ROSEDALE | ROSEDALE GLOBAL HIGH SCHOOL

**Name**_____

# 2-3: Properties of Organic Compounds Lab

Total: 96 Marks [K:24,I:51,C:21)

**Purpose:** To investigate the properties of organic compounds.

**Equipment:**

- safety goggles
- lab coat
- gloves
- beakers
- thermometers
- hot plate

**Materials:**

- pentane
- hexane
- heptane
- octane
- 2-propanol
- propanal
- propanone
- ethyl methoanoate
- propanoic acid
- methoxyethane
- oil
- ethanol
- 1-pentanol
- 1-decanol
- methoxymethane
- propanoic acid
- propyl ethanoate
- propanamine

**Procedure:**
Follow the procedure in the virtual lab. Refer to the real procedures below to help you understand exactly what you would do in each procedure.

**To determine Boiling Points:**

1. Put on lab coat, goggles and gloves
2. Under the fumehood, pour 50 mL of each solution into a labeled beaker
3. Insert a thermometer into each beaker
4. Place the beakers, one at a time onto the hot plate
5. Wait for the solution to begin boiling and record the temperature at which it boils.
6. Remove the beaker from the hot plate and keep it under the fumehood to cool down.

**To determine Solubility:**

1. To test the solubility of each sample in water, pour the sample into a beaker of water and observe how the two solutions mix with each other
2. Use the solubility chart posted on the lab wall to determine the solubility of each sample in water

**<u>Part A: Observations & Results (21K; 21T/I)</u>**

**Table 1: Alkane Boiling Point Trends**

| Molecular Formula | Hydrocarbon Name (4K) | Boiling Point (°C) (4T/I) |
|---|---|---|
| $C_5H_{12}$ | | |
| $C_6H_{14}$ | | |
| $C_7H_{16}$ | | |
| $C_8H_{18}$ | | |

**Table 2: Organic Compound Boiling Points Data**

| Compound Name | Total Number of Carbons (7K) | Boiling Point (°C) (7T/I) |
|---|---|---|
| Propane | | |
| 2-Propanol | | |
| Propanal | | |
| Propanone | | |
| Ethyl methanoate | | |
| Propanoic Acid | | |
| Methoxyethane | | |

**Table 3: Organic Compound Solubility**

| Compound Name | Total Number of Carbons (7K) | Solubility in Water (8T/I) (soluble, partially soluble, insoluble) |
|---|---|---|
| Oil | ---------- | |
| Ethanol | | |
| 1-pentanol | | |
| 1-decanol | | |
| methoxymethane | | |
| Propanoic Acid | | |
| Propyl ethanoate | | |
| Propanamine | | |

**Table 3: Amine Boiling Points**

| Compound Name | Total Number of Carbons (3K) | Boiling Point (°C) (3T/I) |
|---|---|---|
| **Propanamine** | | |
| **N-methylethanamine** | | |
| **N,N-dimethylethanamine** | | |

**Part B: Drawing of Structures (21C)**

Draw the structural line diagrams for each of the organic compounds listed in the observation within the table below:

| Compound Name | Structural Diagram (21C) |
|---|---|
| **Pentane** | |
| **Hexane** | |
| **Heptane** | |
| **Octane** | |
| **Propane** | |
| **2-propanol** | |
| **Ethyl methanonate** | |
| **Propanoic acid** | |
| **Methoxyethane** | |

| | |
|---|---|
| **Ethanol** | |
| **1-pentanol** | |
| **1-decanol** | |
| **Methoxymethane** | |
| **Propanoic acid** | |
| **Propyl ethanoate** | |
| **Propanamine** | |
| **N-methylethanamine** | |
| **N,N-dimethylethanamine** | |

**Part C: Boiling Points (19T/I):**

1a) **Describe** the relationship between the number of carbons in an alkane and its boiling point. **(1T/I)**

1b) Explain the reasons for this relationship using your knowledge of intermolecular forces, polarity, and molecular structure. **(2T/I)**

2a) **Compare** the boiling point of an alcohol to the boiling point of a hydrocarbon with the same number of carbons. What do you notice? Be specific. **(1T/I)**

2b) Explain the reasons for these differences using your knowledge of intermolecular forces, polarity, and molecular structure. **(3T/I)**

3a) **Compare** the boiling point of an ether to the boiling point of an alcohol with the same number of carbons. What do you notice? Be specific. **(1T/I)**

3b) Explain the reasons for these differences using your knowledge of intermolecular forces, polarity, and molecular structure. **(3T/I)**

4a) **Order** the boiling points of aldehydes and ketones, hydrocarbons, and alcohols with the same number of carbons from lowest boiling point to highest boiling point. **(1T/I)**

4b) Explain the reasons for these differences using your knowledge of intermolecular forces, polarity, and molecular structure. **(3T/I)**

5a) For the three different amines in this experiment, **describe** how the number of hydrogen atoms bound to the nitrogen affects the boiling point. **Rank** the amines based on boiling point. **(2T/I)**

5b) **Explain** your ranking based on your knowledge of intermolecular forces, polarity, and molecular structure. **(2T/I)**

**Part D Solubility (3K;10T/I):**

1. **Explain** why some organic compounds are soluble in water. Provide an example to support your explanation. **(2K)**

2. If two solutions are insoluble with each other, **describe** the appearance of a mixture of the two solutions. **(1K)**

3. **Explain** the expression "like dissolves like" when discussing solubility. **Provide** an example that demonstrates the meaning of this expression. **(2T/I)**

4. **Describe** the trend in solubility for alcohols in water as the number of carbons in the parent chain increases. **Explain** why this trend occurs. **Provide** an example to support your answer. **(3T/I)**

5. **Order** the following groups of compounds from most soluble in water to least soluble in water.

   **Primary amines** or **secondary amines** or **tertiary amines**

   **Justify** your reasoning using your knowledge of polarity and intermolecular bonding. **(2T/I)**

6. **Predict** whether an alcohol with a 20-carbon parent chain would be soluble or insoluble in oil. **Justify** your prediction using the solubility rules and your knowledge of molecular structure and polarity. **(3T/I)**