

Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

## Lab 5.1 - Double Displacement Reactions

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
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- \_\_\_\_ 1. Obtain 10 small test tubes.
- \_\_\_\_ 2. Refer to the Solutions Chart below;
  - \_\_\_\_ 2a) Add 10 drops of the solution in Column # 1 to a test tube
  - \_\_\_\_ 2b) Now add 10 drops of the solution in Column # 2 to the same test tube
  - \_\_\_\_ 2c) Pluck the test tube gently
  - \_\_\_\_ 2d) Record all observations in the Observation column
- \_\_\_\_ 3. Do all the combinations in the Solutions Chart listed below.

### Solutions Chart

Pair #	Column # 1	Column # 2	Observations
1	sodium carbonate	barium chloride	
2	sodium carbonate	copper (II) sulfate	
3	sodium carbonate	potassium hydroxide	
4	sodium carbonate	magnesium nitrate	
5	barium chloride	copper (II) sulfate	
6	barium chloride	potassium hydroxide	
7	barium chloride	magnesium nitrate	
8	copper (II) sulfate	potassium hydroxide	
9	copper (II) sulfate	magnesium nitrate	
10	magnesium nitrate	potassium hydroxide	

## Questions

1. For the equations below, write a word equation for each pair of solutions you mixed above; 2 products are formed each time.

### Pair #

1. sodium carbonate + barium chloride -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
2. sodium carbonate + copper (II) sulfate -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
3. sodium carbonate + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
4. sodium carbonate + magnesium nitrate -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
5. barium chloride + copper (II) sulfate -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
6. barium chloride + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
7. barium chloride + magnesium nitrate -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
8. copper (II) sulfate + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
9. copper (II) sulfate + magnesium nitrate -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
10. magnesium nitrate + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_

2. Look up each product in the **Table of Solubilities in Water**. Circle the name of any product which is a precipitate (a precipitate is a solid, is insoluble, will not dissolve, in water). Do not do anything to the names of the products which are soluble.

3. If you had a solution of barium chloride and a solution of potassium hydroxide, but you did not know which was which, what would you react with these 2 solutions in order to tell them apart ? **Please explain your answer.**  
(Hint: Refer to Pair #s 1 and 3)

4. If you had a solution of copper sulfate and a solution of potassium hydroxide, but you did not know which was which, what would you react with these 2 solutions in order to tell them apart ? **Please explain your answer.**  
(Hint: Refer to Pair #s 9 and 10)

5. Refer to the **Table of Solubilities in Water**:

a) Reading across the top of the table, which of these groups form soluble combinations with all the groups listed down the left? \_\_\_\_\_

b) Reading down the left of the table, which of these groups form soluble combinations with all the groups listed across the top? \_\_\_\_\_



Name: \_\_\_\_\_

## Exercise 5-A: Writing Double Exchange Word Equations

Part I: Write the products which are formed from each of these double exchange reactions. Circle any products which are precipitates.

1. sodium bromide + barium chloride -----> \_\_\_\_\_ + \_\_\_\_\_
2. calcium nitrate + sodium carbonate -----> \_\_\_\_\_ + \_\_\_\_\_
3. ammonium chloride + sodium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_
4. potassium hydroxide + lead nitrate -----> \_\_\_\_\_ + \_\_\_\_\_
5. magnesium iodide + sodium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_
6. aluminum sulfate + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_
7. copper chloride + zinc nitrate -----> \_\_\_\_\_ + \_\_\_\_\_
8. lead nitrate + sodium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_
9. silver nitrate + sodium chloride -----> \_\_\_\_\_ + \_\_\_\_\_
10. zinc chloride + potassium carbonate -----> \_\_\_\_\_ + \_\_\_\_\_
11. calcium chloride + ammonium carbonate -----> \_\_\_\_\_ + \_\_\_\_\_
12. barium chloride + potassium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_
13. copper (II) nitrate + sodium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_
14. aluminum sulfate + barium nitrate -----> \_\_\_\_\_ + \_\_\_\_\_

