Stoichiometry: Predicting Amounts in Reactions

I. Stoichiometry is the process of determining how much product is made or how much reactant is needed during a chemical reaction.

II. The balanced chemical equation tells us two things:

1. **The substances present before the reaction and the substances present after the reaction.**
2. The **ratio of particles** involved. This ratio can be seen either as a ratio of individual particles OR as a ratio of moles.

3. **Coefficients**: (mole) ratio between reactants and/or products in a chemical reaction allow you to

quantitate.

1 mole = 6.023 X 1023 particles

1 mole = 22.4 L gas at STP

1 mole = molar mass in grams

Use coefficients to switch from one reactant or product to another.

V. Procedure:

**Problem Solving Dimensional Analysis**

a. Identify given and unknown

b. Identify conversion factors that apply using mole relationships

c. Set up ratio so want

given

d. multiply to cancel units

e. Use another conversion if necessary.

VI. Example:

1. **Moles to moles:** How many *moles of oxygen gas* are required to react completely with *10 moles of hydrogen gas*?

**Dimensional Analysis**

**2 H2(g) + O2(g) 🡪 2 H2O(g)**

**# wanted = # given X wanted =**

**given**

**# moles O2(g) = 10 moles H2(g ) X 1 mole O2(g) = 5 moles O2(g)**

**2 moles H2(g)**

**2. Mass to Moles:** If *27 g of hydrogen gas* react with an excess of oxygen gas, how many *moles of water* will be produced?

**Dimensional Analysis**

**2 H2(g) + O2(g) 🡪 2 H2O(g)**

**# moles H2O(g) = 27 g H2(g) X 1 moles H2(g) X 2 moles H2O(g) = 13.5 moles H2O(g)**

**2 g H2(g) 2 moles H2(g)**

**3. Grams to Grams**: If *27 g of hydrogen gas* react with an excess of oxygen gas, what *mass of water* will be produced?

**Dimensional Analysis**

**2 H2(g) + O2(g) 🡪 2 H2O(g)**

**# wanted = # given X wanted =**

**given**

**# g H2O(g) = 27 g H2(g) X 1 mole H2(g) X 2 moles H2O (g) X 18 g H2O(g) = 243 g**

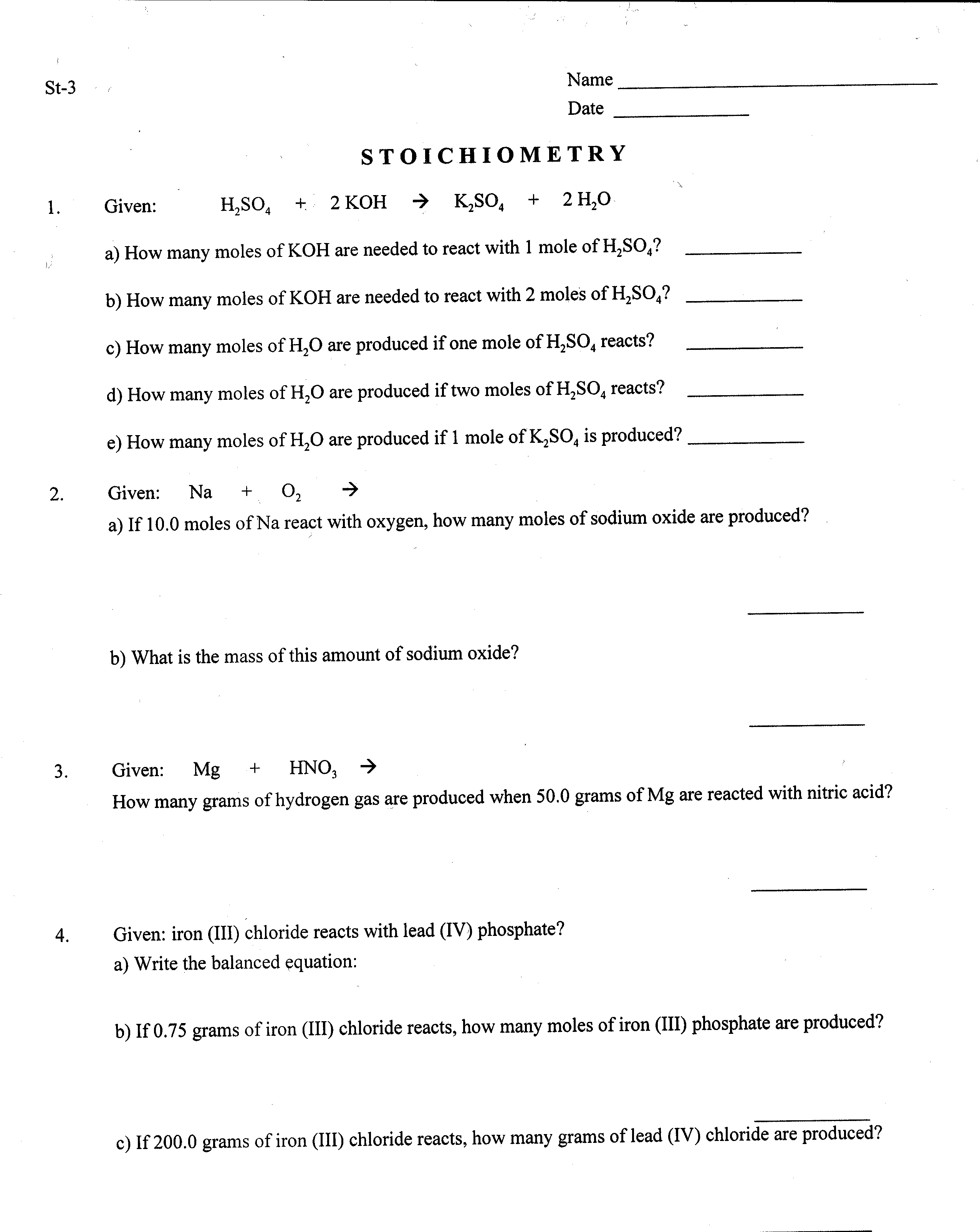
**2 g H2(g) 2 moles H2 (g) 1 mole H2O(g)**

**3. PRACTICE – Moles to Mass**: How many *grams of oxygen gas* are required to react with *2.2 mol NO* in the production of nitrogen dioxide gas?

**Dimensional Analysis**

**PRACTICE – Mass to Mass**: How many *grams of iron* can be produced from *100. g Fe2O3*?

**Dimensional Analysis**

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