LESSON MAKER PRO

Mole Ratio Moves

Follow a reaction from moles to grams.

HIGH SCHOOL · CHE.4.b

CHE.4.b "Use mathematical representations of the mole concept to solve reaction stoichiometry problems, involving mole-to-mole conversions, mass-to-mole conversions, and mass-to-mass conversions."

NAME _____ DATE _____

FOLLOW THE COEFFICIENTS

In a balanced equation, coefficients show the mole ratio between substances. To start with grams, divide by molar mass to find moles. Use the coefficient ratio, then multiply by molar mass if the answer needs to be in grams.

WORKED EXAMPLE

For $N_2 + 3H_2 \rightarrow 2NH_3$, how many moles of NH_3 can form from 15 mol H_2 if N_2 is in excess?

1. Read the ratio: 3 mol H_2 make 2 mol NH_3.
2. Set up 15 mol H_2 * (2 mol NH_3/3 mol H_2).
3. Calculate 15 * 2/3 = 10 mol NH_3.

Answer: 10 mol NH_3

PRACTICE 6 problems

1 For $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of H_2O form from 4 mol O_2 if H_2 is in excess?

ANSWER _____

2 For $2CO + O_2 \rightarrow 2CO_2$, how many moles of O_2 react with 6 mol CO?

ANSWER _____

3 For $2Mg + O_2 \rightarrow 2MgO$, how many moles of MgO form from 48 g Mg if O_2 is in excess? The molar mass of Mg is 24 g/mol.

ANSWER _____

4 For $2H_2O_2 \rightarrow 2H_2O + O_2$, how many moles of O_2 form from 68 g H_2O_2? The molar mass of H_2O_2 is 34 g/mol.

ANSWER _____

5 For $C + O_2 \rightarrow CO_2$, what mass of CO_2 forms from 24 g C if O_2 is in excess? The molar masses are 12 g/mol for C and 44 g/mol for CO_2.

ANSWER _____

6 For $4Al + 3O_2 \rightarrow 2Al_2O_3$, what mass of Al_2O_3 forms from 54 g Al if O_2 is in excess? The molar masses are 27 g/mol for Al and 102 g/mol for Al_2O_3.

ANSWER _____

APPLY IT Show your work

1 A race car burns ethanol fuel. Its reaction is $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$. What mass of CO_2 forms when 23 g ethanol burns with excess oxygen? The molar masses are 46 g/mol for ethanol and 44 g/mol for CO_2.

WORK SPACE

ANSWER _____

2 When baking soda heats up in muffin batter, it releases CO_2 that helps the muffins rise. The reaction is $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$. What mass of CO_2 can form from 42 g baking soda? The molar masses are 84 g/mol for $NaHCO_3$ and 44 g/mol for CO_2.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A metal sculpture rusts according to $4Fe + 3O_2 \rightarrow 2Fe_2O_3$. If 112 g Fe reacts completely with excess oxygen, what mass of O_2 reacts, and what mass of Fe_2O_3 forms? The molar masses are 56 g/mol for Fe, 32 g/mol for O_2, and 160 g/mol for Fe_2O_3. Show both mole ratios you use.

WORK SPACE AND ANSWER

Mole Ratio Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of H_2O form from 4 mol O_2 if H_2 is in excess?	**8 mol H_2O**
2	For $2CO + O_2 \rightarrow 2CO_2$, how many moles of O_2 react with 6 mol CO?	**3 mol O_2**
3	For $2Mg + O_2 \rightarrow 2MgO$, how many moles of MgO form from 48 g Mg if O_2 is in excess? The molar mass of Mg is 24 g/mol.	**2 mol MgO**
4	For $2H_2O_2 \rightarrow 2H_2O + O_2$, how many moles of O_2 form from 68 g H_2O_2? The molar mass of H_2O_2 is 34 g/mol.	**1 mol O_2**
5	For $C + O_2 \rightarrow CO_2$, what mass of CO_2 forms from 24 g C if O_2 is in excess? The molar masses are 12 g/mol for C and 44 g/mol for CO_2.	**88 g CO_2**
6	For $4Al + 3O_2 \rightarrow 2Al_2O_3$, what mass of Al_2O_3 forms from 54 g Al if O_2 is in excess? The molar masses are 27 g/mol for Al and 102 g/mol for Al_2O_3.	**102 g Al_2O_3**

PART 2 · APPLY IT

1. **44 g CO_2** The fuel is 23/46 = 1/2 mol ethanol. The 1:2 ratio gives 1 mol CO_2, or 44 g.
2. **11 g CO_2** The baking soda is 42/84 = 1/2 mol. The 2:1 ratio gives 1/4 mol CO_2, or 11 g.

CHALLENGE

112 g Fe is 2 mol Fe. For oxygen, 2 mol Fe * (3 mol O_2/4 mol Fe) = 3/2 mol O_2, or 48 g O_2. For rust, 2 mol Fe * (2 mol Fe_2O_3/4 mol Fe) = 1 mol Fe_2O_3, or 160 g Fe_2O_3.

Accept equivalent fraction or decimal mole values in students' work. For mass answers, require grams and the correct substance.