

## Physics: Heat

### Whole unit overview

Learning Outcomes	Suggested Teaching Activities	Resources
2.1 (a)		
2.1(b)	<p>Use examples of phenomena that are explained by the particle theory to build up understanding e.g. diffusion in liquids, diffusion of gases (bromine in air – fume cupboard required), crystal structure etc.</p> <p>Students should observe Brownian motion e.g. using the 'smoke cell' experiment.</p> <p>Models should be used to illustrate as much as possible (e.g. crystal model).</p>	<p>This site has a good JAVA Applet that shows diffusion.  <a href="http://www.geocities.com/pirator/browni/Difus.html">http://www.geocities.com/pirator/browni/Difus.html</a></p> <p>Brownian motion is well illustrated on this site.  <a href="http://www.phys.virginia.edu/classes/109N/more_stuff/Applets/">http://www.phys.virginia.edu/classes/109N/more_stuff/Applets/</a></p> <p>Click on Einstein's Explanation of Brownian Motion.</p>

	<p>Relate the properties of solids, liquids and gases to the forces and distances between molecules and to the motion of the molecules.</p> <p>Show an appreciation that massive particles may be moved by light, fast-moving molecules.</p>		
2.1 (c)	<p>Describe evaporation in terms of the escape of more-energetic molecules from the surface of a liquid.</p> <p>Relate evaporation and the consequent cooling.</p>	Students should experience the cooling effect of evaporation.	
	Demonstrate an understanding of how temperature, surface area and draught over a surface influence evaporation.		
2.1 (d)	Relate the change in volume of a gas to change in pressure applied to the gas at constant temperature.	A direct measuring Boyle's Law apparatus can be used here. Useful graph plotting and interpretation skills are included.	<p>Extend this work by using the practical experiment suggested on this site about the temperature and pressure of a gas.</p> <p><a href="http://school.discovery.com/lessonplans/">http://school.discovery.com/lessonplans/</a></p> <p>Click on Physical Science, then Temperature and Pressure</p>
	Recall and use the equation $pV = \text{constant}$ at constant temperature.		<p>This site may provide an interesting interactive experience for a more able student to explore the ideas around the gas laws.</p> <p><a href="http://jersey.uoregon.edu/vlab/Piston/index.html">http://jersey.uoregon.edu/vlab/Piston/index.html</a></p>

2.2 (a)	<p>Describe qualitatively the thermal expansion of solids, liquids and gases.</p> <p>Identify and explain some of the everyday applications and consequences of thermal expansion.</p> <p>Describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure.</p>	<p>Experiments to show expansion of a metal rod and the 'bar breaker' demonstration. A large round bottom flask filled with (coloured) water and fitted with a long glass tube shows expansion of the water when heated gently.</p> <p>The 'fountain' experiment shows the expansion of air and brings in good discussion of the effect of pressure difference to stretch the more able students.</p>	
	<p>Show an appreciation of the relative order of magnitude of the expansion of solids, liquids and gases.</p>		
2.2 (b)	<p>Appreciate how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties.</p> <p>Recognise the need for and identify fixed points.</p> <p>Describe the structure and action of liquid-in-glass thermometers.</p>	<p>Different types of thermometer can be used e.g. resistance thermometer, thermocouple.</p>	
	<p>Demonstrate understanding of sensitivity, range and linearity.</p> <p>Describe the structure of a thermocouple and show understanding of its use for measuring high temperatures and those which vary rapidly.</p>	<p>A simple thermocouple can be constructed and used.</p>	

2.2 (c)	<p>Relate a rise in temperature of a body to an Increase in internal energy.</p> <p>Show an understanding of the term thermal capacity.</p>	1 kg metal blocks of different metals can be heated with immersion heaters to show their different thermal capacities.	
	Describe an experiment to measure the specific heat capacity of a substance.	This can be extended to a quantitative determination of specific heat capacity.	
2.2 (d)	<p>Describe melting and boiling in terms of energy input without a change in temperature.</p> <p>State the meaning of melting point and boiling point.</p> <p>Describe condensation and solidification.</p>	Heating and cooling curves can be plotted from experimental readings (e.g. timed temperature readings when heating ice until the water boils and during the solidification of stearic acid).	<p>An interesting animated mystery for students to solve.</p> <p><a href="http://teams.lacoe.edu/documentation/classrooms/gary/heat/activities/mystery/Mystery.html">http://teams.lacoe.edu/documentation/classrooms/gary/heat/activities/mystery/Mystery.html</a></p>
	<p>Distinguish between boiling and evaporation</p> <p>Use the term latent heat and give a molecular interpretation of latent heat.</p> <p>Describe an experiment to measure specific latent heats for steam and for ice.</p>	Simple and direct experiments to determine specific latent heat (e.g. using a low voltage immersion heater).	