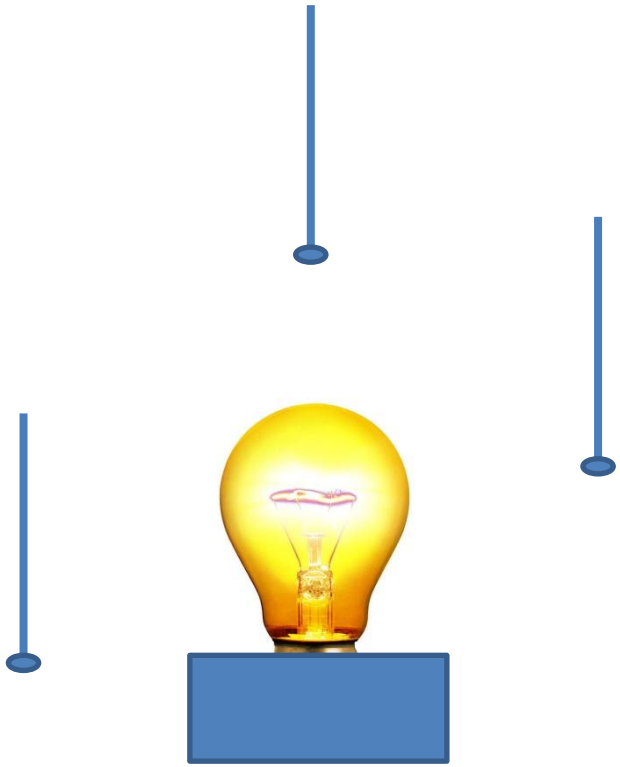


This method is **radiation**. You have met this before as **infra-red** radiation – one of the forms of radiation outside the visible spectrum.

Radiation is heat travelling as heat **rays**.



What direction do heat rays travel in?



- Fix 3 thermometers 10 cm from the light bulb
- One should be above the bulb, one level with it and one below it.
- Measure the starting temperature on each.
- Record again after the bulb being on for 10 minutes

*While you are waiting record the **title**, a **diagram** of what you set up and a **table** for your **results**.*

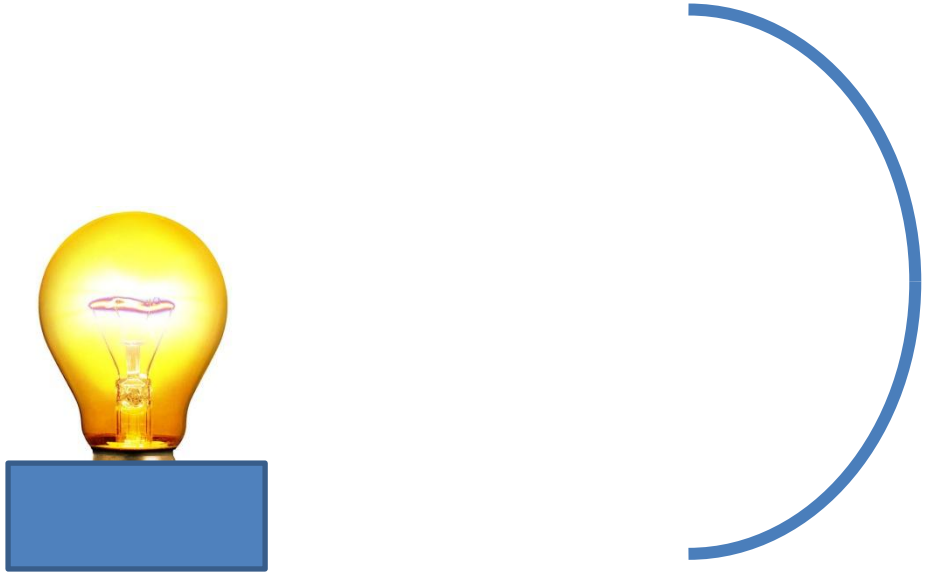
	Temp. at start (^{0}C)	Temp. at 10 min (^{0}C)	Temp. rise(^{0}C)
Thermometer above			
Thermometer level			
Thermometer below			

Conclusion -

Prove that heat is travelling as **rays**.

One of the features of light rays is that they can be **reflected** by mirrors and **focussed** by lenses. Lets be smart and see if we can focus using a mirror.

Prove that heat is travelling as rays.



Heat source Parabolic mirror

Record the **title**, a **diagram** of what we set up and a description of **how we know the heat rays were being focussed**.

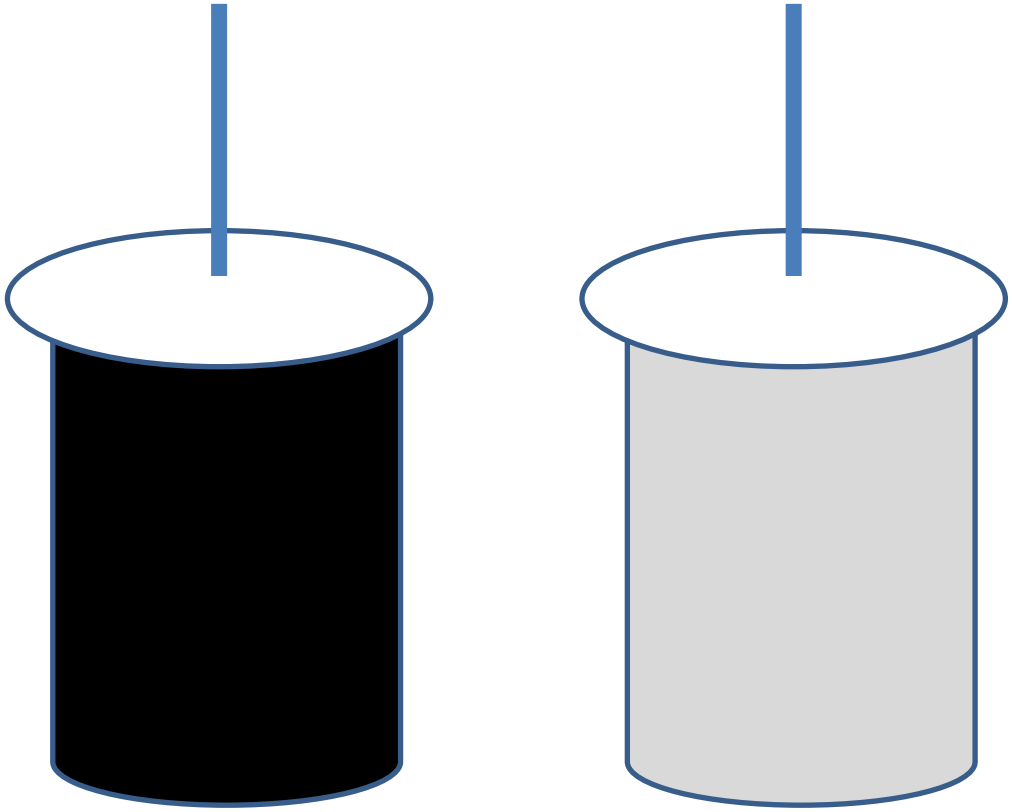
How might knowing how to focus heat rays from the sun help you if you were marooned on a desert island with no matches?

