Problem:

You must make a cheese sandwich. Cheese slices come in packages of two. The slices of bread also come in packages of two. How many packages of cheese and bread do you need to make your sandwich if each sandwich can only have one piece of cheese in it?

No food can be thrown in the garbage.

Answer:

You need 1 cheese package (2 slices) and 2 bread packages (4 slices). You end up having to make two sandwiches.

1 cheese package (2 cheese slices) + 2 bread packages (4 bread slices) → 2 cheese sandwiches (2 cheese slices & 4 bread slices)

Balancing Chemical Equations

- all chemical equations should be written in the balanced form
- the # of atoms of each element should be the same on both sides of the equation

WHY?????

- **Law of Conservation of Mass**
  - matter cannot be created or destroyed in chemical reactions
  - the mass of products must equal the mass of reactants

Balancing

- to balance we use ratios
- coefficients are placed in front of each molecule and apply to each element in that particular molecule
- subscripts in a formula CANNOT be changed or you have changed the compound involved (H_2O is not the same as HO_2)

Rules for Balancing

1) Balance one type of atom or ion at a time
2) Balance the atom or ion of which you have the most first
3) Balance H and O last

Examples:

Determine the number of atoms for each element. Try to add coefficients to the equation to get the same # of atoms on each side.

a) 2 $Mg(s)$ + __ $O_2(g)$ + energy → 2 $MgO(s)$

Mg - ~~1~~	Mg - ~~1~~ 2
O - 2	O - ~~1~~ 2

a) Because there is more O on the reactants side, I must multiply my product to get the same # of O on the product side

b) Now there is more Mg on the products side so I must multiply to balance Mg.

b) 2 $H_2(g)$ + __ $O_2(g)$ → 2 $H_2O(l)$

H - ~~2~~ 4	H - ~~2~~ 4
O - 2	O - ~~1~~ 2

c) __ $Zn(s)$ + 2 $HCl(aq)$ → __ $ZnCl_2(aq)$ + __ $H_2(g)$

Zn - 1	Zn - 1
Cl - ~~1~~ 2	Cl - 2
H - ~~1~~ 2	H - 2

****EXTRA TIPS:

1. If the complex ion stays the same on both sides of the equation, we can "cheat" and balance the complex ion as a single unit.

d) __Cu(s) + 2 $AgNO_3(aq)$ → 2 Ag(s) + __ $Cu(NO_3)_2(aq)$

Cu – 1	Cu – 1
Ag – ~~1~~ 2	Ag – ~~1~~ 2
NO_3 – ~~1~~ 2	NO_3 – 2

2. If oxygen is in more that 1 compound in the reactants or products, represent them separately so it is easier to multiply.

e) __CH_4 + 2 O_2 → __CO_2 + 2 H_2O

C – 1	C – 1
H – 4	H – ~~2~~ 4
O – ~~2~~ 4	O – 2 + ~~1~~ 2
	= 4