

Exercise 9.1a

Mole Ratios in Stoichiometry – Answers

Name: _____

Date: _____ Per: _____

DIRECTIONS: Answer each set of questions in the space provided.

Balance the following equations

- 1 FeCl₃(aq) + 3 KOH(aq) → 1 Fe(OH)₃(s) + 3 KCl(aq)
- 1 Pb(C₂H₃O₂)₂(aq) + 2 KI(aq) → 1 PbI₂(s) + 2 KC₂H₃O₂(aq)
- 1 P₄O₁₀(s) + 6 H₂O(l) → 4 H₃PO₄(aq)
- 1 Li₂O(s) + 1 H₂O(l) → 2 LiOH(aq)

Find the mole ratio of:

- KO₂ to KOH in $4\text{KO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 4\text{KOH}(\text{aq}) + 3\text{O}_2(\text{g})$

$$\frac{4 \text{ mol KO}_2}{4 \text{ mol KOH}}$$
- BaCl₂ to NaCl in $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$

$$\frac{1 \text{ mol BaCl}_2}{2 \text{ mol NaCl}}$$
- H₂O₂ to O₂ in $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$

$$\frac{2 \text{ mol H}_2\text{O}_2}{1 \text{ mol O}_2}$$

Given the following unbalanced equations:

- 1 MnO₂(s) + 1 C(s) → 1 Mn(s) + 1 CO₂(g)

What is the mole ratio of MnO₂ to CO₂?

$\frac{1 \text{ mol MnO}_2}{1 \text{ mol CO}_2}$
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- 2 Sb(s) + 3 Cl₂(g) → 2 SbCl₃(s)

What is the mole ratio of Sb to Cl₂?

$\frac{2 \text{ mol Sb}}{3 \text{ mol Cl}_2}$

- 1 CH₄(g) + 1 H₂O(g) → 1 CO(g) + 3 H₂(g)

How many moles of H₂ would be produced from:

- 2 moles of CH₄? 6 mol

$$\frac{2 \text{ mol CH}_4}{1 \text{ mol CH}_4} \times \frac{3 \text{ mol H}_2}{1 \text{ mol CH}_4} = 6 \text{ mol H}_2$$

- 3 moles of CH₄? 9 mol

$$\frac{3 \text{ mol CH}_4}{1 \text{ mol CH}_4} \times \frac{3 \text{ mol H}_2}{1 \text{ mol CH}_4} = 9 \text{ mol H}_2$$

- 4 moles of H₂O? 12 mol

$$\frac{4 \text{ mol H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \times \frac{3 \text{ mol H}_2}{1 \text{ mol H}_2\text{O}} = 12 \text{ mol H}_2$$

- 0.50 moles of H₂O? 1.5 mol

$$\frac{0.50 \text{ mol H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \times \frac{3 \text{ mol H}_2}{1 \text{ mol H}_2\text{O}} = 1.5 \text{ mol H}_2$$

- 1 Zn(s) + 2 CrCl₃(aq) → 2 CrCl₂(aq) + 1 ZnCl₂(aq)

How many moles of CrCl₂ would be produced from:

- 2 moles of Zn? 4 mol

$$\frac{2 \text{ mol Zn}}{1 \text{ mol Zn}} \times \frac{2 \text{ mol CrCl}_2}{1 \text{ mol Zn}} = 4 \text{ mol CrCl}_2$$

- 4 moles of CrCl₃? 4 mol

$$\frac{4 \text{ mol CrCl}_3}{2 \text{ mol CrCl}_3} \times \frac{2 \text{ mol CrCl}_2}{1 \text{ mol CrCl}_3} = 4 \text{ mol CrCl}_2$$

- 3 moles of Zn? 6 mol

$$\frac{3 \text{ mol Zn}}{1 \text{ mol Zn}} \times \frac{2 \text{ mol CrCl}_2}{1 \text{ mol Zn}} = 6 \text{ mol CrCl}_2$$

- 2.5 moles of CrCl₃? 2.5 mol

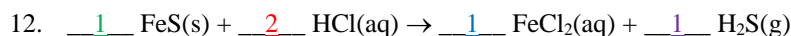
$$\frac{2.5 \text{ mol CrCl}_3}{2 \text{ mol CrCl}_3} \times \frac{2 \text{ mol CrCl}_2}{1 \text{ mol CrCl}_3} = 2.5 \text{ mol CrCl}_2$$

