Cycle 4 Chemistry I Honors Topic

OBJECTIVE: Use mass composition data to write formulas and names for ionic compounds.

WARMUP:

Please name the following compounds using roman numeral notation:

V_2O_5 , V_2O_3 ,VO_2 , VO

HINT: All have the form of "Vanadium (____) Oxide"

CLASSWORK:

Mass Composition, Formulas, and Names Worksheet

End Of Slide

Cycle 4 Chemistry I Honors Topic

WARMUP:

Please name the following compounds using roman numeral notation:

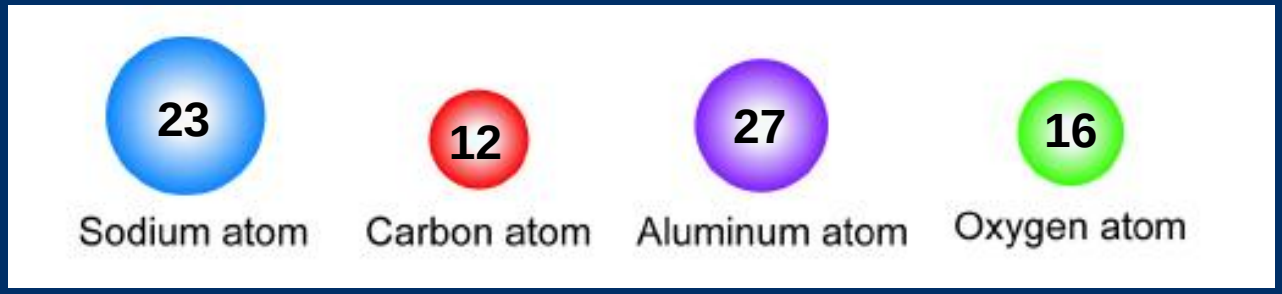
V_2O_5 , V_2O_3 ,VO_2 , VO

- We know that oxide is O^{-2}: see your PT.
- Remember total charge in formula must be zero!
- V_2O_5 has 5 oxides, total charge -10: V must be +5.
  - V_2O_5 is therefore "Vanadium (V) Oxide"
- V_2O_3 has 3 oxides, total charge -6: V must be +3.
  - V_2O_3 is therefore "Vanadium (III) Oxide"
- VO_2 has 2 oxides, total charge -4: V must be +4.
  - VO_2 is therefore "Vanadium (IV) Oxide"
- VO has 1 O^{-2} & one V^{+2}: "Vanadium (II) Oxide"

End Of Slide

Our Friend, The Mole

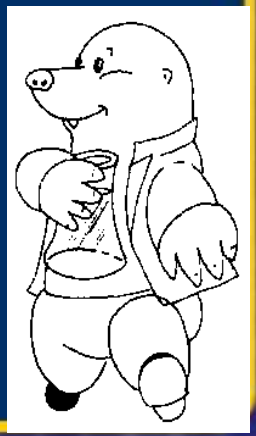
- Suppose we know the mass of each element in a sample of a compound.
- How can we find out how many atoms of each element are in the compound's formula?
- We can't just compare the mass in grams of each element, because different elements have different masses.
- We can divide the mass in grams by the mass of each type of atom in atomic mass units.



Our Friend, The Mole

Example: A compound has 1.26 grams of iron and 0.54 grams of oxygen. Find its formula and name!

- Divide the mass in grams by the mass of each type of atom in atomic mass units.
- 1.26 g Fe ÷ 55.845 amu = 0.02256 **mole** Fe
- 0.54 g O ÷ 15.999 amu = 0.03375 **mole** O
- What is a gram/amu? It is the ratio of two mass units. As grams are much larger than atomic mass units, it is a big number of atoms. Too big to count. We call it a **'mole'**.
- The **mole** is useful because it is proportional to the actual number of atoms in a substance!



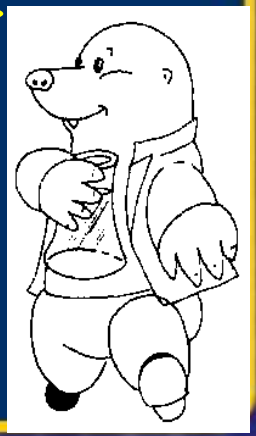
Example: A compound has 1.26 grams of iron and 0.54 grams of oxygen. Find its formula and name!

- 1.26 g Fe ÷ 55.845 amu = 0.02256 mole Fe
- 0.54 g O ÷ 15.999 amu = 0.03375 mole O
- Is $Fe_{0.02256}O_{0.03375}$ a good formula? No, we really want an integer ratio!
- Let's start by dividing by the smaller number: $Fe_{0.02256}O_{0.03375} \div 0.2256 = Fe_1O_{1.496}$
- This is pretty much $Fe_1O_{1.5}$. We're almost there!
- How to get rid of a '.5'? Multiply by 2.
- Formula is Fe_2O_3
- Name must be : Iron (III) Oxide (why?)

General Rules for Mass/Formula Problems

- Don't round too early! Find the 'moles' of each element and keep lots of extra decimal places.
- Divide all the mole quantities by the smallest.
- Now you can round.
- If you have fractions here, you can multiply everything to remove them.
- 0.5: multiply by 2
- 0.33, 0.66: multiply by 3
- 0.25, 0.75: multiply by 4

As it is above, so it is below, and as it is below, so it is above.
Hermes Trismegistus (c.a. 700 AD)



- **REMEMBER THE MOLE.** It's proportional to actual number of atoms! It is very important.