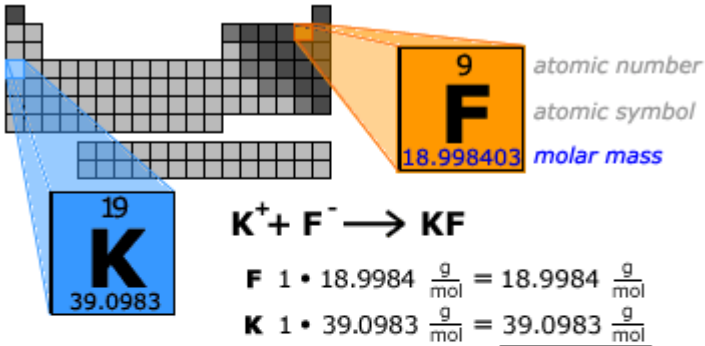
Introducing Conversions of Masses, Moles, and Number of Particles

key concepts:

- The **molar mass** of a substance represents the **mass** of one **mole** of that substance.
- The molar mass of a substance can be used as a conversion factor between mass and moles.



$K^+ + F^- \longrightarrow KF$

F $1 \cdot 18.9984 \frac{g}{mol} = 18.9984 \frac{g}{mol}$

K $1 \cdot 39.0983 \frac{g}{mol} = 39.0983 \frac{g}{mol}$

$58.0967 \frac{g}{mol}$

ethanol (C_2H_5OH)

C $2 \cdot 12.011 \frac{g}{mol} = 24.022 \frac{g}{mol}$

H $6 \cdot 1.0079 \frac{g}{mol} = 6.04764 \frac{g}{mol}$

O $1 \cdot 15.999 \frac{g}{mol} = 15.999 \frac{g}{mol}$

$46.069 \frac{g}{mol}$

The molar mass of a substance represents the mass of one mole of that substance. The molar masses of **elements** can be found on the **periodic table**.

For example, the molar mass of fluorine (F) is 18.998403 g/mol. One mole of fluorine has a mass of 18.998403 g.

Molar masses are additive. To find the mass of one mole of potassium fluoride (KF), simply add together the masses of potassium and fluoride. The molar mass of potassium fluoride is 58.0967 g/mol.

The molar mass of a more complex **molecule** such as ethanol (C_2H_5OH) can be found by multiplying the number of **atoms** of each element by the element's molar mass and summing these individual masses. The molar mass of ethanol is 46.069 g/mol.

What is the mass of 0.9628 mol of iron (Fe)?

$$\text{mass of iron} = \frac{0.9628 \text{ mol Fe}}{1} \left| \frac{55.845 \text{ g Fe}}{1 \text{ mol Fe}} \right. = 53.77 \text{ g Fe}$$

53.77 g iron = 0.9628 mol iron

The molar mass of a substance can be used as a conversion factor between mass and moles.

For example, to find the mass of 0.9628 moles of iron, simply multiply 0.9628 mol by the molar mass of iron (55.845 g/mol).

Notice that the mass of 0.9628 moles of iron is lower than the mass of one mole of iron. This makes sense, because 0.9628 is less than one.