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- a. How many moles of HCl are required to react with 1.5 moles of FeS? 3 mol HCl

$$\frac{\cancel{1.5 \text{ mol FeS}}}{\cancel{1 \text{ mol FeS}}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol FeS}} = 3 \text{ mol HCl}$$

- b. How many moles of FeS are required to react with 3 moles of HCl? 2 mol FeS (only 1 SF)

$$\frac{\cancel{3 \text{ mol HCl}}}{\cancel{2 \text{ mol HCl}}} \times \frac{1 \text{ mol FeS}}{1 \text{ mol FeS}} = \underline{1.5} \text{ mol FeS}$$

- c. How many moles of HCl are required to produce 1.5 moles of FeCl₂? 3 mol HCl

$$\frac{\cancel{1.5 \text{ mol FeCl}_2}}{\cancel{1 \text{ mol FeCl}_2}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol FeCl}_2} = 3 \text{ mol HCl}$$

- d. How many moles of HCl are required to produce 0.5 moles of H₂S? 1 mol HCl

$$\frac{\cancel{0.5 \text{ mol H}_2\text{S}}}{\cancel{1 \text{ mol H}_2\text{S}}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol H}_2\text{S}} = 1 \text{ mol HCl}$$

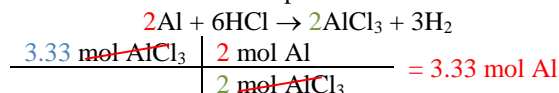
- e. How many moles of FeS are required to produce 3 moles of H₂S? 3 mol FeS

$$\frac{\cancel{3 \text{ mol H}_2\text{S}}}{\cancel{1 \text{ mol H}_2\text{S}}} \times \frac{1 \text{ mol FeS}}{1 \text{ mol FeS}} = 3 \text{ mol FeS}$$

DIRECTIONS: Write the balanced equation and solve each of the following.

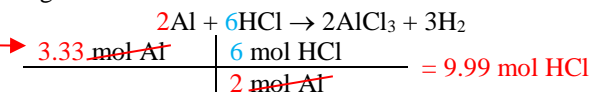
13. Aluminum metal and hydrogen chloride react to form aluminum chloride and hydrogen gas.

- a. How many moles of aluminum metal are needed to produce 3.33 moles of aluminum chloride?



3.33 mol Al

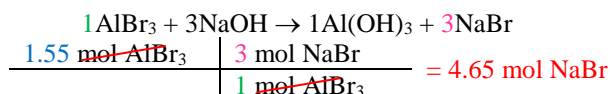
- b. How many moles of hydrogen chloride are needed to react with this number of moles of aluminum metal?



9.99 mol HCl

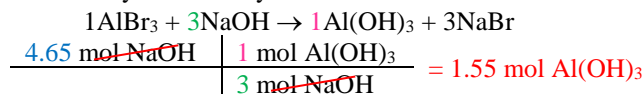
14. Aluminum bromide and sodium hydroxide react to form aluminum hydroxide and sodium bromide.

- a. How many moles of sodium bromide can be formed from 1.55 moles of aluminum bromide?



4.65 mol NaBr

- b. How many moles of aluminum hydroxide may be formed from 4.65 moles of sodium hydroxide?

1.55 mol Al(OH)₃

Exercise 9.1a

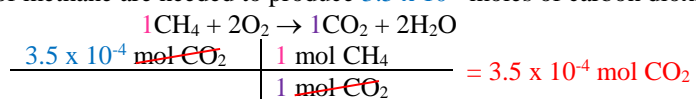
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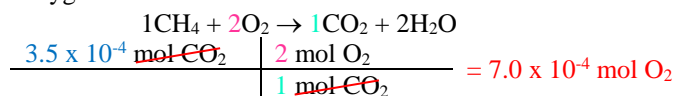
15. Methane gas (carbon tetrahydride) reacts with oxygen by combustion.

a. How many moles of methane are needed to produce 3.5×10^{-4} moles of carbon dioxide?



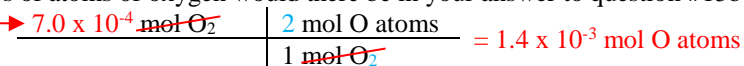
$3.5 \times 10^{-4} \text{ mol CO}_2$

b. How many moles of oxygen are needed to react to form the 3.5×10^{-4} moles of carbon dioxide?



$7.0 \times 10^{-4} \text{ mol O}_2$

c. How many moles of atoms of oxygen would there be in your answer to question #15b?



$1.4 \times 10^{-3} \text{ mol O atoms}$