15. iron (II) chloride + aluminum iodide -----> \_\_\_\_\_ + \_\_\_\_\_
16. zinc nitrate + potassium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_
17. aluminum bromide + sodium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_
18. silver nitrate + calcium chloride -----> \_\_\_\_\_ + \_\_\_\_\_
19. magnesium iodide + lead nitrate -----> \_\_\_\_\_ + \_\_\_\_\_
20. silver nitrate + copper(II) bromide -----> \_\_\_\_\_ + \_\_\_\_\_
21. calcium nitrate + potassium carbonate -----> \_\_\_\_\_ + \_\_\_\_\_
22. sodium carbonate + copper (II) chloride -----> \_\_\_\_\_ + \_\_\_\_\_
23. copper (II) sulfate + barium acetate -----> \_\_\_\_\_ + \_\_\_\_\_
24. zinc chloride + ammonium hydroxide -----> \_\_\_\_\_ + \_\_\_\_\_
25. sodium hydroxide + barium sulfate -----> \_\_\_\_\_ + \_\_\_\_\_

**Part II:** Complete each word equation by writing the names of the 2 reactants.

26. \_\_\_\_\_ + \_\_\_\_\_ -----> silver chloride + aluminum nitrate
27. \_\_\_\_\_ + \_\_\_\_\_ -----> lead sulfide + ammonium nitrate
28. \_\_\_\_\_ + \_\_\_\_\_ -----> magnesium hydroxide + potassium sulfate
29. \_\_\_\_\_ + \_\_\_\_\_ -----> copper (II) hydroxide + sodium sulfate
30. \_\_\_\_\_ + \_\_\_\_\_ -----> barium carbonate + sodium nitrate

31. \_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  potassium acetate + calcium sulfate
32. \_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  zinc carbonate + ammonium chloride
33. \_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  sodium nitrate + calcium phosphate
34. \_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  lead iodide + magnesium nitrate
35. \_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  silver bromide + calcium nitrate

**Part III:** Complete each word equation below. Circle any products which are precipitates. If no precipitate is formed, then a state of equilibrium exists. A state of equilibrium is indicated by a double arrow as such:  $\longleftrightarrow$ . Indicate any equations which are at equilibrium by drawing in the double arrows.

36. silver nitrate + calcium chloride  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
37. ammonium hydroxide + sodium chloride  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
38. potassium bromide + silver acetate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
39. barium nitrate + aluminum chloride  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
40. zinc acetate + potassium hydroxide  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
41. barium iodide + silver nitrate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
42. calcium chloride + ammonium carbonate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
43. potassium bromide + aluminum nitrate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
44. magnesium sulfate + copper (II) nitrate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
45. lead (II) nitrate + barium acetate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_





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## Lab 5.2 - Tap Water vs. Distilled Water vs. Salt Water

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
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- \_\_\_\_ 1. Obtain 3 evaporating dishes.
- \_\_\_\_ 2. Clean and rinse the dishes well.
- \_\_\_\_ 3. Add 5 mL of tap water to the first dish. Observe:\_\_\_\_\_
- \_\_\_\_ 4. Over a medium flame, boil the water until dish just turns dry. Please be careful and DO NOT OVERHEAT THE DISH, it will crack.
- \_\_\_\_ 5. Observe the contents of the dry dish:\_\_\_\_\_
- \_\_\_\_ 6. Set the dish aside for later observation.
- \_\_\_\_ 7. Add 5 mL of distilled water to the second dish. Observe:\_\_\_\_\_
- \_\_\_\_ 8. Over a medium flame, boil the water until dish just turns dry. Please be careful and DO NOT OVERHEAT THE DISH, it will crack.
- \_\_\_\_ 9. Observe the contents of the dry dish:\_\_\_\_\_
- \_\_\_\_ 10. Set the dish aside for later observation.
- \_\_\_\_ 11. Add 5 mL of salt water to the third dish. Observe:\_\_\_\_\_
- \_\_\_\_ 12. Over a medium flame, boil the water until dish just turns dry. Please be careful and DO NOT OVERHEAT THE DISH, it will crack.
- \_\_\_\_ 13. Observe the contents of the dry dish:\_\_\_\_\_
- \_\_\_\_ 14. Set the 3 dishes next to each other. Note the differences in the dry contents of each dish.

