

Unit 8 – Chemical Reactions

Chapter 8 of your textbook.

Early Booklet E.C.: + 2
Unit 8 Hwk. Pts.: / 36
Unit 8 Lab Pts.: / 14
Late, Incomplete, No Work, No Units Fees? Y / N

Learning Targets for Unit 8

- 1.1 I can recognize evidence of chemical change.
- 1.2 I can represent chemical reactions with equations.
- 1.3 I can balance chemical equations.
- 1.4 I can classify chemical reactions.
- 1.5 I can identify the characteristics of different classes of chemical reactions.
- 1.6 I can describe aqueous solutions.
- 1.7 I can write complete ionic and net ionic equations for chemical reactions in aqueous solutions.
- 1.8 I can predict whether reactions in aqueous solutions will produce a precipitate, water, or gas.

Unit Vocabulary for Unit 8

Chemical reaction	Reactant	Product	Chemical equation
Coefficient	Synthesis reaction	Combustion reaction	Decomposition reaction
Single-replacement reaction	Double-replacement reaction	Precipitate	Aqueous solution
Solute	Solvent	Complete ionic equation	Spectator ion
Net ionic equation	Acid-base reaction		

Chemistry	Essential Skill 8.1 - Ionic Compounds Refresher	
Name:		Period:
This is practice to prepare you in the short term for a quiz, and for the long term by reinforcing an essential skill needed to balance chemical reactions.		

We will correct this in class, and have a quiz to be sure that you have retained mastery of this essential chemistry skill!

Write balanced formulas for the following compounds:

1. magnesium fluoride

2. ammonium dichromate

3. lead (IV) carbonate

4. hydrogen peroxide

5. nickel (II) phosphate

6. aluminum chloride

7. copper (I) sulfate

8. silver nitrate

9. sodium sulfide

10. tin (IV) chlorate

Write out the names of the following compounds:

11. $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_2$

12. KMnO_4

13. SrSO_4

14. CuCl

15. NaOH

16. BaSO_3

17. Cr_3N_2

18. PbO

19. $\text{Fe}(\text{NO}_2)_2$

20. Li_2HPO_4

8.1 Problems – Reactions and Equations
Section 8.1 of your textbook.

Possible 8.1 Pts.: 7
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 7

1. Write formulas for the following substances, and designate their physical states.
 - a. nitrogen dioxide gas (hint – binary molecular compound)

 - b. liquid gallium (pure element)

 - c. barium chloride dissolved in water

 - d. solid ammonium carbonate

Write word equations for the following skeleton equations.

2. $\text{Cu}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CuO}_{(s)}$

3. $\text{K}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{KOH}_{(aq)} + \text{H}_{2(g)}$

4. $\text{CaCl}_{2(aq)} + \text{Na}_2\text{SO}_{4(aq)} \rightarrow \text{CaSO}_{4(s)} + \text{NaCl}_{(aq)}$

Write balanced equations for these reactions.

5. lithium_(s) + gold (III) chloride_(aq) → lithium chloride_(aq) + gold_(s)

6. nickel (II) chloride_(s) + oxygen_(g) → nickel (II) oxide_(s) + dichlorine pentoxide_(g)

7. lithium chromate_(aq) + barium chloride_(aq) → lithium chloride_(aq) + barium chromate_(s)

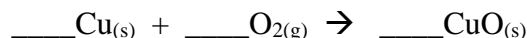
Possible 8.2 Pts.: 10
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3 - 4
Final Score: / 10

8.2 Problems – Classifying Reactions Section 8.2 of your textbook.

Balance the following reactions, and state which type of reaction they are. Study the word equations to see how they look when they are made into skeleton equations.

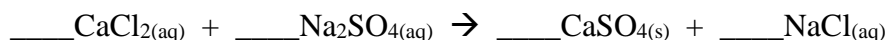
We will correct this in class next time we meet.