Target – **Investigate** radiation and colour

Investigating surface colour an radiation

All hot objects give out heat by **radiation**. The faster they radiate this heat, the faster they cool.
*How does the **colour** of an object affect radiation?*

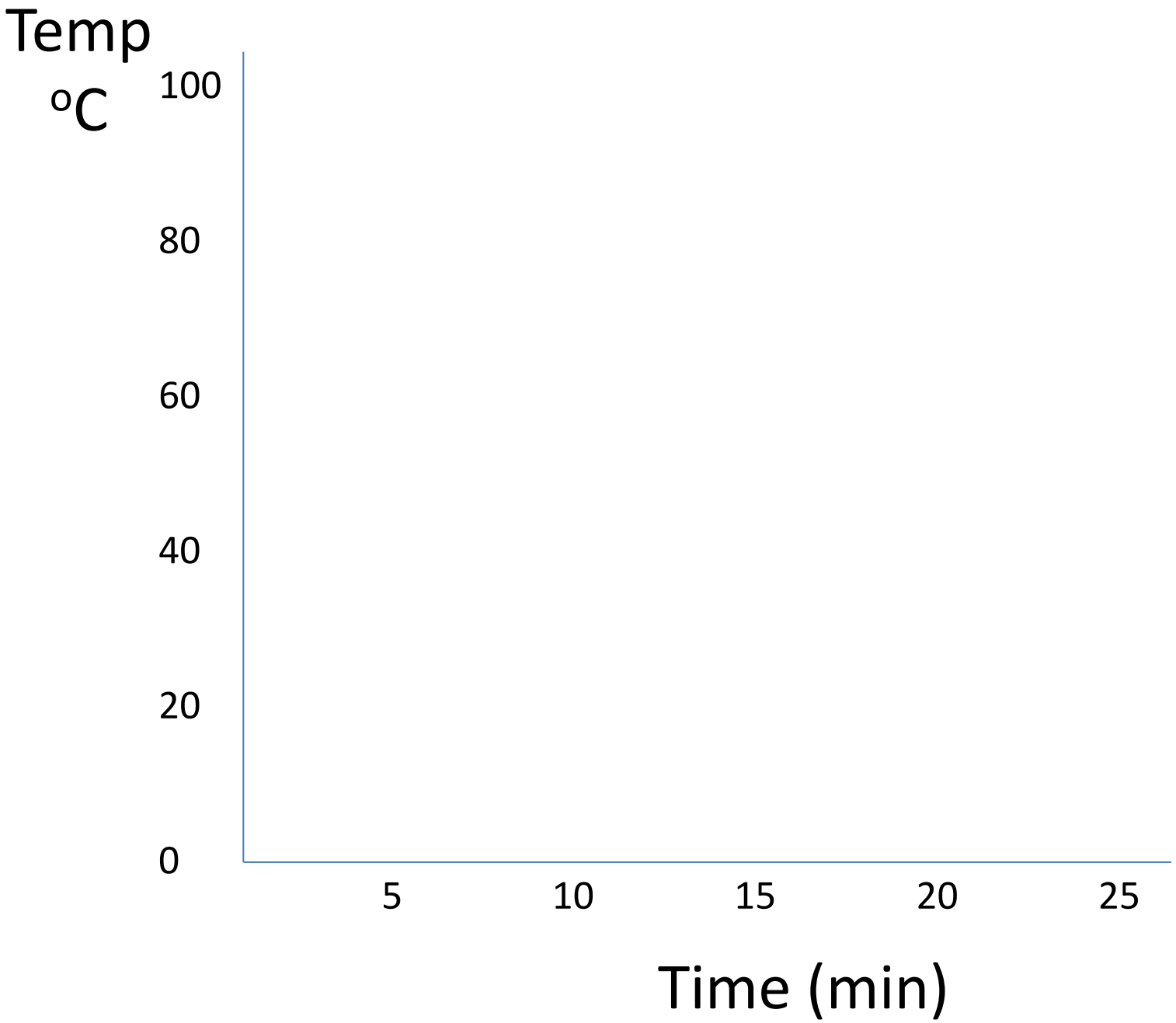
You are supplied with –	**Your task** –
•Kettle •Black beaker •Silver beaker •Lids •thermometers	Investigate what colour of flask radiates heat best.



- What things need to be kept the same?
- What will we measure to get the ‘results’?
- When and how often should you take readings?
- How do you show your results most clearly?

Recording –

Title (what we are trying to find out)
Method (what we set up and what measurements we took)
Results (what data did we get from our experiment)
Conclusion (what our results mean)


Temp
°C
100
80
60
40
20
0
5
10
15
20
25
Time (min)

Target – **Contextualise** heat loss

You know that –

- Heat can travel by **conduction** (solids), **convection** (liquids and gases) and **radiation**.
- Conduction and radiation depend on the presence of **particles**
- Radiation can be affected by **colour**

We now have to take this knowledge and put it into the context of **heat loss from houses**

I can **explain** all the main ways that heat loss can be reduced from homes. I can relate this to energy efficiency and fuel bills.

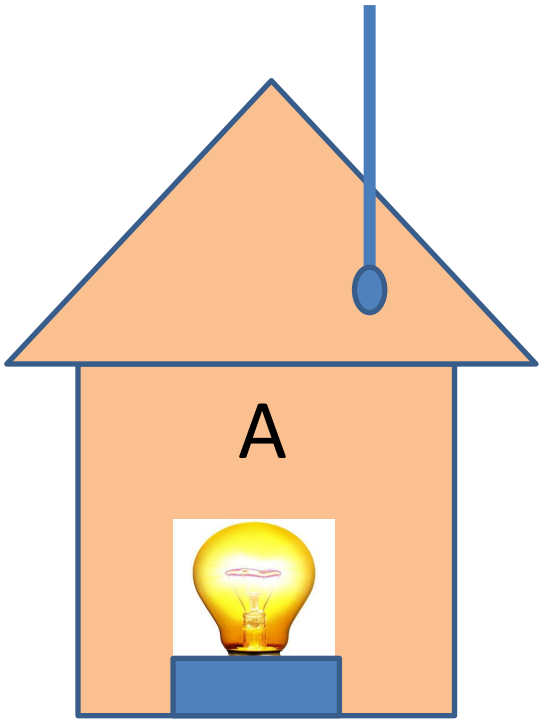
I can **describe** all the main ways that heat loss can be reduced from homes. I can say how this affects energy efficiency and fuel bills.

I can **describe** some of the ways that heat loss can be reduced from homes. I can say how this affects energy efficiency and fuel bills.

