

Chemical Reactions Lab

name: _____ 160/1200

There are 5 basic chemical reactions in our class. During this lab you will do or observe many different experiments that will cover all of these. List the 5 kinds of chemical reactions that you know (so far).

We will be looking for evidence that a chemical reaction has even taken place. List the 6 indicators that a chemical reactions probably happened.

T -

O -

P -

I -

C -

B -

During several of these experiments you will produce different gases, such as oxygen, carbon dioxide, and hydrogen. Each time a gas is produced you will test it using a splint of wood that will be flaming, or glowing (flame out but it's still hot). Fill in this chart.

gas	test procedure	what happens?
carbon dioxide	flaming splint	
oxygen	glowing splint	
hydrogen	flaming splint	

Do not write on this lab report until YOU KNOW EXACTLY WHAT IT IS THAT YOU NEED TO WRITE. You will make this lab report PERFECT.

For each experiment you need a balanced chemical reaction with phases, and a word equation.

Answer all of the questions in complete sentences, in NUMBER ORDER.

ONLY a PROFESSIONAL LOOKING LAB REPORT WILL BE ACCEPTED. I will not be accepting any rough edged paper. No excessive crossing out, no more arrows pointing far away, this one will be the first of many NEATLY done reports. Do not squeeze your thoughts, if you want to express yourself, or if you need to say something, then do so properly and WITH ENOUGH ROOM for my comments.

THIS LAB REQUIRES:

1. A TITLE PAGE with a serious title, an optional funny title, and a few sentences explaining the point of this lab experience
2. All 20 balanced equations with phase symbols
3. All 20 word equations
4. All 20 neatly written answers to the 20 lab questions.

There is NO CONCLUSION FOR THIS LAB

This lab is worth 60 points because it is SO LONG, and SO IMPORTANT.

Grading:

Each word equation - $20 \times 1 \text{ point} = 20$

Each balanced equation with phases - $20 \times 1 \text{ point} = 20$

Then, 20 questions $\times 1 \text{ point each} = 20$

$20 + 20 + 20 = 60 \text{ total}$

CHECK LIST:

Did you check every single equation for PHASE SYMBOLS? _____

Did you check every word equation for spelling? _____

Did you leave any blanks? _____

Reaction # 1 The Decomposition of Water

The Hoffmann Apparatus is set up for you to observe. Watch the demonstration. The two gases fill the tubes in very different volumes. Using electricity to decompose the water is called electrolysis .

Reaction # 2 The Synthesis of Water

The test for hydrogen will elicit a fun toot. Do not drop the tube, you won't get hurt. Note water condenses inside the tube. You need ~25 mL gas to test. It's a one toot event, it won't work again.

Reaction # 3 The Combustion of Wood

Wood is mostly cellulose, which is formed from a chain of glucose molecules. It's "real" formula is $(C_6H_{10}O_5)_n$ where the "n" is an integer (it's a chain molecule of indefinite length). Use this formula in your chemical equation for wood: $C_{12}H_{20}O_{10}$

The test for oxygen is to insert the glowing wood splint (not a flame!) into the tube with oxygen. It should re-ignite if the tube is full of oxygen (it is). The wood will catch on fire again, burning, which is combustion.

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 1 Observations	
Reaction 1 Word Equation	
Reaction 1 Balanced Equation with phase symbols	
Reaction 2 Observations	
Reaction 2 Word Equation	
Reaction 2 Balanced Equation with phase symbols	
Reaction 3 Observations	
Reaction 3 Word Equation	
Reaction 3 Balanced Equation with phase symbols	

Obtain a watch glass. Make sure that you DO NOT cross contaminate the solutions, or touch the eye droppers to each other, or to your watch glass. If you do (and you might) we'll get CLEAN eye droppers. If you make believe it didn't happen, we will ALL KNOW!

Reaction # 7 Double Replacement

Put: 2-3 drops of sodium phosphate into a watch glass with 2-3 drops of silver nitrate solution. Observe.

