Physics: Heat

Whole unit overview

Learning Outcomes		Suggested Teaching Activities	Resources
2.1 (a)	State the distinguishing properties of solids, liquids and gases.		
2.1(b)	Describe qualitatively the molecular structure of solids, liquids and gases. Interpret the temperature of a gas in terms of the motion of its molecules. Describe qualitatively the pressure of a gas in terms of the motion of its molecules. Describe qualitatively the effect of a change of temperature on the pressure of a gas at constant volume. Show an understanding of the random motion of particles in a suspension as evidence for the kinetic molecular model of matter. Describe this motion (sometimes known as Brownian motion) in terms of random molecular bombardment.	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. Students should observe Brownian motion e.g. using the ‘smoke cell’ experiment. Models should be used to illustrate as much as possible (e.g. crystal model).	This site has a good JAVA Applet that shows diffusion. http://www.geocities.com/piratord/browni/Difus.html Brownian motion is well illustrated on this site. http://www.phys.virginia.edu/classes/109N/more_stuff/Applets/ Click on Einstein's Explanation of Brownian Motion.

	Relate the properties of solids, liquids and gases to the forces and distances between molecules and to the motion of the molecules. Show an appreciation that massive particles may be moved by light, fast-moving molecules.		
2.1 (c)	Describe evaporation in terms of the escape of more-energetic molecules from the surface of a liquid. Relate evaporation and the consequent cooling.	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.	Extend this work by using the practical experiment suggested on this site about the temperature and pressure of a gas. http://school.discovery.com/lessonplans/ Click on Physical Science, then Temperature and Pressure
	Recall and use the equation pV = constant at constant temperature.		This site may provide an interesting interactive experience for a more able student to explore the ideas around the gas laws. http://jersey.uoregon.edu/vlab/Piston/index.html

2.2 (a)	Describe qualitatively the thermal expansion of solids, liquids and gases. Identify and explain some of the everyday applications and consequences of thermal expansion. Describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure.	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. 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.	
	Show an appreciation of the relative order of magnitude of the expansion of solids, liquids and gases.		
2.2 (b)	Appreciate how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties. Recognise the need for and identify fixed points. Describe the structure and action of liquid-in-glass thermometers.	Different types of thermometer can be used e.g. resistance thermometer, thermocouple.	
	Demonstrate understanding of sensitivity, range and linearity. Describe the structure of a thermocouple and show understanding of its use for measuring high temperatures and those which vary rapidly.	A simple thermocouple can be constructed and used.	

2.2 (c)	Relate a rise in temperature of a body to an Increase in internal energy. Show an understanding of the term thermal capacity.	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)	Describe melting and boiling in terms of energy input without a change in temperature. State the meaning of melting point and boiling point. Describe condensation and solidification.	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).	An interesting animated mystery for students to solve. http://teams.lacoe.edu/documentation/classrooms/gary/heat/activities/mystery/Mystery.html
	Distinguish between boiling and evaporation Use the term latent heat and give a molecular interpretation of latent heat. Describe an experiment to measure specific latent heats for steam and for ice.	Simple and direct experiments to determine specific latent heat (e.g. using a low voltage immersion heater).	