Start : _____ ^{0}C

10 min : _____ ^{0}C

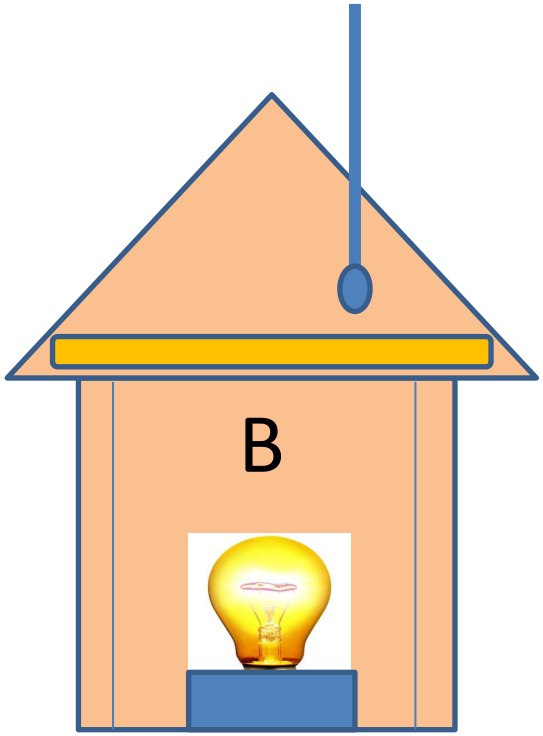
Rise: _____ ^{0}C



Start : _____ ^{0}C

10 min : _____ ^{0}C

Rise: _____ ^{0}C



Loft insulation

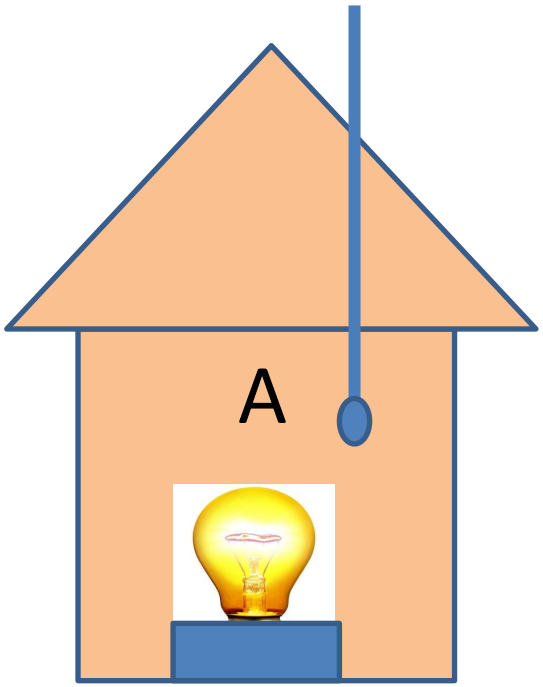
Cavity walls

Switch off!

Start : _____ ^{0}C

~~10~~ **6**min : _____ ^{0}C

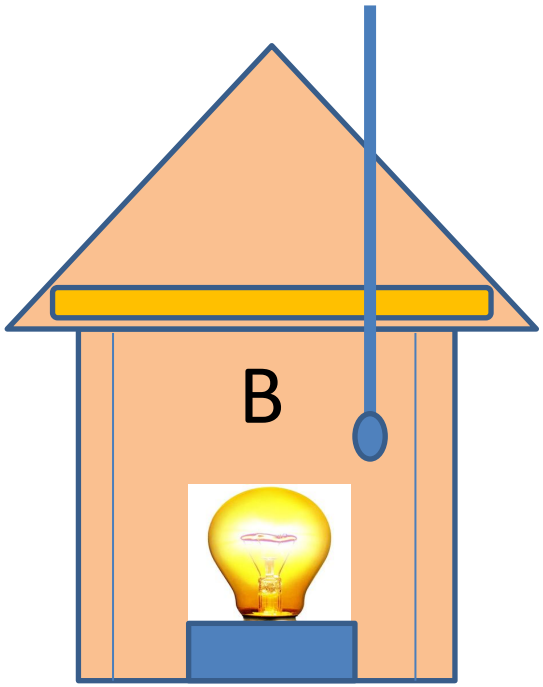
Fall: _____ ^{0}C



Start : _____ ^{0}C

~~10~~ **6**min : _____ ^{0}C

Fall: _____ ^{0}C



Loft insulation

Cavity walls

Home insulation.

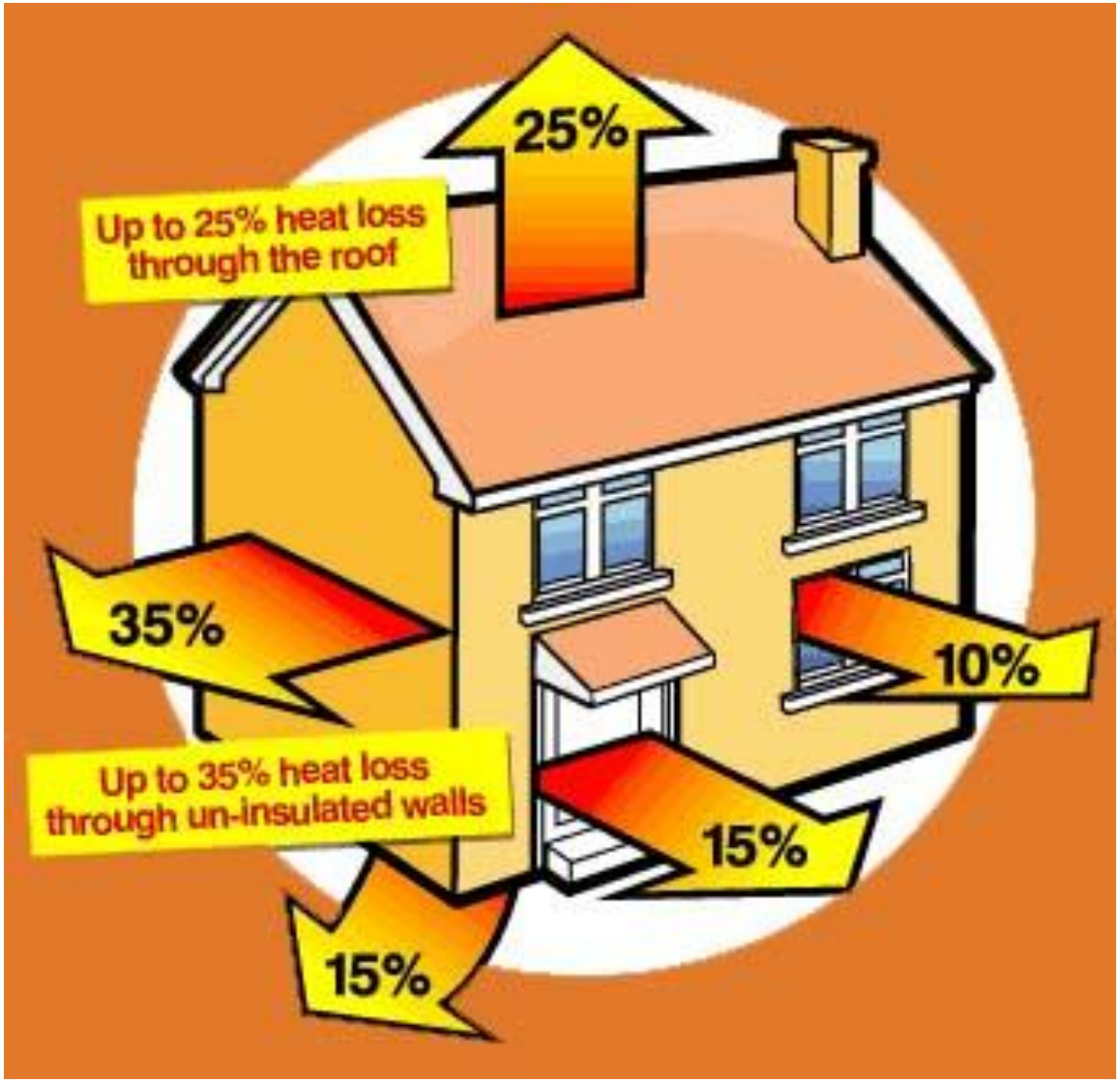
When loft insulation was put into the house, _____ heat got through from the room to the loft. This means that _____ heat is being wasted. This will _____ your fuel bills.

