

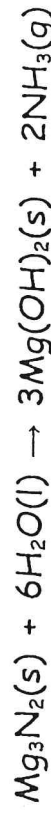
Practice Problems:

Day 1 - Mole Ratio.

1. Aluminum bromide can be prepared by the synthesis reaction of small pieces of aluminum foil with liquid bromine at room temperature. How many moles of bromine are needed to produce 5 mol of AlBr_3 .
2. Hydrogen cyanide gas, HCN(g) , is used to prepare clear, hard plastics, such as Plexiglas. Hydrogen cyanide is formed by reacting ammonia, NH_3 , with oxygen and methane, CH_4 in the reaction below



- (a) How many moles of O_2 are needed to react with 1.2 mol of NH_3 ?
 - (b) How many moles of H_2O can be expected from the reaction of 12.5 mol of CH_4 ? Assume that sufficient NH_3 and O_2 are present.
3. In the complete combustion of Ethane gas C_2H_6
 - (a) How many moles of O_2 are required to react with 13.9 mol of C_2H_6 ?
 - (b) How many moles of H_2O would be produced by 1.40 mol of O_2 and sufficient ethane?
 4. Magnesium nitride reacts with water to produce magnesium hydroxide and ammonia gas, NH_3 according to the balanced chemical equation



- a) How many molecules of water are required to react with 2.3 mol Mg_3N_2 ?

(Answers 1. 7.5 mol 2.a) 1.8 mol b) 37.5 mol 3.(a) 48.7 mol b) 1.20 mol 4.a) 8.3×10^{24})

Name : _____

DAY 1 -

MOLE RATIO

EXTRA PRACTICE

Mole Ratio Assignment -

This assignment will require you to use many of your skills, some of which include...determining formula's for compounds, writing and balancing chemical equation, predicting and writing chemical reaction types, and the correct use of significant digits to express your final answers.

1. If 3.45×10^{-2} moles of mercury (II) oxide decomposes, how many moles of oxygen would be produced?
2. When heated, xenon can be made to react with fluorine in a synthesis reaction to produce colourless crystals of xenon tetrafluoride. How many moles of fluorine gas would be required to react with 3.54×10^{-1} mol of xenon?
3. An iron weight is suspended in a solution of magnesium nitrate. If the weight contains 2.00 moles of iron, how much magnesium will be displaced.
4. Ethyne (C_2H_2) is burned completely. If 2.0 moles of oxygen is consumed in the reaction, how many moles of each of the products would you expect to find?
5. Iron (III) nitrate and ammonium carbonate react in a double displacement reaction. If 2.35×10^{-2} moles of precipitate are recovered, how many moles of each of the reactants were used in the reaction. (Remember to include states in the double displacement reaction).

Day 2 & 3 - STOICH.

PRACTICE

Stoichiometry Practice Questions - Day I

1. Bubbling chlorine gas through a solution of potassium iodide results in a single displacement reaction of the halogens. What mass of iodine can be produced from 1.5 Kg (* Note this mass needs to be in grams) of chlorine? [answer = 5.4Kg]

2. Iron undergoes a synthesis reaction to form iron (III) oxide when heated in air. If 4.60g of iron (III) oxide is produced, what mass of iron reacted? [answer = 3.22g]

3. Ethanol (C_2H_6O) is an important additive in gasoline. Determine the amount of carbon dioxide produced during the complete combustion of 1.15g of ethanol. [answer = 2.20g]

4. The addition of heat causes ammonium nitrate to form dinitrogen monoxide (laughing gas) and water. Predict the mass of dinitrogen monoxide produced when 1.00g of ammonium nitrate decomposes. [answer = 0.55g]

Day 2 & 3 - STOCH
EXTRA PRACTICE

V - A FEW MORE!

Stoichiometry - A FEW MORE

1. If 3.0 moles of propane (C_3H_8) combusts completely, what mass of carbon dioxide will be produced? (oxygen is in excess so you know propane is limiting)
2. Phosphorus pentachloride, reacts with water to form hydrogen phosphate and hydrochloric acid. What mass of water is needed to produce 23.5g of hydrogen phosphate?

