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Partner Name:

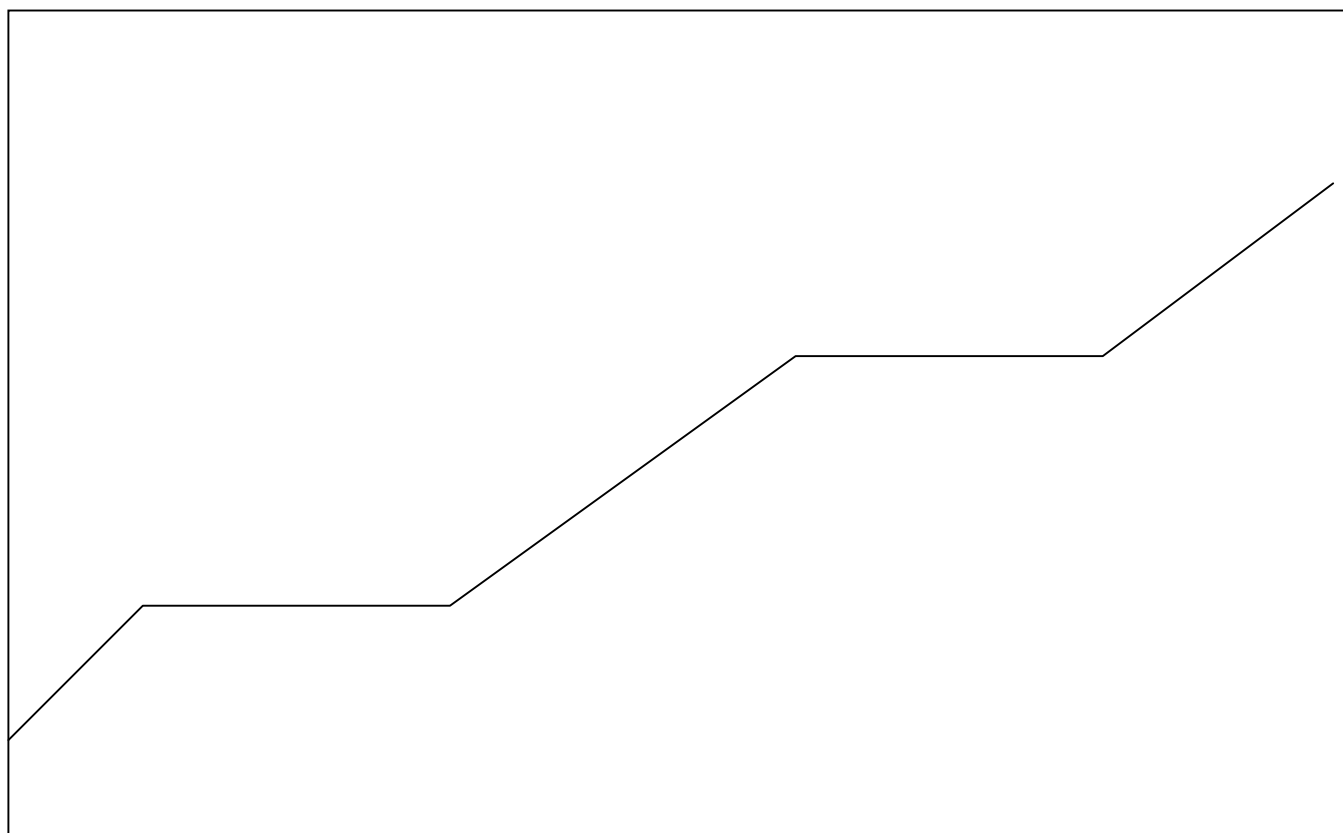
Laboratory 4: Liquids and Solids

Lecture Notes

What are the six different changes of state?

Change	Name	Example
Solid \rightarrow liquid		
Solid \rightarrow gas		
Liquid \rightarrow gas		
Liquid \rightarrow solid		
Gas \rightarrow liquid		
Gas \rightarrow solid		

What causes a change in state?



Purpose: To develop a theory that explains why liquids and solids behave the way they do.

Procedure and Observations and Data:

- In this lab you will work in groups of three. Go to each station (not necessarily in order) and follow the directions on the instruction card.
- Record observations and give a brief explanation for each station.
- Draw a diagram (model) for stations 2, 5 and 6 showing at the molecular level, what the particles are doing.

- Station one:** Drops on a penny
Station two: Boyle's law apparatus: Noncompressibility of liquids
Station three: Drops on a microslide
Station four: Floating a paper clip on water
Station five: Food coloring in hot and cold water
Station six: Marbles in different liquids
Station seven: Dragging drops
Station eight: Observing crystals

Return each station to its original condition when your group is finished.

Calculations

None

Stations

Station one: Drops on a penny

Materials: Beaker of de-ionized water and a beaker of soapy water, droppers in each and 2 pennies.

Challenge: Put as many drops of de-ionized water on one of the pennies and then as many drops of soapy water on the other penny.

Observations:

How many drops of pure water fit onto the penny? _____

How many drops of soapy water fit onto the penny? _____

Explain the difference

What property(s) of liquids is/are demonstrated here? How?

Station two: Boyle's law apparatus noncompressibility of liquids

Materials: 2 Boyle's Law apparatus, (syringes): one with water, and one with water and air.

