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Inquiry Lab

**Using Scientific Methods** 

# **Ionic and Covalent Conductivity**

The structural nature of ionic and covalent compounds causes their physical properties to differ dramatically. For instance, ionic compounds separate into their individually charged ions when combined with water. Covalently bonded molecules, depending on their shape and thus the distribution of charge on them, may not dissolve in water at all. Even if they do, this is often due to breaking of weak bonds between the molecules, rather than dissociation of the molecule itself. The degree of separation of a substance into ions or uncharged molecules in solution can be determined by how well the solution conducts electricity. As charge carriers, ions can move easily though a solution, and so conduct electricity well, whereas uncharged molecules do not. In this lab, you will determine whether various compounds are ionic or covalent according to how well they conduct electricity.

## **OBJECTIVES**

Using Scientific Methods Test how electrical conductivity varies with chemical composition.

**Compare** and contrast the electrical conductivities of different solutions. **Infer** which solutions are ionic or covalent based on how well they conduct electricity.

## **MATERIALS**

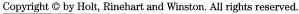
- baking soda, 35 g
- beakers, 250 mL, 7
- distilled water, 750 mL
- flashlight bulb, 6 V
- grain alcohol (ethanol), 150 mL
- granulated sugar, 150 g

- insulated copper wire, 20 cm long, 3
- lantern battery, 6 V
- silica gel, 25 g
- socket for 6 V bulb
- table salt, 25 g
- vinegar, 150 mL



#### **ASK A QUESTION**

**1.** How might electrical conductivity indicate the presence or absence of ions in a solution?



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FORM A HYP	POTHESIS	ent Conductiv		
2. Form a hy	ypothesis that ans	wers your question. Ex	plain your reasor	ning.
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#### **TEST THE HYPOTHESIS**

- 3. Strip off 1 cm of the insulation from both ends of each piece of copper wire. Construct the conductivity tester by connecting one length of copper wire between the socket and the battery, another wire to the other battery terminal, and the third wire to the other socket terminal. Screw the bulb into the socket, and test the device by touching the two loose ends of copper wire to each other and noting if the bulb lights up. CAUTION: Do not touch the exposed ends of the copper wire. Handle the wire only using the insulated portion. Use care when handling copper wire. It can scratch or puncture the skin.
- 4. Pour 150 mL of distilled water into each of five beakers.
- **5.** Prepare four solutions by dissolving the table salt, baking soda, sugar, and silica gel into four of the five beakers of water. Label each beaker with a number and a description of its contents.
- **6.** Pour 150 mL of alcohol into a sixth beaker, and 150 mL of vinegar into a seventh beaker. Label each beaker with a number and a description of its contents. **CAUTION:** Do not use alcohol near an open flame.
- **7.** Place the ends of the conductivity tester's wires into each of the seven beakers. Note whether the lamp burns brightly, dimly, or not at all. Record your observations in the table.

# TABLE: IONIC AND COVALENT CONDUCTIVITY

Solution	Lamp Burns Brightly	Lamp Burns Dimly	Lamp Does Not Burn
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Distilled Water and Table Salt		4 . A.	Contrologia.
Distilled Water and Baking Soda			
Distilled Water and Sugar		**	,
Distilled Water and Silica Gel	Conservation Prof	e di la raya	
150 mL Alcohol	i de guiet de la	afwathea 14	* * * * * * * * * * * * * * * * * * *
150 mL Vinegar			

8. When you've completed your of to your teacher's instructions, a Disconnect the wires of the combands thoroughly with soap or ANALYZE THE RESULTS  1. Making Comparisons Which so tions were weak conductors of conclusions? Explain your answers.  2. Analyzing Results Which solutions appeared to contain covariance.	oservations, dispond and thoroughly rinductivity tester for detergent when the lutions conducted electricity? What	nse out each of the beakers. From the battery. Wash your he lab is completed. d electricity well? Which solu-
<ul> <li>8. When you've completed your of to your teacher's instructions, a Disconnect the wires of the combands thoroughly with soap or ANALYZE THE RESULTS</li> <li>1. Making Comparisons Which so tions were weak conductors of conclusions? Explain your answere weak to the conclusions of the conclusions which so the conclusions were weak conductors of the conclusions of the conclusions which so the conclusions were weak conductors of the conclusions.</li> <li>2. Analyzing Results Which solutions were weak which were weak which solutions which were weak which was also were weak which were well which were well which were well were well when we want which were well when we want which we will well with t</li></ul>	oservations, dispond and thoroughly rinductivity tester for detergent when the lutions conducted electricity? What	nse out each of the beakers. From the battery. Wash your he lab is completed. d electricity well? Which solu-
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Making Comparisons Which so tions were weak conductors of conclusions? Explain your answer.      Analyzing Results Which solutions.	electricity? What	d electricity well? Which solu- t observations led to these
2. Analyzing Results Which solutitions appeared to contain cova		
2. Analyzing Results Which solutions appeared to contain cova		
	ons contained ion lent compounds?	nic compounds? Which solu- Explain your answer.
DRAW CONCLUSIONS		
<b>3. Evaluating Methods</b> What do y mine the conductivity of a solu		ve limited your ability to deter
<b>4. Drawing Conclusions</b> How doe tested relate to electrical cond		omposition of the solutions

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Holt Earth Science

Earth Chemistry

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