Lab 4: Properties of Ionic vs Covalent Compounds

Name: _____ Partner(s): _____

Date: _____ Period: _____

Purpose:

Use solubility, conductivity, and melting behavior to classify substances as ionic or covalent.

Standards: *HS-PS1-1, HS-PS1-2, HS-PS1-3*

Materials & Equipment:

• NaCl, $CaCl_2$, sucrose, paraffin wax, unknown

• Distilled water; 100 mL beakers; stirring rods; conductivity tester/probe

• Hot plate; foil; spatula; tongs; safety gear

Procedure:

1. Label samples. Test solubility: add a spatula-tip amount to 10 mL water; stir and record.

2. Test conductivity of the solution using a probe/tester; record qualitative level (none/weak/strong).

3. Place a small amount of each dry sample on foil and gently heat on a hot plate; note softening/melting (teacher assists).

4. Classify each sample as ionic or covalent and justify using your data.

Data & Observations:

Substance	Solubility in Water	Conductivity (aq)	Melting/Softening	Classification	Justification
NaCl					
$CaCl_2$					
Sucrose					
Paraffin wax					
Unknown					

Analysis Questions:

1. Explain why most ionic compounds conduct in aqueous solution, while most covalent compounds do not.

2. Two samples were both soluble but had different conductivity. Explain this difference.

3. Your unknown produced mixed results. Propose two follow-up tests to clarify classification.

Conclusion (CER):

1. **Claim**: Classify each substance (including the unknown) as ionic or covalent.

2. **Evidence**: Cite your observed solubility, conductivity, and melting/softening behavior.

3. **Reasoning**: Explain structure–property links (ions vs molecules, mobile charge carriers, intermolecular forces).

4. **Error/Improvement**: Note measurement/technique limits and propose follow-up tests to confirm your classification.

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*Weights: Only **Analysis & Explanations (×2)** and **Conclusion (×2)** are doubled.*

Criterion	1	2	3	4	5
Experimental Technique	Unsafe; frequent errors; mishandles equipment.	Basic technique; corrections needed; some unsafe moments.	Correct technique; minor issues; follows directions.	Careful, consistent technique; minimizes error; appropriate repeats.	Exemplary precision; anticipates pitfalls; models best practices.
Data & Observations	Sparse/incorrect; missing key fields.	Basic records; limited detail; some omissions.	Complete with units/notes; legible tables.	Detailed; compares across properties; anomalies flagged.	Exceptional; justifications embedded; uncertainty acknowledged.
Analysis & Explanations (×2)	Minimal/incorrect; weak links to structure.	Partial reasoning; generic structure–property claims.	Correct reasoning supported by data.	Strong structure–property links; addresses anomalies/errors.	Sophisticated reasoning; mechanism-level explanations; evaluates alternatives.
Conclusion (×2)	No/weak claim; unsupported.	Vague claim; limited evidence.	Clear claim; some evidence cited.	Well-supported claim; multiple data points referenced.	Compelling claim; integrates quantitative /qualitative evidence.
Clarity & Mechanics	Disorganized; frequent grammar/format issues impede understanding.	Partly organized; several errors; hard to follow at times.	Generally clear; minor errors; readable structure.	Well organized; concise; almost no errors; visuals/tables support text.	Polished, professional scientific writing; precise vocabulary; flawless formatting.