Procedure: Try pressing on the two blocks. (Don't press too hard)

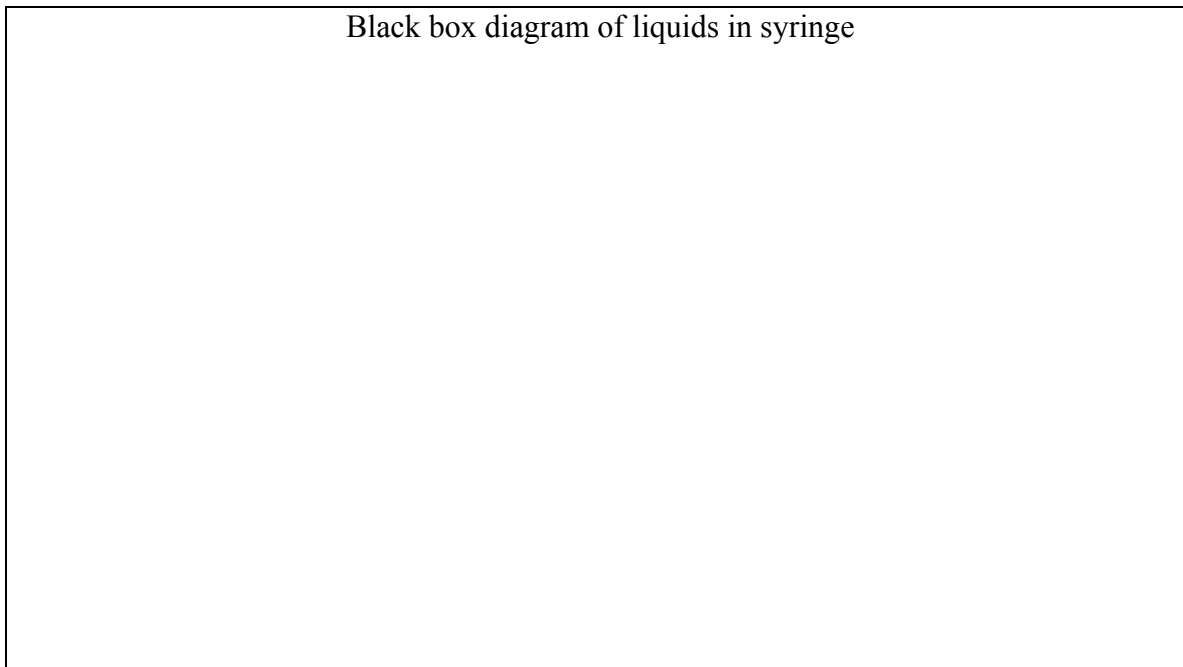
Observations:

What is the difference between the two?

What causes the difference between the two?

What property(s) of liquids is/are demonstrated here? How?

Black box diagram of liquids in syringe



Station three: Drops on a microslide

Materials: 6 microslides, two droppers, a 100 ml beaker of water, and a 100 ml beaker of soapy water

Procedure:

Put two dry microslides together and then pull them apart.

Put a drop of water on two slides. Place them together and then pull them apart.

Put a drop of soapy water on two slides place them together and then pull them apart.

Observations:

What was it like pulling the three different pairs of microslides apart?
Explain the difference.

What property(s) of liquids is/are demonstrated here? How?

Station four: Floating a paper clip on water

Materials: 2-600 ml beakers, one with de-ionized water and one with soapy water, 4 paper clips

Procedure: Using one of the opened paper clips, try to make another paper clip float on the surface of the water in the beaker.

Observations:

Was it easier to float the paper clip in one of the beakers? Explain why.

What property(s) of liquids is/are demonstrated here? How?

Station five: Food coloring in hot and cold water

Materials: Hot plate, beaker tongs, 2-1000 ml beakers, ice, 2 - 250 ml beakers, food coloring

Procedure: Using the beaker tongs, pour some hot water from the beaker on the hot plate into one of the empty beakers. Pour some of the ice water (without pouring any ice) into the other empty beaker. Add one drop of food coloring to each of the beakers you poured water into. Remember to add clear de-ionized water to the hot beaker and a little ice to the ice water beaker.

Record your observations.

What property(s) of liquids is/are demonstrated here? How?

Black Box diagram:

Food coloring in hot water	Food coloring in cold water

Station six: marbles in 3 different liquids

Materials: Three marbles each in a labeled and sealed jar/bottle of water, oil, and glycerin

Procedure: Invert the three flasks and watch the marbles go to the bottom of each bottle

Observations:

Did the marbles fall through the liquids at the same rate? Explain

Draw 3 black box diagrams that show at the molecular level why the marbles fall at different rates in the different liquids:

Alcohol	Water	Glycerin

What property(s) of liquids is/are demonstrated here? How?

Station seven: Dragging drops

Materials: 2 sheets of wax paper, two eyedroppers, beaker of de-ionized water and a beaker of soapy water.

Procedure: Put drops of water from each beaker onto the separate pieces of wax paper (do not contaminate the beakers by switching droppers.)

Try to drag the drops around with the dropper

Observations:

How many drops of the soapy water could you drag? _____

How many drops of the de-ionized water could you drag? _____

What property(s) of liquids is/are demonstrated here? How?

Station Eight: Observing Crystals

Materials: Examples of several crystals, models of crystals.

Make some observations about the crystals.

How are they different from each other?

What property(s) of solids is/are demonstrated here? How?

Look at the models of the crystals. What do you observe? What is the major difference between liquids and solids?

Questions and Answers:

What properties of liquids are different from gases?

What causes this difference?

Do you like to have a lecture and then a hands-on activity or do you like the reverse order when you learn a difficult concept?

Draw a black box diagram that shows the difference between gases solids and liquids.

Gases	Liquids	Solids

Conclusions and Reflections

How do experiments at different stations help you learn?

Explain how the Black box diagrams help you better understand the concept behind the definitions? If they do not help your understanding, why?

1. Assessment: Mystery Liquid (Instructor's option)

Tray of Ooblek (Corn starch and water)