8A2 Heating and Cooling
Lesson 9: Changes of State

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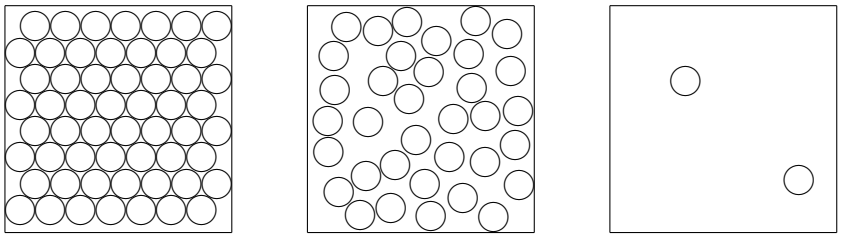
Quite a number of the class were away for this lesson (on the geography 'rivers' trip), and so for homework on Wednesday 20 October, I want you all to copy up and complete all of the work on this sheet into the front of your exercise books, which ought to ensure that everyone is at the same point.

Changes of State Notes



Start by drawing 3 boxes in your book, and draw what the the molecules look like in a solid, liquid and gas in them, labelling your drawings carefully. Underneath your boxes, write a sentence or two about the properties of each state of matter.

Evaporation of Propanone

There isn't that much difference in the spacing between the molecules in a liquid and a solid (much less than I have shown on the diagrams above, because I haven't enough time to draw a better picture in LaTeX right now). To show this, and to emphasize the huge difference in spacing between the molecules in a gas and a liquid, we did a demonstration in which I allowed 1 cm^3 of propanone, measured with a hypodermic syringe, evaporate in a gas syringe.

Solidification of Salol

In the lesson, those who were there investigated changes of state with a class practical on the solidification of phenyl salicylate (also known as salol).

If you have your own results, you need to draw a graph of these on graph paper. Make sure that you label your axes, use a ruler, put a title and draw a smooth curve through the points. For those who did not do the experiment, or whose data are known to be flawed in some obvious way, I have produced some data for you to use.

t/min	T/ °C
0.0	45
0.5	43
1.0	41
1.5	39
2.0	38
2.5	38
3.0	36
3.5	35
4.0	34
4.5	35
5.0	36
5.5	36
6.0	37
6.5	37
7.0	37

t/min	T/ °C
8.0	37
9.0	36
10.0	37
11.0	37
12.0	37
13.0	37
14.0	36
15.0	35
15.0	35
16.0	34
16.0	34
17.0	34
17.0	33
18.0	33
18.5	32

To complete the write up, you also need to write out what we did, and your interpretation of the results. Remember to stick in your graph, and your completed write up must include the aim of the experiment and also a diagram of how we did it. Answer the following points thoughtfully:

- Why did the temperature stay the same for so long? Was heat being lost to the surroundings during this time? If so, where did this heat energy come from?
- What was the freezing temperature of the salol (from your graph)? When did you see solidification start and finish?
- Most groups found that the salol cooled for a time, and then warmed back up to settle at the same temperature for ages... Where did the heat come from to warm back up (it can't have come from the lab, which was cooler)? Why did this happen?

Changes of State Notes (continued)

Once you have completely finished your write up of the practical, I should like you to make some brief notes on changes of state in the front of your books.

Try to write down all of the scientific words for changes of state – you might like to draw a triangle for this, with solid, liquid and gas at each corner, try and find 2 words for each side, drawing arrows to make it clear which direction the change refers to.

Finally, try to draw diagrams (maybe near the edges of your triangle) to show what is happening to molecules in each kind of change of state. Think about what you could see e.g. for melting, at the surface of a lump of ice.