1. Copper metal reacts with oxygen in the air to form solid green copper (II) oxide.



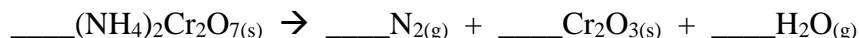
Reaction Type: _____

2. Solutions of calcium chloride and sodium sulfate react to form solid calcium sulfate and aqueous sodium chloride.



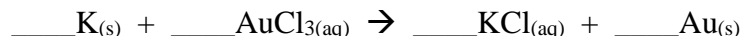
Reaction Type: _____

3. Solid ammonium dichromate breaks down into three products: nitrogen gas, solid chromium (III) oxide, and water vapor.



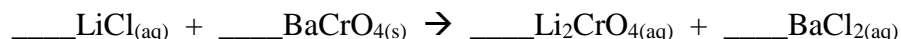
Reaction Type: _____

4. Potassium metal and an aqueous solution of gold (III) chloride react to form a solution of potassium chloride and solid gold.



Reaction Type: _____

5. A solution of lithium chloride and solid barium chromate are the products of the reaction between aqueous solutions of lithium chromate and barium chloride.



Reaction Type: _____

Write balanced equations for each word equation, including states of matter of reactants and products (solid, liquid, gas, aqueous).

Remember: hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine, and iodine are all diatomic!

6. Potassium metal reacts with water to form dissolved potassium hydroxide and hydrogen gas.

Reaction Type: Single Replacement

7. In plants, carbon dioxide from the atmosphere and water will combine to form dissolved sugar ($C_6H_{12}O_6$) and oxygen during photosynthesis.

Reaction Type: Synthesis

8. Hydrogen iodide gas breaks down into gaseous hydrogen and iodine vapor when heated.

Reaction Type: _____

9. Ethene (C_2H_4) gas burns, reacting with oxygen in the air to form carbon dioxide gas and water vapor.

Reaction Type: _____

10. Sodium hydroxide reacts with sulfuric acid to form aqueous sodium sulfate and water.

Reaction Type: _____

Possible 8.3 Pts.: 9	
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3	
Final Score:	/ 9

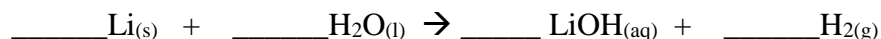
8.3 Problems – Reactivity Series Section 9.3 of your textbook.

Use your reactivity chart to answer the following questions. Include states of matter in your reactions. We will correct this in class next time we meet.

1. Arrange the following elements by increasing reactivity: lead, calcium, platinum, tin, potassium, iron, aluminum, sodium, silver, zinc, and hydrogen.

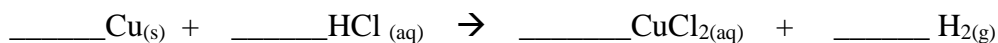
Will the following reactions occur? Balance the ones that react. If no reaction occurs, write NR. You will have to write out some of the reactions fully, while others are already made for you. Not all of the reactions will occur; you must check your reactivity series!

2. Lithium metal and water react to produce aqueous lithium hydroxide and hydrogen gas.



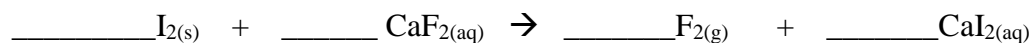
3. Calcium metal and sulfuric acid react to form solid calcium sulfate and hydrogen gas.

4. Copper metal reacts with hydrochloric acid to produce a solution of copper (II) chloride and hydrogen gas.



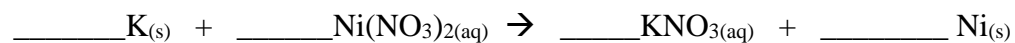
5. Chlorine gas reacts with aqueous sodium bromide to produce liquid bromine and aqueous sodium chloride.

