

Organic chemistry essay sample

[Science](#), [Chemistry](#)



When doing each procedure, take extra care and wear eye protection, gloves, and lab coat because there's a high risk due to the organic chemical been unknown.

Risk assessment before the test alkene and phenol:

Procedure / Chemical

Risk

Precaution

Information derived from

Bromine water

Toxic: very toxic by inhalation.

Irritant: irritant to skins and eyes

Harmful: by inhalation, contact with skin or swallowed.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling. Dispose using fume cupboard.

Cleapss card page number 15

Unknown organic compound

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

Test 1: Alkene

Shake the unknown compound with a few drops of bromine water. If solution changes colour from orange to colourless then an alkene is present. However if a negative result is observed where colour change doesn't occur, then proceed to the next test.

Test 2: Phenol

Pipette 2ml of bromine water into a test tube and add a few drops of the unknown compound to it and gently shake. For a positive result, bromine water will decolourise and white precipitate forms, this indicates phenol is present. If no positive test is observed, proceed to the next test.

Risk assessment before carrying out the test for aldehyde and ketone:

Procedure / Chemical

Risk

Precaution

Information derived from

2, 4-dinitrophenylhydrazine

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

Cleapss card number 30

Unknown organic compound

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

Test 3: Aldehyde / ketone

Pipette 2ml of 2, 4-dinitrophenylhydrazine into a test tube and add a few drops of the unknown compound and gently shake. If unknown is either an aldehyde or a ketone, an orange/yellow crystalline will form so proceed to test 4 to distinguish between them. If no positive result is observed, proceed to test 5.

Risk assessment before carrying out the test for aldehyde and ketone:

Procedure / Chemical

Risk

Precaution

Information derived from

Silver ions

Corrosive: causes burns. Solutions are very dangerous to the eyes and blacken the skin. Ingestion can cause internal damage.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling

Cleapss card number 87

Sodium hydroxide

Corrosive: causes severe burns. Very dangerous to the eyes and skin.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling.

Cleapss card number 91

Ammonia

Corrosive: causes burn. If swallowed, causes severe internal damage. Vapour is toxic and extremely irritating to eyes and lungs.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling

Cleapss card number 6

Unknown organic compound

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

<http://www.jtbaker.com/msds/englishhtml/P5719.htm>

Test 4: Aldehyde / ketone

To make Tollens' reagent, add 2 cm³ of 0.1 mol dm⁻³ of silver ions in solution and add few drops of sodium hydroxide until a brown precipitate forms. Then add aqueous ammonia until the brown precipitate dissolves. This is a Tollens' reagent. Add 1 cm³ of the unknown compound to the reagent. If it's an aldehyde a silver mirror will form on the test tube, if nothing is observed then the unknown compound is a ketone.

Risk assessment before doing the test for carboxylic acids and alcohols:

Procedure / Chemical

Risk

<https://assignbuster.com/organic-chemistry-essay-sample/>

Precaution

Information derived from

Sodium

Highly flammable: reacts violently with water liberating a highly flammable gas (hydrogen).

Burns vigorously and difficult to extinguish.

Corrosive: causes burns.

Dangerous: with water and hydrogen given off and it may ignite.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling

Cleapss card number 88

Unknown organic compound

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

<http://www.jtbaker.com/msds/englishhtml/P5719.htm>

Test 5: Carboxylic acids / Alcohols

Add a few drops of unknown sample to 0.5g of solid sodium. Carboxylic acids and alcohols react with sodium to form separate products with hydrogen gas. To test it use the 'squeaky pop' test. If it pops it shows either of the organic compounds could be present so continue to test 6 to distinguish between them. But if the lighted splint didn't pop after 3 trials, it shows neither of the organic compounds is present so continue to test 9.

Risk assessment before doing the test for carboxylic acids and alcohols:

Procedure / Chemical

Risk

<https://assignbuster.com/organic-chemistry-essay-sample/>

Precaution

Information derived from

Litmus paper

Minimal hazard.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling

Cleapss card number 32

Unknown organic compound

Explosive: risk of explosion by shock, friction, fire, or other source of ignition.

Toxic: by inhalation or if swallowed. And it's very toxic to skin. Skin stain yellow on contact with which may be followed by dermatitis.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

<http://www.jtbaker.com/msds/englishhtml/P5719.htm>

Test 6: Carboxylic acids / Alcohols

Add few drops of unknown compounds to blue litmus paper. If the unknown is a carboxylic acid, colour of the litmus paper will change from blue to red.

But if it's an alcohol, the colour of the litmus paper will remain blue so proceed to test 7 and 8 to distinguish between primary and tertiary alcohol.

