**IB Physics Topic 3: Thermal Physics.**
**Thermodynamics is the study of heat and its relationship to other forms of energy.**

## 3.1 Thermal concepts

3.1.1 State that temperature determines the direction of thermal energy transfer between two objects. Heat flows from bodies with higher temperature into bodies with lower temperature until thermal equilibrium is met. **(Law of Heat Exchange.)**

3.1.2 State the relation between the Kelvin and Celsius scales of temperature.
$T_K = T_C + 273$

3.1.3 State that the internal energy of a substance is the total potential energy and random kinetic energy of the molecules of the substance.

- Potential energy arises from forces of interaction between molecules.
- Kinetic energy is the average random/ translational/rotational motion of the molecules.

3.1.4 Explain and distinguish between the macroscopic concepts of temperature, internal energy, and thermal energy (heat).

3.1.5 Define mole and molar mass. Molar mass is the mass of a mole of molecules ($6.02\times10^{23}$ molecules) and is equal to the gram atomic weight.

3.1.6 Define the Avogadro constant.
$6.02\times10^{23}$ molecules/mol.

## 3.2 Thermal properties of matter

*Specific heat capacity, phase changes and latent heat*

3.2.1 Define specific heat capacity and thermal capacity.

- The c in $Q = mc\Delta T$.
- Be sure when you define a concept using a formula you explain each part of the formula.

3.2.2 Solve problems involving specific heat capacities and thermal capacities.
$Q = mc\Delta T$.

3.2.3 Explain the physical differences between the solid, liquid, and gaseous phases in terms of molecular behavior.

3.2.4 Describe and explain the process of phase changes in terms of molecular structure and particle motion.

3.2.5 Explain in terms of molecular behavior why temperature does not change during a phase change.
During phase changes heat energy goes into changing the potential energy of the forces bonding the molecules, rather than changing the kinetic energies of the molecules.

3.2.6 Distinguish between evaporation and boiling.

3.2.7 Define specific latent heat.

- The L in $Q = mL$.
- Be sure when you define a concept using a formula you explain each part of the formula.
- There is no temperature change during phase change, yet energy is added or removed to break or make inter-molecular bonds.
- The word “latent” means hidden.

3.2.8 Solve problems involving specific latent heats.

$Q = mL$.

*Kinetic model of an ideal gas*

3.2.9 Define pressure.

$p = F/A$. "pressure equals force per unit area"

3.2.10 State the assumptions of the kinetic model of an ideal gas.

3.2.11 State that the temperature is a measure of the random kinetic energy of the molecules of an ideal gas.

3.2.12 Explain the macroscopic behavior of an ideal gas in terms of a molecular model. For example, how does a change in volume produce a change in pressure or temperature?

Be able to use the Ideal Gas Law

$pV = nRT$.