The cavity walls made the room cool down _____. This means that _____ heat is kept in the living areas. _____ heat is lost, so fuel bills will be _____.

Home insulation.

When loft insulation was put into the house, **less** heat got through from the room to the loft.
This means that **less** heat is being wasted.
This will **reduce** your fuel bills.

The cavity walls made the room cool down **slower**. This means that **more** heat is kept in the living areas. **Less** heat is lost, so fuel bills will be **reduced**.

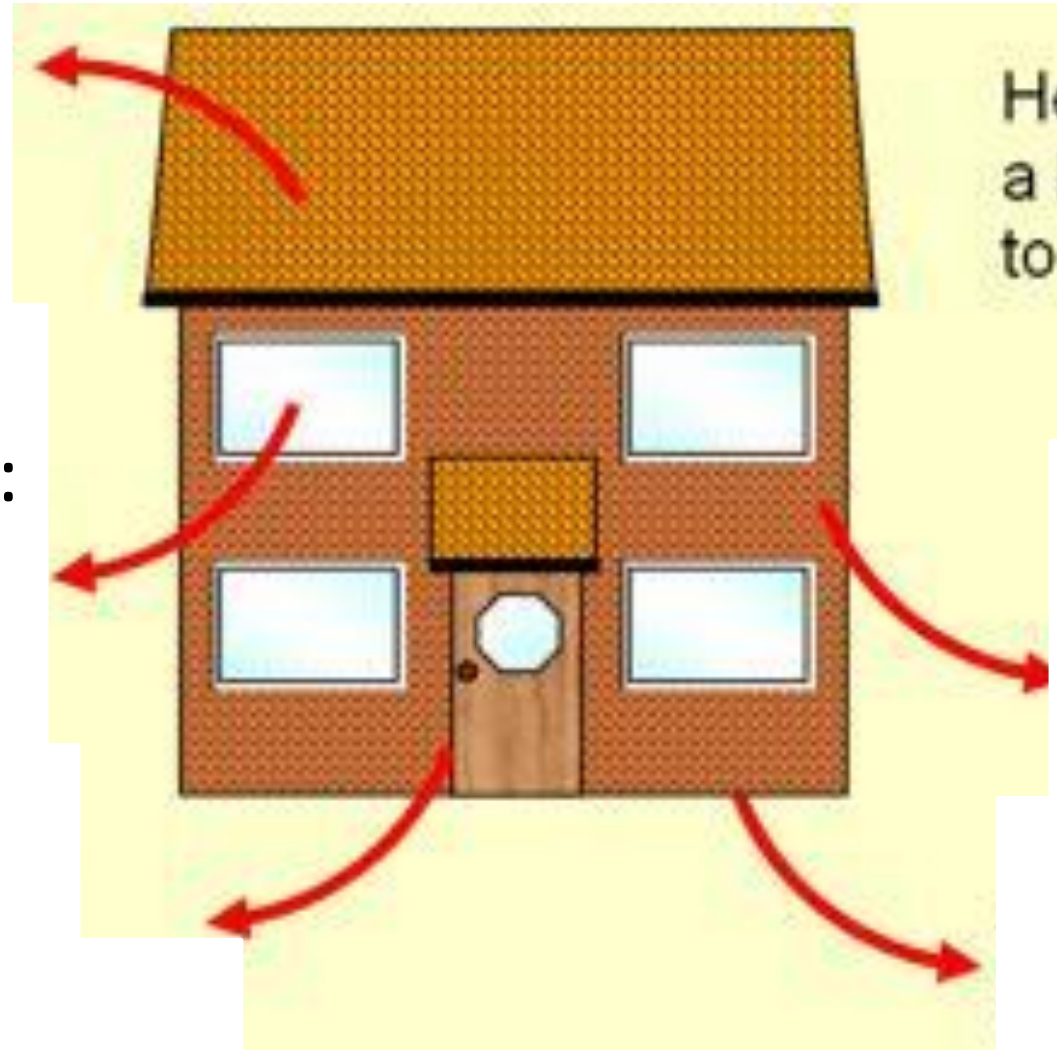

25%
Up to 25% heat loss through the roof
35%
10%
Up to 35% heat loss through un-insulated walls
15%
15%

Home insulation summary –

Complete the diagram to –

- **Name** and **describe** the method of reducing heat loss
- **State** whether this method stops heat loss by **conduction, convection** or **radiation**.

Roof:



