
IB THERMAL PHYSICS DEFINITIONS

Topic 3: Thermal physics

$$P = \frac{F}{A}$$

$$Q = mc\Delta T$$

$$Q = mL$$

TEMPERATURE: A measurement of how hot an object is. A scalar quantity. If two objects have the same temperature, there will be no net heat flow between them (they are at thermal equilibrium).

ABSOLUTE ZERO: The lowest temperature possible. $-273.16\text{ }^{\circ}\text{C}$ or zero kelvin (0 K). Kelvin is the absolute thermodynamic temperature scale.

INTERNAL ENERGY: The energy contained in an object due to the random KE and PE of the molecules.

THERMAL ENERGY: The non-mechanical transfer of energy between a system and its surroundings.

MOLE: The amount of a substance that contains the same number of particles as there are atoms in 12g of carbon-12.

MOLAR MASS: The mass of 1 mole of a substance. e.g. molar mass of water is 18g

AVOGADRO CONSTANT: The number of particles in a mole. $A = 6.02 \times 10^{23}$

THERMAL CAPACITY: The amount of thermal energy required to raise the temperature of an object by 1K.

SPECIFIC HEAT CAPACITY: The amount of thermal energy required to raise the temperature of 1kg of a substance by 1K.

MACROSCOPIC DESCRIPTION: Considers properties of matter such as pressure, volume, temperature (not in terms of particles).

MICROSCOPIC DESCRIPTION: Considers properties of matter at a particle level. Molecules are in motion and collide with each other and the container.

KINETIC ENERGY OF PARTICLES: Temperature is a measure of the average random kinetic energy of the particles.

PHASES OF MATTER: Particles in a solid are locked into the crystal structure and do not have enough KE to escape. In a liquid, they overcome the chemical bonds but cannot separate completely for the other atoms. The particles in a gas have enough KE to escape from each other.

EVAPORATION: The process by which faster-moving molecules escape from the surface of a liquid. This results in a cooling of the liquid.

BOILING: The process by which a liquid changes into a gas at the constant temperature of the boiling point.

SPECIFIC LATENT HEAT: The amount of thermal energy required to change the state of 1kg of a substance without a change in temperature. SLH of fusion is solid to liquid; SLH of vaporisation is liquid to gas.

PRESSURE: The force exerted per unit area. Measured in pascals.

MICROSCOPIC DESCRIPTION OF PRESSURE: Many moving particles exert forces when they collide with container walls give the effect of pressure being exerted by the gas.

IDEAL GAS: A theoretical gas composed of a randomly moving non-interacting particles. It is a useful idea because many real gases behave like an ideal gas unless temperature or pressure are very high or low.

KINETIC MODEL OF AN IDEAL GAS: A model which treats a gas as many molecules subject to the following assumptions:

- The molecules obey Newton's laws
- The intermolecular forces are negligible
- The molecules are spherical with negligible volume
- The motion of the molecules is random.
- The collisions are perfectly elastic.
- The time taken for a collision is negligible.