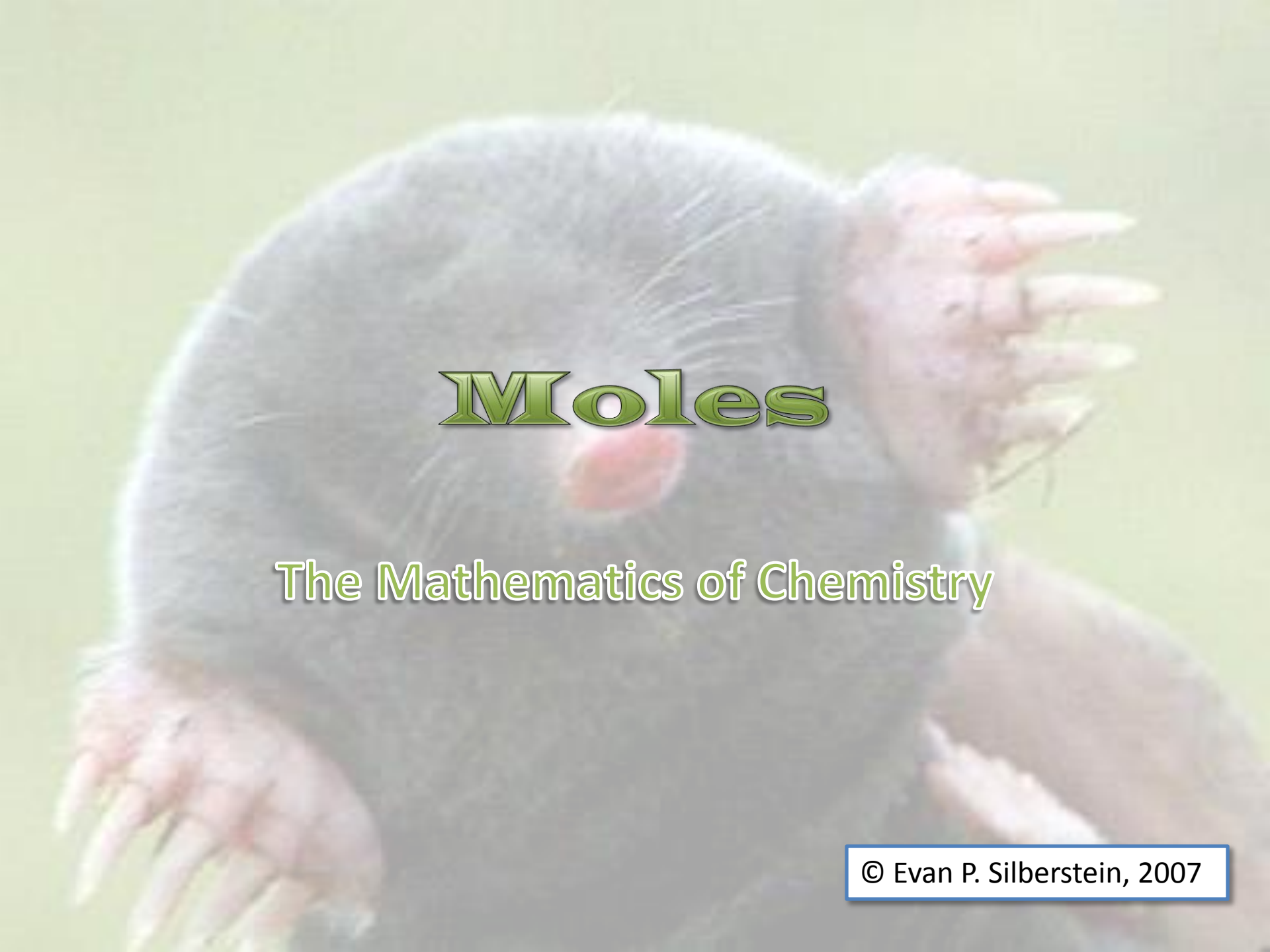
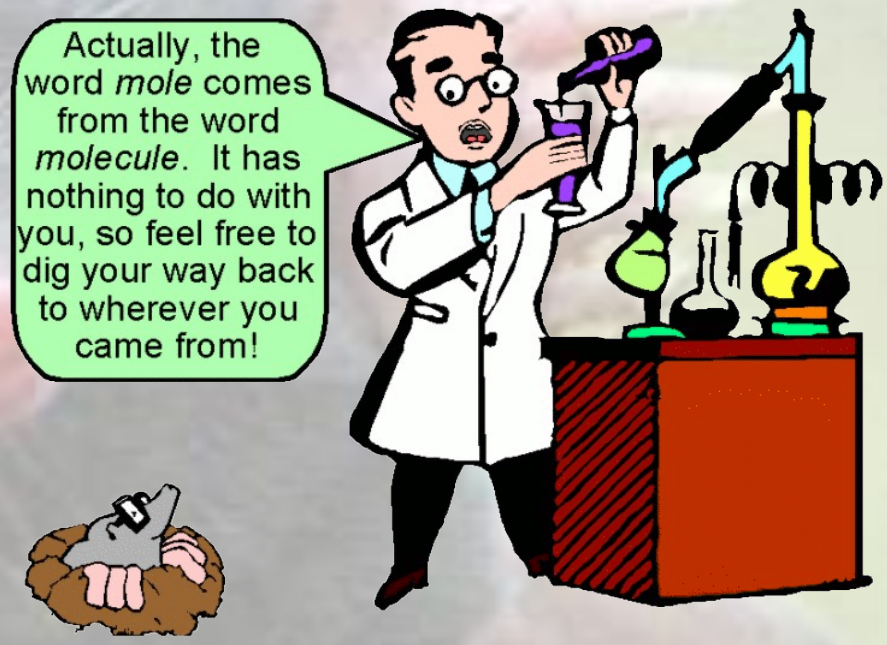