6. Solid iodine reacts with aqueous calcium fluoride to produce fluorine gas and dissolved calcium iodide.



7. Solid zinc and a solution of silver nitrate. Predict the products if a reaction occurs.

8. Potassium metal and a solution of nickel (II) nitrate.



9. Solid tin and a solution of iron (III) bromide. Predict the products if a reaction occurs.

Possible 8.4 Pts.: 10
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3 - 4
Final Score: / 10

8.4 Problems – Reactions in Aqueous Solutions
Section 9.4 of your textbook.

Balance the following reactions (one point each), and tell what type of reaction is demonstrated. Include states of matter for all reactants and products. Some of the problems require that you interpret a word problem, making correct chemical formulas for compounds.

We will correct this in class.

1. Iron metal reacts with oxygen in the air to form rust (iron (III) oxide).

Reaction type? _____

2. Octatomic sulfur crystals (S₈) react with oxygen, forming sulfur dioxide, a smelly choking gas.

Reaction type? _____

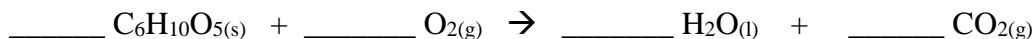
3. Sodium azide, (NaN₃), is in the airbags of vehicles. It rapidly forms nitrogen gas and sodium metal when it explodes.

Reaction type? _____

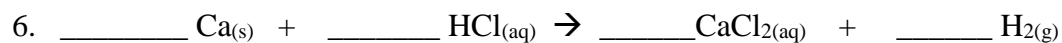
4. Solutions of hydrochloric acid and aluminum hydroxide react to form water and aluminum chloride.

Reaction type? _____

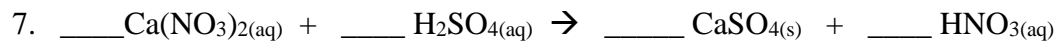
5. Cellulose (C₆H₁₀O₅) forms the structure of plants and trees, and when it is burned it produces carbon dioxide and water vapor.



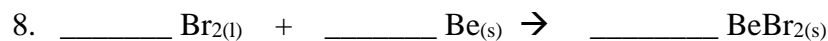
Reaction type? _____



Reaction type? _____



Reaction type? _____



Reaction type? _____



Reaction type? _____

For the following double replacement reaction, predict the products, states of matter, and then balance it:



Chemistry	8.1 Lab: Reactions Practice						
Name:					Correction Credit: Half		
Lab Points:	Missed:	Late, No Units, No Work Fee:			First Score:	Corrections:	Final Score:
14		-1	-2	-3			

Balance the following chemical reactions (2 points each). Pay attention to diatomic reactants or products, and include the state of matter of your reactants or products.

When you get to an **Observation**, observe it and take notes. When you get to a **Lab Activity**, follow the procedure and balance the reaction.

We will correct this in class next time we meet.

Synthesis Reactions combine two or more chemicals to form one product.

1. Aluminum metal reacts with crystalline octatomic sulfur (S_8) to form solid aluminum sulfide. Write out this reaction and balance it.

Combustion Reactions combine oxygen with hydrocarbons (or other elements).

A usual byproduct is carbon dioxide and water vapor.

2. Propane (C_3H_8) burns in air to form carbon dioxide and water vapor.

3. **Lab Activity:** Obtain a candle and set it on fire. This reaction involves the burning of light paraffin ($C_{20}H_{42}$) and oxygen from the air. Write your observations of the burning candle and balance the reaction.

Decomposition Reactions involve one chemical breaking down into two or more.

4. **Lab Activity:** Liquid hydrogen peroxide decomposes to form water and oxygen gas. Pour 5.0 mL of hydrogen peroxide into a small test tube and add a pinch of pulverized manganese (IV) oxide (MnO_2) to it. Record your observation of this reaction and balance it. Note: MnO_2 is a catalyst, and does not react.

5. **Observation:** Nitrogen triiodide (NI_3) decomposes rapidly to form nitrogen and iodine vapor. After observing this, write your observations and balance the reaction.

Single Replacement Reactions involve exchanging one component with another.

6. **Observation:** silver nitrate and copper react to form silver metal and copper (II) nitrate. Observe the demonstration and write down your observations. Then, balance the reaction.

