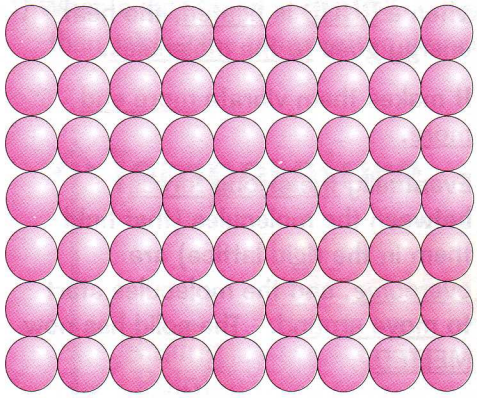
Solids, Liquids and Gases

These are known as the three states of matter. Make sure you know everything there is to know.

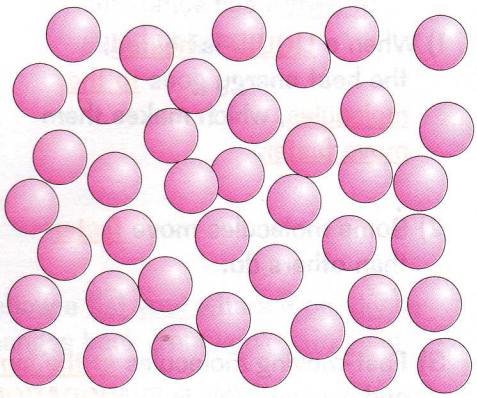
Solids have Strong Forces of Attraction



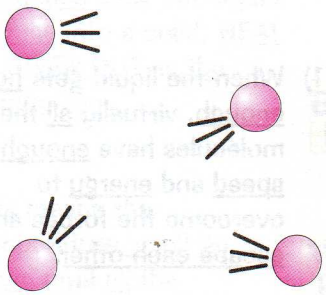
1) There are strong forces of attraction between molecules.
2) The molecules are held in fixed positions in a very regular lattice arrangement.
3) They don't move from their positions, so all solids keep a definite shape and volume, and don't flow like liquids.
4) They vibrate about their positions.
The hotter the solid becomes, the more they vibrate.
This causes solids to expand slightly when heated.
5) Solids can't be compressed easily because the molecules are already packed very closely together.
6) Solids are generally very dense.

Liquids have Moderate Forces of Attraction

1) There is some force of attraction between the molecules.
2) The molecules are free to move past each other, but they do tend to stick together.
3) Liquids don't keep a definite shape and will flow to fill the bottom of a container. But they do keep the same volume.
4) The molecules are constantly moving in random motion.
The hotter the liquid becomes, the faster they move.
This causes liquids to expand slightly when heated.
5) Liquids can't be compressed because the molecules are already packed closely together.
6) Liquids are quite dense, but not as dense as solids.



Gases have No Forces of Attraction



Pressure exerted by molecules bouncing off the walls of the container.

1) There is no force of attraction between the molecules.
2) The molecules are free to move. They travel in straight lines and only interact with each other when they collide.
3) Gases don't keep a definite shape or volume and will always expand to fill any container. Gases exert a pressure on the walls of the container.
4) The molecules are constantly moving in random motion.
The hotter the gas becomes, the faster they move. When heated, a gas will either expand or its pressure will increase.
5) Gases can be compressed easily because there's a lot of free space between the molecules.
6) Gases all have very low densities.

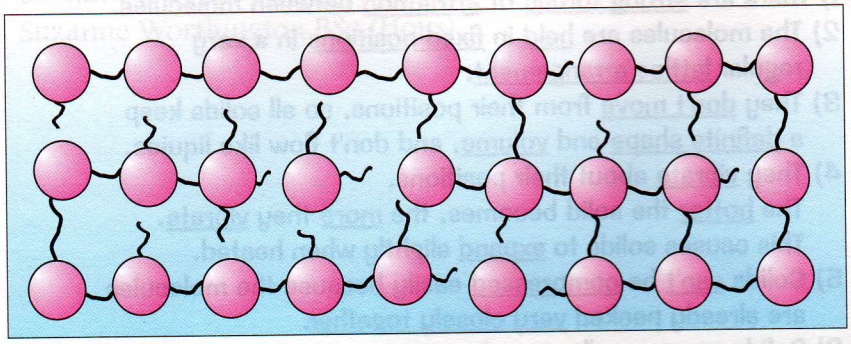
Don't get yourself in a state about this lot, just learn it...

