The BCA Method in Stoichiometry

Step 1- Balance the equation

Hydrogen sulfide gas, which smells like rotten eggs, burns in air to produce sulfur dioxide and water. How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide?

$2\ H_2S + 3\ O_2 \text{ ----> } 2\ SO_2 + 2\ H_2O$

Before:

Change

After

Step 2: fill in the before line

$2\ H_2S + 3\ O_2 \text{ ----> } 2\ SO_2 + 2\ H_2O$

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
Before:	2.4	xs	0	0
Change				
After				

Assume more than enough O_2 to react

Step 3: use ratio of coefficients to determine change

$2\ H_2S + 3\ O_2 \text{ ----> } 2\ SO_2 + 2\ H_2O$

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
Before:	2.4	xs	0	0
Change	-2.4	-3.6	+2.4	+2.4
After				

Reactants are consumed (-), products accumulate (+)

Step 4: Complete the table

$2\ H_2S + 3\ O_2 \longrightarrow 2\ SO_2 + 2\ H_2O$

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
Before:	2.4	xs	0	0
Change	-2.4	-3.6	+2.4	+2.4
After	0	xs	2.4	2.4

Only moles go in the BCA table

- The balanced equation deals with *how many*, not *how much*.
- If given mass of reactants for products, convert to moles first, then use the table.

Limiting reactant problems

Distinguish between what you start with and what reacts.

When 0.50 mole of aluminum reacts with 0.72 mole of iodine to form aluminum iodide, how many moles of the excess reactant will remain?
How many moles of aluminum iodide will be formed?

$$2\ Al + 3\ I_2 \rightarrow 2\ AlI_3$$

Before: 0.50 0.72 0

Change

After

Limiting reactant problems

Guess which reactant is used up first, then check

$$2\ Al + 3\ I_2 \rightarrow 2\ AlI_3$$

Before: 0.50 0.72 0

Change -0.50 -0.75

After

It's clear that there's not enough I_2 to react with all the Al.

Limiting reactant problems

Now that you have determined the limiting reactant, complete the table, then solve for the desired answer.

	$2\ Al$	+	$3\ I_2$	→	$2\ AlI_3$
Before:	0.50		0.72		0
Change	-0.48		-0.72		+0.48
After	0.02		0		0.48

Complete calculations on the side

In this case, desired answer is in moles

If mass is required, convert moles to grams in the usual way

$$3.6 \text{ moles } O_2 \times \frac{32.0 \text{ g}}{1 \text{ mole}} = 115 \text{ g } O_2$$