UNIT 3: ATOMS, ELEMENTS, MOLECULES

Lesson 18: Step up to the Line

GUIDING QUESTION: HOW CAN WE USE MOLE RATIOS TO FIND THE MOLES OF PRODUCT GIVEN THE MOLES OF REACTANT?

Do Now:

You are making sandwiches for Chef Wayne. Each sandwich requires 2 slices of bread, 2 slices of turkey, 3 slices of tomato, and 1 slice of cheese.

What is the ratio of bread:turkey:tomato:cheese?

TYPOS!

#2 – page 22

Step 2: Determine ratio

You are solving for **lithium**. How many moles of **lithium** are in 1 mole of **Li_2S**.

#3 – page 23

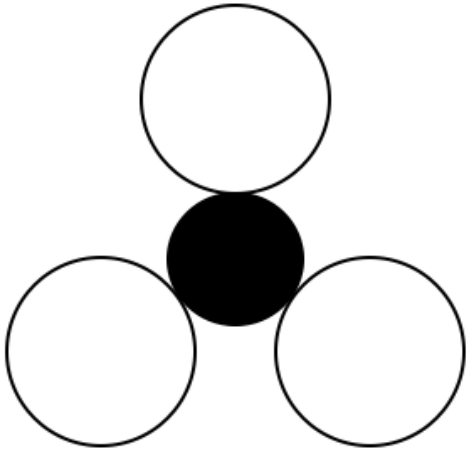
Step 2: Determine ratio.

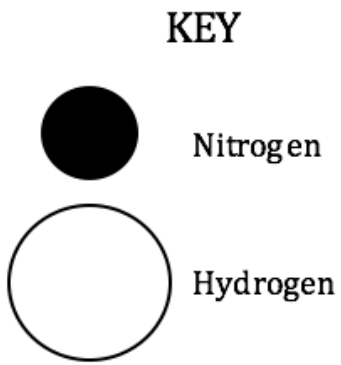
You are solving for **Na_3P**. How many moles of **Na** are in 1 mole of **Na_3P**?

STEP UP TO THE LINE:

Scientists sometimes don't need to reference mass or moles directly. Instead they want to compare the components of substances for various reasons -- toxicity, effectiveness of a specific part of a compound, cost, and so on. Scientists use a concept that has been discussed in your math class to do this: ratios. Using ratios, or as a chemist would say, *mole ratio*, one can compare different elements or parts of compounds to the whole compound or other parts within a compound. We will look at this in the section that follows.

MODEL 1 - Ammonia





LETS REVIEW- MODEL 1:

1. In model 1, what atoms are there and how many of each? **1 Nitrogen, 3 Hydrogen**

2. Using this, write a possible chemical formula for this compound. **NH_3**

3. Write a ratio for the atoms in this compound. **$1NH_3$:1N:3H**

4. If you had two molecules of ammonia, how many of each atom do you have? **$2NH_3$:2N:6H**

5. Compare question 4 to question 3. Do these two have the same ratio? Explain your answer. **Yes, They have the same exact ratio.**

LETS REVIEW- MODEL 1:

6. If you have 1 million molecules, how many of each atom do you have?

N: 1million; H: 3 million

- How does this relate to the ratio in question 3?

It is the same exact ratio!

- Explain how a ratio can help you relate amounts of atoms and molecules.

Ratio's are another conversion factor!