Reaction # 8 Double Replacement

Put: 2-3 drops of sodium hydroxide into a watch glass with 2-3 drops of copper (II) sulfate solutions together. Observe.

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 7 Observations	
Reaction 7 Word Equation	
Reaction 7 Balanced Equation with phase symbols	
Reaction 8 Observations	
Reaction 8 Word Equation	
Reaction 8 Balanced Equation with phase symbols	

Reaction # 9 Double Replacement

Put: 2-3 drops of cobalt (II) nitrate into a watch glass with 2-3 drops of sodium hydroxide solution. Observe.

Reaction # 10 Double Replacement

Put: 2-3 drops of potassium chloride into a watch glass with 2-3 drops of ammonium nitrate solution. Observe.

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 9 Observations	
Reaction 9 Word Equation	
Reaction 9 Balanced Equation with phase symbols	
Reaction 10 Observations	
Reaction 10 Word Equation	
Reaction 10 Balanced Equation with phase symbols	Balance this equation, including phase symbols

Reaction # 11 A Single Replacement Reaction between magnesium and hydrochloric acid

Put about 1 inch of hydrochloric acid into a large test tube. Have another CLEAN large test tube in hand. Put the metal into the acid. Quickly top the tube with the empty tube, to catch the gas produced. This might get too hot to hold, so have an empty beaker on the black table to put the bottom tube into. Keep this upper tube facing down, and test with a flaming splint.

Reaction # 12 A Single Replacement Reaction between Iron and sodium chloride solution.

Put about one inch of sodium chloride solution (salty water) into a small test tube. Gently insert an iron nail into this solution, and let sit for 10 minutes. Dump the solution out in your hands, and observe the nail.

Reaction # 14 A Single Replacement reaction between iron and copper (II) sulfate solution

Obtain an iron nail and put about 1 inch of copper (II) sulfate solution into another small test tube. Very carefully slide in the nail, point down. Let this sit for 10 minutes. Dump the solution into a sink, and catch the nail by the head (the clean end). Observe the pointy side. What is that stuff? Since we can't "know" which Iron ion compound forms, do BOTH reactions

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 11 Observations	
Reaction 11 Word Equation	
Reaction 11 Balanced Equation with phase symbols	
Reaction 12 Observations	
Reaction 12 Word Equation	
Reaction 12 Balanced Equation with phase symbols	
Reaction 14 Observations	
Reaction 14 Word Equation	
Reaction 14 TWO Balanced Equations, phase symbols	Balance with Fe ⁺² cation product
	Balance with Fe ⁺³ cation product

Reaction # 15 Combustion of Methane gas

Turn on your Bunsen burner (that's a capital B for Mr. Bunsen, thank you very much!) The methane gas burns with the oxygen in the air. The products are invisible gases, but they are really there. Combustion reactions are always a hydrocarbon + oxygen which always forms water and carbon dioxide gases.

Reaction # 16 Combustion of candle wax

Attach a candle to a watch glass, and mass the "system". Light candle for 15 minutes, then blow out the candle. Record the final mass of this "system" as well. The wax formula is: $C_{20}H_{42}$ but there are many kinds of wax, all with different formulas as well, wax is a general term. State the Law of Conservation of Matter and explain this to yourself.

Reaction # 17 Combustion of Ethanol (an alcohol)

Using lithium chloride salt in an evaporating dish. We will combust the ethanol (C_2H_5OH) by sparking with a "clicker lighter". Observe. The salt are only heated up, but they are NOT USED UP. It's the ethanol that burns. Technically speaking, ethanol is NOT a hydrocarbon, it's an oxygenated-hydrocarbon; but it burns well and will be a bit harder to balance!

