**CSEC Physics Handout**

**Topic:** Phase Changes

The caloric theory could not explain the fact that when substances undergo a change of phase, their temperature remains constant even though they are still being supplied with energy. The kinetic theory explained this by stating that although the average kinetic energy of the molecules remained constant during a phase change, the average potential energy was being increased as bonds between molecules were being broken. Hence the average distance between molecules was increasing as the substance changed either from a solid to a liquid or from a liquid to a gas. So this is what the latent heat was doing.

During the phase changes, a great amount of energy is absorbed or released. The specific latent heat of fusion is the amount of energy required to change unit mass of the substance from the solid to the liquid state without changing the temperature. For example, if 1 kg of ice changes to water at 0 °C then 336 000 J of thermal energy is absorbed, whereas only 4 200 J of heat is needed to raise the temperature of 1 kg of water by 1 K. For steam, the specific latent heat of vaporization is 2 260 000 J kg-1.

This explains why a burn (scald) from steam is more dangerous than a burn from boiling water since so much more heat is given out by the steam.

During a change of phase the temperature remains constant. For example, when ice melts the temperature of the melting ice remains constant until all the ice has melted, even though heat is being supplied to the container with ice and water.

When the ice has melted, only then will the temperature start rising. Similarly, with water and steam- when water begins to boil, the temperature remains constant until all the water has boiled away.

***To demonstrate constant temperature during a phase change***

Heating a solid can cause it to melt and become a liquid at a point called its melting point if it’s pure, allowing it to cool again causes it to become a solid again at the same temperature, this time called it’s freezing point. The freezing point can be determined by a simple laboratory demonstration.

Pour acetamide (or any suitable solid) into a boiling tube until it is half-filled. Set up a bunsen burner under a gauze. Place a beaker of water on the gauze with the test tube in it and heat it until the acetamide has melted completely.

As soon as the acetamide has melted, remove the test tube from the beaker and place it in a boss and clamp stand, with a thermometer completely in the acetamide. Record the temperature every thirty seconds to the nearest degree or half-degree Celsius until it reaches about 65°C.

Plot a graph with temperature on the y-axis and time on the x-axis. The melting point is the y value of the flat region of the graph. During this time, heat is lost by forming bonds rather than its temperature falling.