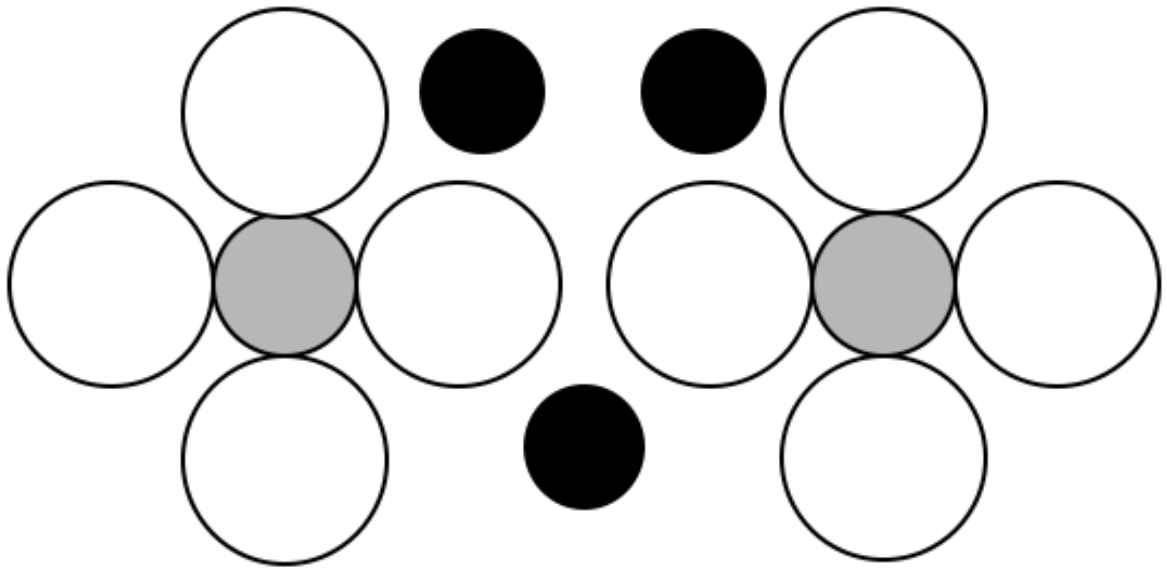
If you have 602 sextillion molecules of ammonia, how much do you have? (*HINT*: it is one word)

1 Mole!

Workbook 3.3

Date:

MODEL 2 - Calcium Phosphate



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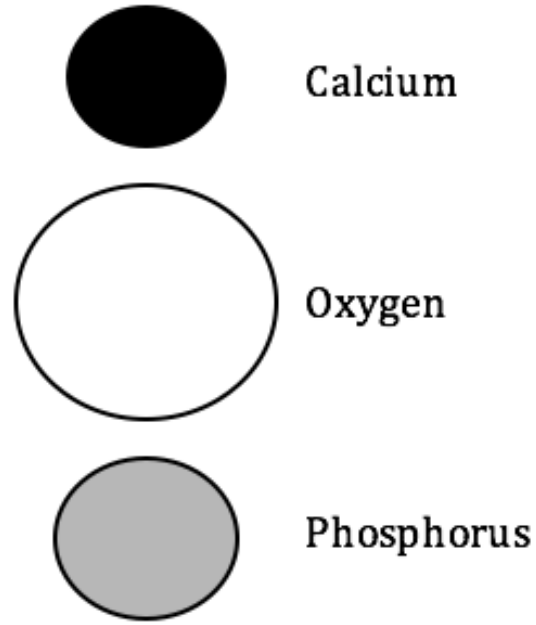


LETS REVIEW- MODEL 2:

9. In model 2, what atoms are there and how many of each?

3 Ca, 8 O, 2 P

10. Using this, write a possible chemical formula for this compound.

$Ca_3O_8P_2$

11. The technical formula for calcium phosphate is $Ca_3(PO_4)_2$. How does this compare to your formula? Do they still have the same number of atoms of each? Explain.

Yes! They have the same number of atoms.

12. Write a ratio for the atoms in this compound.

3Ca: 8O: 2P

LETS REVIEW- MODEL 2:

If you have 2 moles of calcium phosphate:

- how many moles of calcium do you have?

6 mol Ca

- how many moles of phosphorus do you have?

4 mol P

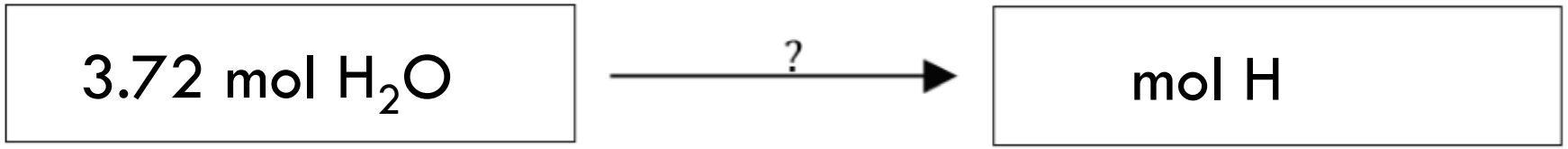
- how many moles of oxygen do you have?

