

Name \_\_\_\_\_

Date \_\_\_\_\_ Hour \_\_\_\_\_

## 6A Bond Types

### Goal




- Investigate some of the physical properties of substances containing ionic, covalent, and metallic bonds.

### Prelab

### Concepts

Ionic, covalent, and metallic bonds largely determine the physical properties of substances. Therefore, if you observe the physical properties of a substance, you can often determine its bond type. Notice in Table 6A-1 the properties that result from each bond type.

Table 6A-1

Bond Types			
1. Type of Bond	Ionic Bond	Covalent Bond	Metallic Bond
2. Description	Transferred electrons	Shared electrons	Free electrons
3. Smallest Unit	Formula unit 	Molecule 	Atom 
4. Melting Point	Forms solids with high melting points	Forms solids with low melting points, liquids, and gases	Forms solids with relatively high melting points
5. Solubility	Often soluble in water but insoluble in organic solvents	Usually insoluble in water but soluble in organic solvents	Insoluble in water and insoluble in organic solvents
6. Conductivity	Compounds conduct electricity when melted or dissolved.	Compounds usually do not conduct electricity.	Pure metals and alloys conduct electricity well.

In this experiment you will examine the melting points, solubilities, and conductivities of several solids in order to establish the type of bonds they contain.

### Checkup

- What can you often determine from the physical properties of substances?  
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- If a substance has a high melting point and is insoluble in an organic solvent, what type(s) of bonds could it contain?  
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- If a substance has a high melting point and is soluble in water, what type(s) of bond(s) could it contain?  
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4. How will a conductivity tester indicate that an electrical current is flowing?

### Materials

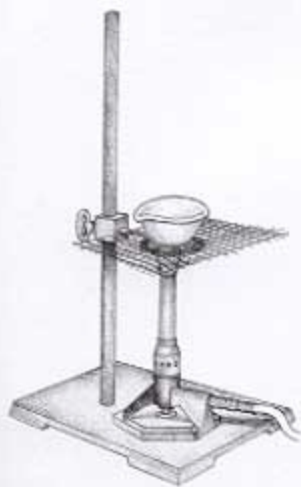
balance	acetone
Bunsen burner	unknowns, three
conductivity tester	
evaporating dish	
goggles	
iron ring	
laboratory apron	
matches	
ring stand	
test tubes, six	
weighing paper	
wire gauze	

### Procedure

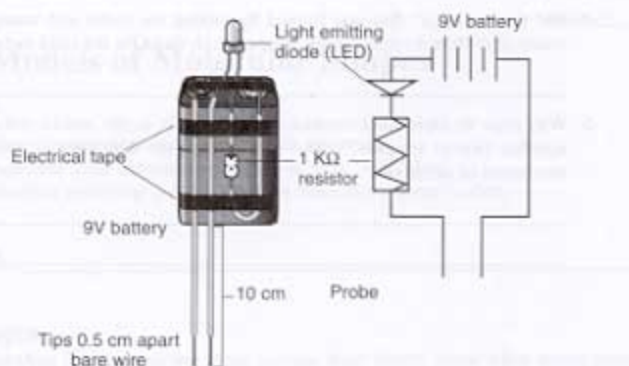
- Obtain small samples of the three unknowns provided by your teacher. Put each sample on a separate piece of weighing paper.
- Observe the substances during heating.
  - Set up an apparatus according to Figure 6A-2.
  - Place a small amount (about the size of an uncooked grain of rice) of unknown 1 in an evaporating dish. Set the dish on the wire gauze and gently heat the contents.
  - If the unknown does not readily melt, heat it strongly for a minute or two. Describe the ease of melting. (Record: 1.) Repeat for unknowns 2 and 3. (Record: 1.)
- Observe the solubility.
  - Solubility in water.
 

Attempt to prepare a solution of unknown 1 by placing a small amount of the substance (about the size of a grain of rice) in a test tube and adding about an inch of water. Note the relative solubility. (Record: 2.) Save for step 4. Repeat the test for relative solubility with unknown 2 and then with unknown 3. (Record: 2.) Be sure to save each mixture in separate labeled test tubes for step 4.
  - Solubility in acetone.
 

Repeat the solubility test for each unknown, using similar amounts of acetone and unknown as you did for water and unknown in 3a. Note the relative solubility of each. (Record: 3.) Save these mixtures.
- Observe the conductivity.
  - Lower the two electrodes of the conductivity tester (Figure 6A-3) into the mixture that you prepared for unknown 1 in step 3a. If the sample conducts, the circuit will be complete and the light will glow. Did the sample conduct? (Record: 4.) Repeat the conductivity test for the aqueous ("water") mixtures of unknowns 2 and 3. Rinse the electrodes between tests. (Record: 4.) Pour your mixtures into the aqueous waste container when you are finished with them.
  - Repeat the conductivity tests for your three unknowns, using the acetone-unknown mixtures from step 3b. Note whether or not they conduct. (Record: 5.) Pour your mixtures into the acetone waste container when you are finished with them.
  - Test the conductivity of the remaining small amounts of each unknown *solid* by touching the electrodes to each. (Record: 6.)



6A-2 Heating apparatus



6A-3 Conductivity tester and wiring diagram

**Data**

	Unknown 1	Unknown 2	Unknown 3
1. Melting			
2. Solubility in H <sub>2</sub> O			
3. Solubility in CH <sub>3</sub> COCH <sub>3</sub> (acetone)			
4. Conductivity of the aqueous mixture			
5. Conductivity of the acetone mixture			
6. Conductivity of the solid			

**Analysis**

- Identify the bond type in each of the substances tested.  
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- On the basis of your electrical conductivity tests, describe the conductivity of the three types of bonds, both in solution and as the solid.  
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- As you will learn in more depth in Section 12A of your text, a rule of thumb that is often used in chemistry is "like dissolves like." Did the substances you used in this lab follow that rule? Explain.  
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