

Post Lab 2: Melting Point and Distillation

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Lab 2: Melting Point and Distillation

Introduction

The melting point is the temperature at which the solid and the liquid state of a chemical substance is at equilibrium. Chemical substances comprise of molecules that are formed through the covalent bonding of atoms, and then the intermolecular forces (IMAFs) attach the molecules. The physical properties of chemical substances are determined in part by their melting points as every single substance has characteristic IMAFs that need a specific amount of energy to be broken. This energy, required as heat, is measured by the temperature at which the substance changes from solid to liquid state. Molecular substances commonly exist as gases, liquids, or low melting point solids. This is because the IMAFs are weak as compared to covalent bonds between atoms and breaking the covalent bonds is not needed in melting or boiling a molecular substance. The melting point of molecular substances is a characteristic figure and is useful in predicting the identity of a particular substance based on the measured melting temperature. Distillation is a conventional chemistry lab technique that is used to separate and purify liquid substances by their boiling points. With liquids being molecular substances, their transition from the liquid state to gaseous state during heating is characterized by a specific temperature, the boiling point. This is the point when the IMAFs between the molecules become weaker, and the molecules drift further apart and as a result the state of the substance changing into being gaseous. In distillation, the liquid with the lowest boiling point is distilled first with the impurities having a different, higher boiling point being left behind. The vapor of the liquid being distilled condenses on the thermometer bulb, and since a liquid substance condenses at the same temperature it boils, the temperature at which it will condense is the boiling point. The

temperature recorded as the boiling point is necessary for the identification of unknown liquids because every liquid substance has a characteristic and specific boiling point.

Results and Discussion

In using the melting point to identify an unknown molecular substance, solid 7A was heated and its melting point recorded as displayed in table1 below.

Table 1: the melting point determination of unknown solid 7A

Melting point of solid 7A	Possible Identities of solid 7A	Melting point of possible identities of solid 7A
98 ⁰ C- 103 ⁰ C	3-Hydroxyacetophenone (ketone)	96 ⁰ C
	Pentanal (2, 4-DNP Derivative) (aldehydes)	98 ⁰ C

The solid started melting at a temperature of 96⁰C and with an allowed range up to 99⁰C, the solid could be either 3-Hydroxyacetophenone (ketone) or 2, 4-DNP Derivative of Pentanal (aldehydes). It is thus plausible to maintain a narrow melting point range to reduce the number of possible substances. Moving below 96⁰C or beyond 99⁰C increases, the number of the possible compounds as the melting point of solid ketones and derivatives of aldehydes has a narrow difference among the various compounds.

In the determination of an unknown using the distillation process, liquid 7B was heated and its boiling point recorded as displayed in table 2 below.

Table 2: the boiling point determination of unknown liquid 7B

Boiling point of Liquid 7B	Possible Identities of Liquid 7B	Boiling Points of the Possible Identities of Liquid 7B
110 ⁰ C- 115 ⁰ C	1-Methoxy-2-propanone	115 ⁰ C

	3,3-Dimethyl-2-butanone (pinacolone)	106 ⁰ C
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The liquid started boiling at an observed temperature of 1100C and so to reduce the possibility of an error in measuring the temperature, a range of 105 -1150C was used. The substances in that boiling point range are 1-Methoxy-2-propanone and 3,3-Dimethyl-2-butanone (pinacolone), with both of them being ketones.

References

Lewis, R. A., & Hawley, G. G. (2016). *Hawley's condensed chemical dictionary*. John Wiley & Sons.