

Moles – Avogadro's Number

- I. The chemical formula represents 1 mole of that substance.
- II. The formula mass (expressed in grams) is the mass of 1 mole of that substance.
- III. 1 mole of a substance contains 6.02×10^{23} particles (atoms, molecules, ions, electrons, etc.)
- IV. 1 mole of any gas at STP (1 atmosphere of pressure and 0°C) occupies 22.4 liters of volume.

Name	Formula	Formula mass	# of particles
Atomic nitrogen	N	14.0	6.02×10^{23} atoms
Nitrogen gas	N ₂	28.0	6.02×10^{23} molecules (1.20×10^{24} atoms)
Silver ions	Ag ⁺¹	108	6.02×10^{23} ions
Sodium chloride	NaCl	58.5	6.02×10^{23} ion pairs
Ammonium sulfate	(NH ₄) ₂ SO ₄	132	6.02×10^{23} molecules

Problems:

1 mole Mo = _____ g

1 mole Mo = _____ atoms

7 moles Mo = _____ g

7 moles Mo = _____ atoms

1 mol Th₃(PO₄)₄ = _____ molecules = _____ g

0.5 mol CO₂ = _____ g = _____ molecules

1.5 mol MgCl₂ = _____ g = _____ ion pairs

1 mol KNO₃ = _____ mol K, _____ mol N, _____ mol O

NAME _____

SECTION _____

PARTNERS _____

DATE _____

MOLES, MOLECULES, FORMULAS

This activity is designed to introduce a convenient unit used by chemists and to illustrate uses of the unit.

Part I: What Is a Mole And Why Are Chemists Interested in It?

Counting things is a normal part of everyday life. How many days left until vacation? How many eggs do I need for the recipe? If large numbers of things are involved, we use grouping strategies to make the numbers easier to manage. For example, 4 more *weeks* until vacation, tells us that there are twenty-eight days. One *dozen* eggs is the common way of expressing the quantity 12. Half of a dozen of anything would be 6 units. One *gross* is 144 items (12 dozen) and a *ream* of paper contain 500 sheets.

Chemist are faced with a unique problem when dealing with numbers of atoms or molecules. The particles are so small that any amount of them that we are able to physically handle contains a number of particles so large that there is nothing else in our experience that contains so many units. This *incredibly large number calls for a special counting group - the MOLE.*

A MOLE is 6.022×10^{23} particles. This is often referred to as *Avogadro's number*. Let's make sure we understand how big this is. One mole of the element carbon has a mass of 12.01 grams. The smallest particle of an element is an atom. So one mole of carbon contains 602,200,000,000,000,000,000,000 atoms of carbon.

Look for the element carbon on the periodic table. Do you notice anything special about the value 12.01? Explain _____

The mass of one mole of the element magnesium is 24.30 grams. How many atoms does a sample of magnesium with a mass of 24.30 grams contain? _____

Stated in general terms, the mass of one mole of any element is equal to the _____ of that element expressed in grams. The mass of a mole of any element can be found by looking on _____.

The mass of 0.5000 moles of carbon is _____ and contains _____ atoms of carbon.

Remember when dividing numbers written in scientific notation the number portion is divided

