

OCR (A) Chemistry A-level

PAG 7: Qualitative Analysis of Organic Functional Groups

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7.1 Identifying Organic Unknowns 1

Part 1: Identification of an alkene

Chemicals provided for the experiment

- Heptane
- Cyclohexane
- Cyclohexene
- Limonene
- Bromine water

1. Set up a water bath in a 250 cm³ beaker. Leave this to one side.
2. Heat each haloalkane separately under reflux with sodium hydroxide to release the halide ions.
3. For each of the haloalkanes, in a separate test tube:
 - a. Add five drops of the refluxed haloalkane solution.
 - b. Add 1 cm³ of ethanol and 1 cm³ of silver nitrate solution to the test tube.
 - c. Shake side to side to mix the solution well, and place the test tube into the water bath.
 - d. Record any observations after 3 minutes.

Expected results

<i>Chemical</i>	<i>Colour of bromine water / observation</i>
Heptane	Orange
Cyclohexane	Two separate layer forms, top layer orange and bottom layer water
Cyclohexene	Colourless
Limonene	Colourless

Safety

- Heptane - highly flammable; fatal if swallowed; causes skin irritation; may cause drowsiness or dizziness.
- Cyclohexane - highly flammable; fatal if swallowed; causes skin irritation; may cause drowsiness or dizziness.
- Cyclohexene - highly flammable; fatal if swallowed; toxic in contact with skin.
- Limonene - highly flammable; fatal if swallowed; causes skin irritation; causes serious eye damage.
- Bromine water - causes severe skin burns and eye damage; fatal if inhaled.



Part 2: Identification of a haloalkane

Chemicals provided for the experiment:

- 1-chlorobutane
- 1-bromobutane
- 1-iodobutane
- Ethanol
- Aqueous silver nitrate

1. Set up a water bath in a 250 cm³ beaker. Leave this to one side.
2. Heat each haloalkane separately under reflux with sodium hydroxide to release the halide ions.
3. For each of the haloalkanes, in a separate test tube:
 - a. Add five drops of the refluxed haloalkane solution.
 - b. Add 1 cm³ of ethanol and 1 cm³ of silver nitrate solution to the test tube.
 - c. Shake side to side to mix the solution well, and place the test tube into the water bath.
 - d. Record any observations after 3 minutes.

Expected results

<i>Name of the chemical</i>	<i>Observations</i>
1-chlorobutane	White precipitate forms. Slow reaction.
1-bromobutane	Cream precipitate forms. Quick reaction
1-iodobutane	Yellow precipitate forms. Very quick reaction

Safety

- 1-chlorobutane - highly flammable.
- 1-bromobutane - highly flammable; causes skin irritation and serious eye irritation; may cause respiratory irritation.
- 1-iodobutane – flammable; harmful if inhaled.
- Ethanol - highly flammable.
- Silver nitrate solution - causes severe skin burns and eye damage.
- Sodium hydroxide - causes severe skin burns and eye damage.



Part 3: Identification of Aldehydes

Chemicals provided for the experiment:

- Fehling's reagent
- Tollens' reagent
- Brady's reagent
- Ethanal
- Propanone

1. Set up a hot water bath.
2. Add 2 mL Fehling's reagent to two separate test tubes and place in a test tube rack.
3. Add a few drops of ethanal to one test tube and a few drops of propanone to the other test tube. Warm in the water bath and record any observations.
4. Add 2 mL Tollen's reagent to two separate test tubes and place in a test tube rack.
5. Add a few drops of ethanal to one test tube and a few drops of propanone to the other test tube. Warm in the water bath and record any observations.
6. Add 2 mL Brady's reagent to two separate test tubes and place in a test tube rack.
7. Add a few drops of ethanal to one test tube and a few drops of propanone to the other test tube. Record any observations.

Expected results

	<i>Ethanal</i>	<i>Propanone</i>
<i>Fehling's reagent</i>	Brick red precipitate forms	No precipitate, solution remains deep blue
<i>Tollens' reagent</i>	Silver mirror forms on the surface of the test tube	No change
<i>Brady's Reagent</i>	Orange precipitate forms.	Orange precipitate forms.

Safety

- Fehling's Reagent - causes skin irritation and serious eye damage.
- Tollen's Reagent - may cause skin and eye irritation; explosive.
- Brady's Reagent - flammable; harmful if swallowed; causes serious eye irritation.
- Ethanal - highly flammable.
- Propanone - highly flammable; causes serious eye irritation; may cause drowsiness or dizziness.



Part 4: Identification of alcohols

Chemicals provided for the experiment:

- Butan-1-ol
- Butan-2-ol
- 2-methyl-propan-2-ol
- Phenol
- Acidified potassium dichromate solution
- Bromine water

1. Heat the butan-1-ol under reflux with the acidified potassium dichromate and make a note of any observations.
2. Repeat for butan-2-ol and 2-methyl-propan-2-ol.
3. Add bromine water to a sample of phenol and note any changes.

Expected results

<i>Compound</i>	<i>Classification of alcohol</i>	<i>Observation</i>
Butan-1-ol	Primary	Colour change from orange to green
Butan-2-ol	Secondary	Colour change from orange to green
2-methylpropan-2-ol	Tertiary	Solution remains orange

Phenol causes a solution of bromine water to change from orange to colourless and a white precipitate will form.

Safety

- Butan-1-ol - flammable; harmful if swallowed; causes skin irritation and serious eye damage; may cause respiratory irritation; may cause drowsiness or dizziness.
- Butan-2-ol - flammable; causes serious eye damage; may cause respiratory irritation; may cause drowsiness or dizziness.
- 2-methylpropan-2-ol - highly flammable; causes serious eye irritation; harmful if inhaled.
- Phenol - Toxic if swallowed; toxic if inhaled; toxic in contact with skin; causes severe skin burns and eye damage; can cause damage to organs and genetic defects.
- Potassium dichromate - Oxidizer; toxic if swallowed; fatal if inhaled; causes severe skin burns and eye damage; can cause damage to organs, cancer, and genetic defects; environmental hazard.



Part 5: Identification of carboxylic acids

Chemicals provided for the experiment:

- Ethanoic acid
- Dilute sodium carbonate solution
- Limewater

1. Place a test tube containing limewater in a test tube rack, with the delivery tube in the solution.
2. In a second test tube, add a few mL of sodium hydrogen carbonate solution, then add a few mL of ethanoic acid and immediately insert the bung attached to the delivery tube.
3. Bubble the gaseous product from the delivery tube through the limewater.

Expected Results

The ethanoic acid reacts with the sodium hydrogen carbonate, producing carbon dioxide. Effervescence will be observed. CO_2 turns limewater cloudy.

Safety

- Limewater - causes skin irritation and serious eye damage.
- Ethanoic acid - flammable, causes severe skin burns and eye damage.