Double Replacement Reactions involve exchanging two components with a pair of other ones.

7. **Lab Activity:** Measure 5 mL of copper (II) sulfate (CuSO_4) solution in a 10 mL graduated cylinder, then pour it into a test tube. Drop a few drops of aqueous sodium hydroxide (NaOH) in and write down your observations. This reaction is a double replacement reaction – predict the products and balance the reaction. Note: Copper retains a +2 charge throughout the reaction.

Chemistry		Unit 8: Double Replacement Reactions Lab		Due: _____
Lab Scoring Guide - One Report per Student				Points
Title Page:	The first page should be a cover sheet with the lab title, your name, and period on it.			/ 2
Objectives:	States the purpose of this lab clearly, telling what you intend to do in complete sentences.			/ 3
Procedure:	Clearly describe the procedure you used to test reactants.			/ 3
Safety:	List all safety precautions, including chemical hygiene.			/ 2
Conclusions:	Part 1: Describe any errors or problems that another run through would solve (3 points), then describe the exact details (what you observed) of your <u>favorite</u> reaction (3 points).			/ 6
	Part 2: Identify unknown compounds here (3 pts. each), describing exactly how you determined what they were.			/ 6
Extra Credit:	Each additional unknown determined and explained = 2 points.			0 2 4
Data Table:	Contains thorough observations from the experiment: formation of solids, gases, colors, etc. This will help you determine your unknowns as well. This can be the original.			/ 10
Reactions:	All 28 combinations of the 8 chemicals are written and balanced (include states of matter - fee applies if missing). Write NR for no reaction. These can be hand written. Check formulas carefully. Ex: BaCl _{2(aq)} + H ₂ SO _{4(aq)} -> H₂Cl_{2(aq)} + BaSO _{4(s)} is wrong!			/ 8
Penalty:	Text is not typed.			-7
Penalty:	Late			-10
Scores:	First Score:	/ 40	Corrections:	Final Score: / 40

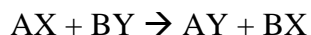
Objectives:

1. Predict the products of double replacement reactions.
2. Write balanced chemical formulas and reactions.
3. Identify unknown compounds by deductive reasoning.

Overview:

When ionic compounds dissolve in water, the ions in the crystals separate and move through the solution. When two such solutions are mixed, all types of positive ions in the new solution are attracted to all types of negative ions in the solution. Sometimes a reaction takes place, in which a solid, liquid, or gas is produced.

The general form of a double replacement reaction is:



As the solutions are mixed, positive A and B ions will mix, possibly reacting with the negative X and Y ions. If a solid, liquid, or gas forms, then that component will leave the solution.

Safety:

Wear goggles, long pants and closed-toed shoes throughout the entire lab, even if you are done but others are working.

Some of these chemicals are corrosive to clothing: lab aprons are recommended.

Don't pick up bottles by their tops, they can disconnect from the bottle and spill all over.

Know what good chemical hygiene is, and how to use it.

Materials:

- 0.1 M Barium Chloride BaCl₂
 - 0.1 M Copper (II) Sulfate CuSO₄ – assume copper has a +2 charge throughout reaction.
 - 1.0 M Hydrochloric Acid HCl
 - 0.1 M Silver Nitrate AgNO₃
 - 0.2 M Sodium Carbonate Na₂CO₃
 - 1.0 M Sodium Hydroxide NaOH
 - 0.1 M Sodium Phosphate Na₃PO₄
 - 1.0 M Sulfuric Acid H₂SO₄
- 4 unknown solutions: A, B, C, D
Plastic testing plate
Deionized Water Bottle

Chemicals	Chemical 1	Chemical 2	Chemical 3	Chemical 4	Chemical 5	Chemical 6	Chemical 7	Chemical 8
Chemical 1	X							
Chemical 2	X	X						
Chemical 3	X	X	X					
Chemical 4	X	X	X	X				
Chemical 5	X	X	X	X	X			
Chemical 6	X	X	X	X	X	X		
Chemical 7	X	X	X	X	X	X	X	
Chemical 8	X	X	X	X	X	X	X	X
Unknown 1								
Unknown 2								
Unknown 3								
Unknown 4								

Procedure:

Use a data table to react all combinations of the eight chemicals used in the lab. Consider making a 9 X 13 table with chemicals along the top and side. As you combine the different chemicals, write your observations in the appropriate box. Be sure not to duplicate reactions that you have already done.

