

SCH4U- 2-4I: Content Formative: Organic Chemistry Reaction Lab

This lab comprises two separate experiments. You should read through the information about the tests here first before going on to analyze the lab data.

Step #1 Read the information about the tests.

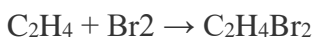
1. Test for Saturation - Bromine Test

The presence of the C=C double bond allows alkenes to react in ways that alkanes cannot. This allows us to tell alkene apart from alkane using a simple chemical test.

Bromine water is an orange solution of bromine. It becomes colourless when it is shaken with an alkene. Alkene can decolourise bromine water, but alkanes cannot. The slideshow shows this process.

The reaction between bromine and alkenes is an example of a type of reaction called an **addition reaction**. The bromine is decolourised because a colourless dibromo compound forms. For example:

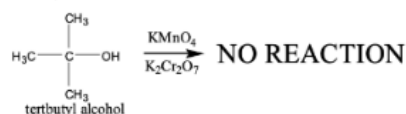
ethene + bromine → dibromoethane



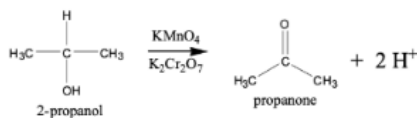
2. Test for Oxidation - Potassium Permanganate Test

This reaction can also be used as a qualitative test for the different types of alcohols because there is a distinct color change. Potassium permanganate is purple in color and an oxidizing agent. In the presence of alcohols, potassium permanganate attempts to oxidize these alcohols and the solution turns clear if the alcohol is oxidized.

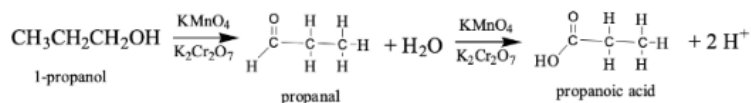
Tertiary Alcohol → not oxidized under normal conditions



Secondary Alcohol → ketone + hydrogen ions



Primary Alcohol → aldehyde + water → carboxylic acid + hydrogen ions



Step #2

Read the data collected in the real lab. Please see the assignment page for the data set.

Step #3

Read the information about Experiment 1 and Experiment 2 below, and use data provided by the teacher to fill in the observations and answer the analysis questions.

Experiment #1: Saturated or Unsaturated

General Overview: This lab involves adding bromine solution to two unknown samples and observing any chemical reactions that take place. Based on your observations, you should be able to determine your unknown sample contains a saturated or unsaturated organic compound. ****NOTE: UV is not used as a catalyst in this lab****

Equipment List

- Lab coat
- gloves
- safety goggles
- eyedroppers (3)
- beakers (3)
- test tubes (3)
- test tube rack

Materials:

- unknown organic sample #1
- unknown organic sample #2
- bromine solution

Procedure:

1. Put on lab coat, goggles and gloves
2. Label 3 test tubes: water, unknown #1 and unknown #2
3. Under the fume hood, add 10 mL of water, unknown #1 and unknown #2 to their own test tubes
4. Add 4 drops of bromine water solution to each test tube.
5. Observe each tube over time for any changes, record your observations in the table below

**Observations:**

1. Colour of bromine water solution: _____

	Colour of sample before adding bromine	Colour of sample after adding bromine
Water	clear	
Unknown #1		
Unknown #2		

Other observations:

Analysis:

1. Based on your observations and knowledge of chemical reactions involving organic compounds which of your samples contained a saturated compound and which contained an unsaturated compound?

2. If you were told that the unknown samples were cyclohexane and cyclohexene, which would be sample #1 and which would be sample #2?

Sample #1: _____

Sample #2: _____

3. Complete the reaction equation below for sample #1 and sample #2 based on the information in question #2 above.

Sample #1:



Sample #2:



Experiment #2: Oxidation Reactions of Alcohols

General Overview:

This lab involves mixing an oxidizing agent with different alcohols and observing any chemical reactions that occur. Based on these reactions you should be able to classify the different alcohols

Materials

- unknown sample #1
- unknown sample #2
- unknown sample #3
- potassium permanganate solution (KMnO_4)

Procedure:

1. Put on lab coat, goggles and gloves
2. Place 3 test tubes in the test tube rack and label them #1, #2 and #3. Place the labeled test tubes under the fume hood
3. Put 4 drops of each unknown into their respective test tubes
4. Using the eye dropper, add 20 drops of potassium permanganate (KMnO_4) solution to each test tube
5. Observe each test tube for any changes over the course of 5 minutes
6. Record your observations below

Observations:

1. Colour of KMnO_4 : _____

2. Qualitative observations:

	Colour of sample before adding KMnO_4	Colour of sample 5 seconds after adding KMnO_4	Colour of sample 90 seconds after adding KMnO_4	Colour of sample 5 minutes after adding KMnO_4
Unknown #1				
Unknown #2				
Unknown #3				

Name: _____

3. Describe in your own words how the samples behaved differently in the presence of KMnO_4 :

Analysis:

1. The unknown samples were made up of 3 different isomers of butanol (C_4H_{10}): 1-butanol, 2-butanol and 2-methyl-2-propanol. Draw structural diagrams for each and label them as primary, secondary and tertiary.

Name: _____

2. Based on their structures, and classification as primary, secondary or tertiary, predict which of the unknown samples corresponds to each isomer of butanol:

1-butanol = sample # _____

2-butanol = sample # _____

2-methyl-2-propanol = sample # _____

3. Explain your reasoning for the answer above. (hint: think about reactivity, your observations, and the structure of each isomer)