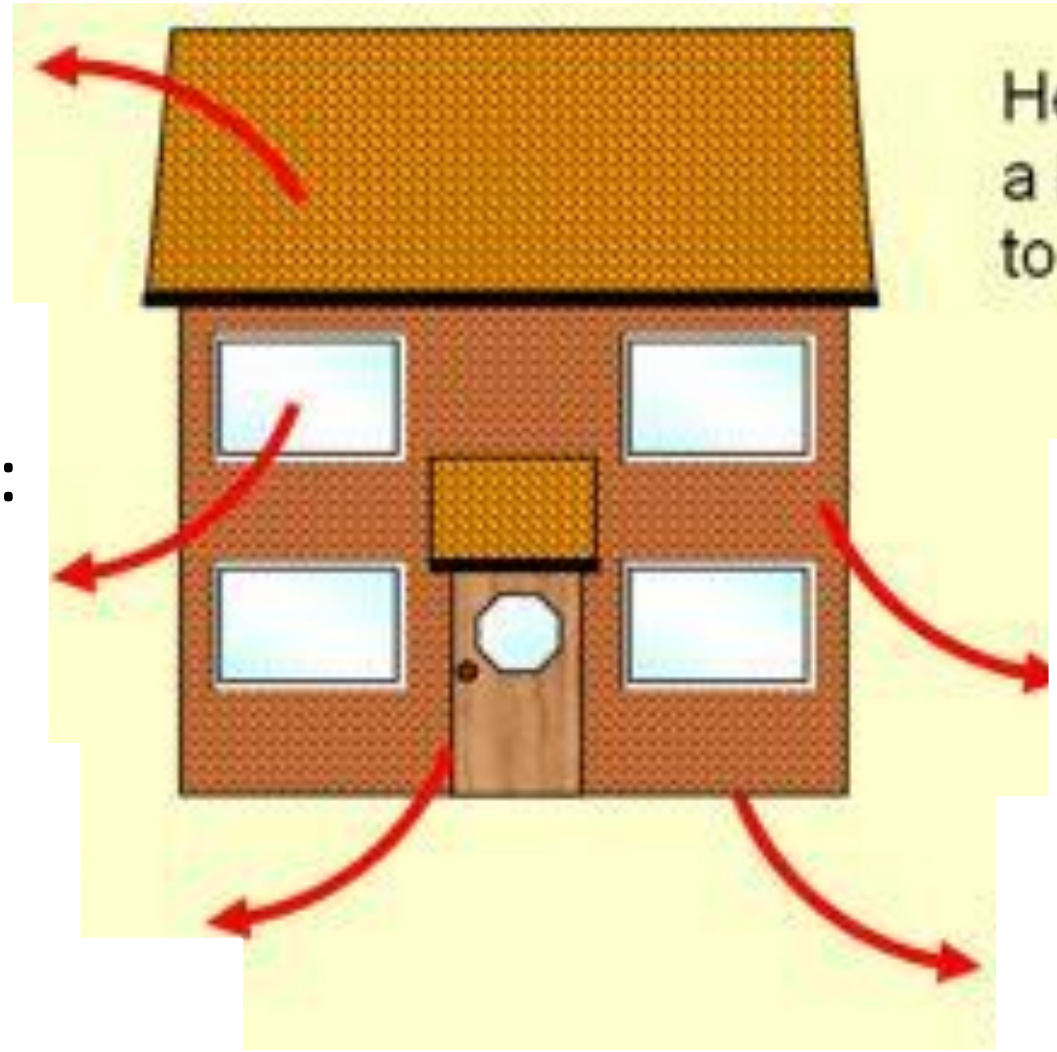
Windows:

Walls:

Doors:

Floors:

Roof:



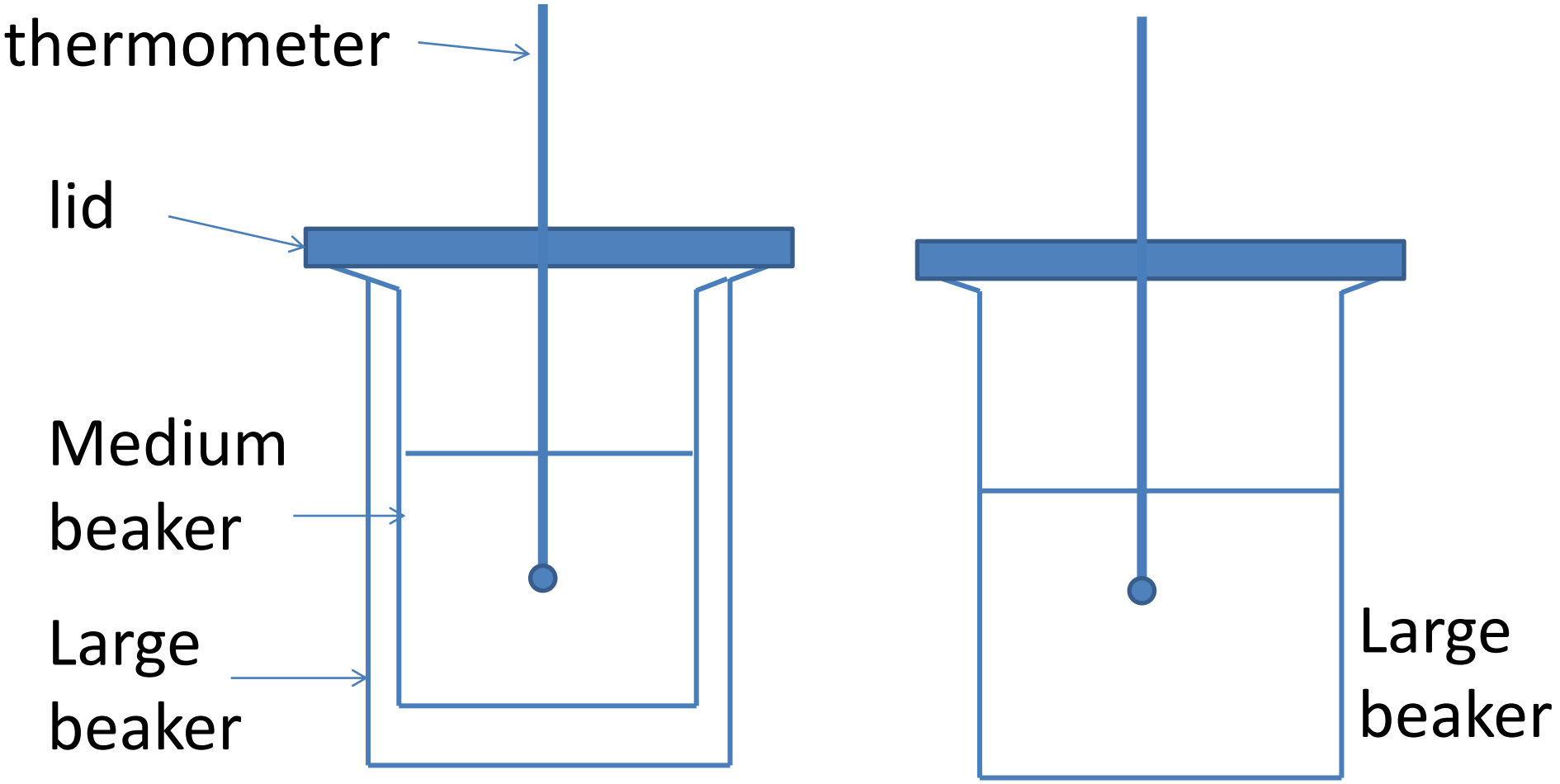
Windows:

Walls:

Doors:

Floors:

Target – **Investigate** double glazing



What are we investigating?

What do we measure to get the results?

What do you predict?