### Questions

1. Which dish gave you the greatest amount of residue ? \_\_\_\_\_
  - 1a. Describe the appearance of this residue:\_\_\_\_\_



2. Which dish gave you the least amount of residue ? \_\_\_\_\_
3. What was the difference between the residue in the tap water dish and the distilled water dish ? \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
4. Steam irons should be filled with distilled water. Knowing that steam irons have very small holes where the steam comes out, what is the reason that distilled water should be used ? \_\_\_\_\_
- \_\_\_\_\_
5. Assuming that your tap water has iron (II) in it, what might be the name of the residues which might build up in your steam iron ? (Refer to the Table of Solubilities in Water) \_\_\_\_\_
- \_\_\_\_\_

## Review Questions

6. What is a precipitate ? \_\_\_\_\_
- \_\_\_\_\_
7. Write the names of the products for the following:
- a) magnesium nitrate + potassium hydroxide ----->
- \_\_\_\_\_ + \_\_\_\_\_
- b) copper (II) sulfate + barium chloride ----->
- \_\_\_\_\_ + \_\_\_\_\_
- c) sodium carbonate + aluminum sulfate ----->
- \_\_\_\_\_ + \_\_\_\_\_
- d) zinc bromide + iron (II) iodide ----->
- \_\_\_\_\_ + \_\_\_\_\_
- e) silver nitrate + ammonium phosphate ----->
- \_\_\_\_\_ + \_\_\_\_\_
8. Circle the products which are precipitates in question 7.



Name: \_\_\_\_\_

## Exercise : 5-B Review Word Equations (Synthesis and Double Displacement)

Write the entire and complete word equation (both the reactants and the products) for each situation below:

1. The formation of copper (II) oxide from its elements:

2. Combining solutions of aluminum sulfate and iron(II) chloride:

3. Reacting zinc and bromine:

4. Adding ammonium sulfide to sodium chloride solution:

5. Making manganese chloride from its elements:

6. Forming sulfur oxide by a synthesis reaction:

7. Pouring sodium nitrate solution into a solution of aluminum sulfate:

8. Reaction of potassium chloride and silver nitrate solutions:

9. Reacting cobalt with fluorine gas:

10. Heating iodine and copper together:

11. Which of the above reactions are synthesis reactions? \_\_\_\_\_

12. Which of the above reactions are double displacement reactions? \_\_\_\_\_

13. For the double displacement reactions above, circle the precipitates.

14. For the above reactions at equilibrium, indicate the equilibrium double arrow sign.

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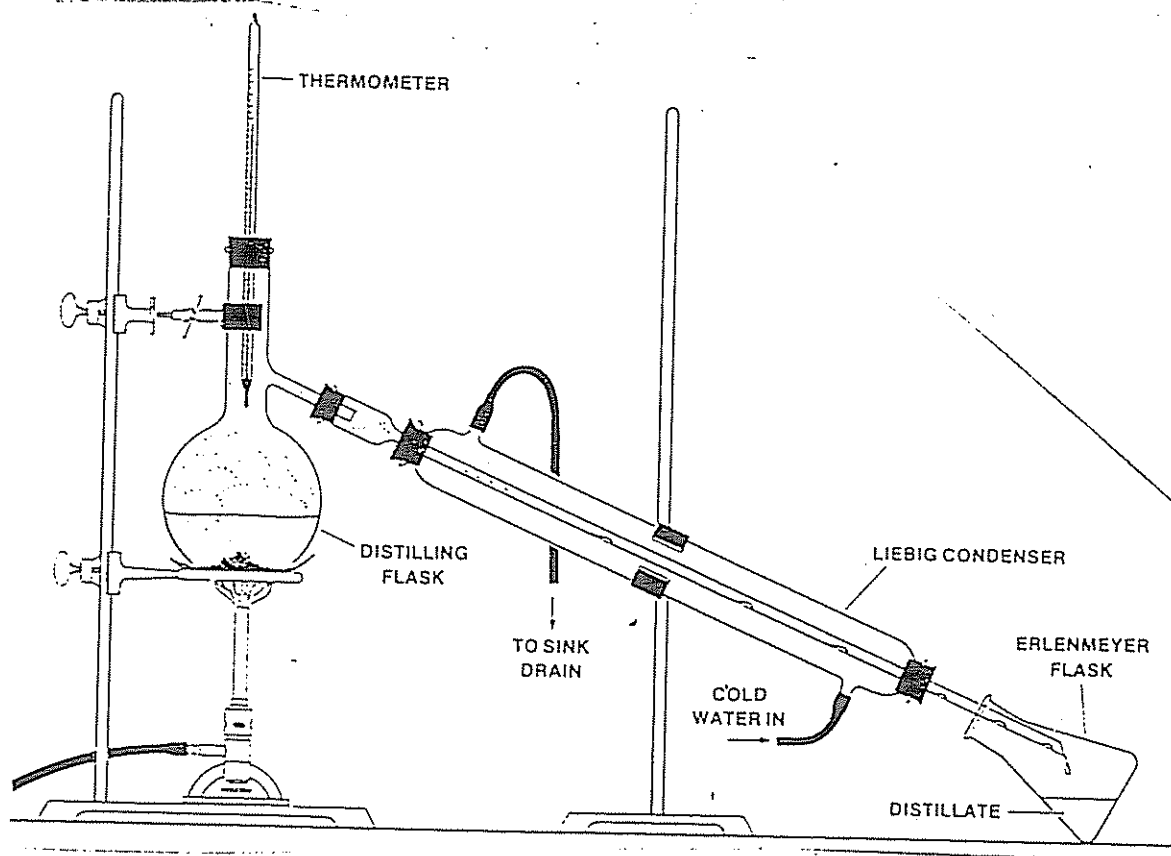
## Lab 5.3 - Simple Distillation

