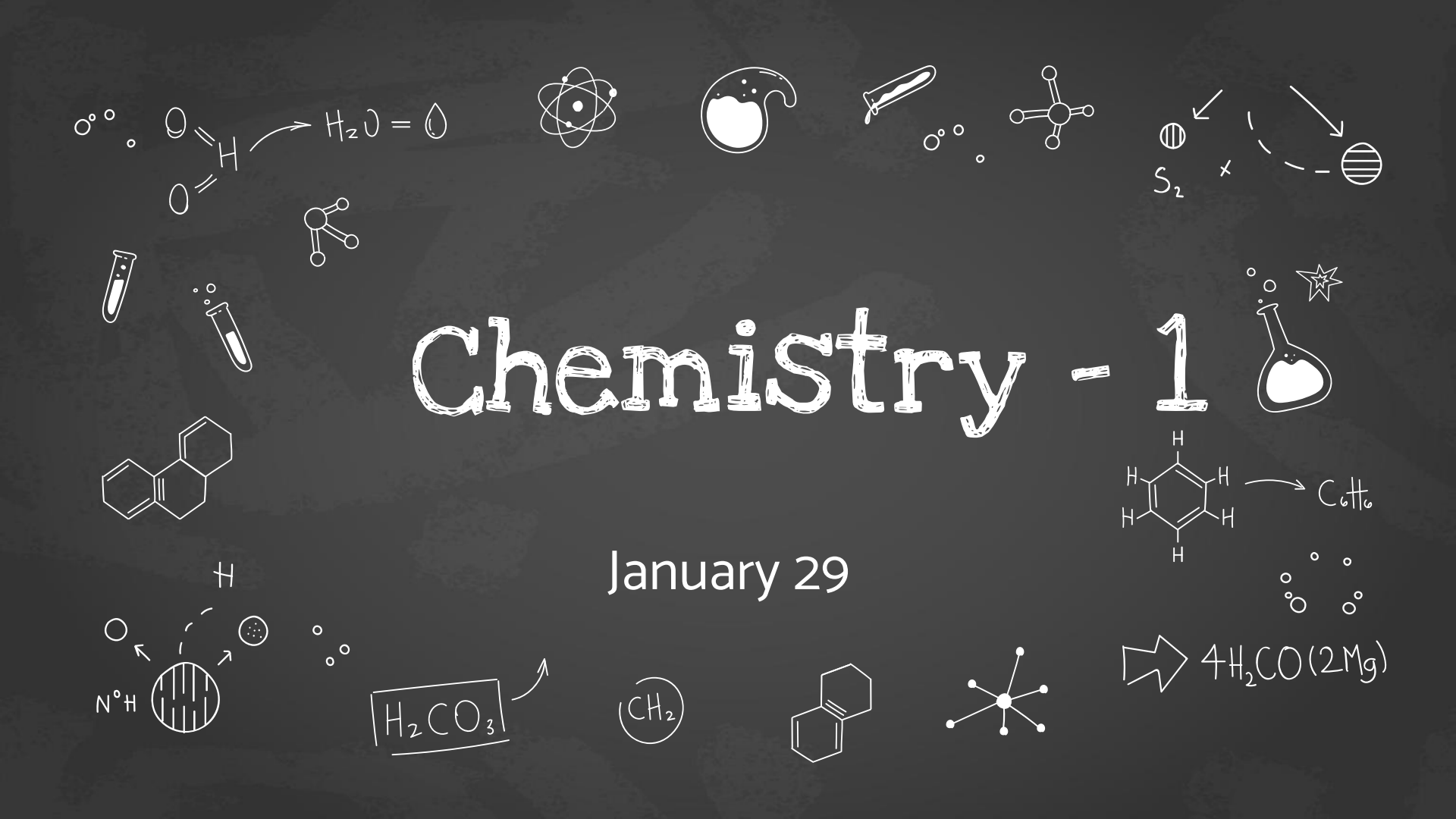
Chemistry - 1
January 29

Moles - unit of counting used in chemistry

Avogadro's number (6.022×10^{23}) represents the number of particles (atoms, ions, formula units, or molecules) in one mole of any substance

Any atom, element, or compound can have its mass expressed in atomic mass units (amu). The average atomic mass (in amu) for atoms of any element can be found on the periodic table.

Mole and amu

The numerical value of the amu of the atoms of a given elements is equal to the mass in grams of one mole of that element.

The mass of a single Na atom is 22.99 amu
One mole of Na has an average mass of 22.99 grams

Conversions of # of particles, # of moles, and the mass

E.g. NaCl has a mass of (22.99 + 35.45) = 58.44 amu
One mole of NaCl has a mass of (22.99 + 35.45) = 58.44 g

$$HCl_{(gas)} + NH_{3(gas)} \rightarrow NH_4Cl_{(solid)}$$
$$2H_{2(gas)} + O_{2(gas)} \rightarrow 2H_2O_{(gas)}$$
$$H_{2(gas)} + Cl_{2(gas)} \rightarrow 2HCl_{(gas)}$$

Equal gas volumes (at equal temperature and pressure) contain the same number of particles

- 1 mole of any gas takes a volume of **22.4 liters** at "normal conditions ". This is a molar gas volume under normal conditions.

- Normal conditions are temperature of 0°C (273 K) and pressure of 1 atm (101 325 Pa)

Clapeyron-Mendeleev equation

$$pV = nRT$$

n - gas mole number

p - gas pressure (atm)

V - gas volume (liters)

T - temperature (K)

R - gas constant (0.0821 l x atm/mole x K)

Example

A closed flask of 2.6 L contains oxygen under the pressure of 2.3 atm and temperature of 26°C.
How many moles of O_2 are there in the flask?

$$pV = nRT$$

$$n = PV/RT$$

$$n = (2.3\ atm \times 2.6\ L)/(0.0821\ (L \times atm/mole \times K) \times 299\ K)$$

$$273^{o}C + 26^{o}C = 299\ K$$

This class uses the materials from the following books:
Larry Gonick and Graig Criddle “The cartoon guide to chemistry”
Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”