Solubility of Lead (II) Iodide Lab Experiment

*Based on Lab 19C from the Heath Lab Manual

Objectives:

1) To prepare a number of solutions of each of Pb^{2+} and I^-, of differing concentrations.

2) To mix combinations of the above solutions and note whether a precipitate occurs.

3) To obtain a K_{sp} range for PbI_2 at room temperature.

Materials:

0.010M $Pb(NO_3)_2$ 0.020M KI   10 test tubes

test tube rack   2 – 10mL graduated cylinders   pencil

3 disposable pipettes   3 – 50mL beakers   water

Procedure:

1) Put on lab apron and safety glasses.

2) Obtain in separate 50mL beakers about 40mL of each of 0.010M $Pb(NO_3)_2$ and 0.020M KI, and label the beakers with a pencil. ***Lead nitrate should be washed away immediately if it gets on skin.***

3) Obtain ten test tubes and arrange them in two lines, each with 5 test tubes. Label each set *A* to *E* with your pencil.

4) Using a graduated cylinder, a pipette for 0.010M $Pb(NO_3)_2$ and a pipette for water, for the first set of test tubes: in A, place 10.0mL of 0.010M $Pb(NO_3)_2$. In B, place 8.0mL of 0.010M $Pb(NO_3)_2$ then add water up to 10mL. In C, place 6.0mL $Pb(NO_3)_2$ then add water up to 10mL. In D, place 4.0mL $Pb(NO_3)_2$ then add water up to 10mL. In E, place 2.0mL $Pb(NO_3)_2$ then add water up to 10mL.

5) Using a graduated cylinder, a pipette for 0.020M KI and a pipette for water, for the first set of test tubes: in A, place 10.0mL of 0.020M KI. In B, place 8.0mL of 0.020M KI then add water up to 10mL. In C, place 6.0mL KI then add water up to 10mL. In D, place 4.0mL KI then add water up to 10mL. In E, place 2.0mL KI then add water up to 10mL.

6) Mix the contents of test tube A from the lead nitrate set with the contents of test tube A from the potassium iodide set.

7) Repeat *Step 6* for each of the other 4 combinations.

8) Record in which test tubes a precipitate occurs in Table 1.

9) After you are finished, empty the test tubes into the designated waste container.

10) Clean the lab bench with wet paper towel, and wash hands with soap.

Data and Observations:

Table 1 – Give appropriate title

Test Tubes	A	B	C	D	E
Final [Pb^{2+}] (M)					
Final [I^-] (M)					
Trial K_{sp}					
'ppt' or 'no ppt'					

Keep in mind that the final volume after dilution is 20.0mL

Sample Calculations:

1) Sample Calculation of dilution to get final [Pb^{2+}] after mixing with $KI_{(aq)}$

2) Sample Calculation of dilution to get final [I^-] after mixing with $Pb(NO_3)_{2(aq)}$

3) Sample Calculation of a Trial K_{sp} calculation

<u>Questions:</u>

1) State the experimental range of values in which the K_{sp} of PbI_2 must lie. This will be between the first test tube not giving a precipitate, and the last test tube to give a precipitate. Why should the actual K_{sp} lie between the two aforementioned test tubes?

2) Compare your experimental K_{sp} range with the K_{sp} of lead iodide from your data booklet. Does the data booklet K_{sp} lie within your experimental K_{sp} range? If not, suggest some reasons for the difference.

3) If you are in the lab with all equipment at your disposal, and were given a saturated solution of lead iodide that was made from lead iodide salt (with excess solute on the bottom), and asked to determine the solubility (molarity at saturation), how would you proceed?

4) Suppose you had a saturated solution of lead iodide.

What could you add to make:

a) More of the lead iodide solid dissolve? Explain how.

b) Cause more lead iodide solid to be recrystallized? Explain how.

When answering question 4, provide the equilibrium for the situation

<u>Conclusion:</u>

State the results of Objective 3.