Recording –

Title – **<u>Modelling double glazing</u>**

Aim – *what we are trying to find out*

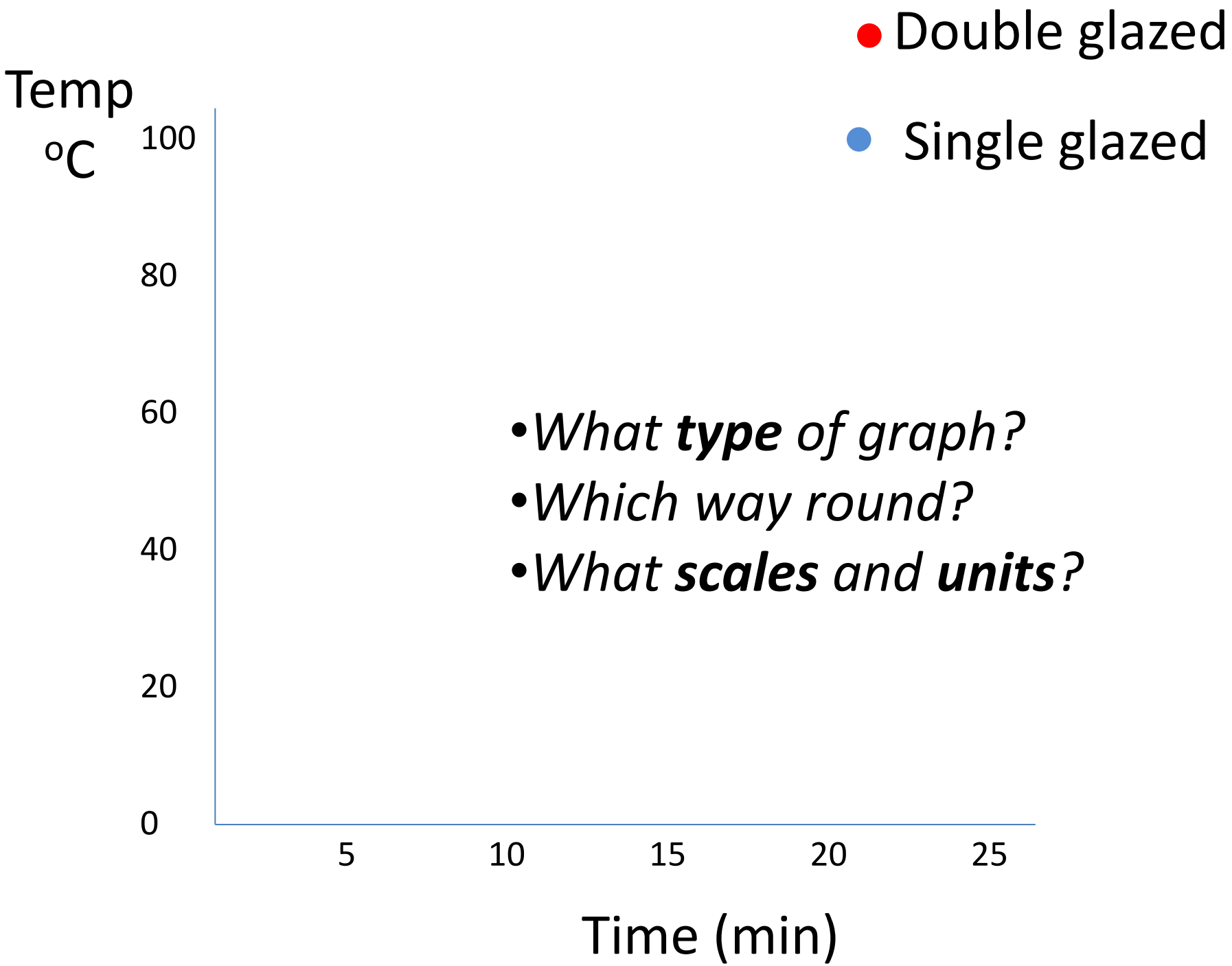
Method – *what we set up (diagram)*

Results – *Table and graph*

Conclusion – *a statement of what the results mean*

	Temperature (^{0}C)	
Time (min)	Double glaze beakers	Single glaze beakers
0 5 10 15 20		

Conclusion:


Double glazed
Single glazed
Temp
°C
100
80
60
40
20
0
5
10
15
20
25
Time (min)
•What type of graph?
•Which way round?
•What scales and units?

Target – Apply thermodynamics

Chinese lanterns work according to the rules of heat transfer that you have learned.

You are provided with -

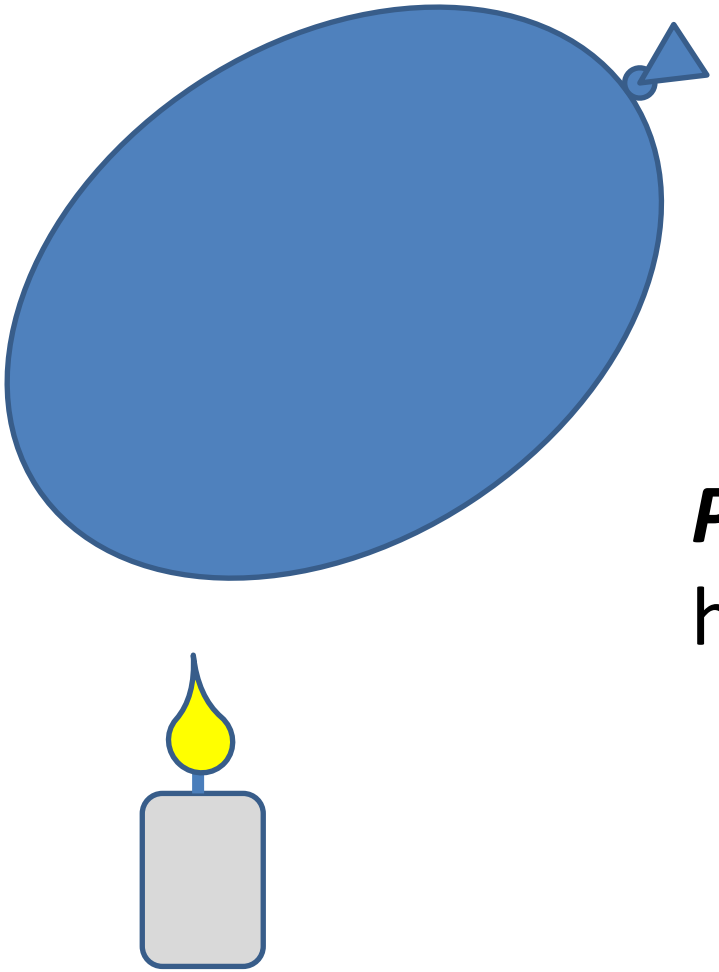
- A shopping bag
- A hair drier
- A stairwell

