

Experiment 2 Identification of a Compound: Physical Properties

Physical properties are used to identify substances, these are like:

Color, odor, density, solubility, melting point, boiling point, and ^{Solid / Required} state of substance (s, l, g). No need to know the chemical reactivity of the substance in order to notice these physical properties.

^{درجہ الشماره} Purity is a physical property, but chemical tests may be needed in order to determine this property.

Purpose of Today's Experiment:

Identification of a chemical compound ^{اگر کسی} from its solubility, density and boiling point.

Solubility:

▪ The maximum mass of a compound (in grams) that can be dissolved in 100 g of solvent at a given temperature.

▪ This means that the solubility of a chemical differs in different solvents and at different temperatures.

▪ Solubility depends on chemical structure of both solute and solvent, as the solute and solvent are more similar in structure, the solubility of the solute in that solvent will be higher. LIKE DISSOLVES LIKE. Table salt is soluble in water but not in benzene.

LIKE DISSOLVES LIKE

▪ In today's experiment, we will determine the solubility of some substances in three different solvents:

Water : $H_2O \rightarrow$ polar
Cyclohexane : $C_6H_{12} \rightarrow$ non polar

Ethanol : ^{Palaw} C₂H₅OH See the table 2.1 page 44 in your lab. Manual

— The solubility is termed as:

- Soluble (s) (complete dissolution)
- Slightly Soluble (sls) (partial dissolution)
- Insoluble (i)

— The solubility test:

About 10 drops of the unknown solute is added to about 15 drops of the above three different solvents in three different test tubes. Stir and wait.

Density:

- Remember: density = mass/volume
 لو اذن في كمية قليلة من المادة
 في يطلع الكتلته تقريبا كل مرة يعني انه انما الكتلته ما يتغير مع كمية المادة

Higher density substance has larger mass in certain volume.

- Remember: density is an **INTENSIVE** property; its value is **independent** on the **amount** of the substance. The **extensive** property depends on the amount of the substance as explained in experiment one.
 تعتمد على كمية المادة مثلا في
 volume و mass

- When we say a substance is heavy, we mean that large mass can be taken by taking small volume of that substance.

Boiling Point:

مثلا الموي درجة غليانها 100 درجة مئوية
 الضغط الجوي وصلح يعني اذا جيت في الجو عنده ضغطه الجوي يكون مثلا يتكون درجة الغليان
 لا يتغير كلما زاد الضغط
 الجو
 دكلما قل يتقل

- Boiling happens at constant temperature at certain atmospheric pressure. This temperature is called the **BOILING POINT**. It is an **INTENSIVE** property. When liquids boil, the liquid is converted into gas. Constant stream of air bubbles is noticed.

- The boiling temperature depends on the **atmospheric pressure**. When the pressure is 1.0 atm, the boiling point is called **NORMAL** boiling point.
 درجة الغليان تعتمد على
 جوي اتمو 1.0 يتكون
 اسمها درجة الغليان الطبيعية

- The magnitude of the boiling point depends on the **strength** of the intermolecular forces. As the strength of **intermolecular forces** increases the B.P. increases.
 in the sea level

في الكحول الكتلته يتكون قوة الترابط
 بين الجزيئات و ضعيفة (weak)
 لسهل يقول بسهولة من الماء لانه
 له قوة الترابط

درجة الغليان تعتمد على
 جوي اتمو 1.0 يتكون
 اسمها درجة الغليان الطبيعية

الترابطة
 الهيدروجينية
 في الكحول الكتلته
 بين الجزيئات
 من ترابطها
 افعال الكحول كالجزيئات

• إذا كانت نقطة الغليان منخفضة فليكون صاغر الجليان volatile المادة

المواد التي درجة غليانها منخفضة - أي حتى 100 °C boiling point substances
 تكون عادة مواد متطايرة volatile liquid

- Liquids that boil at temperature below 100 are called **VOLATILE** liquids. Their boiling points are experimentally determined by the use of **water bath** **NOT** by **direct heating**. In this experiment your unknown substance is a **volatile compound**.
- Table 2.1, page 44 in your manual, shows some of the physical properties of some solvents. It shows density, B.P., and solubility.

Experimental Part: (Record your observations in your report sheet)

- Solubility (Solubility in cyclohexane, in water and ethanol).
- Density.
- Boiling Point

Results: Find your unknown by comparing your results with those reported in the table 2.1.

Compound	Density (g/mL)	Boiling Point Co	Solubility		
			Water	cyclohexane	Ethanol
Acetone	0.79	56	s	s	s
2-Butanone	0.81	80	s	s	s
Cyclohexane	0.79	81	i	---	s
				s	s
				s	s
				s	s
				s	s
Cyclohexene	0.81	83	i	s	s
				s	s
				s	s
				s	s
				s	s
Ethanol	0.79	79	s	s	----
				s	s
				s	s

				S S S	S S S
Ethylacetate	0.90	77	قابل الذوبان في المذيبات العضوية الغير قطبية (بنزولين لا) sls soluble	S S S S S S	S S S S S S
Heptane	0.68	98	i	s	s
n-Hexane	0.66	68	i	s	s
1-Hexene	0.67	63	i	s	s
isopropanol	0.79	83	s	s	S S S S S S
Methanol	0.79	65	s	s	S S S S S S
n-Propanol	0.81	97	s	s	S S S S S S
Water	1.00	100	----	i	s

Density Demonstration

The Experiment (Demonstrated by Lama Dmour):

Part I: Solubility and Density

Part II: Boiling Point

The End