Ib physics chapter 3 notes

Science, Physics

I did not understand how to explain why temperature does not change during a phase change and am not entirely sure if I have accurately or thoroughly described 3. 2. 3 and 3. 2. 4. This is also the case for 3. 2. 12 Thermal Physics Thermal Concepts: Temperature (T) is a measure of how hot or cold an object is, and it is the temperature that determines the determines the direction of thermal energy transfer between two objects. It is a scalar quantity and is measure in degrees celcius (°C) or kelvin (K). 0 °C is equal to -273K. Kelvin is based on the properties of a gas. Thermal energy is the receiving of energy from a hot body by a cold body when placed next to each other. Internal energy of a substance is the total potential energy and random kinetic energy of the molecules of the substance. It is where molecules in a body gain energy internally and are able to be move faster (increased KE) and move apart (increased PE) from work being acted upon it. Moles: - A mole of any material contains 6. 022Ã—10^23 atoms or molecules. This is also known as Avogadro's constant. - However, all moles don't have the same mass due to the different types of particles which have different mass Thermal Properties of Matter: Specific Heat Capacity (C) of a material is the amount of heat required to raise the temperature of 1kg of the material by 1°C. It is measured in J Ã— °C / kg. It is expressed by the equation: c = Q/ mÎ” T; where m is mass, Q is the quantity of heat and Î” T is the change in temperature. Thermal Capacity (c) of a material is the amount of heat needed to raise the temperature by 1°C. It is measured in J / °C . It is expressed by the equation: C = Q/ Î” T; where Q is the quantity of heat added and Î” T is the amount of increase in temperature of a body. The physical difference between liquids, solids and gaseous phases in terms of molecular structure and particle motion involve atoms having KE and having strong attraction to each other when solid and having both KE and PE with less attraction and more room to move around when liquid with even more PE and increased potential to move around when gaseous. Evaporation is the change of state of matter from a gas to liquid, whereas boiling is the change of state from liquid to a gas. Specific Latent Heat (L) of a material is the amount of heat required to change the state of 1kg of the material without change in temperature. It is measured in J / kg. It is expressed by the equation: L = Q/m; where Q is the amount of energy and m is the mass. Kinetic Model of an Ideal Gas: Pressure = force/area The assumptions of the kinetic model of an ideal gas are: - The Molecules are perfectly elastic - The Molecules are spheres - The Molecules are identical - There is no force between the molecules (excepting collision) with constant velocity between collisions. - The molecules are very small Temperature is hence a measure of the average random kinetic energy of the molecules of an ideal gas as the speed of particles increase as the temperature rises. Thermodynamics: Thermodynamics relates to a thermodynamic system — this is a collection of bodies that can do work on and exchange heat between each other. These laws apply to all systems. 0K is absolute zero temperature, where molecules do not move The equation of state for an ideal gas: PV = nRT; where n is the number of moles and R is the molar gas constant. A real gas molecule has a shape and a finite size, whereas an ideal gas molecule (imaginary) is a point with no shape and it occupies no space. A real gas molecule interacts with others. An ideal gas molecule reacts totally independent of all others. There are no ideal gas molecules, only real gas molecules. However, as pressure decreases and the temperature increases, real gas molecules act more like ideal gas molecules. Thermodynamic Processes: The expression for the work involved in a volume change of a gas at constant pressure: PÎ” V; where P is pressure and V is volume According to the law of conservation of energy, energy cannot be created or destroyed. Hence, the first law of thermodynamics basically states that as a gas expands and gets hot, heat must have been added: Q = Î” U + W; where Î” U is the increase in internal energy, W is the work done by the gas and Q is the amount of heat added to a gas. Examples of changes of state of an ideal gas: - Isobaric (Constant pressure contraction) - Isochoric/Isovolumetric (Constant volume increase in temperature) - Isothermal expansion - Adiabatic contraction The Second Law of Thermodynamics: The second law states that it is not possible to convert heat completely into work, implying that thermal energy cannot spontaneously transfer from a region of low temperature to a region of high temperature. Hence, it is about the spreading out of energy. Entropy: - Entropy is used to quantify this second law. - Entropy is expressed by the equation: Î” S = Q/T; where Î” S is change in entropy and Q/T is the quantity of heat flow into a body at a certain temperature. It is measured in J/ K - The second law in terms of entropy changes states that in any thermodynamic process the total entropy always increases - Even though locally entropy may decrease, the total entropy of a system will always increase. i. e. the stock in a fridge may get colder and the molecules become more ordered, with entropy in the fridge decreasing; however the total entropy of the room will increase and the room will gain heat.