16 mol O

Explain how you can use mole ratios to determine the amount of atoms in a sample.

APPLY IT: YOU HAVE 3.72MOL H_2O. HOW MANY MOLES OF HYDROGEN ARE IN THIS SAMPLE?

Step 1: Road Map



Step 2: Determine ratio

1 H_2O: 2H: 1O

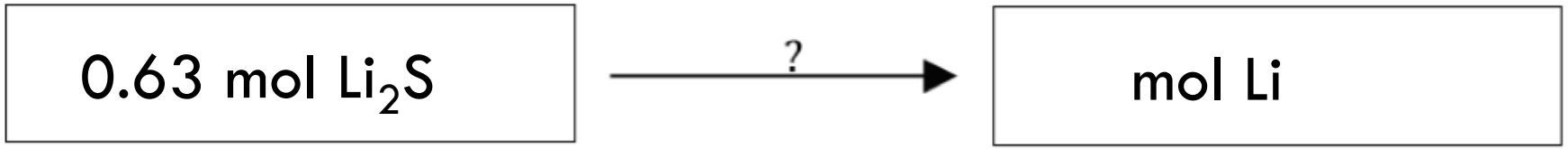
Step 3: Set-up train track

$$3.72 \text{ mol } H_2O \times \frac{2 \text{ mol H}}{1 \text{ mol } H_2O} = 7.44 \text{ mol H}$$

Final Answer (include units and substance)

APPLY IT: A SAMPLE OF LITHIUM SULFIDE, Li_2S, HAS 0.63MOL. HOW MANY MOLES OF LITHIUM ARE IN THIS SAMPLE?

Step 1: Road Map



Step 2: Determine ratio

1 Li_2S: 2Li: 1S

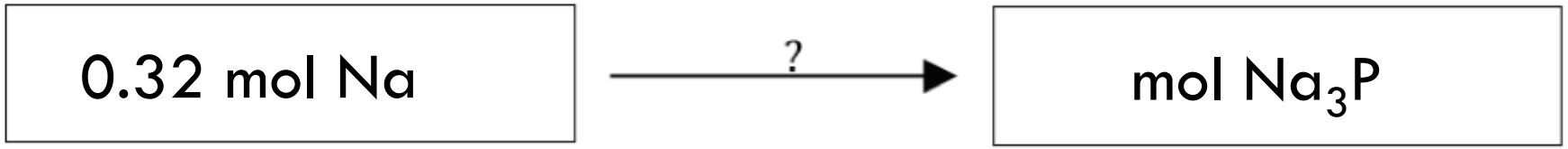
Step 3: Set-up train track

$$0.63\text{mol } Li_2S \times \frac{2 \text{ mol Li}}{1 \text{ mol } Li_2S} = 1.26 \text{ mol Li}$$

Final Answer (include units and substance)

APPLY IT: YOU NEED 0.32MOL NA FOR A REACTION STUDY. HOW MUCH SODIUM PHOSPHIDE, NA_3P, DO YOU NEED FOR IT?

Step 1: Road Map



Step 2: Determine ratio

1 Na_3P: 3Na: 1P

Step 3: Set-up train track

$$0.32 \text{ mol Na} \times \frac{1 \text{ mol } Na_3P}{3 \text{ mol Na}} = 0.106 \text{ mol } Na_3P$$

Final Answer (include units and substance)

INDEPENDENT PRACTICE: (PAGE 25)

Directions:

1. On your own, try and solve the 4 practice problems.
2. It is very important that you follow the 3 steps, so you don't make any mistakes.
3. When you have solved all 4 problems, come to the front of the room to check your answers and get a **STAMP!**

NOTES (PAGE 18)

Mole Ratio: The ratio in which reactants have to combine to form the maximum amount of products.

- You determine the mole ratio by looking at the coefficients in the balanced chemical equation.

Example: Use the the following equation

- $CH_4O + O_2 \rightarrow CO_2 + H_2O$

NOTES (PAGE 18)

How many moles of carbon dioxide will you make if you react 4 moles of O_2?