3. A chemist has a beaker containing a solution of lead (II) nitrate, and adds sodium iodide, a bright yellow precipitate is formed. The precipitate is collected and dried and found to have a mass of 1.43 grams. Write a balanced chemical equation (including states) and determine the mass of lead (II) nitrate needed to produce the precipitate.

Name : _____

DIGI - Stoichiometry

Day 2 of 3 - could
have been submitted

for feedback

Freshly cut sodium undergoes a synthesis reaction with oxygen gas in the air. What mass of oxygen is required to react completely with 3.45 grams of sodium?



Day 2 & 3 - even more stoichi.

EXTRA PRACTICE - STOICH.

Practice Problems

- The production of acetic acid, $\text{CH}_3\text{COOH}(\ell)$, is represented by the following chemical equation:

$$\text{CH}_3\text{OH}(\ell) + \text{CO}(\text{g}) \rightarrow \text{CH}_3\text{COOH}(\ell)$$

Calculate the mass of acetic acid that is produced by the reaction of 6.0×10^4 g of carbon monoxide with sufficient methanol, $\text{CH}_3\text{OH}(\ell)$.
- Calculate the mass of silver nitrate, $\text{AgNO}_3(\text{aq})$, that must react with solid copper to provide 475 kg of copper nitrate, $\text{Cu}(\text{NO}_3)_2(\text{aq})$.

$$\text{Cu}(\text{s}) + 2\text{AgNO}_3(\text{aq}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cu}(\text{NO}_3)_2(\text{aq})$$
- What mass of oxygen is produced if 22.7 mol of carbon dioxide is consumed in a controlled photosynthesis reaction?

$$6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\ell) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g})$$
- Sodium phosphate, $\text{Na}_3\text{PO}_4(\text{aq})$, is an all-purpose cleaner that can be used to clean walls before painting. It is often referred to as trisodium phosphate, or TSP, and it must be handled with care because it is corrosive. It is prepared by the following reaction:

$$3\text{NaOH}(\text{aq}) + \text{H}_3\text{PO}_4(\text{aq}) \rightarrow \text{Na}_3\text{PO}_4(\text{aq}) + 3\text{H}_2\text{O}(\ell)$$

What amount in moles of TSP is produced if 14.7 g of sodium hydroxide reacts with phosphoric acid, $\text{H}_3\text{PO}_4(\text{aq})$?
- What mass of hydrogen is produced when 3.75 g of aluminum reacts with sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$?

$$2\text{Al}(\text{s}) + 3\text{H}_2\text{SO}_4(\text{aq}) \rightarrow 3\text{H}_2(\text{g}) + \text{Al}_2(\text{SO}_4)_3(\text{aq})$$
- Nitrogen monoxide, $\text{NO}(\text{g})$, reacts with oxygen gas to form nitrogen dioxide, $\text{NO}_2(\text{g})$. What mass of nitrogen dioxide is produced from 2.84 g of nitrogen monoxide?
- Iron(III) oxide, $\text{Fe}_2\text{O}_3(\text{s})$, reacts with carbon monoxide to form solid iron and carbon dioxide in the following reaction:

$$\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$$

What mass (in grams) of carbon dioxide is produced from 12.4 g of iron(III) oxide?
- Methane, $\text{CH}_4(\text{g})$, reacts with sulfur, $\text{S}_8(\text{s})$, to produce carbon disulfide, $\text{CS}_2(\ell)$, and hydrogen sulfide, $\text{H}_2\text{S}(\text{g})$. Carbon disulfide is often used in the production of cellophane.

$$2\text{CH}_4(\text{g}) + \text{S}_8(\text{s}) \rightarrow 2\text{CS}_2(\ell) + 4\text{H}_2\text{S}(\text{g})$$