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 15 Observations	
Reaction 15 Word Equation	
Reaction 15 Balanced Equation with phase symbols	
Reaction 16 Observations	mass of wax and eye glass to start _____ g mass of wax and eye glass at end _____ g
Reaction 16 Word Equation	
Reaction 16 Balanced Equation with phase symbols	
Reaction 17 Observations	
Reaction 17 Word Equation	
Reaction 17 Balanced Equation with phase symbols	

Reaction # 18 Combustion of butane gas

The “clicker lighter” contains a liquid called butane. It’s formula is C_4H_{10} and it’s sprayed through a tiny hole in the metal tube, where it vaporizes into a gas, and mixes with the oxygen in the air. The “click” sparks it and it combusts well.

Reaction # 19 TRICKY SITUATION part one

Measure the centigrade temperature of 40 mL of deionized water. Add a scoop of potassium nitrate powder. Stir carefully with the thermometer. Record the final temperature of this solution and the ΔT . Think: is this a physical change or a chemical reaction? Show the symbols below, use the “WORD EQ” box to explain.

Reaction # 20 TRICKY SITUATION part two

Put about an inch of the $KCl_{(AQ)}$ solution into a small test tube. Add an aluminum nail. Observe. Is this a chemical reaction?

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 18 Observations	
Reaction 18 Word Equation	
Reaction 18 Balanced Equation with phase symbols	
Reaction 19 Observations	Start Temp _____ °C End Temp _____ °C ΔT _____ °C
Reaction 19 Word Equation	
Reaction 19 Balanced Equation with phase symbols	
Reaction 20 Observations	
Reaction 20 Word Equation	
Reaction 20 Balanced Equation with phase symbols	

20 Questions, to be answered on loose leaf paper, with spaces in between each one, written NEATLY, and IN PROPER ORDER. Show that you care, this represents YOU. 1 point each.

1. Define decomposition and give an example balanced chemical reaction for decomposition. (not from this lab)
2. Define synthesis + give an example balanced chemical reaction for synthesis. (not from this lab)
3. Define combustion + give an example balanced chemical reaction for the combustion of octane C_8H_{18} .
4. Why is acid added to the water in the Hoffmann Apparatus? Does it participate in the chemical reaction? What if it was not added, then what would have happened?
5. If cellulose is just bonded together molecules of glucose, why doesn't wood taste sweet? Why is it that human beings can't we digest wood?
6. What are 2 differences between the copper (I) oxide and copper (II) oxide?
7. In the 5th reaction we did, a gas product forms from a solid reactant. Is that gas in reactant?
8. Why is the mass of the products MgO reaction more than the mass of Mg you started out with? State the Law of Conservation of Matter and explain how can you connect it with this obvious increase in mass?
9. Explain how a double replacement is set up and when that set up ends up being no reaction instead.
10. Define Aqueous. What table is used to determine if an ionic salt is going to be aqueous?
11. Define soluble and insoluble.
12. Define electrolyte. $NaCl_{(AQ)}$ and $NaCl_{(S)}$ are both electrolytes. Can they both conduct electricity? How is *THAT* possible?
13. Skip this one, of course
14. What happened in your "reaction #10"?
15. Explain how a single replacement reaction is set up, and why the reaction might not happen even if it looks like it's set up properly.
16. When fluorine gas is added to $NaCl_{(AQ)}$ a reaction occurs. Write that balanced chemical reaction. How is this reaction is the same BUT different than when we put Mg into hydrochloric acid?
17. Define exothermic reaction, define endothermic reaction. Include a mention as to where energy is written in a word equation for both kinds of reactions. (with the reactants or with the products).
18. Go back to question #16 just above. What replaces what in the solution?
19. When the hydrogen and the oxygen gases exploded on our first day in class, was that a combustion reaction? It sure as heck looked like one! Explain.
20. In lab "reaction #19", there is a temperature change (it's endothermic). How is this not really an indication of a chemical reaction? If it's not a reaction, what is it called instead? Using chemical symbols, show how the ionic compound cobalt (III) nitrate dissolves into water. (this is sometimes called DISASSOCIATION, but it's NOT decomposition because IT IS NOT a chemical reaction)
21. Adding atoms of aluminum to a sodium chloride solution appears to be the perfect set up for a single replacement reaction. Explain why it was NOT single replacement, and why it's NOT even a chemical reaction.