- **1 Mole [mol]** of any substance contains the same number of molecules , called **Avogadro Number:**

$$N_A \approx 6.02 \cdot 10^{23} \frac{1}{mol}$$

- Molar Mass, **μ [g/mol]** is the mass of 1 mole of a given substance. To find it, you need to add up **atomic weights** of all the atoms in a single molecule. Those can be found in Periodic Table.

Example:

$$\mu_{H_20} = (2+16)\frac{g}{mol} = 18\frac{g}{mol}$$

	Volume	Mass	Amount of Substance	Number of Molecules
Symbol	**V**	**M**	**n**	**N**
Units	[m^3] or [cm^3]	[kg] or [g]	[mol]	**1**

$$\rho = \frac{M}{V}$$

Greek 'rho'

$$n = \frac{M}{\mu}$$

Greek 'mu'

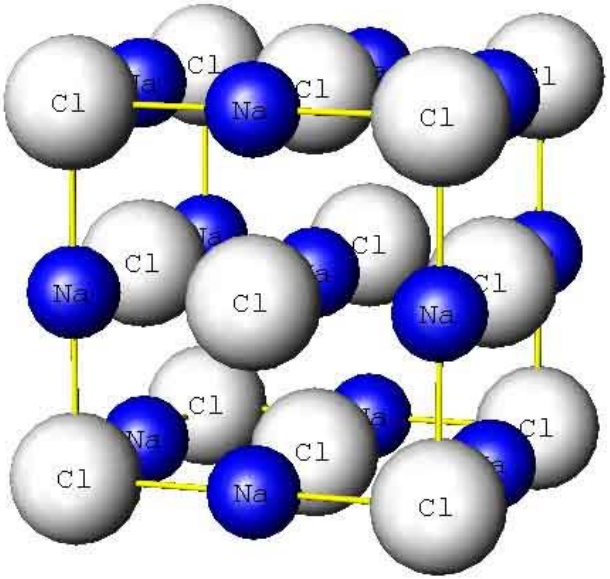
$$\nu = \frac{N}{N_A}$$

Problem 1

Suppose you know density ρ (in g/ml) and molar mass μ (in g/mol) for certain substance. Find how many molecules are contained in volume V of this substance. Using this general formula, determine how many molecules are there in V= 100 ml of each of the materials in the table (you will need to consult the Periodic table to find μ):

Substance	ρ (g/ml)	μ (g/mol)	# of molecules in V = 100 ml
liquid water, H_20	1		
liquid propane, C_3H_8	0.5		
Calcite (chalk)	2.7		
Aluminum*, Al	2.7		
Gold*, Au	19.3		

For metals (Al and Au) consider one atom to be a molecule.



Problem 2

Table salt (or Sodium Chloride, *NaCl*) is made of Sodium (Na+) and Chlorine (Cl−) ions held together by static electricity. Ions are atoms with extra or missing electrons (in this case, Chlorine steals one electron from Sodium). These ions form a cubic crystal as the one shown in the Figure. Find the distance between neighboring ions (Na and Cl), in cm, if the density of *NaCl* is ρ=2.16 g/ml.

Hint: from the previous problem you can find the number of Na and Cl ions in any volume. On the other hand, each ions occupies one cube of volume a^3. Remember that 1 ml=1cm^3.