Risk assessment before doing the test for both primary and tertiary alcohols:

Procedure / Chemical

Risk

Precaution

Information derived from

Acidified potassium dichromate

Poison! Danger! May be fatal if swallowed, inhaled or absorbed through skin.

Strong oxidizer. Contact with other material may cause a fire. Corrosive.

Causes severe burns to every area of contact. Affects the respiratory system,

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liver, kidneys, eyes, skin and blood. May cause allergic reaction. Cancer hazard. Can cause cancer. Risk of cancer depends on duration and level of exposure.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

<http://www.jtbaker.com/msds/englishhtml/P5719.htm>

Boiling bath

Hot water can burn the skin

Stay quite away from it and avoid playing near it

Bunsen burner

Heat can cause serious damage to skin.

Don't play with fire; take special care when using the Bunsen burner.

Unknown organic compound

Poison! Danger! May be fatal if swallowed, inhaled or absorbed through skin. Strong oxidizer. Contact with other material may cause a fire. Corrosive. Causes severe burns to every area of contact. Affects the respiratory system, liver, kidneys, eyes, skin and blood. May cause allergic reaction. Cancer hazard. Can cause cancer. Risk of cancer depends on duration and level of exposure.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

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Test 7: Primary alcohol

Add 5 drops of unknown chemical into boiling tube, and then add 4cm³ of acidified potassium dichromate. Place in boiling bath and allow reacting. If primary alcohol is present the solution will go from orange to green, but if the solution stays orange then it isn't primary alcohol.

Test 8: Tertiary alcohol

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Add 4cm³ of unknown compound into a boiling tube and add 3 drops of acidified using dropping pipette. Then heat. If colour remains orange, it's tertiary alcohol because they don't get oxidised.

Risk assessment before doing the test for ester:

Procedure / Chemical

Risk

Precaution

Information derived from

Hydroxylamine hydrochloride

Irritant: to eyes and skin.

Heat: explosive if heated to high temperature.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection and gloves during handling.

Cleapss card number 53

Unknown organic compound

Poison! Danger! May be fatal if swallowed, inhaled or absorbed through skin. Strong oxidizer. Contact with other material may cause a fire. Corrosive. Causes severe burns to every area of contact. Affects the respiratory system, liver, kidneys, eyes, skin and blood. May cause allergic reaction. Cancer hazard. Can cause cancer. Risk of cancer depends on duration and level of exposure.

If swallowed, wash out mouth and drink a glass or two of water. Seek medical attention as soon as possible.

If inhaled, remove victim and put where there's fresh air.

If chemical gets into eyes, wash off with plenty of water and seek medical help.

Wear eye protection, and wear gloves during handling of chemical.

If chemical is in a bottle, open slowly and keep damp at all times.

<http://www.jtbaker.com/msds/englishhtml/P5719.htm>

Test 9: Ester

In a test tube, mix 1 drop of unknown compound with 1ml of 0.5mols of hydroxylamine hydrochloride into 95% ethanol and add 0.2ml of 6mols aqueous sodium hydroxide. Heat the mixture until it boils. On cooling, add 2ml of hydrochloric acid. If the solution is cloudy, add 2ml of 95% ethanol.

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Then add 1 drop of 5% iron (III) chloride. A positive test will be a distinct burgundy or magenta colour which is a confirmation that an ester is present.

COMPOUND B

A negative result was observed in test 1 and 2 for both phenol and alkene as decolourisation of bromine water occurred and no precipitation was formed.

Test 3 using 2, 4-dinitrophenylhydrazine was positive as an orange precipitation was formed. Following this, test 4 was also positive as adding the tollens' reagent to the unknown compound silver solid deposit formed on the test tube. The silver deposit formed as the silver ions (Ag^+) in the ammonia silver nitrate is reduced to silver metal (Ag), which forms on the test tube (oxidation number of silver fell from +1 to 0).

These observations could be drawn to a simple conclusion that compound B is an aldehyde. However, another chemical test that can be used to confirm the compound is a Fehling's solution. Fehling's solution has a bright blue colour and when added to an aldehyde there is a colour change of the solution from blue to brick red precipitate. This colour change emphasised that the organic compound is an aldehyde.

An infrared, NMR and mass spectrum has been provided. Analysing these three spectra will confirm the test findings and help to deduce the exact structure of compound B (an aldehyde).

On the mass spectrum, the peak that has the largest mass to charge ratio is the molecular ion peak (M^+). This has a mass that is equal to the M_r of the

compound. After observing the mass spectrum, it shows that the molecular ion and hence the M_r of the aldehyde is 44. This could help to deduce the structure of the aldehyde.

