KESTEVEN AND SLEAFORD HIGH SCHOOL
Physics Scheme of Learning

P6: Molecules and Matter

Intent – Rationale

The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain!

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
KS3: Topic P10 – Density and floating KS3: Topic C1 - States of matter	• GCSE: Pl0 Force and motion • A-Level: Topic 9 Thermodynamics
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work	• GB4e – Lesson 1 - Practical work problem solving • GB4i – Lesson 4 – Using models to creatively
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY *Solids Liquids and Gasses*-530.4 *Dictionary Of Physics-530.03* *Changing Materials-530.4* *Complete Physics-530*	• Make calculations using ratios and proportional reasoning to convert units and to compute rates (1c, 3c). • Make calculations of the energy changes associated with changes in a system, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes; thereby express in quantitative form

Matter and Waves-532	and on a common scale the overall redistribution of energy in the system (1a, 1c, 3c). • Calculate relevant values of stored energy and energy transfers; convert between newtonmetres and joules (1c, 3c). • Apply the relationship between density, mass and volume to changes where mass is conserved (1a, 1b, 1c, 3c). • Apply the relationship between change in internal energy of a material and its mass, specific heat capacity and temperature change to calculate the energy change involved; apply the relationship between specific latent heat and mass to calculate the energy change involved in a change of state (1a, 3c, 3d).

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Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?
Know Describe density as a property of a material and not a particular object. Calculate the volume of some regular shapes and the density of materials, with support. Outline the behaviour of particles in solids, liquids, and gases. Describe pressure as being caused by collisions of gas particles with the walls of its container. State that the temperature of a gas is related to the kinetic energy of the gas particles. **Apply** Calculate the density of materials. Measure the density of a solid and a liquid. Describe how the behaviour of particles changes as the energy of a system increases. Describe the behaviour of particles in a gas as the gas is heated. Describe how the pressure of a gas can change when it is compressed or allowed to expand. **Extend**

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Evaluate in detail the experimental measurement of density, accounting for errors in measurements. Use the concepts of kinetic and potential energy to explain changes in internal energy. Describe the linear relationship between changes in temperature and pressure for a gas. Use the relationship pV = constant to solve a variety of problems in which gas pressure or volume changes.

What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?
boiling point temperature at which a pure substance boils or condenses **Boyle's Law** for a fixed mass of gas at constant temperature, its pressure multiplied by its volume is constant **density** mass per unit volume of a substance **freezing point** the temperature at which a pure substance freezes **internal energy** the energy of the particles of a substance due to their individual motion and positions **latent heat** the energy transferred to or from a substance when it changes its state **melting point** temperature at which a pure substance melts or freezes (solidifies) **physical change** a change in which no new substances are produced **pressure** force per unit cross-sectional area for a force acting on a surface at right angles to the surface. The unit of pressure is the pascal (Pa) or newton per square metre (N/m^2) **specific latent heat of fusion L_f** energy needed to melt 1 kg of a substance with no change of temperature **specific latent heat of vaporisation L_v** energy needed to boil away 1 kg of a substance with no change of temperature	P6 L7 End of topic Test Past exam question assessed homework "Properties of solids and gases" Teams assignment

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
1(CP). Measuring density (Core practical)	I can describe density as a property of a material and not a particular object. I can state that the density of a material is the mass per unit volume. I can calculate the volume of some regular shapes and the density of materials, with support.	I can use the density equation in a wide variety of calculations. I can use appropriate significant figures in final answers when measuring density. I can evaluate in detail the experimental measurement of density, accounting for errors in measurements.	12x(solid block materials, plasticine, measuring cylinders, scales) Link
2. States of matter	I can describe the simple properties of solids, liquids, and gases. I can name the changes of state. I can state that there are changes in stores of energy associated with a material when its temperature is increased.	I can describe the forces acting between particles in a solid, liquid, and gas. I can describe the changes in the energy of individual particles during changes of state. I can explain in detail why the density of a material changes during a change of state, using a particle model.	Link
3. Internal Energy and Specific Latent Heat	I can state that the internal energy of a system increases as it is heated. I can identify which changes of state are related to increases in internal energy and which are related to decreases. I can outline the behaviour of particles in solids, liquids, and gases.	I can use the concepts of kinetic and potential energy to explain changes in internal energy. I can describe the changes in the size of intermolecular forces during changes of state. I can explain in detail why the pressure of a gas increases as it is heated.	12x(Steric acid, boiling tube, thermometer, hot water batch at temperature of 90°C) Link

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4. Gas Pressure and Temperature	I can state that as the temperature of a gas in a sealed container increases, the pressure of the gas increases. I can describe a gas as consisting of a large number of rapidly moving particles. I can describe pressure as being caused by collisions of gas particles with the walls of its container.	I can describe the linear relationship between changes in temperature and pressure for a gas. I can explain Brownian motion in terms of particle behaviour and collisions, relating the speeds of smoke particles and air molecules. I can describe in detail how the relationship between the pressure of a gas and its temperature can be investigated.	Demo (Hard boiled egg and conical flask, 1L glass beaker, kettle) Link
5. Gas pressure and volume (Physics only)	I can state that the temperature of a gas is related to the kinetic energy of the gas particles. I can state that the pressure of a gas increases when it is compressed (at a constant temperature). I can state that forces are required to compress a gas.	I can explain in terms of particle behaviour why the pressure of a gas increases when its volume decreases. I can use the relationship pV = constant to calculate the pressure or volume of a gas.	Demo (Boyles law and pump) Link
6. Gas pressure and volume (Physics only)	I can explain how gas pressure / temperature and pressure / volume are related I can apply the formula: P x V = constant	I can use the relationship pV = constant to solve a variety of problems in which gas pressure or volume changes.	Demo (Boyles law and pump) Link
7. End of Topic Test			