What mass of methane is required if 4.09 g of hydrogen sulfide is produced?
- The addition of concentrated hydrochloric acid to manganese(IV) oxide, $\text{MnO}_2(\text{s})$, produces chlorine gas, $\text{Cl}_2(\text{g})$.

$$4\text{HCl}(\text{aq}) + \text{MnO}_2(\text{s}) \rightarrow \text{MnCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\ell)$$

What mass of manganese(IV) oxide is needed to react with 8.65×10^{-2} g of hydrochloric acid?
- Aluminum carbide, $\text{Al}_4\text{C}_3(\text{s})$, is a yellow powder that reacts with water, $\text{H}_2\text{O}(\ell)$, to produce aluminum hydroxide, $\text{Al}(\text{OH})_3(\text{s})$, and methane, $\text{CH}_4(\text{g})$. Write a balanced chemical equation for the reaction and determine the mass of water required to react with 14.0 g of aluminum carbide.

21. 1.3×10^5 g

22. 860 kg

23. 726 g

24. 0.123 mol

25. 0.421 g

26. 4.35 g

27. 10.3 g

28. 0.963 g

29. 5.16×10^{-2} g

30. 21.0 g

Day 4 - Limiting PRACTICE

Limiting Practice

1. Liquid hydrazine, N_2H_4 , reacts with a solution of hydrogen peroxide, to produce hydrogen nitrate gas and water. If 120.0g of hydrazine reacts with equal amounts of hydrogen peroxide, what mass of hydrogen nitrate is expected to be produced?

[ans. 63.5 g]

2. Solid manganese (III) fluoride can be formed by the single displacement reaction of solid manganese (II) iodide with fluorine. If 1.23 g of manganese iodide reacts with 25.0 g of fluorine, what mass of manganese fluoride is expected to form.

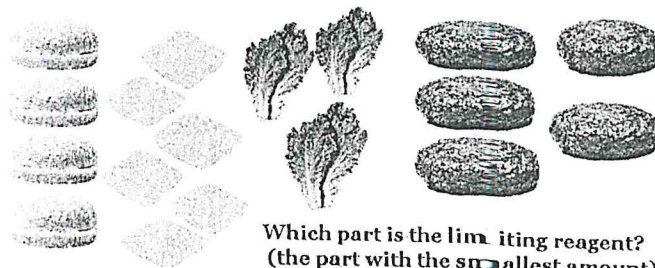
[ans. 0.436 g]

Day 4 - Could Have Been Submitted
For Feedback.

Name: _____

Question 1

How many burgers can be made?



Limiting Reagent Assessment

1. Determine the mass of sulfur trioxide produced when 5.8 mol of sulfur dioxide and 2.8 mol of oxygen combine in a synthesis reaction.

Over →

2. Aluminum hydroxide in antacid tablets neutralizes hydrochloric acid in the stomach (you may need to review neutralization reactions). If 0.50 g of aluminum hydroxide is placed in a solution containing 0.60 g of hydrochloric acid, predict what mass of aluminum chloride will form.



EXTRA PRACTICE - LIMITING

DAY 4 - LIMITING - EVEN MORE!