Infrared spectroscopy identifies the type of functional group present in an organic molecule using its absorption peaks. Different functional groups absorb at certain frequencies of infrared radiation. Analysing the spectrum provided shows a strong sharp absorption peak at approximately 1720cm^{-1} . This peak indicates the presence of a C=O functional group found in both ketones and aldehydes. However, an infrared spectrum cannot distinguish between ketones and aldehydes.

Nuclear magnetic resonance spectroscopy (NMR) is used to determine the structure of a compound. Peaks on an NMR spectrum occur at different chemical shift values (ppm). The position of the peak gives information on the proton-containing groups present. The height of the peak provides information on the number of protons (hydrogen atoms) in the group. The splitting pattern of each peak shows the number of protons adjacent to each group. Overall an NMR spectrum provides information on the different groups and how these groups are bonded together in a molecule. Protons attached to oxygen won't split in a high resolution NMR.

The NMR spectrum provided gives the following information:

Chemical shift (ppm)

Number of proton pattern (intensity)

Relative splitting

Identity

2. 1

3H

Doublet

CH₃

9. 8

1H

Quartet

CH

From the splitting pattern of the two peaks, the following points can be deduced: to produce a quartet, the group at chemical shift 9. 8 must be adjacent to a carbon atom with 3 protons. The peak at 2. 1 is split into a doublet which suggests it's adjacent to a carbon with 1 proton.

Using information from the NMR spectrum, I suggest the skeletal formula of compound B is:

Ethanal (an aldehyde)

The Mr of ethanal is 44 which is equal to the Mr taken from the mass spectrum.

Mr of ethanal (C₂H₄O): (12 $\frac{1}{2}$ 2) + (16 $\frac{1}{2}$ 1) + (1 $\frac{1}{2}$ 4) = 44

Information from all three spectra supports the original findings of the chemical tests and has given the further details concerning the structure of the aldehyde allowing the exact identity of compound B to be established as ETHANAL.

COMPOUND F

A negative result was observed in test 1 and 2 for both alkene and phenol as no decolourisation or any change to bromine water was observed.

Test 3 with 2, 4-dinitrophenylhydrazine gave no colour change meaning that both aldehyde and ketone aren't present so no point of carrying out test 4.

Test 5 for both carboxylic acid and alcohol also showed no observable change meaning both carboxylic acid and alcohol are not present. Their absence was further emphasised by test 6 with the blue litmus paper which remained blue to show that no alcohol is present in regards to test 7 and 8. And the blue litmus didn't change colour to red also proving that no carboxylic acid is present.

A process of elimination can then be used to identify compound F as an ester. And to further prove this, a hydroxamic acid test can be done as in test 9.

Analysing the three spectra provided will help to confirm the test result and give the exact structure of compound F (an ester).

On the mass spectrum, the M^+ which has the mass that is equal to the M_r of compound F is 88 hence, the M_r of compound F an ester is 88. The structure of the ester can be deduced from this.

Analysing the infrared spectroscopy shows a strong absorption peak at approximately 1720cm^{-1} . this peak indicates the presence of a $\text{C}=\text{O}$ functional group which can be found in esters.

Nuclear magnetic resonance spectroscopy (NMR), which determines the structure of compounds shows peak at different chemical shift values (ppm). This provides information on the different groups present and how they are bonded together in a molecule. Proton attached to oxygen will not split in a high resolution NMR.

The information derived from the NMR is:

Chemical shift (ppm)

Number of proton pattern (intensity)

Relative splitting

Identity

1. 2

3H

Triplet

CH_3

2.3

2H

Quartet

CH₂

3.6

3H

Singlet

CH₃

From the splitting pattern of the 3 peaks, the chemical shift on 1.2 with a triplet splitting must be adjacent to a CH₂, and the chemical shift on 2.3 with a quartet splitting must be adjacent to a CH₃ and the chemical shift on 3.6 with a singlet splitting must be adjacent to a C.

Using the information derived from the NMR spectrum, I suggest the skeletal formula of compound F is:

Ethyl ethanoate (an ester)

The Mr of ethyl ethanoate is 88 which is equal to the MR derived from the mass spectrum. Mr of ethanal is $C_4H_8O_2$ ($4 \times \frac{1}{2} \times 12$) + ($8 \times \frac{1}{2} \times 1$) + ($16 \times \frac{1}{2} \times 2$) = 88

The information from all three spectra supports the original findings of the chemical tests and has given details on the structure of the ester and the exact identity of compound F is established as ETHYL ETHANOATE.

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