Reactivity of Alkaline Earth Metals

In this experiment, you will examine the reactivity of two alkaline earth metals (Group 2 or 2A), magnesium (Mg) and calcium (Ca). You will then use aluminum (Al), a Group 3 or 3A metal for comparison purposes. You will determine the relative reactivity of the two alkaline earth metals.

Your Task:
Part One: You will examine the three metals’ reactions with water. In general, pure metals that react with water usually produce flammable hydrogen gas and that metal’s hydroxide (calcium hydroxide, magnesium hydroxide, etc.). Hydroxides are basic or alkaline compounds.
Part Two: You will examine the reaction of magnesium and aluminum with oxygen to produce their oxides (magnesium oxide and aluminum oxide). Oxides are also basic compounds. These reactions are typically very slow processes at room temperature so you will speed up the reaction by heating these metals in a Bunsen burner flame. Since the hydrogen gas produced in Part One is flammable, you will complete this part on a separate day. Since calcium oxide is too dangerous for each of you to produce, you will simply consider it without attempting to make it.

Pre-Lab Requirements:
Write your hypothesis for the question in the lab report section. Construct a data table in pen that you will use to record your qualitative observations during the lab. Be sure to leave yourself plenty of space to take detailed observations.

In the Lab:
Calcium metal is quite corrosive and magnesium has a tendency to disappear. Mrs. Atkins will dispense these chemicals to you when you are ready for them.
Part One:
1. You will use a Petri dish to contain each reaction. The larger piece is the top of the Petri dish while the smaller piece is the bottom.
2. Fill the bottom of the Petri dish labeled Calcium about halfway full of water. Place a piece of calcium in the middle of the Petri dish and quickly cover it using the top of the dish. Make careful observations about the reaction that follows.
3. After 2-3 minutes, open the Petri dish and add one drop of phenolphthalein indicator to the dish. Phenolphthalein is clear in neutral and acidic solutions but is pink in basic (alkaline) solutions. Caution: Phenolphthalein is a strong laxative, so be sure to wash your hands following this lab.
4. Repeat Steps 2-3 for magnesium and aluminum using the Petri dishes labeled for their reactions.
5. Waste from the calcium reaction should be poured carefully into the waste container at the front of the room. Waste pieces of magnesium should be removed from the Petri dish, carefully washed and dried and placed in the magnesium waste container at the front. Yes, I will be counting how many there are after lab is over. Waste aluminum should be thrown in the trash can. Liquids from the aluminum and magnesium dishes may be flushed down the sink with plenty of water.
6. Carefully wash and dry your Petri dishes and return them to the appropriate bins.
Part Two:

1. Fill the Petri dishes labeled calcium, magnesium, and aluminum halfway with water.
2. Light your burner. Obtain a piece of magnesium from Mrs. Atkins and carefully hold it in the flame with crucible tongs. As soon as the magnesium begins its reaction, hold the burning magnesium over the Petri dish labeled magnesium. **Caution:** Do NOT look directly at the magnesium as it burns. It can seriously damage your eyes. Look at from the corner of your eye. Once the fire is out, carefully observe the product of the reaction.
3. Place the product from the magnesium reaction in its Petri dish. Add a drop of phenolphthalein indicator to the Petri dish. Phenolphthalein is dissolved in ethanol to prepare the indicator solution. Ethanol is flammable. **Please ensure that your Bunsen burner is extinguished while you are dispensing the phenolphthalein.** Carefully record your observations.
4. Attempt to burn the aluminum. Feel free to directly look at the aluminum in the flame. If it begins to soften without lighting on fire, remove it from the flame and allow it to cool briefly. Unfortunately, the oxide formation for aluminum is an exceedingly slow process. Aluminum tends to form a very thin impermeable oxide layer on the outside. This prevents the further reaction of the aluminum in the interior. If you see no evidence of a white product on the surface of the aluminum after burning it, set your piece of aluminum aside to cool and place a small amount of aluminum oxide from the front table in your Petri dish labeled aluminum. Repeat Step 3 for this dish.
5. Add a small amount of calcium oxide to the Petri dish labeled calcium and repeat Step 3 for this dish. **Caution:** Use care. Calcium oxide is corrosive.
6. When you are finished, put all waste solutions in the waste container at the front of the room. Place any unreacted aluminum in the trash can.
7. Carefully wash and dry your Petri dishes and return them to the appropriate bins.

**Lab Report:**
Follow all policies and general instructions in the Lab Report Instructions handout and be sure to include these things:

A) Purpose
B) Hypothesis (Which is more reactive, calcium or magnesium?)
C) Analysis Questions
   1) Explain, **using specific evidence from lab**, why this group of metals has alkaline as part of its name.
   2) Did magnesium react with the water to form hydrogen gas and magnesium hydroxide? **Justify your answer with specific evidence from lab.**
   3) **Predict likely observations** for strontium for each major step of this lab and explain your predictions.
   4) Explain in detail why I chose aluminum as the comparison point for this lab. It may be helpful to consider other choices I could have made as well as why it would be useful to have a metal with reactions like aluminum.
D) Conclusions
E) Original Data Sheet