Practice Problems

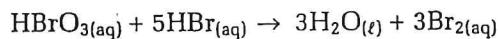
31. Hydrogen fluoride, HF(g) , is a highly toxic gas. It is produced according to the following balanced chemical equation:
- $$\text{CaF}_2(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{HF(g)} + \text{CaSO}_4(\text{s})$$
- Determine the limiting reactant when 1.00 g of calcium fluoride, $\text{CaF}_2(\text{s})$, reacts with 15.5 g of sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$.
32. An ester is an organic compound that forms when a carboxylic acid reacts with an alcohol. Esters often are used as essences or scents. One such ester is methyl salicylate, $\text{C}_8\text{H}_8\text{O}_3(\text{aq})$, which is oil of wintergreen. It is formed by the reaction of salicylic acid, $\text{C}_7\text{H}_6\text{O}_3(\text{aq})$, and methanol, $\text{CH}_3\text{OH}(\text{aq})$, as shown below:
- $$\text{C}_7\text{H}_6\text{O}_3(\text{aq}) + \text{CH}_3\text{OH}(\text{aq}) \rightarrow \text{C}_8\text{H}_8\text{O}_3(\text{aq}) + \text{H}_2\text{O}(\ell)$$
- If 100.11 g of salicylic acid and 90.4 g of methanol are used to produce oil of wintergreen, which is the limiting reactant?
33. Acetylene, $\text{C}_2\text{H}_2(\text{g})$, is used in welding. It forms when calcium carbide, $\text{CaC}_2(\text{s})$, reacts with water, as shown below:
- $$\text{CaC}_2(\text{s}) + 2\text{H}_2\text{O}(\ell) \rightarrow \text{Ca(OH)}_2(\text{aq}) + \text{C}_2\text{H}_2(\text{g})$$
- If 5.50 mol of calcium carbide reacts with 3.75 mol of water, which is the limiting reactant?
34. Nickel(II) chloride, $\text{NiCl}_2(\text{aq})$, reacts with sodium phosphate, $\text{Na}_3\text{PO}_4(\text{aq})$, according to the following balanced chemical equation:
- $$3\text{NiCl}_2(\text{aq}) + 2\text{Na}_3\text{PO}_4(\text{aq}) \rightarrow \text{Ni}_3(\text{PO}_4)_2(\text{s}) + 6\text{NaCl}(\text{aq})$$
- If 10.0 g of each reactant is used, which is the limiting reactant?
35. Copper metal reacts with nitric acid, $\text{HNO}_3(\text{aq})$, as follows:
- $$3\text{Cu(s)} + 8\text{HNO}_3(\text{aq}) \rightarrow 3\text{Cu(NO}_3)_2(\text{aq}) + 2\text{NO(g)} + 4\text{H}_2\text{O}(\ell)$$
- If 2.5 g of copper reacts with 25.0 g of nitric acid, which reactant is in excess?
36. Lithium reacts with oxygen to form lithium oxide, $\text{Li}_2\text{O(s)}$.
- $$4\text{Li(s)} + \text{O}_2(\text{g}) \rightarrow 2\text{Li}_2\text{O(s)}$$
- When 20.0 g of lithium metal reacts with 30.0 g of oxygen gas, which reactant is limiting and which reactant is in excess?
37. Chlorine gas is used in the textile industry to bleach fabric. Excess chlorine is removed by a reaction with sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$, as shown below:
- $$\text{Na}_2\text{S}_2\text{O}_3(\text{aq}) + 4\text{Cl}_2(\text{g}) + 5\text{H}_2\text{O}(\ell) \rightarrow 2\text{NaHSO}_4(\text{aq}) + 8\text{HCl}(\text{aq})$$
- If 42.5 g of sodium thiosulfate and 175 g of chlorine gas react with excess water, which is the limiting reactant?
38. Acrylonitrile, $\text{C}_3\text{H}_3\text{N(g)}$, is prepared by the reaction of propylene, $\text{C}_3\text{H}_6(\text{g})$, with nitric oxide, NO(g) .
- $$4\text{C}_3\text{H}_6(\text{g}) + 6\text{NO(g)} \rightarrow 4\text{C}_3\text{H}_3\text{N(g)} + 6\text{H}_2\text{O(g)} + \text{N}_2(\text{g})$$
- If 126 g of propylene reacts with 175 g of nitric oxide, which is the limiting reactant?
39. Insoluble silver carbonate, $\text{Ag}_2\text{CO}_3(\text{s})$, forms in the following balanced chemical reaction:
- $$2\text{AgNO}_3(\text{aq}) + \text{K}_2\text{CO}_3(\text{aq}) \rightarrow \text{Ag}_2\text{CO}_3(\text{s}) + 2\text{KNO}_3(\text{aq})$$
- What mass of silver nitrate, $\text{AgNO}_3(\text{aq})$, reacts with 25.0 g of potassium carbonate, $\text{K}_2\text{CO}_3(\text{aq})$, if there is at least 5.5 g of silver nitrate in excess?