This is pretty basic stuff, but people still lose marks in the Exam because they don't make sure to learn all the little details really thoroughly. And there's only one way to do that: COVER THE PAGE UP AND SCRIBBLE IT ALL DOWN FROM MEMORY. That soon shows what you really know — and that's what you've got to do for every page. Do it now for this one, AND KEEP TRYING UNTIL YOU GET IT ALL RIGHT.

Changes of State

CHANGES OF STATE always involve HEAT ENERGY going either IN or OUT.

Melting — the rigid lattice breaks down



1) When a SOLID is heated, the heat energy goes to the molecules.

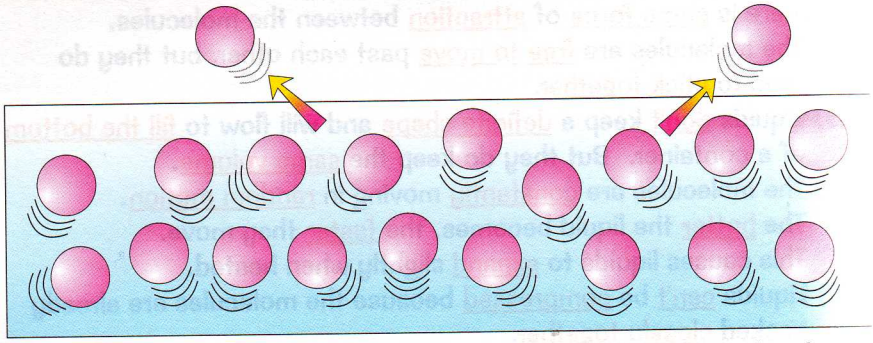
2) It makes them vibrate more and more.

3) Eventually the strong forces between the molecules (that hold them in the rigid lattice) are overcome, and the molecules start to move around. The solid has now MELTED.

Evaporation — the fastest molecules escape

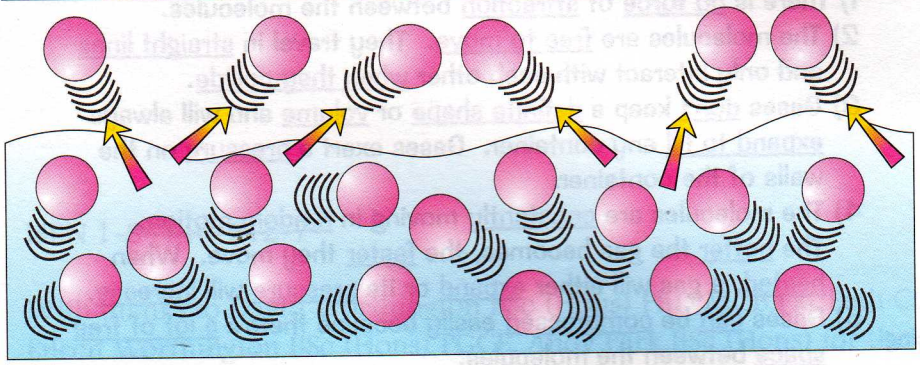
1) When a LIQUID is heated, the heat energy goes to the molecules, which makes them move faster.

2) Some molecules move faster than others do.



3) Fast-moving molecules at the surface will overcome the forces of attraction from the other molecules and escape. This is EVAPORATION.

Boiling — all molecules are fast enough to escape



1) When the liquid gets hot enough, virtually all the molecules have enough speed and energy to overcome the forces and escape each other.

2) At this point big bubbles of gas form inside the liquid as the molecules break away from each other. This is BOILING.