Moles

The Mathematics of Chemistry

Introducing Moles

- The mole is a very useful concept in chemistry. It is a quantity, just as a dozen is a quantity, but it is much more than a dozen.
- The number of objects in a mole is 6.02×10^{23}.
- The importance of the mole as a quantity in chemistry comes from the fact that all moles, just like all dozens, have the same number of particles.



A Practical Definition

- A mole is a formula mass expressed in grams.
  - 1 mole = 1 gram formula mass (1 mol = 1 GFM)

Substance	Formula Mass	Gram Formula Mass
Carbon	12 amu	12 g
Sodium Chloride (NaCl)	58 amu	58 g
Glucose ($C_6H_{12}O_6$)	180 amu	180 g

- Atomic mass units are too small to measure on a laboratory balance, but grams are not.

Calculating with Moles

- The gram formula mass (GFM) is the number of grams per mole.

- $\text{GFM} = \frac{\text{g}}{\text{mol}}$
- $\text{g} = \text{GFM} \times \text{mol}$
- $\text{mol} = \frac{\text{g}}{\text{GFM}}$

- Basic mole calculations can be done with these equations or by the factor label method.

Mole Problems

What is the mass of 2 moles of sodium thiosulfate?

- **Step1:** Find the formula mass of the substance and express it in grams

$\underline{Na_2S_2O_3}$

Na =	23	×	2	= 46
S =	32	×	2	= 64
O =	16	×	3	= 48
				158 g

- **Step 2:** Apply the factor label method

$$(2\ \text{mol})\left(\frac{158\ \text{g}}{1\ \text{mol}}\right) = 316\ \text{g}$$

- *or* **Step 2:** Apply the formula

g = GFM × moles

= $158\ {}^{g}/_{mol}$ × 2 mol

= 316 g

More Mole Problems

How many moles are in 390g of calcium chloride?

- **Step1:** Find the formula mass of the substance and express it in grams

$\underline{CaCl_2}$

Ca =	40	×	1	= 40
Cl =	35	×	2	= 70
				110 g

- **Step 2:** Apply the factor label method

$$(290\ g)\left(\frac{1\ mol}{110\ g}\right) = 3.5\ mol$$

- *or* **Step 2:** Apply the formula

$$mol = \frac{g}{GFM}$$

$$mol = \frac{290\ g}{110\ {}^{g}/_{mol}} = 3.5\ mol$$