31. $\text{CaF}_2(\text{s})$
 32. $\text{C}_7\text{H}_6\text{O}_3(\text{aq})$
 33. $\text{H}_2\text{O}(\ell)$
 34. $\text{NiCl}_2(\text{aq})$
 35. $\text{HNO}_3(\text{aq})$
 36. Li(s) is limiting, $\text{O}_2(\text{g})$ is in excess
 37. $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$
 38. $\text{C}_3\text{H}_6(\text{g})$
 39. 61 g

Practice Problems

DAY 5
PERCENT
YIELD

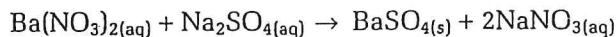
31. 20.0 g of bromic acid, HBrO_3 , is reacted with excess HBr .



(a) What is the theoretical yield of Br_2 for this reaction? (74.4g)

(b) If 47.3 g of Br_2 is produced, what is the percentage yield of Br_2 ? (63.6%)

32. Barium sulfate forms as a precipitate in the following reaction:

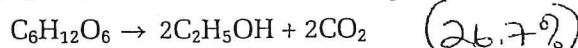


When 35.0 g of $\text{Ba}(\text{NO}_3)_2$ is reacted with excess Na_2SO_4 , 29.8 g of BaSO_4 is recovered by the chemist.

(a) Calculate the theoretical yield of BaSO_4 . (31.3g)

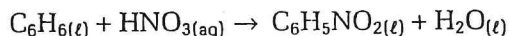
(b) Calculate the percentage yield of BaSO_4 . (95.2%)

33. Yeasts can act on a sugar, such as glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, to produce ethyl alcohol, $\text{C}_2\text{H}_5\text{OH}$, and carbon dioxide.



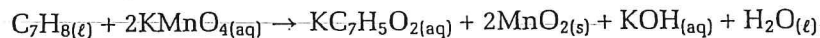
If 223 g of ethyl alcohol are recovered after 1.63 kg of glucose react, what is the percentage yield of the reaction?

34. The following reaction proceeds with a 70% yield.



Calculate the mass of $\text{C}_6\text{H}_5\text{NO}_2$ expected if 12.8 g of C_6H_6 reacts with excess HNO_3 . (14.1g)

35. The reaction of toluene, C_7H_8 , with potassium permanganate, KMnO_4 , gives less than a 100% yield.



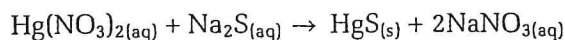
(a) 8.60 g of C_7H_8 is reacted with excess KMnO_4 . What is the theoretical yield, in grams, of $\text{KC}_7\text{H}_5\text{O}_2$? (15.0g)

(b) If the percentage yield is 70.0%, what mass of $\text{KC}_7\text{H}_5\text{O}_2$ can be expected? (10.5g)

(c) What mass of C_7H_8 is needed to produce 13.4 g of $\text{KC}_7\text{H}_5\text{O}_2$, assuming a yield of 60%? (12.8g)

36. Marble is made primarily of calcium carbonate. When calcium carbonate reacts with hydrogen chloride, it reacts to form calcium chloride, carbon dioxide and water. If this reaction occurs with 81.5% yield, what mass of carbon dioxide will be collected if 15.7 g of CaCO_3 is added to sufficient hydrogen chloride? (5.63g)

37. Mercury, in its elemental form or in a chemical compound is highly toxic. Water-soluble mercury compounds, such as mercury(II) nitrate, can be removed from industrial wastewater by adding sodium sulfide to the water, which forms a precipitate of mercury(II) sulfide, which can then be filtered out.



If 3.45×10^{23} formula units of $\text{Hg}(\text{NO}_3)_2$ are reacted with excess Na_2S , what mass of HgS can be expected if this process occurs with 97.0% yield?