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| **Lesson Number – 19.3** |
| **Lesson Title – Change of state** |
| **Specification Reference** | **3.6.2.1** |
| **Learning Objectives** |
| Internal energy is the sum of the randomly distributed kinetic energies and potential energies of the particles in a body.The internal energy of a system is increased when energy is transferred to it by heating or when work is done on it (and vice versa), e.g. a qualitative treatment of the first law of thermodynamics.Appreciation that during a change of state the potential energies of the particle ensemble are changing but not the kinetic energies.Calculations involving transfer of energy.Calculations including continuous flow.For a change of state *Q* = *ml* where *l* is the specific latent heat. |
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| **Opportunities for Assessment** |
| Page 315 questions |
| **Starter:** | Slide #1 recaps change of state terms (Note that I have excluded Plasma however the tutor may want to extend the vocabulary here out of interest), the question at the bottom should create some discussion. |
| **Main:** | Slides #1 - #3 are simple recaps of states and their properties. Students may want to create them themselves as a warm up exerciseSlides #5 and #6 are a detailed explanation of the changes that occur as you continually heat a *pure* substance. It should be noted that mixtures do not have definite melting / boiling pointsSlide #7 introduces the latent heat ideas and poses an interesting question about a snowman. This test knowledge quite well and irons out preconceptions.Slide #8 defines specific latent heat. The pop up units may trip up students who misunderstand the difference with specific heat capacity.Slide #9 analyses the graph from and earlier slide and enables the tutor to discuss what measurements and calculations can e achieved from gradients and time / power calculationsSome people may wish to try and demo or perform a practical by heating a substance or allowing it to cool. Salol can be used for this or ice water however without slow heating, stirring and data logging equipment this seldom generates useful results. |
| **Plenary:** | Slide #10 is a summary |

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| **Homework:** | Page 315 questions, researching “Why a snowman does not melt” |
| **Differentiation / Extension / S&C** |
| Understanding the amount of energy needed to change state – links to astrophysics (Measuring the power output of the sun from the evaporation of water from a black baking tray in direct sunlight) |
| **Numeracy / Literacy** | **SMSC / Fundamental British Values** |
| Use of formula for specific latent heat | History of latent heat and the meaning of the word “latent” to mean “hidden” |
| **RESOURCES:** |
| None (Optional demo can be performed if equipment is in stock, see lesson plan) |
| **Risk Assessment** e.g. CLEAPSS card reference |
| N/A |
| **Working Scientifically (HSW)** |
| Optional homework / experiment to measure the output of the sun (See extension) |