The Polos go to who can make the bag go highest

Recording –

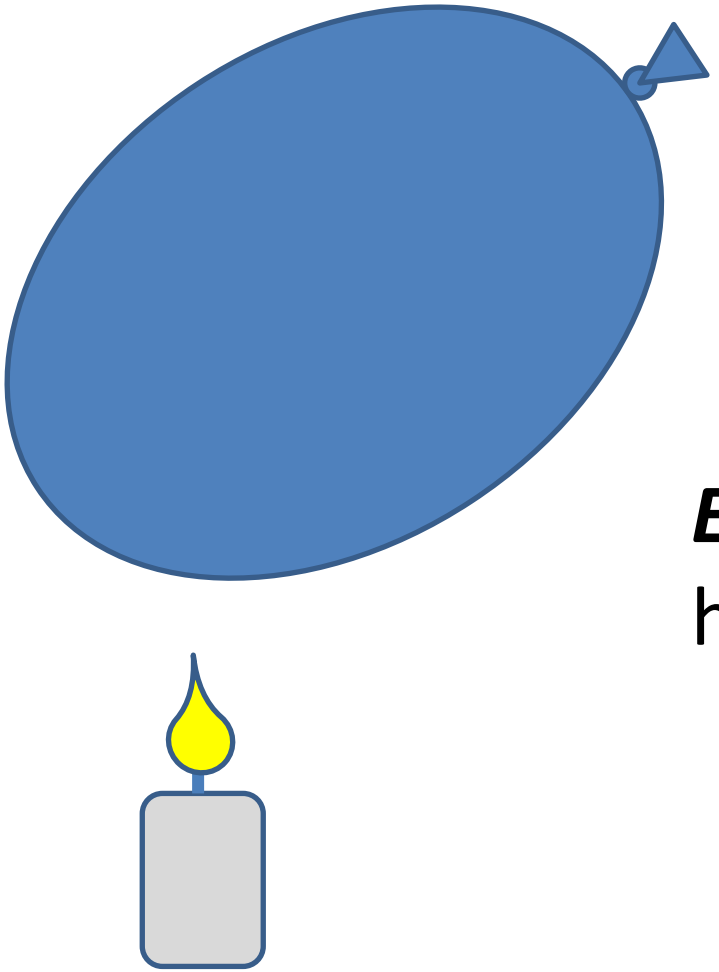
- **Explain** how a Chinese lantern works
- What did you have to do to your design to get it to fly successfully?
- Why did Mr Wood give you a hairdrier instead of a candle?

The magic balloon



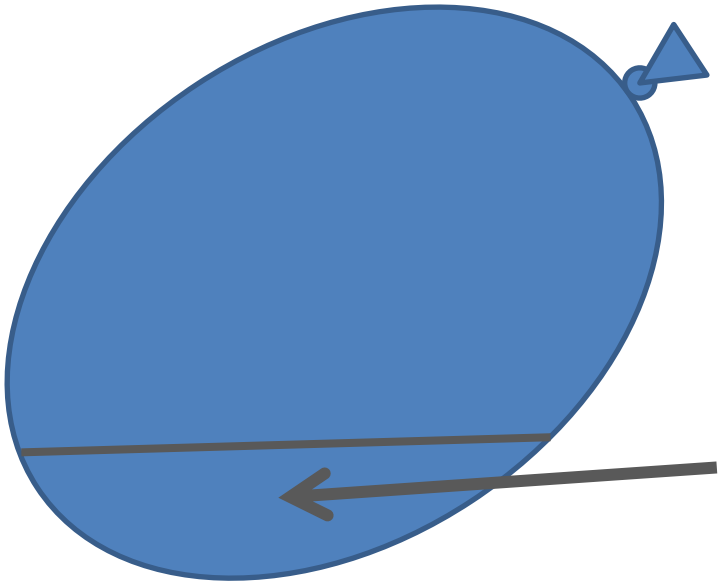
Predict – what will happen?

The magic balloon

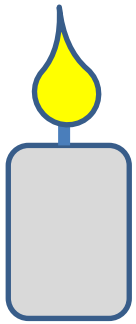


Explain– why did it happen?

The magic balloon

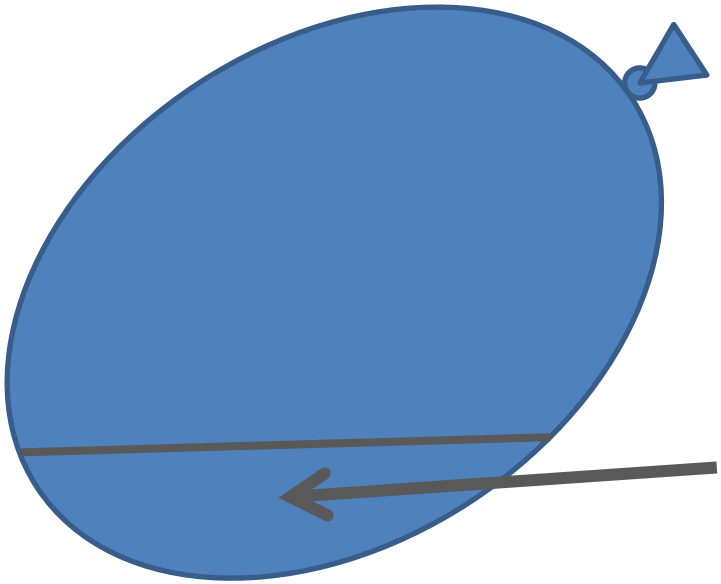


water

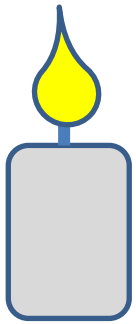


Predict – what will happen?

The magic balloon



water



Explain– why did it happen?

A scarily enthusiastic teacher ……

https://www.youtube.com/watch?v=10Zz3aulq9w

Recording –

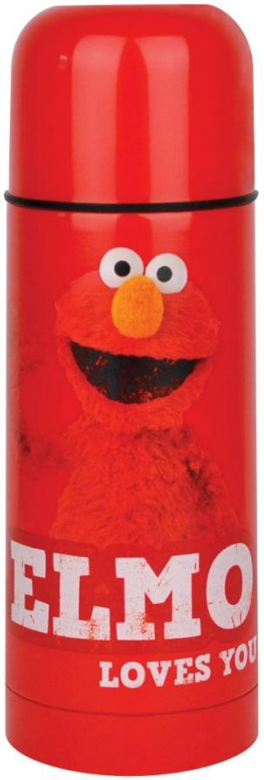
Explain why the balloon is not really magic, but is simply obeying the laws of heat transfer.

Target – Evaluate consumer research

- I can decide which product is most cost effective.
- I can compare the effectiveness of different products.
- I can compare heat loss from different flasks

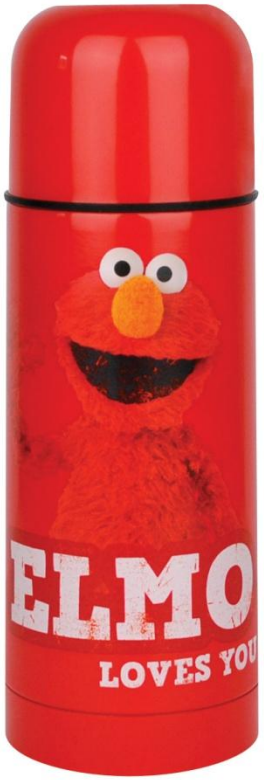

When I get to the top, I’m going to need a nice cup of tea.

So, how do you take a nice cup of tea up a mountain and keep it warm?



