LESSON MAKER PRO

Reaction Ratio Lab

Track what a reaction uses and makes

HIGH SCHOOL · CHE.6.3

CHE.6.3 "Use mathematics and computational analysis to represent the ratio of reactants and products in terms of masses, molecules, and moles (stoichiometry)."

NAME _____ DATE _____

FOLLOW THE COEFFICIENTS

In a balanced equation, the coefficients give the ratios of moles and molecules. To find a product mass, convert the reactant mass to moles, use the coefficient ratio, then convert the product moles to grams.

WORKED EXAMPLE

For 2 $KClO_3 \rightarrow$ 2 KCl + 3 O_2, what mass of O_2 forms from 245 g $KClO_3$? Use 122.5 g/mol for $KClO_3$ and 32 g/mol for O_2.

1. 245 g $KClO_3$ ÷ 122.5 g/mol = 2 mol $KClO_3$.
2. 2 mol $KClO_3$ × 3 mol O_2/2 mol $KClO_3$ = 3 mol O_2.
3. 3 mol O_2 × 32 g/mol = 96 g O_2.

Answer: 96 g O_2

PRACTICE 6 problems

1 For $N_2 + 3\ H_2 \rightarrow 2\ NH_3$, how many moles of NH_3 form from 7 mol N_2 if H_2 is in excess?

ANSWER _____

2 For $2\ H_2 + O_2 \rightarrow 2\ H_2O$, how many moles of H_2O form from 11 mol O_2 if H_2 is in excess?

ANSWER _____

3 For $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$, how many moles of H_2O form from 4 mol CH_4 if O_2 is in excess?

ANSWER _____

4 For $2\ CO + O_2 \rightarrow 2\ CO_2$, how many moles of CO_2 form from 5 mol O_2 if CO is in excess?

ANSWER _____

5 For $C + O_2 \rightarrow CO_2$, what mass of CO_2 forms from 36 g C if O_2 is in excess? Use 12 g/mol for C and 44 g/mol for CO_2.

ANSWER _____

6 For $2\ SO_2 + O_2 \rightarrow 2\ SO_3$, how many molecules of SO_3 form from 9 molecules of O_2 if SO_2 is in excess?

ANSWER _____

APPLY IT Show your work

1 A model car's hydrogen fuel cell combines hydrogen and oxygen to make water: $2\ H_2 + O_2 \rightarrow 2\ H_2O$. If it uses 6 g H_2 with excess O_2, what mass of water forms? Use 2 g/mol for H_2 and 18 g/mol for H_2O.

WORK SPACE

ANSWER _____

2 A science-fair volcano uses baking soda and vinegar. Their reaction is $NaHCO_3 + CH_3COOH \rightarrow CH_3COONa + CO_2 + H_2O$. If 42 g $NaHCO_3$ reacts with excess vinegar, what mass of CO_2 forms? Use 84 g/mol for $NaHCO_3$ and 44 g/mol for CO_2.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $N_2 + 3\ H_2 \rightarrow 2\ NH_3$, 56 g N_2 reacts with 9 g H_2. Which reactant limits the reaction? What mass of NH_3 forms, and what mass of the other reactant remains? Use 28 g/mol for N_2, 2 g/mol for H_2, and 17 g/mol for NH_3. Show your mole ratios.

WORK SPACE AND ANSWER

Reaction Ratio Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $N_2 + 3\ H_2 \rightarrow 2\ NH_3$, how many moles of NH_3 form from 7 mol N_2 if H_2 is in excess?	**14 mol NH_3**
2	For $2\ H_2 + O_2 \rightarrow 2\ H_2O$, how many moles of H_2O form from 11 mol O_2 if H_2 is in excess?	**22 mol H_2O**
3	For $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$, how many moles of H_2O form from 4 mol CH_4 if O_2 is in excess?	**8 mol H_2O**
4	For $2\ CO + O_2 \rightarrow 2\ CO_2$, how many moles of CO_2 form from 5 mol O_2 if CO is in excess?	**10 mol CO_2**
5	For $C + O_2 \rightarrow CO_2$, what mass of CO_2 forms from 36 g C if O_2 is in excess? Use 12 g/mol for C and 44 g/mol for CO_2.	**132 g CO_2**
6	For $2\ SO_2 + O_2 \rightarrow 2\ SO_3$, how many molecules of SO_3 form from 9 molecules of O_2 if SO_2 is in excess?	**18 molecules of SO_3**

PART 2 · APPLY IT

1. **54 g H_2O** The 6 g H_2 is 3 mol. The 1:1 mole ratio of H_2 to H_2O gives 3 mol H_2O, or 54 g.
2. **22 g CO_2** The 42 g $NaHCO_3$ is 0.5 mol. The 1:1 mole ratio gives 0.5 mol CO_2, which has a mass of 22 g.

CHALLENGE

H_2 is limiting. The 9 g H_2 is 4.5 mol, which makes 3 mol NH_3, or 51 g. It uses 1.5 mol N_2 of the 2 mol available, leaving 0.5 mol N_2, or 14 g.

Accept equivalent ratio calculations with correct units. In the challenge, students must identify H_2 as limiting and report the remaining mass as N_2, not H_2.