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
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\_\_\_\_ 1. Set up the distillation apparatus as indicated below; start at the burner side. This takes cooperation and patience by both lab partners. **BE CAREFUL:** The equipment is expensive and can easily be broken ! Do **NOT** turn on the flame until the procedure indicates to do so !!

\_\_\_\_ 2. Your teacher must approve your set up before proceeding.



\_\_\_\_ 3. Take the thermometer out of the distilling flask.

\_\_\_\_ 4. Place a funnel in the distilling flask.

- \_\_\_\_5. Pour a colored water into the distilling flask until it is about 1/2 full. Color of the water:\_\_\_\_\_
- \_\_\_\_6. Take out the funnel.
- \_\_\_\_7. Rinse the funnel well.
- \_\_\_\_8. Place the thermometer back into the distilling flask.
- \_\_\_\_9. Slowly turn on the water feeding into the condenser.
- \_\_\_\_10. Once the condenser is full of water and it is draining out the other end (into the sink), you may increase the water flow slightly.
- \_\_\_\_11. Begin heating the colored water in the distilling flask.
- \_\_\_\_12. Boil the water in the distilling flask. What is the temperature during boiling ? \_\_\_\_\_
- \_\_\_\_13. Note what happens to the color of the water as the boiling continues.
- \_\_\_\_14. What is the color of the distillate (see diagram) ? \_\_\_\_\_
- \_\_\_\_15. Continue boiling until approximately 1/2 of the colored water has boiled off.
- \_\_\_\_16. When the apparatus is cool, remove the thermometer from the distilling flask.
- \_\_\_\_17. Place the funnel back into the distilling flask.
- \_\_\_\_18. Pour the distillate into the funnel back into the distilling flask.
- \_\_\_\_19. Carefully take apart your apparatus and place the pieces where your teacher indicates to do so.

## Questions

1. What was the color of the water in the distilling flask at the beginning ? \_\_\_\_\_
2. What happened to the color of the colored water as it boiled ? \_\_\_\_\_
3. What was the color of the distillate ? \_\_\_\_\_
4. **What** is the distillate ? \_\_\_\_\_
5. Name the common phases of matter ? \_\_\_\_\_
6. What phase change occurred in the distilling flask ? \_\_\_\_\_
7. What phase change occurred in the condenser ? \_\_\_\_\_
8. Why is it necessary to run cold water through the condenser ? \_\_\_\_\_

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## Lab 5.4 - Suds and Types of Water

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
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- \_\_\_\_ 1. Obtain 4 clean, dry test tubes which are all the same size.
- \_\_\_\_ 2. Put **exactly** 5 mL of distilled water in the first test tube.
- \_\_\_\_ 3. Put **exactly** 5 mL of tap water in the second test tube.
- \_\_\_\_ 4. Put **exactly** 5 mL of "hard" water in the third test tube (supplied by your teacher).
- \_\_\_\_ 5. Put **exactly** 5 mL of milk in the fourth test tube (supplied by your teacher).
- \_\_\_\_ 6. Put 10 drops of standard soap solution in each test tube.
- \_\_\_\_ 7. Stopper all 3 test tubes.
- \_\_\_\_ 8. Shake all 4 test tubes for exactly 30 seconds in exactly the same manner.
- \_\_\_\_ 9. Complete the Data Table below for Trial # 1:

	Trial 1-Type of water, or milk	Trial 2-Type of water, or milk
Most suds		
Next to most suds		
Next to least suds		
Least suds		

- \_\_\_\_ 10. Obtain 4 more test tubes and do a second trial and complete the Data Table above for Trial # 2:
- \_\_\_\_ 11. Clean your test tubes well, and wipe down the counter top.
- \_\_\_\_ 12. Have your teacher pour "hard" water on your hands, and have your partner put a small amount of soap on your hands. Without using any more water, try to lather the soap.