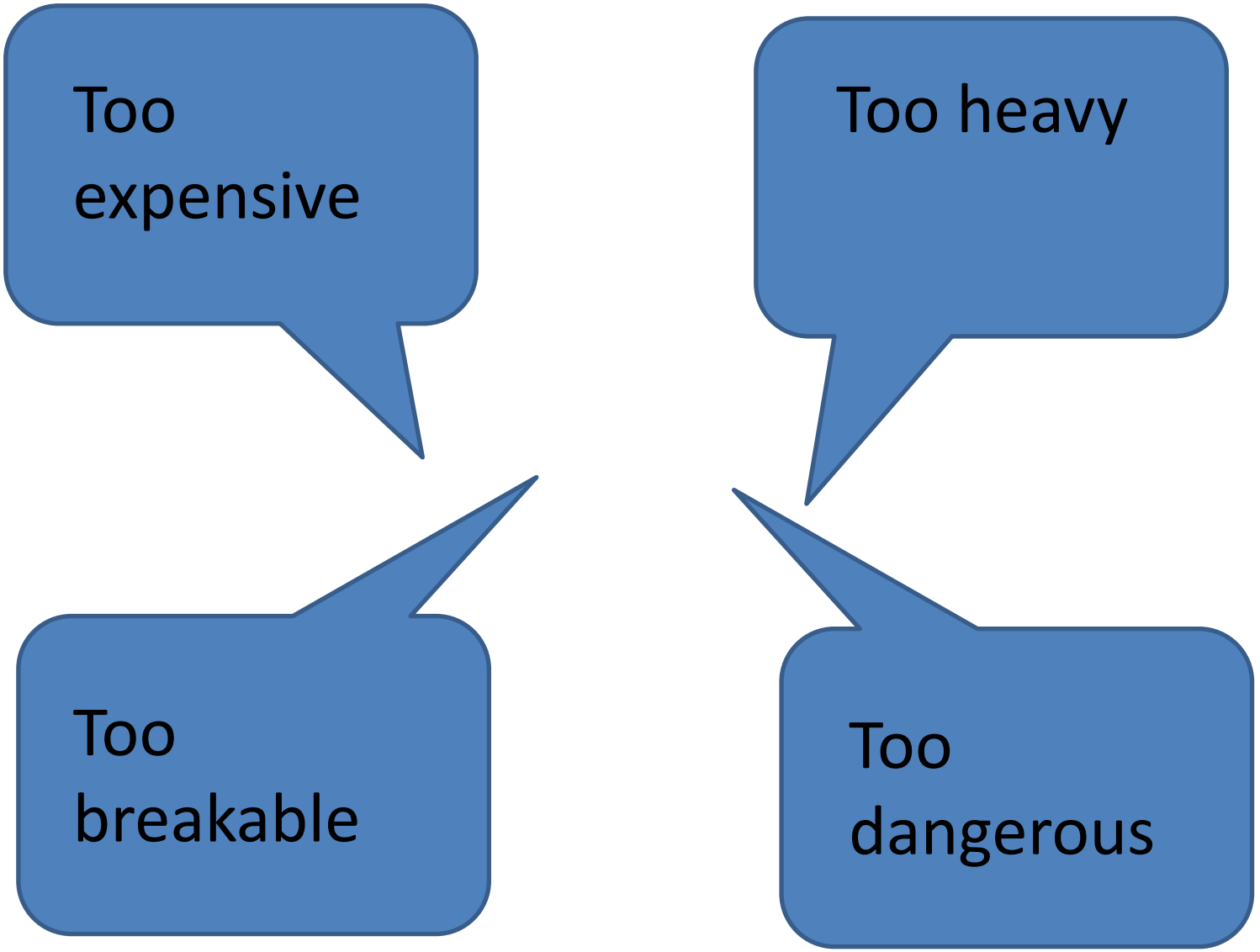
Flasks

Metal vacuum



Glass vacuum

Plastic vacuum


Too expensive
Too heavy
Too breakable
Too dangerous

You will be supplied with –

- Beakers
- Flask(s)
- Kettle
- Thermometers

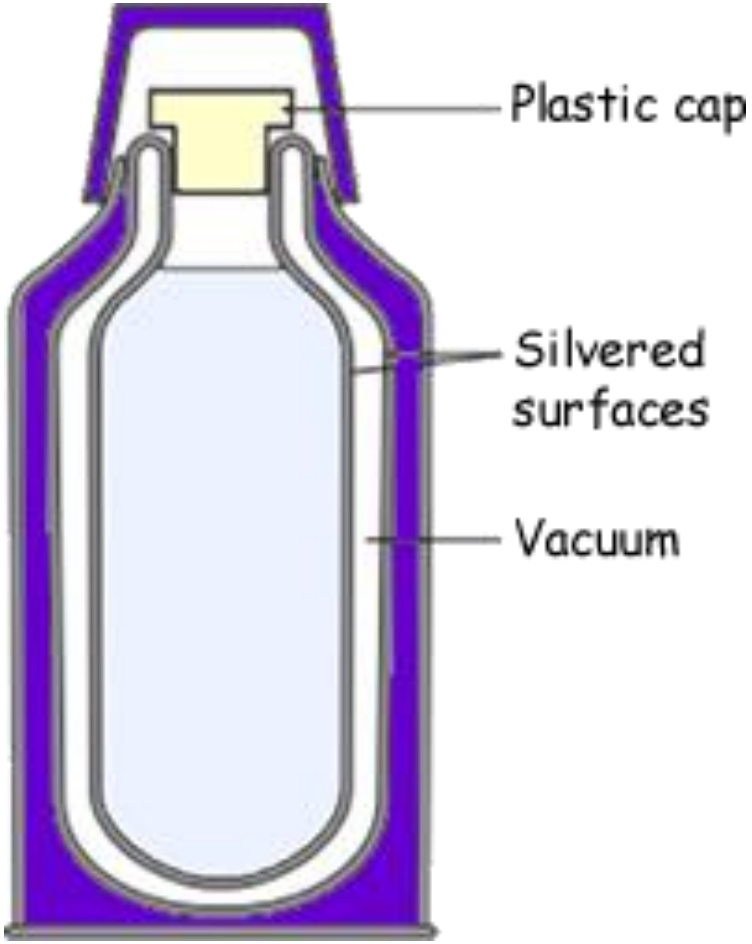
Your **task** is to find out the most cost effective way to take a cup of tea to the top of a mountain.
Your group has to produce a **poster** to say **how** you investigated this and **what you found**

How a flask stops heat loss -

Conduction

Convection

Radiation



Target – Design for survival

?

At the end of a marathon, the runners are collected together, wrapped in tin foil and baked in an oven at 300^0C for 3 hours.

Your task –

Design a **survival blanket**.

Think -

- Material
- Colour
- Thickness
- Layers
- Size / space needed
- Weight
- Cost

(space blanket)

If it works for keeping heat **in**, how about keeping heat **out**?

Title – **Investigate** space blankets

- Choose one investigation
- Carry out the investigation
- Write up the investigation –

  - ❑ Aim
  - ❑ Apparatus
  - ❑ Results
  - ❑ Conclusion

One layer or more?

Hood or not?

Tight or loose?

Fire resistant suit?