Using four drops of each chemical, observe the reactions to see which ones form gases, colored solutions, or precipitates. Some of the reactions will produce water, which you will not be able to see, but if it is an acid/base reaction you should know that this will be a product. Remember what makes an acid an acid, and what makes a base a base.

Be very careful to avoid contamination here – make sure not to touch the tip of the dropper bottle to any other chemicals. Doing so can jeopardize not only your results but the results of other groups as well. Any lab equipment that needs washing should be rinsed off with tap water, then deionized water.

Once you have observed all combinations, you will have to determine the identity of two of the four unknowns. You will react the unknown compounds one at a time with all of the known chemicals, and see how they react. You should be able to deduce their identities by comparing observations made from your unknown to those made for your known chemicals.

The unknown compounds are one of the eight known compounds.

Extra credit will be given for any additional unknowns correctly determined.

Cleanup:

Pour trays down the drain, and wash your dropper plates and lab area.

Report: One per student.

The reports must be typewritten, but I will allow hand written chemical reactions. When writing chemical reactions, only balance the ones that formed a product. If a reaction does not form a product, write NR for “no reaction.” Watch out! Some reactions will form water, and will have to be balanced too.

Your data table can be the original, but if you wish to retype it that’s fine.

Use the scoring guide to help you craft your report. There should be at least 6 titled sections after the cover sheet: Objectives, Procedure, Safety, Conclusions, Data Table, and Reactions. Each section should be as complete as possible with data and information you gathered during the lab.

Points Possible:	10
Late/Inc. Fee:	-1 -2 -3
Final Score:	/ 10

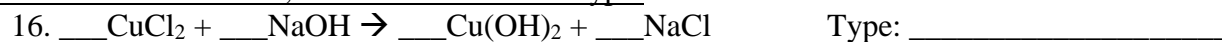
Unit 8 Review – Chemical Reactions

This serves as test preparation for the Unit 5 Test. Points earned are based on completion, and we will go over any questions you have during the review.

1. List four signs that a chemical reaction has occurred.
2. What happens for a metal atom to become a cation?
3. Which are the seven diatomic elements?
4. What is the formula for dinitrogen trioxide?
5. What is the name of CaCl_2 ?
6. Define spectator ion.
7. Write $2 \text{H}_2\text{SO}_{4(\text{aq})}$ as it would appear in a complete ionic equation.
8. What are three signs that a double replacement reaction has occurred?
9. Define skeleton equation.
10. Is burning paper a chemical change? Why or why not?
11. List three acids.
12. What are the two products of an acid/base reaction?
13. List three bases.
14. What ion makes an acid an acid?

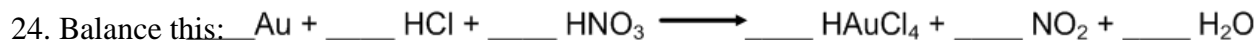
15. What ion makes a base a base?

Balance These Reactions, and state the reaction type:



22. List three monatomic ions, and three polyatomic ions

23. Which are the spectator ions in: $\text{AgNO}_{3(\text{aq})} + \text{HCl}_{(\text{aq})} \rightarrow \text{AgCl}_{(\text{s})} + \text{HNO}_{3(\text{aq})}$



25. Is aluminum bromide soluble or insoluble?

26. What is an endothermic reaction?

27. How is a coefficient different from a subscript?

28. Is calcium phosphate soluble or insoluble?

29. What does insoluble mean?

30. What is an exothermic reaction?

31. What does soluble mean?

Balance these, and list their reaction type:

