

Some Useful Information

Chapters 11 & 12

Ideal Gas Law:

$$pV = nRT \quad \text{-or-} \quad pV = NkT$$

p: pressure measured in Pascal (or in atmospheres)

V: volume measured in m^3 (or in liters)

T: absolute temperature (in Kelvin)

n: number of moles of the ideal gas

N: number of particles (atoms) of the ideal gas (*Note: Sometimes non-ideal gases are treated as ideal gases, and in this case, N can represent the number of molecules of the gas.*)

k: Boltzmann's Constant: $1.38 \times 10^{-23} \text{ J/K} = 1.38 \times 10^{-23} (\text{Pa} \cdot \text{m}^3)/\text{K}$

R: Universal Gas Constant: $8.31 \text{ J}/(\text{mol} \cdot \text{K}) = 0.0821 (\text{L} \cdot \text{atm})/(\text{mol} \cdot \text{K})$

N_A : Avogadro's Number: 6.02×10^{23} particles/mole

$$k = R/N_A$$

Ideal Gas:

The average kinetic energy for the atoms of an ideal gas is equal to

$$K_{\text{avg}} = \frac{3}{2} (kT),$$

where k is Boltzmann's Constant and T is the absolute temperature.

For an ideal gas, the total thermal energy of the gas is equal to the total kinetic energy of the moving atoms of the gas.

The total thermal energy of N atoms of an ideal gas is equal to

$$E_{\text{th}} = NK_{\text{avg}} = \frac{3}{2} (NkT),$$

where k is Boltzmann's Constant, and T is the absolute temperature of the gas.

The diagram shows a periodic table element card for Hydrogen (H). The card is white with a black border and features the word "hydrogen" in black, the atomic number "1" in black, the chemical symbol "H" in blue, and the atomic mass "1.0079" in black. A blue circle with a black border is positioned to the right of the card, containing the text: "The atomic mass of an element is the mass of one atom of the element in atomic mass units (a.m.u.), and the atomic mass of an element is also the mass of one mole of the substance in grams." A blue arrow with a black border points from the circle towards the atomic mass value "1.0079" on the card. The arrow is labeled "Atomic Mass" in black text.