Chem 108: Lab

Week 10

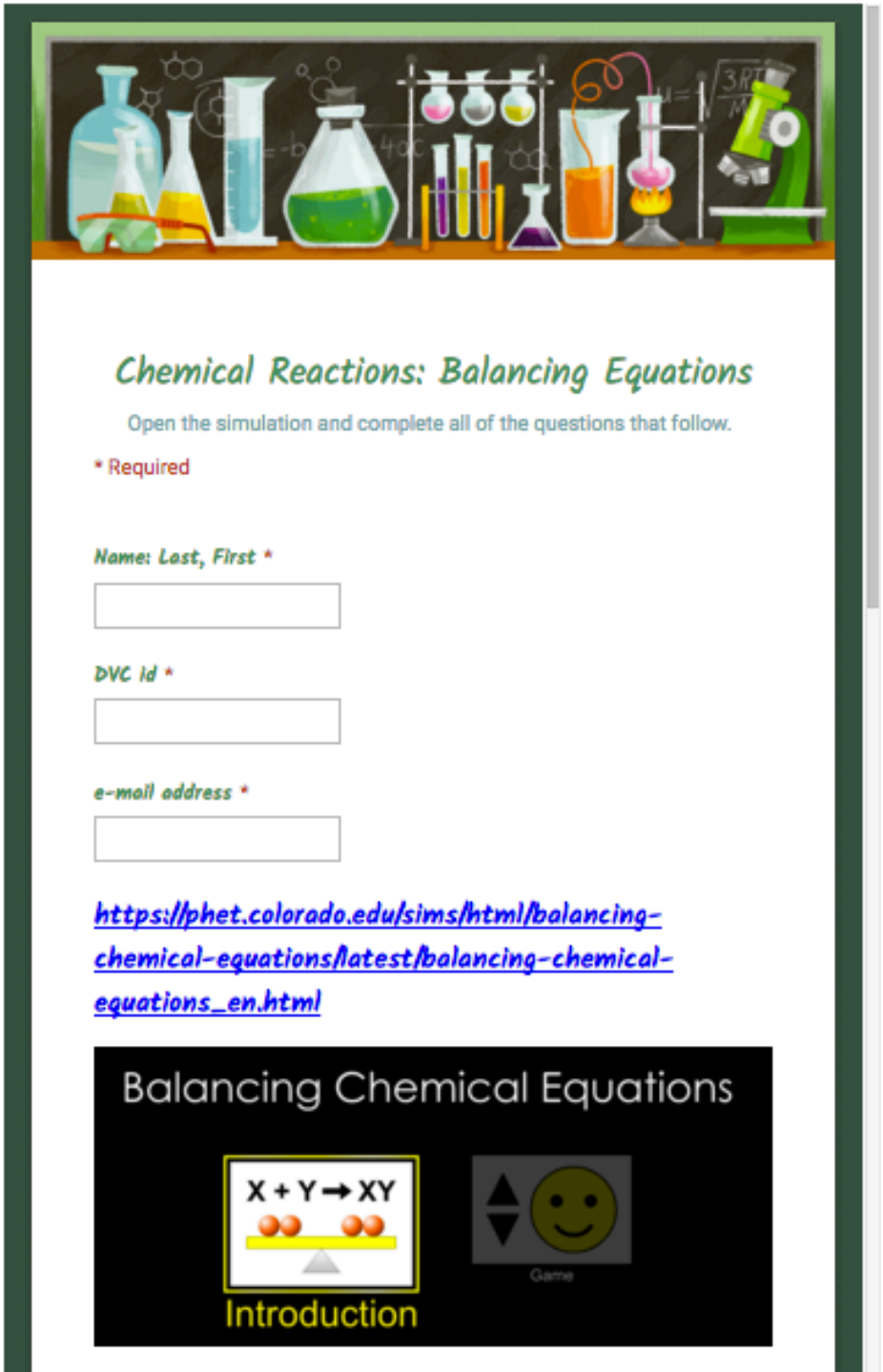
Sign in
Pick up graded papers
Sit at Lab Drawer Station

Chemical Reactions

Laboratory Manual: Report Form

pp.46-52 DUE Today

Post Lab (Individually Submitted): On-line Balancing Equations DUE Today



Chemical Reactions: Balancing Equations

Open the simulation and complete all of the questions that follow.

* Required

Name: Last, First *

DVC Id *

e-mail address *

https://phet.colorado.edu/sims/html/balancing-chemical-equations/latest/balancing-chemical-equations_en.html

7 Solution Problem

Laboratory Manual: Procedure pp. 73-75;
Report Form pp. 76-80;

Aqueous Reactions

Do Today

To Do Today

Chem 108: Lab

Week 10

In this experiment, you will react each of the following solutions with each of the others.

