

Relative Atomic Mass

The Mole

Name: KEY
Date: _____

Mass: a measure of the amount of matter

Atomic Mass: the average mass of all isotopes of a particular element

- Atoms of different elements have different masses

ATOMIC MASS

- The mass of one individual ATOM is extremely small
- A LARGE # of atoms is required to provide enough mass to measure its mass
- A MOLE is a unit that measures the number of atoms that is equivalent to the atomic mass of a particular element.

A mole is used to upscale



THE MOLE

Avogadro's Number

1 mole = $6.02214179 \times 10^{23}$ items

**items = atoms/molecules/particles etc

Think about the term "dozen".

We can say ... $\frac{1 \text{ doz}}{12 \text{ eggs}} = \frac{12 \text{ eggs}}{1 \text{ doz}}$

... a dozen eggs = 12 eggs

... a dozen books = 12 books

Similarly, $\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ part}} = \frac{6.02 \times 10^{23} \text{ part}}{1 \text{ mol}}$

... a mole of particles = 6.02×10^{23} particles

... a mole of eggs = 6.02×10^{23} eggs

The abbreviation for the unit mole is mol. (do not confuse this with molecules!) molec

Reminder: All unit conversions must be completed in the chain conversion format!

Example: How many lithium atoms are in 3.2 mol of lithium?

$$? \text{ Li atoms} = 3.2 \cancel{\text{ mol Li}} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \cancel{\text{ mol}}} = \boxed{1.9 \times 10^{24} \text{ atoms Li}}$$

Example: How many oxygen atoms are in 6.02×10^{23} molecules of oxygen gas?

$$? \text{ atoms O} = 6.02 \times 10^{23} \cancel{\text{ molec O}_2} \times \frac{2 \text{ atoms O}}{1 \cancel{\text{ molec O}_2}} = \boxed{1.20 \times 10^{24} \text{ atoms O}}$$

Practice Problems: USE the Unit Conversion techniques discuss in the previous unit!

1. Find the number of chromium ions in 3.5 mol of chromium ions.

$$? \text{ Cr ions} = 3.5 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ ions}}{1 \text{ mol}} = 2.1 \times 10^{24} \text{ Cr Ions}$$

2. How many molecules of sodium chloride are in 0.23 mol NaCl?

$$? \text{ molec NaCl} = 0.23 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} = 1.4 \times 10^{23} \text{ molec NaCl}$$

3. 7.3×10^{24} carbon monoxide molecules represent how many moles of carbon monoxide?

$$? \text{ mol CO} = 7.3 \times 10^{24} \text{ CO molec} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec}} = 12 \text{ mol CO}$$

4. How many moles of argon do 1.81×10^{22} atoms of argon represent?

$$? \text{ mol Ar} = 1.81 \times 10^{22} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} = 0.0301 \text{ mol Ar}$$

5. How many moles of hydrogen are there in a mole of water? How many moles of oxygen are there in a mole of water? **Hint:** What is the ration of hydrogen atoms to oxygen atoms?

$$? \text{ mol H} = 1 \text{ mol H}_2\text{O} \times \frac{2 \text{ H}}{1 \text{ H}_2\text{O}} = 2 \text{ mol H}$$

$$? \text{ mol O} = 1 \text{ mol H}_2\text{O} \times \frac{1 \text{ O}}{1 \text{ H}_2\text{O}} = 1 \text{ mol O}$$

6. 1.4×10^{18} Ag atoms represent how many moles of atoms?

$$? \text{ mol Ag} = 1.4 \times 10^{18} \text{ Ag} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} = 2.3 \times 10^{-6} \text{ mol Ag}$$

7. If your body contains 0.0042 mols of Fe ions in a body, how many atoms of Fe are there in this body?

$$? \text{ atoms Fe} = 0.0042 \text{ mol Fe} \times \frac{6.02 \times 10^{23} \text{ atoms Fe}}{1 \text{ mol}} = 2.5 \times 10^{21} \text{ atoms Fe}$$