Identification of an organic compound

Aim: To identify an unknown compound that has one oxygen atom per molecule, To establish the functional group of the compound, to prepare a derivative and find its melting point, and finally to determine the boiling pont of the original compound.

Plan

Establishing the functional group of the compound: To firstly determine the functional group I will carry out Diagnostic tests for functional groups, The test and positive observed reaction is shown below:

Functional groupTestPositive resultCarbonylCollect some 2,4-dinitrophenylhydrazine (Brady's reagent) in a dry tube and add a very small amount of the compound and shake.A yellow or orange precipitate forms slowlyAldehydeCollect some silver nitrate solution. Add 2 drops of sodium hydroxide solution, then aqueous ammonia until the mixture is almost colorless. Now add a very small amount to the substance.A grey/black precipitate or silver mirror will be formedKetoneTake some iodine in potassium iodide solution; add sodium hydroxide until it is pale yellow. Add a few drops of compound and shake.A yellow precipitate (iodoform) slowly forms.Primary/secondary alcoholsAdd a small amount of Phosphorus Pentachloride to the compound in a fume cupboard.Steamy fumes of HCl gas are observed, these can be tested with damp litmus paper to confirm acidic gas.

After testing the compound with these diagnostic tests, the unknown compounds functional group can be determined.

Preparing a derivative and finding its melting point:

The first stage of preparing a derivative is filtration under reduced pressure: Mixing a small amount of the substance with 2,4-dinitrophenylhydrazine and then adding 20 ml of ethanol, after heating the mixture in a water bath until limpid, the substance was filtered through the Buchner funnel.

To isolate a solid product from a liquid, suction filtration using a Buchner funnel is an effective method.

A small amount of cold solvent should be used to wet the filter paper prior to filtration,
and to remove any solid remains from the reaction flask.

The second stage is recrystallisation, to purify the solid product. Dissolve the solid in the
minimum volume of hot solvent (the original compound), Quickly filter the hot solution using
preheated filter funnel and fluted filter paper. Collect the filtrate and allow to cool and the solid
to recrystallise. Use suction filtration (Buchner funnel) to collect the solid. Wash the solid with a
small amount of cold solvent, finally dry the solid product. To prepare a derivative of the
compound.

To determine the melting point of the solid, melting point apparatus should be used;

The sample is placed in a capillary tube, and the temperature increased slowly until it
melts.

Determining the boiling point of the original compound:

Boiling points can be used for identification purposes. Boiling points are most commonly
measured in the process of distillation.

The boiling point can be determined by setting up apparatus shown below:

When bubbles begin to flow in a steady stream from the capillary tube the substance should then be left to cool, observe until the bubbles begin to be drawn back up the capillary tube this point is the boiling temperature of the substance.

Safety issues:

Fume cupboards should be used for all reactions involving toxic, irritant or carcinogenic chemicals.

No naked flames should be used with flammable chemicals.

The use of gloves is required when dealing with corrosive or irritant chemicals such as concentrated acids.

How to determine the compound.

The unknown compound can be identified by its functional group and boiling temperature which can be referenced in a data book for identification purposes.

Results.

The unknown organic compound named substance D, gave a positive result for a carbonyl group, and a negative result for an aldehyde, and a positive result for a Ketone, the organic substance was therefore a Ketone.

After preparing the derivative 2,4-dinitrophenylhydrazone, the solid was heated it melted at 117oC, making the melting point of the derivative 117oC.

The Original organic compound D, had a boiling point of 80oC.

Using these results, the unknown organic compound D was compared to information in a Data book, the boiling point of the compound and the melting point of its derivative matched that of the organic substance, a ketone, 2-Butanone.

Conclusions:

Functional group-- Positive result for ketone

Boiling point-- 80oC

Melting point of Derivative-- 117oC

Organic chemical D-- 2-Butanone