

# Mystery Substance

## Chemistry

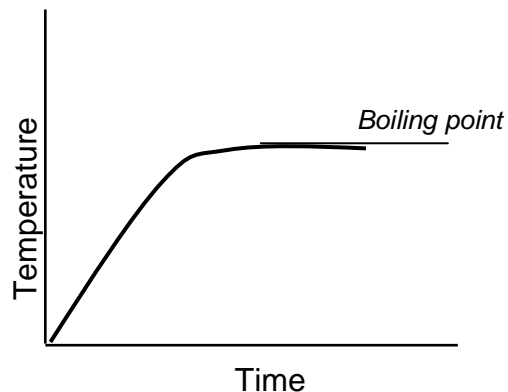
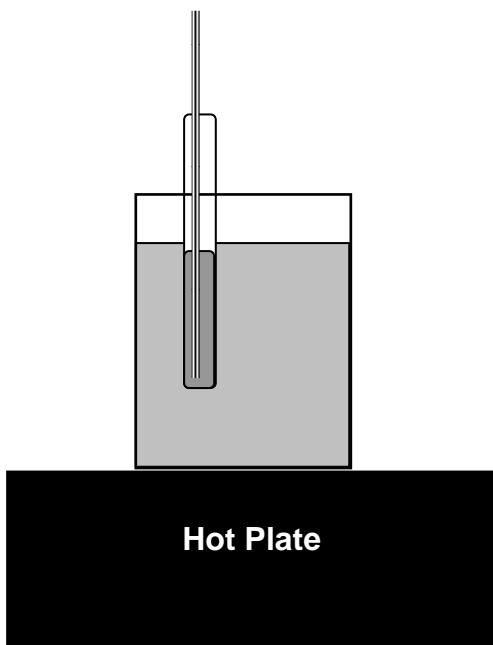
As you know by now, each substance has unique properties that can be used to identify it. In this lab, you will be given a mystery substance and then try to identify it by determining values for some of its properties.

After you have determined the values for certain properties, used the chart at the end of this sheet to help you select the best match and identify your substance.

### Properties

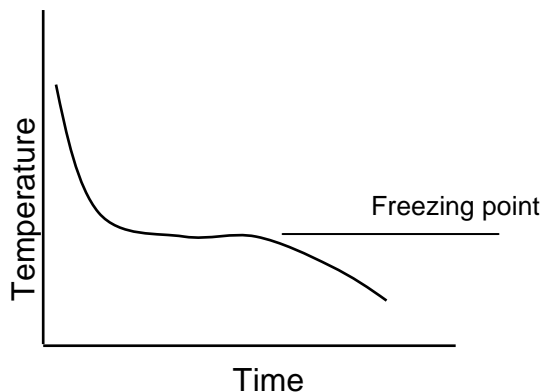
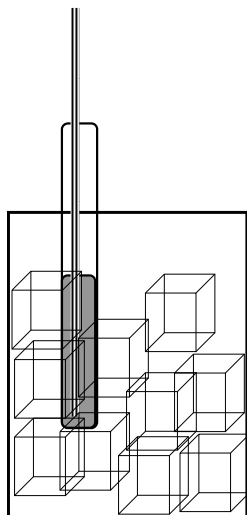
1. Boiling point – if your substance is a liquid, you might be able to determine its boiling point.

*Method – put your substance in a test tube with a thermometer. Lower your test tube into a water bath and slowly heat the water on a hot plate. Record the temperature every 30 seconds until the temperature seems to peak. The boiling point is the peak temperature.*



2. Melting point – if your substance is a solid, you may be able to determine the melting point by using a method similar to the boiling point method above.
3. Freezing point – if your substance is a liquid, you may be able to determine the freezing point.

Method – use a method similar to the melting point above, but put the test tube into a beaker of ice. The temperature will stabilize as the substance crystallizes and then decrease again.



4. Density – you have measured the density of substances before, so you know how to do this.
5. Solubility – your substance may be soluble in alcohol, water, both, or neither. By putting a small amount of your substance into these solvents, you can determine the solubility.
  - Use small amounts! Substances may be soluble in a solvent, but only up to a certain point.
  - For each solvent, determine whether your substance is...
    - Very Soluble**
    - Soluble**
    - Insoluble**

## Report

You need to put all of your data and results into a report. Please include the following...

1. Objective
2. Which sample number you tested
3. Description of which tests you performed
4. Your results for each test, including
  - a. Data chart with data and observations
  - b. Temperature graphs for boiling, melting, and freezing points
5. Conclusions, including
  - a. Which known substance does your mystery substance match best
  - b. Error analysis – what are significant issues with your technique that may have given you erroneous results
  - c. % Error

### Tips & Guidelines

- Neatness and accuracy count! If you messed up during one of the tests, redo it to get more accurate results, don't just accept your poor data.
- Go slow! Hurried measurements include lots of error. You must have accurate measurements to correctly identify your mystery substance.
- Make sure you are reading the scale on measuring devices accurately. Remember to estimate one decimal place beyond the graduation marks.

PHYSICAL PROPERTIES OF SOME COMMON SUBSTANCES					
Substance	Density (g/ml)	Freezing /		Solubility	
		Melting Point (°C)	Boiling Point (°C)	Water	Ethyl Alcohol
Acetic Acid	1.049	16.6	118.1	V	V
Acetone	0.792	-95.0	56.5	V	V
t-Butyl Alcohol	0.789	25.5	82.8	V	V
Cyclohexane	0.779	6.5	80.7	I	V
1,1-Dimethoxyethane	0.847	-113.0	64.5	S	V
Ethyl Alcohol	0.789	-117.0	78.5	V	V
Ethyl Acetate	0.901	-83.6	77.2	S	V
Ethyl propyl ether	0.747	-79.0	64.0	S	V
Ethylene glycol	1.113	-15.6	197.9	V	V
Methyl alcohol	0.796	-97.8	64.6	V	V
Methyl acetate	0.933	-98.1	57.1	S	V
Nitrobenzene	1.198	5.7	210.8	S	V
2-Pentyne	0.711	-109.3	56.0	I	V
2-Propanethiol	0.806	-130.7	60.0	S	V
1-Propyl alcohol	0.804	-127.0	97.2	V	V
2-propyl alcohol	0.785	-89.5	82.4	V	V
Toluene	0.867	-95.0	110.6	I	V
Trichlorotrifluoroethane	1.510	-35.0	47.6	I	V
Water	1.000	0.0	100.0	V	V