

3.6 How Do We Predict Formulas and Name Ionic Compounds.

C *Polyatomics*

Give the correct chemical formula for the ionic compound,
sodium phosphate.

Give the correct chemical formula for the ionic compound,
aluminum carbonate.



It is a **periodic property**. That is, it varies in a systematic way when the elements are arranged in the periodic table.

PERIODIC TABLE OF THE ELEMENTS

| 1A | 2A | 3B | 4B | 5B | 6B | 7B | 8B | 8B | 8B | 1B | 2B | 3A | 4A | 5A | 6A | 7A | 8A |
|--------------------------|--------------------------|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----|
| 3 Li 6.939 | 4 Be 9.012 | Electronegativity | | | | | | | | | | 5 B 10.81 | 6 C 12.01 | 7 N 14.01 | 8 O 16.00 | 9 F 19.00 | |
| 11 Na 22.99 | 12 Mg 24.31 | | | | | | | | | | | 13 Al 26.98 | 14 Si 28.09 | 15 P 30.97 | 16 S 32.07 | 17 Cl 35.45 | |
| 19 K 39.10 | 20 Ca 40.08 | 21 Sc 44.96 | 22 Ti 47.90 | 23 V 50.94 | 24 Cr 52.00 | 25 Mn 54.94 | 26 Fe 55.85 | 27 Co 58.93 | 28 Ni 58.71 | 29 Cu 63.55 | 30 Zn 65.39 | 31 Ga 69.72 | 32 Ge 72.61 | 33 As 74.92 | 34 Se 78.96 | 35 Br 79.90 | |
| 37 Rb 85.47 | 38 Sr 87.62 | 39 Y 88.91 | 40 Zr 91.22 | 41 Nb 92.91 | 42 Mo 95.94 | 43 Tc (99) | 44 Ru 101.1 | 45 Rh 102.9 | 46 Pd 106.4 | 47 Ag 107.9 | 48 Cd 112.4 | 49 In 114.8 | 50 Sn 118.7 | 51 Sb 121.8 | 52 Te 127.6 | 53 I 126.9 | |
| 55 Cs 132.9 | 56 Ba 137.3 | 57 La 138.9 | 72 Hf 178.5 | 73 Ta 181.0 | 74 W 183.8 | 75 Re 186.2 | 76 Os 190.2 | 77 Ir 192.2 | 78 Pt 195.1 | 79 Au 197.0 | 80 Hg 200.6 | 81 Tl 204.4 | 82 Pb 207.2 | 83 Bi 209.0 | 84 Po (209) | 85 At (210) | |
| 87 Fr (223) | 88 Ra 226.0 | 89 Ac 227.0 | 104 Unq (261) | 105 Unp (262) | 106 Unh (263) | 107 Uns (262) | 108 Uno (265) | 109 Une (266) | ★ = hydrogen | | | | | | | | |

4.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships?

What is the mass in grams of 1 mole of Li.

| | | |
|-------------------|-----------|--------|
| ${}^6\text{Li}$: | 6.015 amu | 7.42% |
| ${}^7\text{Li}$: | 7.016 amu | 92.58% |

$$N = 6.0221 \times 10^{23} \text{ mol}^{-1}$$

$$1 \text{ amu} = 1.6606 \times 10^{-24} \text{ g}$$

Important chemical principle(s).

Count by weighing.

Weigh by counting.

Simple arithmetic (often with whole numbers)

A mole is . . . An amount of substance



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A mole is . . . An amount of substance that has the same number of particles as there are atoms in 0.012 kg of ${}^{12}\text{C}$.

Strictly speaking, a mole is not a number (like a million). It is the amount of substance that has an Avogadro's number of particles.

By substance we mean a chemically pure substance.

4.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships. *Molar Mass ... (Formula Weight)*

| | | | |
|-------|-------|-------|-------|
| Al | Si | P | S |
| 13 | 14 | 15 | 16 |
| 26.98 | 28.09 | 30.97 | 32.07 |

IUPAC now replaced some atomic weights with a range: e.g. Si [28.08, 28.09] S [32.05, 32/08]

The numbers in the periodic table are the masses of a very large number of atoms of the individual elements.

4.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 1

a) How many ATOMS of fluorine are present in 3.30 moles of BF_3 ?

b) How many MOLES of fluorine are present in 3.09×10^{22} molecules of BF_3 ?

Now we are counting.



5.3 What Is a Mole and How Do We Use It to Calculate Mass Relationships.

Example 2

How many **MOLES** of water are present in 5.41 grams of this compound ?



- a) 0.1 b) 0.2 c) 0.3 d) 0.4 e) Help

Also counting here. We know the weight.

If a grain of rice weighs 18 mg how many grains are there in 5.41 g of rice.

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Example 3

How many **Grams** of ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) are present in 0.61 moles of this compound ?



a) 46

b) 96

c) 28

d) Help

Now we are weighing by counting.

If a grain of sand weighs 46 mg, what is the weight of 610 grains?

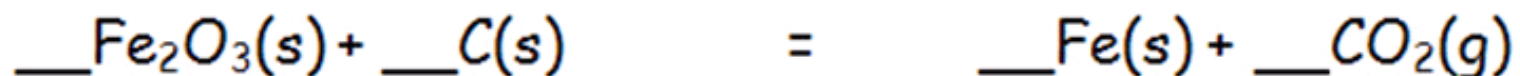


4.4 How Do We Balance Chemical Equations?

Example 1

Start here Thurs 9/19

Balance the following chemical equation:



| Reactants | | | | | |
|-----------|--|--|--|--|--|
| Fe | | | | | |
| O | | | | | |
| C | | | | | |

| Products | | | | | |
|----------|--|--|--|--|--|
| Fe | | | | | |
| O | | | | | |
| C | | | | | |