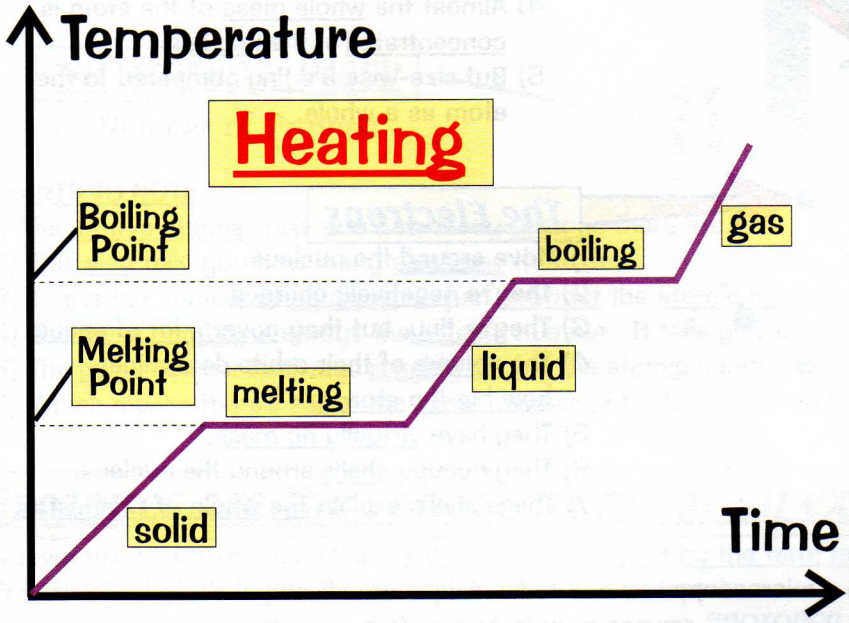
Simmer down — this stuff's really quite easy...

There are three diagrams and just eight numbered points on this page. They wouldn't be there if you didn't need to learn them. So learn them. Then cover the page and scribble them all down. You have to realise this is the only way to really learn stuff properly. And learn it you must.

Changes of State

Heating and Cooling Graphs Have Important Flat Spots

1) When a substance is MELTING or BOILING, all the heat energy supplied is used for breaking bonds rather than raising the temperature, hence the flat spots in the heating graph shown here.



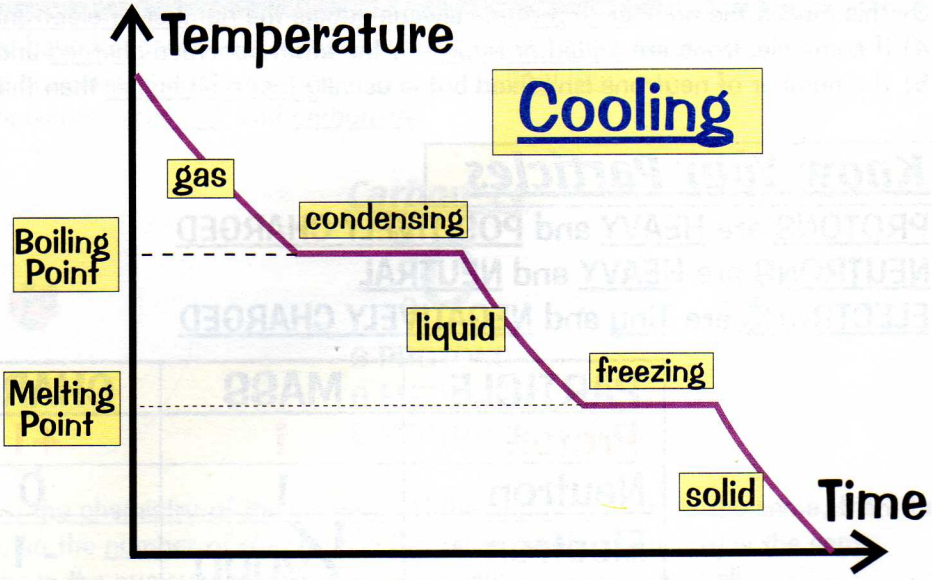
2) As the molecules melt into liquid, or boil into gas, HEAT IS TAKEN IN as the bonds are broken.

3) This means the temperature won't go up until all the substance has turned to liquid or gas.

4) When a substance is being cooled, the graph for temperature will show a flat spot where it condenses from gas back into liquid and also at the freezing point where it changes back from liquid into solid.

5) As the molecules condense back into liquid or fuse into a solid, HEAT IS GIVEN OUT as the bonds form.

6) This means the temperature won't go down until all the substance has turned to liquid or solid.



Revision — don't get all steamed up about it...

They can give you graphs just like these in the Exam and likely as not they'll ask you to explain the flat spots. Remember, it's all to do with the heat energy getting soaked up when bonds are being broken, and then being released again when the bonds are re-forming. Learn and enjoy.