Chemical Reactions Involving Oxygen

Safety: Caution should be used when burning elements. *All burning should be done directly under the fume hood*. Goggles should be worn at all times. Finally, avoid looking directly at burning magnesium.

Part 1:

1. Your teacher will demonstrate the collection of oxygen and the burning of iron (Fe) & magnesium (Mg).
2. Obtain the following equipment: glass plate, 50 mL beaker, 600 mL beaker, glass jar, "deflagrating spoon", 2 pieces of red litmus, 2 pieces of blue litmus, pneumatic trough, and a plastic bag with a hose.
3. Use the large beaker to fill the pneumatic trough with tap water; make sure the hose drains into the sink.
4. Put on your goggles. Ensure that the fume hood is in place. Ignite your Bunsen burner. Place the spoon in the flame (directly under the fume hood) for 30 seconds to burn away any residue from previous labs.
5. Place approximately 10 - 20 ml of distilled water in the 50 mL beaker.
6. Fill the jar with oxygen via the downward displacement of water (as demonstrated earlier).
7. Once your deflagrating spoon is cool, get a tiny amount of sulfur from your teacher. Heat the spoon by placing it in the middle of a moderate flame (directly under the fume hood). Lift the spoon out of the flame periodically to check if the sulphur is on fire. When a small flame rises from the sulphur, place the spoon in the jar (directly under the fume hood). Catch as much gas as possible in the jar and seal it with the glass plate. If any sulphur remains, burn it away (directly under the fume hood).
8. At this point, a glass plate should be on top of your jar, trapping an oxide gas inside. Slide the glass plate off to one side so that you can pour in the distilled water from your beaker. Try not to let any gas escape.
9. Ensuring that the mouth of the jar is tightly covered with the plate, shake the jar vigorously. This will allow the water to react with the oxide – forming either an acid or a base. Place one piece of blue litmus and one piece of red litmus in the water. Note whether the water has become acidic or basic.
10. Wash out the jar with tap water. Repeat steps 5 –9, using phosphorus in place of sulphur.
11. Rinse and return all equipment, but keep your fume hood and burner set up for Part 2 below.

Part 2:

1. Obtain a splint, evaporating dish, and a large clay triangle. Get tongs from your lab bench. Set up your retort stand and ring clamp with the clay triangle. The clay triangle will support the evaporating dish as it is heated with the Bunsen burner flame. Place a scoop of $KClO_3$ into the evaporating dish.
2. Put on your goggles. Gently heat the evaporating dish (the dish should be directly under the fume hood).
3. When bubbles start to be produced, place a glowing splint above the potassium chlorate (hold onto the splint with your tongs – not directly with your fingers). You can put the glowing splint into the potassium chlorate, but be careful: hot potassium chlorate may splatter.
4. Continue to heat until the reaction stops (no more bubbles). Turn off the heat and remove your goggles.
5. Allow the apparatus to cool. When cool, wash the evaporating dish well with tap water (chemicals can be flushed down the sink). Return all equipment. Wipe down your lab bench with a damp paper towel.

Questions: Read pages 108, 109 (up to, but not including, "A Mechanism for Chemical Change"), 111, 115.

1. Define chemical change. What evidence was there that a chemical change took place in part 1?
2. When P is burned in O_2 the product P_2O_5 forms. Write the word equation for this reaction. Write word equations for the formation of SO_2 from S, MgO from Mg and Fe_2O_3 from Fe.
3. Write general equations for the five different reaction types (i.e. copy table 1 on page 115).
4. Which two of the five reaction types describe the reactions from part 1?
5. What test did we perform to indicate that SO_2 and P_2O_5 were formed? Explain.
6. What gas did we test for in part 2? Were the bubbles that formed in part 2 an indication of a physical change (i.e. boiling) or a chemical change? Give evidence to support your answer.
7. Write the word equation for part 2 (assume that all oxygen leaves $KClO_3$). Which reaction type is this?
8. Label each as synthesis, decomposition, single displacement, double displacement, and/or combustion: a) copper + silver nitrate → silver + copper (II) nitrate, b) $CaCO_3 \rightarrow CaO + CO_2$, c) $6Li + N_2 \rightarrow 2Li_3N$, d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$, e) zinc + hydrochloric acid → hydrogen + zinc chloride, f) calcium carbonate + hydroiodic acid → carbonic acid + calcium iodide, g) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$