

# Thermal Physics

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## Atoms

Atoms consist of electrons and protons. The electrons are negatively charged and the protons are positively charged. The size of one atom is around 0.1nm or  $0.1 \times 10^{-9}$  meters known as one Ångström.

A neutral atom has an equal number of protons and electrons, referred to as its atomic number, When an atom loses or gains an electron it becomes an ion. When noting isotopes we use  ${}^A_ZX^+$  where Z is the proton number, A is the nucleon number and X is the chemical symbol.

The number of neutrons can be found with  $\{N = A - Z\}$ .

as Atoms are very small the amount of atoms can be defined with a mole or avogadro's constant  $6.022\,141\,5 \times 10^{23}$  atoms per mole.

atoms mass can be represented with the atomic mass unit  $1.660\,540\,2 \times 10^{-27}$  kg.

Molar mass, M (g/mol), is mass per mole.

$$M \equiv \frac{m}{n}$$

where m is the mass of an atom and n is the number of atoms in a mole.

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## Laws

$$\frac{pV}{t} \equiv c$$

where p is the pressure, V is the volume and t is the temperature.

$$\frac{P_1 V_1}{t_1} = \frac{p_2 V_2}{t_2}$$

Pressure Law  $p \propto t$  where p is the pressure in pascal and t is the temperature in kelvin.

Boyles Law  $p \propto \frac{1}{V}$  where p is the pressure in pascal and V is the volume in liters.

Charles Law  $v \propto t$  where v is the velocity in m/s and t is the temperature in kelvin.

Avogadro Law  $n \propto v$  where n is the number of atoms in a mole and v is the velocity in m/s. R is the gas constant  $\equiv 8.31 \text{ Jk}^{-1}\text{mol}^{-1}$  so

$$\frac{pV}{nT} = R \equiv 8.31$$

$$\therefore pV = nRT$$

KE of one particle  $\text{KE} \equiv \frac{3}{2} K_b T$  where m is the mass of the particle and v is the velocity. and  $K_b = \frac{R}{N_A}$

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## Ideal Gas Law

Where converting  $10^3$  cm to M must multiply by  $10^{-6}$  to get the correct value.

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# Phase Changes

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