

Chemical Quantities Outline

(The Mole)

Three ways to measure matter:

- Number present: Count how many there are
- By Mass/Weight: How many kg/lbs are present?
- By Volume: How many gallons/liters are present?

Explain how apples can be measured differently depending on where you purchase them.

A fruit stand may measure the # of apples purchased.
 A supermarket may measure by the weight (lbs).
 A orchard measure the volume (# bushels of apples).

What is the mass of 90 average sized apples if 1 dozen of the apples has a mass of 2.0 kg?

$$90 \text{ apples} \left(\frac{1 \text{ dozen}}{12 \text{ apples}} \right) \left(\frac{2.0 \text{ kg}}{1 \text{ dozen}} \right) = 15 \text{ kg}$$

What is a mole?

- The mole (abbreviated mol) is a way to determine how many particles are present in chemistry because they are way too small to count
- 1 mole is equal to 6.022×10^{23} representative particles
- This quantity is known as Avogadro's Number
- A representative particle is a species present in a substance and this can vary depending on the substance

Substance	Representative Particle (rp)	Chemical Formula	Representative Particles (rp) n 1.00 mol
Copper	atom	Cu	6.02×10^{23}
Water	molecule	H ₂ O	6.02×10^{23}
Calcium Ion	ion	Ca ⁺²	6.02×10^{23}
Calcium Fluoride	formula unit	CaF ₂	6.02×10^{23}

List the equality and two possible conversion factors between moles and RPs:

$$\frac{1 \text{ mol}}{6.02 \times 10^{23}} \quad \text{OR} \quad \frac{6.02 \times 10^{23}}{1 \text{ mol}}$$

Magnesium is a light metal used in the manufacture of aircraft, automobile wheels, and tools. How many moles of Mg is 1.25×10^{23} atoms of Mg?

$$1.25 \times 10^{23} \text{ atoms Mg} \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms Mg}} \right) = 0.208 \text{ mol Mg}$$

How many moles are in 2.8×10^{24} atoms of silicon?

$$2.8 \times 10^{24} \text{ atoms Si} \left(\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms Si}} \right) = 4.65 \text{ mol Si}$$

Propane gas (C_3H_8) is used for cooking and heating.

a. How many carbon atoms are in 1 molecule of propane?

3

b. How many hydrogen atoms are in 1 molecule of propane?

8

c. How many moles of carbon are in 1.00 mol of propane?

$$1 \text{ mol } \text{C}_3\text{H}_8 \frac{3 \text{ mol C}}{1 \text{ mol } \text{C}_3\text{H}_8} = 3 \text{ moles of C}$$

d. How many moles of hydrogen are in 1.00 mol of propane?

$$1 \text{ mol } \text{C}_3\text{H}_8 \left(\frac{8 \text{ mol H}}{1 \text{ mol } \text{C}_3\text{H}_8} \right) = 8 \text{ moles of H}$$