0.1 M $AgNO_3$	0.1 M $FeCl_3$	0.1 M NaCl
0.1 M $Pb(NO_3)_2$	0.1 M $Ba(NO_3)_2$	0.1 M Na_2SO_4
0.1 M KSCN		

When you have recorded all your observations in the table provided, you will receive an unknown consisting of seven numbered vials. Each vial will contain one of the solutions listed above. By reacting each solution with each of the others, you will identify and report the identity of the solution in each vial.

Equipment

From the stockroom:
6 micro test tubes

From your drawer:
2 beakers

Procedure

Obtain six micro test tubes from the stockroom. Clean them using a cotton swab as a test tube brush and rinse them with deionized water. Use a beaker to hold the test tubes. Put five to ten drops of silver nitrate solution in each test tube. Add to each of these about the same amount of one of the other solutions. Mix well. Wait for at least a minute and report your observations in the table provided. Empty the test tubes into your waste beaker and rinse them with deionized water. Clean the test tubes. Put five to ten drops of lead nitrate solution into five of the test tubes and mix it with equal amounts of the others, except silver nitrate, which it has already been mixed with. Mix well. Wait for at least a minute and report your observations. Continue this process until each solution has been mixed with each of the others. Empty your waste beaker into the **aqueous metal waste container**.

Write a net ionic equation for each reaction. There are twenty–one possibilities. If there is no reaction write NR.

Obtain a set of unknown solutions from your instructor. ***Record the unknown letters.*** Repeat the above procedure with each of the numbered unknown solutions. Report your results in the table provided. Empty your waste beaker into the **aqueous metal waste container**.

Report the identity of each of the unknown solutions.

7 Solution Problem

Given: 7 Unknown Solutions, which comprise the following set in some random order.

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M $FeCl_3$ 0.1 M NaCl

0.1 M KSCN 0.1 M $Pb(NO_3)_2$ 0.1 M Na_2SO_4

Objective:

Identify the individual unknowns, which correspond to the seven, based on their respective aqueous double displacement reactions when mixed with each other.

Consider that there is a 7x7 matrix for all combinations, 49 in total. However, the solutions do not react with themselves and it will not matter in which order that they are added: A to B, or B to A. Reducing the total to (N-1)! (6 factorial, i.e. 6+5+4+3+2+1=21 possibilities)

SOLUBILITY RULES

1. All ionic compounds containing Na^+, K^+, and NH_4^+ are soluble.

2. All ionic compounds containing NO_3^- are soluble.

3. All ionic compounds containing $C_2H_3O_2^-$ are soluble except $AgC_2H_3O_2$.

4. All ionic compounds containing Cl^-, Br^-, and I^- are soluble except AgCl, AgBr, AgI, $PbCl_2$*, $PbBr_2$, PbI_2, Hg_2Cl_2, Hg_2Br_2, and Hg_2I_2. (*$PbCl_2$'s solubility is very dependent on concentration and temperature.)

5. All ionic compounds containing F^- are soluble except MgF_2, CaF_2, SrF_2, BaF_2, and PbF_2.

6. All ionic compounds containing SO_4^{2-} are soluble except $BaSO_4$, $SrSO_4$, and $PbSO_4$. (Ag_2SO_4 and $CaSO_4$ are slightly soluble)

7. All ionic compounds containing OH^- are insoluble except NaOH, KOH, and $Ba(OH)_2$.

8. All ionic compounds containing S^{2-} are insoluble except Na_2S, K_2S, $(NH_4)_2S$, MgS, CaS, SrS, and BaS.

9. All ionic compounds containing CO_3^{2-}, PO_4^{3-}, and CrO_4^{2-} are insoluble except Na_2CO_3, Na_3PO_4, Na_2CrO_4, K_2CO_3, K_3PO_4, K_2CrO_4, $(NH_4)_2CO_3$, $(NH_4)_3PO_4$, and $(NH_4)_2CrO_4$.

10. All common acids are soluble.

Develop an Empirical Data Template for Knowns

(Working with a partner complete pg. 76)

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$

	$Pb(NO_3)_2$	KSCN	$FeCl_3$	$Ba(NO_3)_2$	NaCl	Na_2SO_4
$AgNO_3$						
$Pb(NO_3)_2$						
KSCN						
$FeCl_3$						
$Ba(NO_3)_2$						
NaCl						

Mix solutions and predict the result for:
$AgNO_3(aq)$ + $Ba(NO_3)_2(aq)$

$AgNO_3(aq) + Ba(NO_3)_2(aq) \rightarrow$

$AgNO_3(aq) + Ba(NO_3)_2(aq) \rightarrow$ Nothing Observed

Double Displacement Equation:

$$AgNO_3(aq) + Ba(NO_3)_2(aq) \rightarrow Ba(NO_3)_2(aq) + Ag(NO_3)(aq)$$

Net Ionic Equation:

$$Ag^+(aq) + NO_3^-(aq) + Ba^{2+}(aq) + 2\,(NO_3^-)_2(aq) \rightarrow Ba^{2+}(aq) + 2\,(NO_3^-)_2(aq) + Ag^+(aq) + NO_3^-(aq)$$

