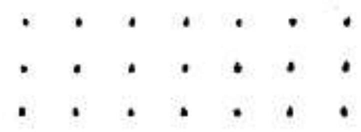
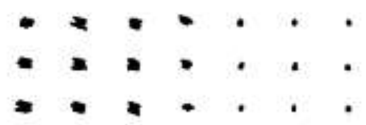
CONDUCTION

1. The particles in a solid each have their own place in much the same way as you keep in the same place while you sit round the table. There you manage to keep in your seat without sitting absolutely still. Sometimes, when you are feeling particularly energetic, you might jostle your neighbour and so pass some of your motion on. Exactly the same thing happens inside solids when you feed energy in. It makes no difference how you feed this energy in. You can shout at a piece of copper or kick it or pass electricity through it or simply heat it over a flame. All that the copper particles can do is move and if they take in any of your energy they will just move faster. This means that if you heat any solid you cause the particles to move backwards and forwards faster so that they jostle their neighbours into vibrating more. The extra jostling is passed through the solid and we can follow its progress by the rise in temperature since the amount of vibration tells you how hot the solid is.

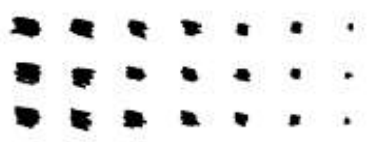
2. Model of a perfectly cold solid



Model of a solid which is warm at one end



Model of a solid which is hot at one end



3. Passing on movement energy from particle to particle like this is called *conduction*.

INSULATION

4. You can explain insulators in the same way because insulators must be materials whose particles are arranged in such a way that it is difficult for them to pass on the movement energy. When you heat one part of such material only those particles which take in the energy vibrate more. They do not pass this extra energy along to their neighbours so you get a hot spot where the heat goes in but cool material all around it.

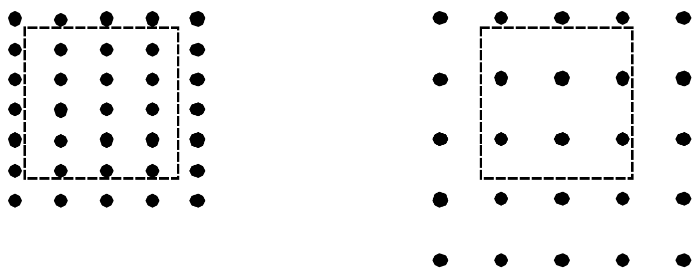
5. We use conductors and insulators together so we can guide the heat to where we want it. A central heating pipe is a good example. We use the pipe to carry the heat from the boiler to the radiators but we cover the pipe with an insulator to stop the heat going to other places.

6. An ordinary pan is another example since it has a good conductor on its base to guide the heat into the pan and it has more insulating materials elsewhere to keep the heat inside the pan.

CONVECTION

7. The hot gas or hot liquid float upwards in convection because the hot substance is *lighter* than an equal volume of cold substance. This is perfectly clear if you look at the behaviour of the particles involved.

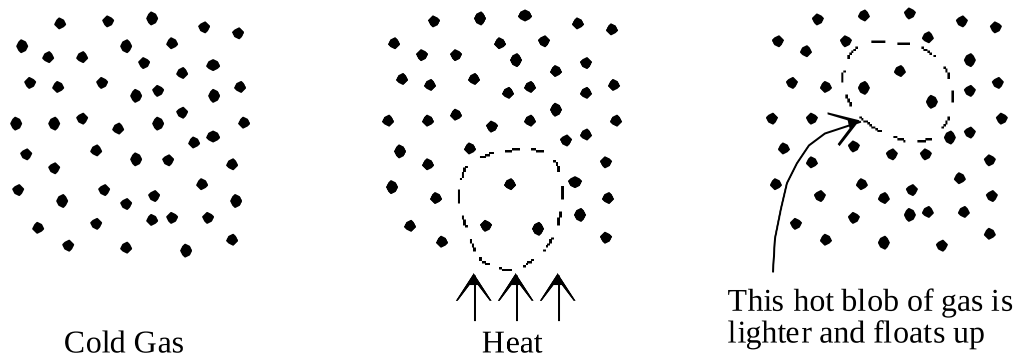
8. When you heat a gas, for example, its atoms move more quickly and take up more room. This means that there will be fewer atoms in one cubic centimetre of hot gas than there is in one cubic centimetre of cold gas as you can see in the diagrams.



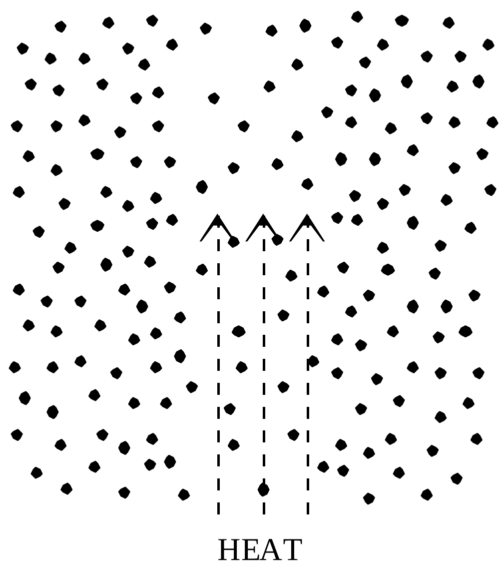
Cold Air Hot Air

9. This means that one cubic centimetre of hot gas is lighter than the same volume of cold gas and will float up through the cold gas just like a hot air balloon without its skin.

10. You can see this in the following diagrams.



11. If you continue heating, you end up with a rising column of hot gas or hot liquid above the heater which we call a *convection current.*



RADIATION

12. The heat radiation from objects is easy to speak about since it is just a form of light energy that cannot be seen by our eyes. We can only pick it up by the feeling of heat it causes on your skin, but it shows up on film so you can photograph it.

13. Apart from being invisible, it does everything you can see light doing. It reflects off shiny surfaces but gets taken in by rougher, black surfaces. It can travel through certain materials like glass and fog but gets stopped by things like stone and paper. You can concentrate it or turn it into a beam with mirrors.

14. The only really new thing you can find out about radiation is that dull, dark surfaces give it out better than shiny surfaces that are equally hot.