Lab - Refining Oil

Purpose: To complete a distillation on a sample of "simulated" crude oil and determine the percent and identity of each fraction.

Introduction: In this lab procedure, you will be separating a sample of "simulated"crude oil. This crude oil is a mixture of methanol, water, glycerin and food coloring. In this experiment, you will separate the components of the crude oil into 3 fractions, and then determine the identity of each fraction.

Procedure:

Part 1: Reactions of three oil components to different materials

Design a procedure to determine the density of the liquids water, methanol and glycerin. Then, design a procedure to test how each liquid reacts with Alka-Seltzer, and test the solubility of salt and sugar in each solution. You may use up to 15 mL of each liquid material. Write out an organized procedure in your lab book that includes all measurements and observations you need to take.

Develop a data table to hold your data.

Part 2: Distillation

1) Mass a graduated cylinder and then measure out 40 mL of crude oil. Determine the mass of the graduated cylinder with the crude oil.
2) Set up a distillation apparatus as shown by your teacher. Be sure that the tubing hoses and thermometer are properly connected. Pour the 40 mL of crude oil into the Erlenmeyer flask. Place on hot plate.
3) Fill the outer sleeve of your distillation apparatus with ice water. Turn on the hot plate to the medium setting.
4) Collect the first fraction distillate that condenses and drips from the distillation apparatus in a beaker. Keep the liquid boiling slowly in the Erlenmeyer flask. Adjust the controls on the hot plate as necessary.
5) When the temperature on the thermometer reaches about 85 ^{o}C, remove the first beaker and replace it with a new one. The new beaker will be collecting the second fraction distillate. Continue to heat until the temperature reaches about 105 ^{o}C. When the temperature reaches 105 ^{o}C, turn off the hot plate. Continue to collect distillate as long as some drips out.
6) The remaining mixture in the Erlenmeyer flask will be the third fraction. Allow it to cool on the table.
7) For each fraction, determine the density of the liquid, taking and recording the necessary measurements. Add more rows to the table below with the measurements needed.
8) Separate the first fraction distillate into 3 equal test tubes. To the first test tube, add a small piece of Alka-Seltzer to the liquid and record the reaction. To the second test tube, add a small amount of sugar and determine its solubility in the liquid. Record observations. To the third test tube, add a small amount of salt and determine its solubility in the liquid. Record observations.
9) Repeat step 8 for the other 2 fractions. Record observations.

Part 2 Data:

Mass of graduated cylinder:_____

Mass of graduated cylinder and crude oil:_____

	First fraction	Second Fraction	Fraction remaining
Mass of fraction (g)			
Volume of fraction (mL)			
Density of fraction (g/mL)			
Reaction with Alka-Seltzer			
Solubility of sugar			
Solubility of salt			

Calculations:

1) Determine the mass and volume percentage of the first fraction compared to the whole sample of crude oil.

2) Determine the mass and volume percentage of the second fraction compared to the whole sample of crude oil.

3) Determine the mass and volume percentage of the remaining fraction compared to the whole sample of crude oil.

Questions:

4) Based on your results for part 1 and part 2, determine the identity of each fraction.

5) What reason(s) can you give for the reactions for salt, sugar and Alka-Seltzer being different in the parts of the lab?

6) What can you conclude about the boiling point of the remaining fraction in the flask?

7) Some people have proposed that distillation would be a better process for the purification of river and salt water for drinking. What advantages and disadvantages does distillation have over the process we learned earlier this year?

8) When petroleum is separated into fractions, the boiling points are much closer together than what we did. What difficulties does this cause in the separation process?

Conclusion: