Fractional Distillation of Cherry Coke

Background
Distillation is a process that can be used to separate the components of a solution using selective evaporation and condensation. Complete or partial separation can occur depending on the goals of the separation. The substances will be separated due to their difference in boiling points. During this experiment, you will distill Cherry Coke. Three components of the soda solution should be observed.

Pre-lab Questions
1. What is distillation?

2. Explain why it is not possible to separate the solution using filtration.

3. What intermolecular forces are holding the carbon dioxide in the water?

4. What intermolecular forces are holding the sugar in solution?

5. What fractions do you expect to find in the Cherry Coke?

Objective
Students should understand the process of distillation and the intermolecular forces that are being broken and formed throughout the process.

Materials
- Limewater
- Test tube rack
- Ice Bath (600 mL Beaker w/ ice)
- Cherry Coke
- 250 mL Erlenmeyer Flask
- Hot Plate
- 50 mL Graduated cylinder
- Two-hole rubber stopper
- Thermometer
- 2 Test tubes
- Bent glass tubing
- Rubber tubing
- Boiling chips
- 2 Ring Stands
- Test Tube Clamp
Safety
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow your teacher’s instructions for clean-up of your materials and disposal of chemicals.
- Always use caution around open flames. Keep flames away from flammable substances.
- Exercise caution when using a heat source. Hot plates should be turned off and unplugged as soon as they are no longer needed.

Procedure
1. Put three boiling chips into a 250 mL Erlenmeyer flask and add 25 mL of Cherry Coke.
2. Place thermometer and bent glass tubing into rubber stopper.
3. Place stopper complex into the flask. Make sure thermometer is immersed in the liquid, but not touching the bottom of flask.
4. Place rubber tubing onto glass tubing.
5. Fill a test tube about 1/2 full with limewater.
6. Secure the test tube with a clamp attached to a ring stand.
7. Place the open end of the tubing into the limewater filled test tube.
8. Heat the soda gently on the hot plate (between the 3 and 4 or on low setting). **DO NOT LET THE SOLUTION REACH A TEMPERATURE OF OVER 100 °C**
9. Set up the ice bath, by placing ice in a 600 mL beaker.
10. Place the second test tube in the ice bath.
11. Once the substance is done bubbling, continue heating and remove tubing from limewater test tube.
12. Place the tubing in the empty test tube.
13. Occasionally waft the odors from this second fraction and record the smell(s) that you recognize.
14. Once you have collected 1-2 mL of the second fraction, turn off the heat source.
15. Wait for flask, glass tubing and other tubing to cool to clean up

Analysis
1. Limewater is aqueous calcium hydroxide. When the carbon dioxide was bubbled into it, an insoluble precipitate was formed, calcium carbonate. Write the balanced reaction for the reaction you observed.

2. What is left in the flask after the distillation?
**Conclusion**

The three fractions that you observed being distilled were carbon dioxide, ester flavorings (a polar molecule), and water. Describe the types of intermolecular forces in each substance and explain why the order of boiling points of each substance was observed.