Investigation Activity

Science Inquiry Skills Focus

— Comparing Ionic and Molecular Compounds —

Purpose

To classify substances as ionic or molecular based on their properties

Materials and Equipment

6 stations each equipped with:

- hot plate
- aluminum foil
- test tubes
- sink and water
- conductivity apparatus
- one of the following substances:
  - table salt
  - table sugar
  - candle wax
  - potassium chloride
  - Epsom salts
  - mothball flakes

Safety Notes

- Put on approved safety eyewear before starting this investigation.
- Handle glassware with care.
- **Caution:** Mothball flakes release toxic fumes during heating. Mothball flakes MUST only be heated in a fume hood. If a fume hood is not available, leave out this step.
- **Caution:** Be extra careful around hot surfaces and chemicals.

Procedure

Work at stations. Go to all the stations in any order. Each station will be identified with the name of the chemical that you will examine there. At each station, complete the following steps.

1. Place a small amount of the test material (about the size of a pea) onto a small sheet of aluminum foil. Examine the material and note, in particular, whether it appears to be crystalline or not.
2. Carefully smell the sample. Remember: always smell a substance in the lab by wafting. Record whether or not the sample has an odour.
3. Using a spatula or pair of tongs, try to crush a piece of the sample. Note your findings.
4. Take the smallest sample you can pick up and place it in a test tube with some water. Do not use a large sample. It is difficult to tell whether a large sample dissolves. Always use the very smallest sample you can see and handle. Shake the mixture and note whether the sample dissolves. If it does dissolve, then record it as "soluble."
5. For each sample that dissolved, test the solution to see if it conducts electricity.
6. Place the aluminum sheet with the pea-sized sample on it onto the hot plate. (**Note**: Mothball flakes MUST be heated in a fume hood.) Time how long it takes the sample to melt. Take the aluminum sheet off the hot plate after the sample has melted or after 2 min, whichever comes first. Wrap the sample up in the aluminum sheet and dispose of it in the garbage.
7. After finishing at each station, clean up, and leave the station tidy. Wash your hands thoroughly before leaving the lab.

Questions

1. Use the following procedure to draw a Venn diagram relating the six substances you have tested in this investigation.

   a) Draw two overlapping circles that are large enough to write the names of several substances tested in your investigation.

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b) In part of one circle that does NOT overlap with the other circle, write "candle wax." In the part of the other circle that does not overlap, write "table salt."

c) Write the names of other substances that are similar to candle wax or table salt in the appropriate parts of the circles that do not overlap. If any substances seem to be similar to both candle wax and table salt, write their names in the part where the circles overlap.

2. Ionic substances conduct electricity in solution. Use this information to decide which part of the Venn diagram represents ionic substances. Label each of the three parts of the Venn diagram as "ionic," "molecular," or "properties of both."

Conclusion

The chemical formulas for the six substances are:

- table salt: NaCl
- table sugar: $C_{12}H_{22}O_{11}$
- candle wax: $C_{18}H_{38}$
- potassium chloride: KCl
- Epsom salts: $MgSO_4$
- mothball flakes: $C_{10}H_8$

Note the elements present in each of the formulas, and suggest a connection between the formula of a compound and whether it is ionic or molecular.

3.2.1 Review Questions

1. What is a compound?

2. Distinguish between the terms "formula unit" and "molecule."

3. What is a crystal lattice?

4. Complete the following table:

Type of Compound	Type of Bond	Metal and/or Non-Metal	Name of Smallest Unit
Ionic compound			
Molecular compound			