

Chemical Reactions Lab

name: _____ 160/1200

This is the largest lab of the year. You will do 20 experiments and write out detailed word and balanced chemical equations for them all. You must read the procedures at the top of each page before doing the experiments.

List the 5 kinds of chemical reactions.		

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 a gas, such as oxygen, carbon dioxide, or hydrogen. To determine which gas it is, you will test them using a splint of wood that will be flaming, or glowing. Fill in this chart.

gas	test procedure, use a...	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

Obtain ~25 mL of hydrogen gas from the Hoffmann Apparatus and test the gas. If it toots, then you had H₂ and it combined with O₂ and made water. Do not drop the tube, you won't get hurt. Note the water condenses inside the tube. It will only toot once, all the hydrogen will react.

Reaction # 3 The Combustion of Wood

Wood is mostly cellulose, which is formed from a chain of glucose molecules. It's "real" formula is (C₆H₁₀O₅)_n where the "n" is an integer Cellulose is a chain molecule of indefinite length. We will use this formula for wood: C₁₂H₂₀O₁₀ Set your splint on fire and observe. Then blow out the wood, and see if the other gas from the Hoffmann Apparatus relights the flame.

The test for oxygen is to insert the glowing wood splint partly into the tube with oxygen (then pull it back out). 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	

Reaction # 4 The Synthesis of a Copper Oxide

Obtain 2 inches of copper wire. Holding it with tongs, put it into the hottest part of the flame of your Bunsen burner. Rotate it (like a hot dog!). It gets red hot, but when it cools, the outside of the wire changes color because the copper reacts with the oxygen in the air. Compare the product to the 2 jars of the two types of copper oxide provided. Determine which of those formed here. (save the piece wire for a few minutes)

Reaction # 5 The Decomposition of Copper (II) carbonate

Put about 1/4 inch of powder into a medium test tube, clamped on an angle as shown. Heat with your Bunsen burner. Have a wood splint ready, set it aflame as you begin to heat the compound. As the color of the powder changes, put flaming splint partly into the tube to test for what gas is produced. Test the gas twice. What is the solid product left over in the test tube?

Reaction # 6 Synthesis of Magnesium Oxide in a Crucible

Be careful! Record the mass of magnesium metal with a crucible. Put the crucible on the black table. Carefully pick up the Bunsen burner, pointing the flame onto the metal. When it's done burning, let it cool down before you mass the crucible and all the product. Compare the mass of the reactants with the mass of the products.

	Observations, Word Equations, and Chemical Equations with Phase Symbols (mandatory for all!)
Reaction 4 Observations	
Reaction 4 Word Equation	
Reaction 4 Balanced Equation with phase symbols	
Reaction 5 Observations	
Reaction 5 Word Equation	
Reaction 5 Balanced Equation with phase symbols	
Reaction 6 Observations	Start mass _____ g End mass _____ g
Reaction 6 Word Equation	
Reaction 6 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! You must BALANCE ALL DR Reactions, and use table F as well.

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	

You must BALANCE ALL DR Reactions, and use table F as well.

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 rubidium bromide 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 3 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 3 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

Mass the candle before you light it. Burn it for 15 minutes, then blow out the candle. Record the final mass of the candle. Do not spill any wax on the table! The wax formula is: $C_{20}H_{42}$ but there are many kinds of wax, all with different formulas as "wax" is a general term, not a compound name. Think of the Law of Conservation of Matter and think about what happened.

Reaction # 17 Combustion of Ethanol (an alcohol)

We will combust the ethanol (C_2H_5OH) by sparking with a "butane lighter". We will burn this alcohol on top of $LiCl_{(s)}$. Observe. The salt is only heated up, but it is not a react to the combustion. 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 sulfuric 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. What are the 2 different ways that you made $CuO_{(s)}$ in lab. What types of reactions produced it as a product?
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? Explain.
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. Give an example of a single replacement reaction that was not in this lab report.