How much lather could you make ? \_\_\_\_\_

\_\_\_\_13. Rinse your hands. Using tap water, and the same amount of soap, try to lather your hands.

How much lather could you make ? \_\_\_\_\_

\_\_\_\_14. Take off your goggles and have a seat.

## Questions

1. Which water, or milk, probably has the most dissolved materials in it ? \_\_\_\_\_

2. Which water, or milk, has the least dissolved material in it ? \_\_\_\_\_

3. Is there a correlation between the amount of suds, and the amount of dissolved material ? \_\_\_\_\_

3a. If yes, what is the correlation ? \_\_\_\_\_

4. What is the dissolved material in milk ? \_\_\_\_\_

5. Why is distilled water recommended to be used in steam irons ? \_\_\_\_\_

6. What makes the stains in sinks and bathtubs in most houses ? \_\_\_\_\_

7. Using complete sentences (with correct spelling and punctuation), explain why chemists, pharmacists, and scientists in general use distilled water for most of the things they do ?

## Review Questions

8. What is a precipitate ? \_\_\_\_\_

9. What is in distilled water ? \_\_\_\_\_

10. What is the only material which boils away during boiling ? \_\_\_\_\_

11. Why is it necessary to run cold water through the condenser during distillation ? \_\_\_\_\_

12. During distillation,  
what phase change occur in the distilling flask ? \_\_\_\_\_

what phase change occur in the condensing column ? \_\_\_\_\_

Name: \_\_\_\_\_

## Exercise 5-C: Chapter Review

1. What is a precipitate ? \_\_\_\_\_  
\_\_\_\_\_
2. What is the abbreviation for precipitate ? \_\_\_\_\_
3. Precipitates are represented by what letter on the Table of Solubilities in Water? \_\_\_\_\_
4. Precipitates are represented by what word on the Table of Solubilities in Water? \_\_\_\_\_
5. What does soluble mean ? \_\_\_\_\_
6. What does insoluble mean ? \_\_\_\_\_
7. What 2 groups of substances from the Table of Solubilities in Water form soluble solutions with all the other groups ? \_\_\_\_\_
8. What is a "state of equilibrium" ? \_\_\_\_\_
9. In an equation, what symbol is used to represent a "state of equilibrium" ? \_\_\_\_\_
10. Write the products formed for the following. Circle all precipitates. Indicate any "state of equilibrium" with the correct symbol.
  - a) barium chloride + potassium hydroxide  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
  - b) copper sulfate + sodium carbonate  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_  
\_\_\_\_\_
11. What is the difference between tap water and distilled water ? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
12. If you have a dish of salt water, what "boils away" during boiling ? \_\_\_\_\_
  - a) What is left in the dish after it has stopped boiling ? \_\_\_\_\_
13. At what temperature does water boil ? \_\_\_\_\_
14. What happens to the color of a solution as you distill the solution ? \_\_\_\_\_  
\_\_\_\_\_

- 14.a) Why does the color of the solution change ? \_\_\_\_\_  
\_\_\_\_\_
15. Which end of a condenser does the water go in during distillation ? \_\_\_\_\_
16. Which end of a condenser does the water leave during distillation ? \_\_\_\_\_
17. What phase change occurs in the distillation flask ? \_\_\_\_\_
18. What phase change occurs in the condenser ? \_\_\_\_\_
19. What color is the distillate during distillation ? \_\_\_\_\_
20. What is produced during distillation ? \_\_\_\_\_
21. What type of water should give you the most suds:
- a) tap or distilled ? \_\_\_\_\_
- b) distilled or hard ? \_\_\_\_\_
22. What mineral causes most stains in sinks and bathtubs ? \_\_\_\_\_
23. Why do most scientists use distilled water during any experiment (be complete) ?  
\_\_\_\_\_  
\_\_\_\_\_
24. What do you get when sodium and chlorine react ? \_\_\_\_\_
25. What must react together to get magnesium oxide ? \_\_\_\_\_
26. How much of the Earth is covered by water ? \_\_\_\_\_
27. What is potable water ? \_\_\_\_\_
28. What is an aquifer ? \_\_\_\_\_
29. How long can a person survive without water ? \_\_\_\_\_
30. What is a saturated solution ? \_\_\_\_\_  
\_\_\_\_\_
31. What is called the universal solvent ? \_\_\_\_\_
32. What is usually used to kill bacteria in drinking water ? \_\_\_\_\_