No Reaction / NR

Develop an Empirical Data Template for Knowns
(Working with a partner complete pg. 76)

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$

	$Pb(NO_3)_2$	KSCN	$FeCl_3$	$Ba(NO_3)_2$	NaCl	Na_2SO_4
$AgNO_3$				No Rxn		
$Pb(NO_3)_2$						
KSCN						
$FeCl_3$						
$Ba(NO_3)_2$						
NaCl						

Mix solutions and predict the result for:
$AgNO_3(aq)$ + $Ba(NO_3)_2(aq)$

Develop an Empirical Data Template for Knowns
(Working with a partner complete pg. 76)

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$

	$Pb(NO_3)_2$	KSCN	$FeCl_3$	$Ba(NO_3)_2$	NaCl	Na_2SO_4
$AgNO_3$				No Rxn		
$Pb(NO_3)_2$						
KSCN						
$FeCl_3$						
$Ba(NO_3)_2$						
NaCl						

Mix solutions and predict the result for:
$AgNO_3(aq)$ + $NaCl(aq)$

$AgNO_3(aq) + NaCl(aq) \rightarrow$[White Precipitate: ppt]

Double Displacement Equation:

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(?) + NaNO_3(?)$

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

Net Ionic Equation:

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

Develop an Empirical Data Template for Knowns
(Working with a partner complete pg. 76)

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$

	$Pb(NO_3)_2$	KSCN	$FeCl_3$	$Ba(NO_3)_2$	NaCl	Na_2SO_4
$AgNO_3$				No Rxn	White ppt	
$Pb(NO_3)_2$						
KSCN						
$FeCl_3$						
$Ba(NO_3)_2$						
NaCl						

Mix solutions and predict the result for:
$AgNO_3(aq)$ + $NaCl(aq)$

Develop an Empirical Data Template for Knowns
(Working with a partner complete pg. 76)

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$

	$Pb(NO_3)_2$	KSCN	$FeCl_3$	$Ba(NO_3)_2$	NaCl	Na_2SO_4
$AgNO_3$				No Rxn	White ppt	
$Pb(NO_3)_2$						
KSCN						
$FeCl_3$						
NaCl						

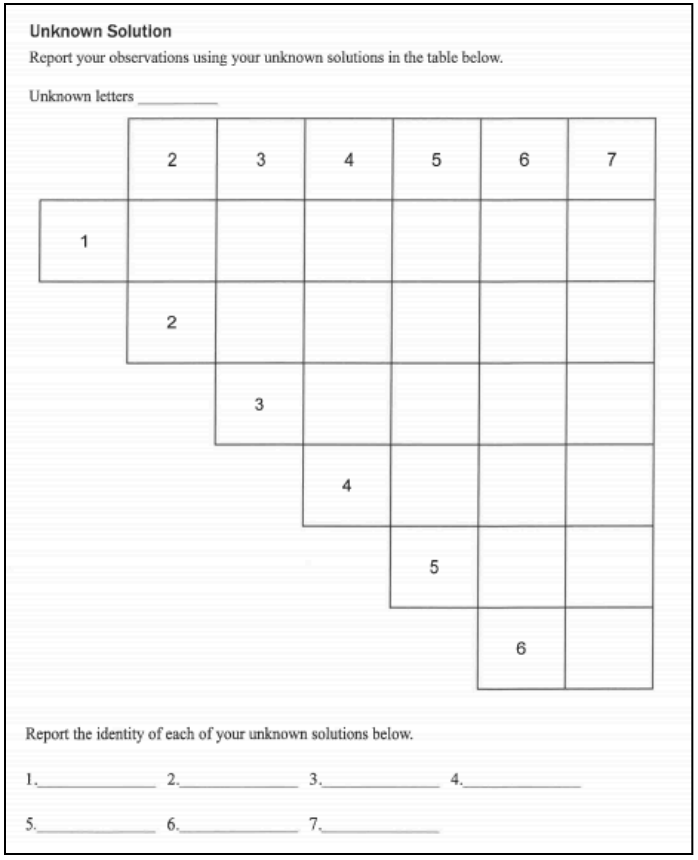
Mix solutions and predict the result for: $AgNO_3(aq)$ + $NaCl(aq)$

(Show Dr.R. completed table & get an individual unknown.)

Compare Empirical Template to Individual Unknown Data Template

0.1 M $AgNO_3$ 0.1 M $Ba(NO_3)_2$ 0.1 M NaCl 0.1 M KSCN

0.1 M $FeCl_3$ 0.1 M Na_2SO_4 0.1 M $Pb(NO_3)_2$



Unknown Solution

Report your observations using your unknown solutions in the table below.

Unknown letters _____

	2	3	4	5	6	7
1						
2						
3						
4						
5						
6						

Report the identity of each of your unknown solutions below.

1._____ 2._____ 3._____ 4._____

5._____ 6._____ 7._____