Bonds Under Test

Use material data to predict bonding and conductivity

PS.4.c "Analyze and interpret data to predict properties of ionic and covalent compounds."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the measurements used to infer bonding, circle the explanations of how charge moves, and number the two table rows that best support a water-based electrical sensor.

Which Materials Carry Charge?

1. A materials lab needs a substance for an electrical sensor that will work in water. A label saying "dissolves" cannot predict whether the sensor will work. Scientists compare melting points and electrical conductivity in different states to infer particles and bonding. A high melting point can signal strong attraction between ions, but one measurement alone cannot settle the question.

2. An ionic solid contains positive and negative ions held in a rigid arrangement. Its ions cannot move freely, so the solid usually does not conduct electricity. When the substance melts or dissolves in water, mobile ions can carry charge. A molecular covalent substance consists of separate molecules that usually remain electrically neutral in water and as a liquid.

3. Use the table as evidence, not as a list of labels. Similar-looking samples can behave differently in water, and dissolving does not guarantee electrical conduction. A water mixture that conducts strongly supplies evidence of moving charged particles. Melting point provides another clue, but some covalent substances form networks with very high melting points. Report a prediction rather than certainty.

MEASURED PROPERTIES OF FOUR SUBSTANCES

Substance	Melting point (°C)	Dissolves or mixes with water?	Solid conducts?	Water mixture conducts?
Sodium chloride (NaCl)	801	Yes	No	Yes
Potassium chloride (KCl)	770	Yes	No	Yes
Ethanol (C_2H_5OH)	−114	Yes	No	No
Naphthalene ($C_{10}H_8$)	80	Very little	No	No

2 ANSWER WITH EVIDENCE

Use the passage

1. Which two substances would you choose for the water-based sensor? Use two measurements from the table to support your prediction.

2. Which substance mixes with water but would fail to carry charge for the sensor? What does its result suggest about its particles in water?

3. Predict whether molten naphthalene would conduct electricity. Use two table results as evidence, and explain why your prediction is not certain.

4. Sodium chloride does not conduct as a solid, but its water mixture does. Predict whether molten sodium chloride would conduct, and explain both results using particle movement.

3 YOUR TURN

Your own words

Invent a new sample Z with a plausible melting point and two electrical test results, one for its solid and one for its melt. In four sentences, predict whether Z is ionic or molecular covalent, compare its pattern with a substance in the table, and name one limit of your evidence.

ANSWER KEY

Bonds Under Test

HIGH SCHOOL · PS.4.c

PART 1 · READ AND MARK

Underline the measurements used to infer bonding, circle the explanations of how charge moves, and number the two table rows that best support a water-based electrical sensor. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which two substances would you choose for the water-based sensor? Use two measurements from the table to support your prediction.	**Sodium chloride and potassium chloride. Both dissolve in water, and both water mixtures conduct electricity.**
2	Which substance mixes with water but would fail to carry charge for the sensor? What does its result suggest about its particles in water?	**Ethanol mixes with water, but the mixture does not conduct. It does not supply appreciable mobile ions.**
3	Predict whether molten naphthalene would conduct electricity. Use two table results as evidence, and explain why your prediction is not certain.	**It probably would not conduct. Its relatively low melting point and nonconducting water mixture suggest separate, neutral molecules, but the table does not test molten naphthalene directly.**
4	Sodium chloride does not conduct as a solid, but its water mixture does. Predict whether molten sodium chloride would conduct, and explain both results using particle movement.	**Molten sodium chloride would conduct. Its ions cannot move freely in the solid, but they can move and carry charge in water or when melted.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sample Z melts at 630 °C and does not conduct as a solid, but its melt conducts. I predict Z is ionic because its melted particles can carry charge. Like potassium chloride, Z has a high melting point and does not conduct as a solid. The table does not test molten potassium chloride, so that comparison alone cannot prove Z's bonding.

Accept predictions supported by a consistent set of invented measurements and a valid comparison. Students should distinguish evidence for a bond type from proof of it.