

NAME _____

DATE _____

PER _____

LAB: FORMATION AND DECOMPOSITION OF ZINC IODIDE (ACP)

SCENARIO:

ZincCorp, Inc., an overseas metal company, has been accused of smuggling zinc into the country illegally to avoid taxes. Zinc metal can easily be identified with the technology used by the customs employees. However, investigators just learned that ZincCorp, Inc. has found a creative way to disguise the zinc and smuggle it past the border police.

They are believed to react the zinc with iodine, create zinc iodide, dissolve it in water, and create a solution which does not have any of the same properties as zinc metal. They are then thought to have smuggled it into the country disguised as tea. Once the solution safely clears the borders and it is once again in their possession, they are believed to use electricity to decompose the zinc iodide back into zinc metal and iodine.

YOUR ROLE:

You are to investigate this lead and decide if this process could actually work. The lead investigator has outlined the procedure that he believes best models the process used by ZincCorp, Inc. He has scaled down the amounts of zinc and iodine that you will be using to conserve resources but he is well aware that ZincCorp, Inc. is able to do this on a much larger scale and smuggle a great deal of zinc into the country. Follow this procedure and decide if zinc metal could be turned into a solution that resembles tea and then, if the zinc metal could be reclaimed from this solution.

PROCEDURE:

Part I. Disguising the Zinc Metal as Tea

1. Add about 1.0 g of zinc metal and 10 ml of distilled water to a large test tube.
2. Place the test tube in a test tube rack and leave it there for the next few steps.
3. Carefully add about 1.0 g of iodine to the test tube. Record your observations in the data table.
4. Put a stopper on the test tube and shake the contents. You should see a drastic color change a few minutes into the reaction. A few minutes after this color change occurs, gently touch the side of the test tube. Record all of your observations below.
5. Remove the stopper and let the reaction proceed for at least 20 minutes. Use a stirring rod to stir every 30 seconds or so. Record observations.

Part II. Getting the Zinc Metal Back

6. Allow the contents of the test tube to settle for about 5 minutes. Carefully pick up the test tube and pour off (decant) the solution phase into the small 100-ml beaker.
7. Add water to the beaker to bring the volume of the solution up to about 25 mL.
8. Obtain a 9-V battery and connect one end of each of the red and black wire leads to the battery. Clip the other end of the lead onto each electrode. Dip the electrodes into the solution and observe the solution for about two minutes. Record your observations. After about two minutes lift the electrodes and check to see if anything is deposited on the tips of the electrodes. Record your observations.

DATA TABLE:

| ACTIONS | OBSERVATIONS |
|---|--------------|
| 1. Addition of Iodine to the Zinc and Water mixture (after you shake and allow reaction to occur – step 4 above) | |
| 2. Reaction of Zinc and Iodine (over the 20 min. period – step 5 above) | |
| 3. Reaction that Occurs Once Electrodes are Placed in Solution (after two minutes of observations) *Was anything deposited on the tip of the electrodes? Elaborate. | |

FOLLOW-UP QUESTIONS:

1. Is the scenario plausible, in other words, do you think the ZincCorp, Inc. could actually use this scenario to smuggle the zinc metal across the border and reclaim the zinc at a later point? ELABORATE.

PART I. DISGUIISING THE ZINC METAL AS TEA

2. When stirring the iodine and the zinc, what evidence was there that a chemical reaction had occurred?

3. Consider that pure iodine (I_2) creates a dark, burgundy red/brown color when in solution. Why did this deep, dark color get lighter as the test tube contents were stirred and time passed?

4. A temperature change occurred during the reaction.

a. Did the reaction give off heat to the surroundings OR absorb heat from the surroundings? _____

b. What is the name for a reaction that makes this type of temperature change? (Hint: Look at section 17.1 in your text book)? _____

5. Using words, complete the equation below for the reaction that occurred in the test tube.

Zinc + Iodine \rightarrow _____

6. Zinc typically gives away its two valence electrons.

a. What charge will it make? _____ b. Does zinc become a cation or an anion? _____

c. Draw a Lewis (electron) dot structure for Zinc: _____

7. Zinc will bond with iodine.

a. How many valence electrons does iodine have? _____

b. Draw a Lewis dot (electron dot) structure for iodine. _____

c. What will an atom of iodine do to become stable? _____

d. What charge will iodine make? _____

8. Consider your responses to the previous two questions and determine the ratio that zinc and iodine will bond in.

a. Write the formula for the compound formed when zinc and iodine bond together. _____

b. Write the name for the compound formed when zinc and iodine bond together. _____

PART II. GETTING THE ZINC METAL BACK

9. The new compound that was just produced was in solution form (it was dissolved in water). Describe the appearance of both the original zinc metal and of the new solution you just produced.

| APPEARANCE OF THE ORIGINAL ZINC METAL | APPEARANCE OF THE NEW COMPOUND DISSOLVED IN WATER |
|---------------------------------------|--|
| | |

a. Did ZincCorp, Inc. do a good job making the zinc metal not look like zinc metal any more? Explain.

10. Electrolysis is a process by which electricity can be used to decompose or break a compound down into its component elements.

a. What two elements make up Zinc Iodide? _____

b. Use words to complete the equation that describes the decomposition of zinc iodide. Put the symbols of each element or compound on the line in the parentheses.

Zinc Iodide (_____) \rightarrow _____ (_____) + _____ (_____)

11. What evidence was there that a chemical reaction occurred during electrolysis (when you placed the electrodes in the solution)? Elaborate.

12. Remember that pure iodine will create a deep, dark burgundy, red/brown solution. Did you see this surrounding one of the electrodes? Why do you suppose this occurred?

13. Do you believe that ZincCorp, Inc. will be able to recover their zinc from the “tea-like” solution? (Remember you worked with a small-scale procedure) Elaborate.

SUMMARY:

In this reaction you created an ionic compound when zinc and iodine combined. You couldn't really see this compound in the solid form because it was dissolved in water. In part II, you ran electricity through the solution and split the compound back into its original components.

Write two equations which represent the formation and decomposition of the compound. Put the symbols of each element or compound in the parentheses.

Formation: Zinc (_____) + Iodine (I₂) \rightarrow _____ (_____)

Decomposition: _____ (_____) \rightarrow _____ (_____) + _____ (_____)