LESSON MAKER PRO

Current Clues

Use circuit measurements to investigate bonding.

HIGH SCHOOL · CHE.2.c

CHE.2.c "Plan and carry out an investigation to identify specific physical and chemical properties of compounds formed from ionic, covalent, and metallic bonding."

NAME _____ DATE _____

COMPARE CONDUCTANCE

Conductance = current / voltage. Test a dry solid first, then test it in water if it dissolves, using the same circuit setup. Among the samples in this worksheet, a metal conducts as a solid, a soluble ionic compound conducts after dissolving, and a molecular covalent compound that forms no ions does not conduct in either test.

WORKED EXAMPLE

A dry sample produces a current of 10 mA at 5 V. Find its conductance and identify its likely bonding.

1. Conductance = current / voltage.
2. Conductance = 10 mA / 5 V = 2 mA/V.
3. The dry solid conducts, which supports metallic bonding.

Answer: 2 mA/V; metallic bonding

PRACTICE 6 problems

1 Find the dry sample's conductance and identify its likely bonding.

DRY SAMPLE TEST

Voltage	Current
3 V	9 mA

ANSWER _____

2 This sample dissolves in water. Find the solution's conductance and identify the sample's likely bonding.

SAMPLE TESTS

Test	Voltage	Current
Dry solid	3 V	0 mA
Dissolved in water	3 V	6 mA

ANSWER _____

3 This sample dissolves in water. Which type of bonding does the evidence support?

SAMPLE TESTS

Test	Voltage	Current
Dry solid	3 V	0 mA
Dissolved in water	3 V	0 mA

ANSWER _____

4 All tests used 3 V. Which sample is likely ionic? Find its conductance after dissolving.

UNKNOWN SAMPLE CURRENTS

Sample	Dry solid	In water
A	0 mA	12 mA after dissolving
B	6 mA	Did not dissolve
C	0 mA	0 mA after dissolving

ANSWER _____

5 Two soluble salts were tested at the same voltage. How many times as great is the conductance of salt A's solution as that of salt B's solution?

SALT SOLUTION TESTS

Solution	Voltage	Current
Salt A	3 V	18 mA
Salt B	3 V	6 mA

ANSWER _____

6 An unknown dry solid produces 0 mA at 3 V. What test would help you decide whether it is a soluble ionic compound or a molecular covalent compound that forms no ions in water? State the result that would support ionic bonding.

ANSWER _____

APPLY IT Show your work

1 A student making a sports drink compares two powders, one containing sodium chloride and the other containing sucrose. Both dissolve in water. Which powder contains sodium chloride, and what is that solution's conductance?

POWDER TESTS

Powder	Dry current at 3 V	Solution current at 3 V
A	0 mA	15 mA
B	0 mA	0 mA

ANSWER _____

2 An electronics club tests a metal wire and a plastic coating before repairing a headset cable. Find the difference between their dry-sample conductances. Which material should carry the current?

CABLE MATERIAL TESTS

Material	Voltage	Dry-sample current
Metal wire	3 V	12 mA
Plastic coating	3 V	0 mA

ANSWER _____

CHALLENGE One step up

Two samples were tested at different voltages. Sample A dissolved in water, but sample B did not. Which tested form has the greater conductance, by how much, and what bonding does each sample likely have? Explain why comparing the currents alone could mislead you.

TESTS AT DIFFERENT VOLTAGES

Sample and test	Voltage	Current
A, dry solid	3 V	0 mA
A, dissolved in water	6 V	12 mA
B, dry solid	3 V	9 mA

WORK SPACE AND ANSWER

Current Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the dry sample's conductance and identify its likely bonding.	**3 mA/V; metallic bonding**
2	This sample dissolves in water. Find the solution's conductance and identify the sample's likely bonding.	**2 mA/V; ionic bonding**
3	This sample dissolves in water. Which type of bonding does the evidence support?	**Molecular covalent bonding**
4	All tests used 3 V. Which sample is likely ionic? Find its conductance after dissolving.	**Sample A; 4 mA/V**
5	Two soluble salts were tested at the same voltage. How many times as great is the conductance of salt A's solution as that of salt B's solution?	**3 times as great**
6	An unknown dry solid produces 0 mA at 3 V. What test would help you decide whether it is a soluble ionic compound or a molecular covalent compound that forms no ions in water? State the result that would support ionic bonding.	**Dissolve the sample in water and test the solution at 3 V. A current greater than 0 mA would support ionic bonding.**

PART 2 · APPLY IT

1. **Powder A; 5 mA/V** Powder A's solution conducts, which supports identifying it as the sodium chloride powder. Its conductance is 15 mA / 3 V = 5 mA/V.
2. **4 mA/V; metal wire** The wire's conductance is 12 / 3 = 4 mA/V, and the coating's is 0 / 3 = 0 mA/V. The wire conducts and should carry the current.

CHALLENGE

B's dry solid has the greater conductance by 1 mA/V. A's solution has 12 / 6 = 2 mA/V, and B's dry solid has 9 / 3 = 3 mA/V. A is likely ionic, and B is likely metallic. Comparing 12 mA with 9 mA alone is misleading because the tests used different voltages.

Accept equivalent descriptions of ionic, molecular covalent, and metallic bonding. These identifications rely on the stated sample types and circuit tests; conductivity alone does not identify every substance.