**LABORATORY REPORT**

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| Organic functional group identification |
| |  |  | | --- | --- | | Name: | Victor Kwansa | | Index Number: | 41350033 | | Class: | O.1.2.1/O.1.2.2 | | Demonstrator: | Ms. Flora Amarh | | Date: | 5th February 2009 | |
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| **AIMS/OBJECTIVES:**   1. Identify the functional groups of unknown compounds by determining their reactivity with certain chemicals. 2. Note the colour changes that would occur in the experiment. 3. Note the various reactions of a particular organic compound (with a specific functional group) with different reagents including distilled water and 1M HCl solution. |
| **INTRODUCTION/THEORY:**  Organic compounds have different functional groups which exhibit different reactivity. Qualitative analysis of an organic compound refers to the analysis of the characterization and identification of the organic compound.  Chemists have learned through experience that organic compounds can be classified into families according to their structural features and that the chemical behaviour of family members is often predictable. The structural features that make it possible to class compounds together are called *functional groups*.  A **functional group** is an atom or group of atoms within a molecule that has a characteristic chemical behaviour. A given functional group undergoes the same kinds of reactions in every molecule it’s a part of. Look at the carbon–carbon double-bond functional group, for example.  Ethylene the simplest compound with a double bond undergoes reactions that are remarkably similar to those of menthene a much larger and more complex molecule (.  Solubility behavior and colour changes of an unknown substance in various solutions such as in distilled water, 1M NaOH solution, 1M HCl solution, 85% H3PO4, Cr2O72- + H+ solution, Benedict’s solution, etc. provides useful information about the nature or type of compound.  When an organic compound contains more than one functional group, the classification is mostly based on that which is easily detected via experimentation. |
| **CHEMICALS & EQUIPMENT:**   1. Distilled water 2. Wash bottle 3. Test tubes 4. 1M NaOH solution 5. 1M HCl solution 6. 85% H3PO4 7. Cr2O72- + H+ solution 8. Benedict’s solution 9. Blue litmus paper 10. Red litmus paper |
| **PROCEDURE:**   |  |  | | --- | --- | | TEST | OBSERVATION | | A. |  | | 1. Unknown liquid sample “3a” was dissolved in little amount of distilled water. | Soluble | | 1. Solution was tested with blue litmus paper. | -blue litmus paper turned red. | | B. |  | | 1. Unknown solid sample “2a” was dissolved in little amount of distilled water. | Soluble | | 1. Solution was tested with blue litmus paper and red litmus paper. | -No colour change was observed. | | 1. Cr2O72- + H+ solution was added to the solution. | -Changed from a pale yellowish colouration to yellowish orange. Reaction occurred. | | 1. Resulting solution was tested with Benedict’s solution. | -Yellowish green colouration of the solution was observed.  Reaction occurred. | | C. |  | | 1. Unknown solid sample “3b” was dissolved in little amount of distilled water. | Insoluble | | 1. 1M NaOH was added to the solution. | Insoluble | | 1. 1M HCl was added to the resulting solution. | Insoluble | | 1. 85% H3PO4 was then added to the solution. | Insoluble | |
| **DISCUSSION:**  Experiment A yielded a result which indicated that the unknown liquid 3a was more likely to be acidic with the functional group being the carboxylic acid group (RCOOH), according to the reference chart. This conclusion is made possible because all acids are characterized by a change from blue to red colouration when blue litmus paper is dipped in acidic solution.  In experiment B, the solid sample was more likely to belong to the aldehyde group (RCHO) with respect to the chart. The solid sample 2a was soluble in the distilled water hence the need arose to determine its pH. Its litmus tests proved that no colour change was observed in both cases thus drawing the conclusion that the substance was neutral.  The Na2Cr2O7 solution had a pale yellowish colouration which made it easy to determine whether a reaction would occur or not with the addition of the 3M H2SO4 solution. Thus, any change in colouration would determine the occurrence of a reaction. Since the experiment yielded a reaction due to the colour change, Benedict’s solution was added to the solution. A reaction would then determine whether we were dealing with an aldehyde or a primary or secondary alcohol. There was a reaction due to another colour change which was observed thus drawing the conclusion that the solid sample 2a was an aldehyde and not a primary or secondary alcohol.  Unknown solid sample 3b did not yield any reasonable results hence no functional group was allocated to this substance. When the sample was dissolve in distilled water, it was insoluble because it was unable to dissociate into its individual ions in the distilled water thus it was reacted with 1M NaOH to determine its solubility. If the sample was soluble in 1M NaOH, it was more likely to be a carboxylic acid. On the other hand if it was insoluble as observed, there was the further need to react it with 1M HCl. This meant that the earlier reaction with the 1M NaOH was to determine whether the sample was slightly acidic. A reaction would have confirmed its acidity since it would undergo a neutralization reaction. Likewise, the further reaction with the 1M HCl would help to determine if the sample was slightly basic thus, a reaction would confirm this. Again, the sample was insoluble in the acidic medium. 85% H3PO4 was added to determine its solubility. Its solubility in 85% H3PO4 could help determine whether it was aldehyde, primary or secondary alcohol, and ester. No reaction occurred hence any solubility. This insolubility thus made it impossible to determine the functional group of this sample. |
| **ERROR ANALYSIS:**   1. On adding the testing reagents, no measurements were made hence, large amounts of the reagents were used in the reactions which could have affected the end results of the experiments. 2. Some of the solid particles of the solid samples remained stuck to the walls of the test tube thus, on dissolving with the distilled water, not all the solid particles took part in the reaction. |
| **PRECAUTIONS:**   1. The test tubes were cleaned and washed thoroughly after every experiment to prevent impurities and to ensure that the chemical reactions take place under the most convenient environment or situation. 2. All additions of dangerous and very reactive solutions were carefully done and undertaken in the fume chamber in order to avoid accidents such as inhalation of dangerous fumes, in the laboratory. 3. Small amounts of solution were used in testing in order to observe reactions quicker and much more effective. 4. The vapour of the volatile solutions was waved towards the nose with the hand in order to determine the substance involved and to prevent direct contact of the substance to the nostrils. |
| **CONCLUSION:**  The functional groups that were identified in this experiment were made based on their reactivity in various reagents including distilled water, 1M NaOH solution, 1M HCl solution, 85% H3PO4 solution and Cr2O72- + H+ solution. All the different reagents produced different reactions to the samples including colour change. The different reactivity of the three samples to these reagents enabled easy identification of the organic functional group. |
| **REFRENCES:**  -**McMurry, F**., *Chemistry*, 4th Edition, pp. 999, 1000, 1001  -**Myers, R**., (2003), *The Basics of Chemistry*, Greenwood Press, London, pp. 207 – 215 |