Stoichiometry
Version 2: The BCA Table

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Chem II

ISB

Typical Algorithm for Stoichiometry

grams A → moles A → moles B → grams B

BCA Method

Before

Change

After

Note: This method isn't about being "easier" or more simple. Rather, it is about having a better conceptual understanding of the process of stoichiometry calculations.

BCA Tables: The Process

Step 1: Write the balanced equation.

Step 2: Make sure you have moles for your starting value. (Convert from grams to moles using the molar mass if needed.)

Step 3: Insert the starting moles into the BCA Table and complete the "B" Row.

Step 4: Calculate the changes necessary based on the mole ratio of the balanced equation. (Complete the "C" Row.)

Step 5: Calculate the "A" Row.

Step 6: Convert any values from the "A" Row into grams (if needed) by using the molar mass.

Practice Problem

Dihydrogen 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? How many moles of each product would be produced?

Step 1: Write the balanced equation.

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Step 1: Write the balanced equation.

$$H_2S\ (g) + O_2\ (g) \rightarrow SO_2\ (g) + H_2O\ (g)$$

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How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide? How many moles of each product would be produced?

Step 1: Write the balanced equation.

$$2\ H_2S\ (g) + 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) + 2\ H_2O\ (g)$$

Practice Problem

Dihydrogen 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? How many moles of each product would be produced?

$$2\ H_2S\ (g) + 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) + 2\ H_2O\ (g)$$

Step 2: Make sure you have <u>moles</u> for your starting value. (Convert from grams to moles if needed.)

Necessary?

Practice Problem

How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide? How many moles of each product would be produced?

$$2\ H_2S\ (g) \ + \ 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) \ + \ 2\ H_2O\ (g)$$

Step 3: Insert the starting moles into the BCA Table and complete the "B" Row.

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
B				
C				
A				

Practice Problem

How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide? How many moles of each product would be produced?

$$2\ H_2S\ (g) + 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) + 2\ H_2O\ (g)$$

Step 4: Calculate the changes necessary based on the mole ratios in the balanced equation. (Complete the "C" Row.)

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
B	2.4	XS	0	0
C				
A				

Practice Problem

How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide? How many moles of each product would be produced?

$$2\ H_2S\ (g) + 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) + 2\ H_2O\ (g)$$

Step 5: Calculate the "A" Row.

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
B	2.4	XS	0	0
C	-2.4	-2.4 (3/2) = - 3.6	+ 2.4 (2/2) = + 2.4	+ 2.4 (2/2) = + 2.4
A				

Practice Problem

How many moles of oxygen gas would be needed to completely burn 2.4 moles of hydrogen sulfide? How many moles of each product would be produced?

$$2\ H_2S\ (g) + 3\ O_2\ (g) \rightarrow 2\ SO_2\ (g) + 2\ H_2O\ (g)$$

Step 6: Convert any values from the "A" Row into grams (if needed) by using the molar mass.

	$2\ H_2S$	$3\ O_2$	$2\ SO_2$	$2\ H_2O$
B	2.4	XS	0	0
C	-2.4	-2.4 (3/2) = - 3.6	+ 2.4 (2/2) = + 2.4	+ 2.4 (2/2) = + 2.4
A	0	XS	+ 2.4	+ 2.4

Sample Problem 2

A chemist has 23.5 g of copper (II) chloride and lots of aluminum foil. How many grams of each product can the chemist produce by reacting the copper (II) chloride with the aluminum foil?

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$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

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$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 2: Make sure you have moles for your starting value. (Convert from grams to moles using the molar mass if needed.)

23.5 grams $CuCl_2$ → moles

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$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 3: Insert the starting moles into the BCA Table and complete the "B" Row.

	2 Al	3 $CuCl_2$	2 $AlCl_3$	3 Cu
B				
C				
A				

Sample Problem 2

A chemist has 23.5 g of copper (II) chloride and lots of aluminum foil. How many grams of each product can the chemist produce by reacting the copper (II) chloride with the aluminum foil?

$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 4: Calculate the changes necessary based on the mole ratio of the balanced equation. (Complete the "C" Row.)

	2 Al	3 $CuCl_2$	2 $AlCl_3$	3 Cu
B	XS	0.1748	0	0
C				
A				

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A chemist has 23.5 g of copper (II) chloride and lots of aluminum foil. How many grams of each product can the chemist produce by reacting the copper (II) chloride with the aluminum foil?

$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 5: Calculate the "A" Row.

	2 Al	3 $CuCl_2$	2 $AlCl_3$	3 Cu
B	XS	0.1748	0	0
C	- 0.1748(2/3) = - 0.1165	- 0.1748	+ 0.1748(2/3) = + 0.1165	+ 0.1748(3/3) = + 0.1748
A				

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A chemist has 23.5 g of copper (II) chloride and lots of aluminum foil. How many grams of each product can the chemist produce by reacting the copper (II) chloride with the aluminum foil?

$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 6: Convert any values from the "A" Row into grams (if needed) by using the molar mass.

	2 Al	3 $CuCl_2$	2 $AlCl_3$	3 Cu
B	XS	0.1748	0	0
C	- 0.1748(2/3) = - 0.1165	- 0.1748	+ 0.1748(2/3) = + 0.1165	+ 0.1748(3/3) = + 0.1748
A	XS	0.0	+ 0.1165	+ 0.1748

Sample Problem 2

A chemist has 23.5 g of copper (II) chloride and lots of aluminum foil. How many grams of each product can the chemist produce by reacting the copper (II) chloride with the aluminum foil?

$$2\ Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$$

Step 6: Convert any values from the "A" Row into grams (if needed) by using the molar mass.

0.1165 moles $AlCl_3$ → grams

0.1748 moles Cu → grams