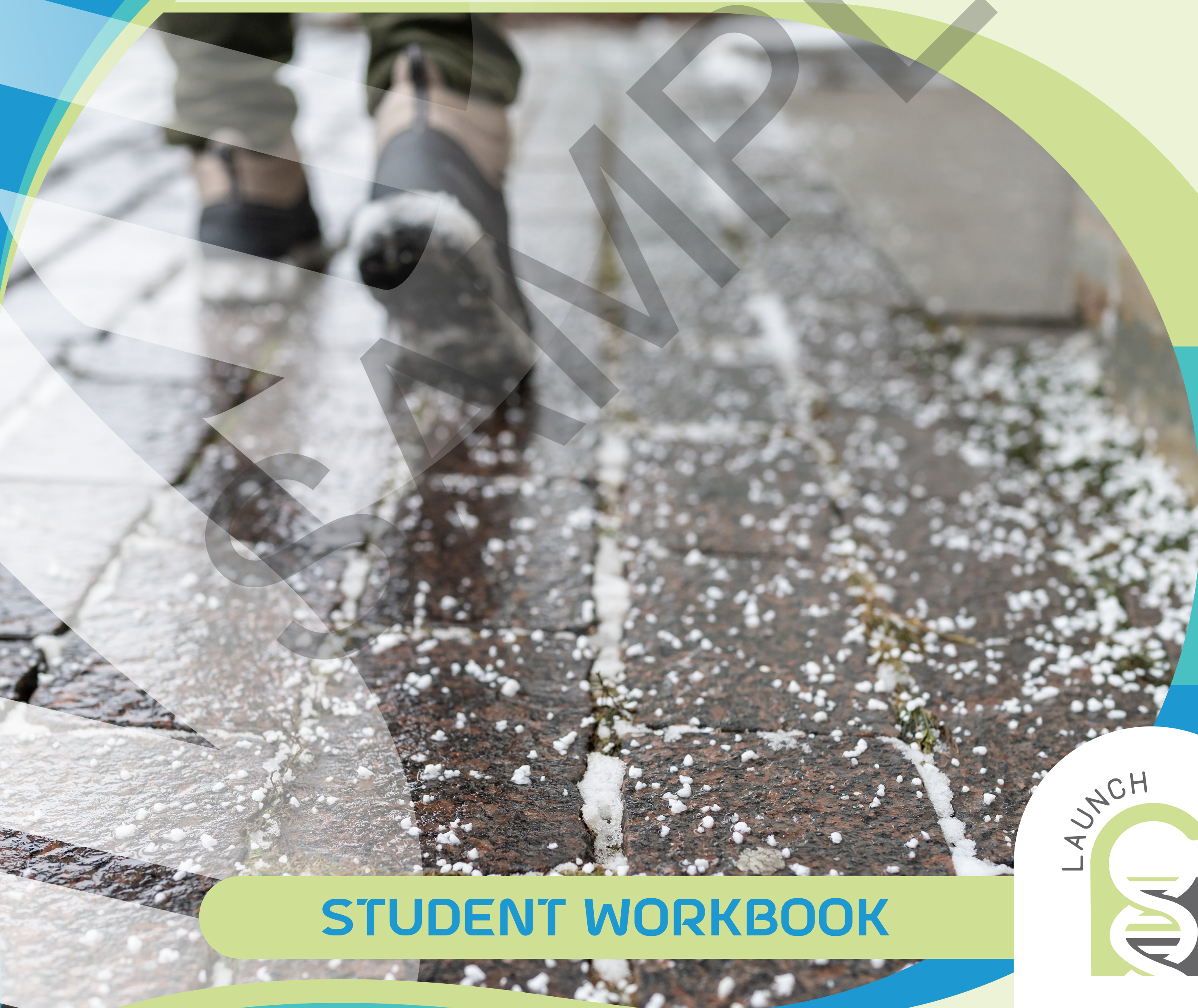
SALTY STATES



STUDENT WORKBOOK

LAUNCH

THINK ABOUT IT!

1. Summarize the results of the vapor races. What were the fastest and slowest liquids to evaporate? Were your predictions correct? Explain.

2. What do you think explains the differences in the evaporation rates?

3. What are two questions you have about the evaporation rates of these liquids, or about these liquids in general?

STATE AND TEMPERATURE

2

States of Matter

The liquids in the vapor races changed to gases at varying rates. What caused those differences? In this subsection and the next, you will gain the precise vocabulary needed to explain what happened.

First, what exactly are liquids and gases? They are two of the three common states of matter, with the third being solid. Each is different on a particle level, which is even smaller than microscopic – the level of a single molecule or atom.

- A **liquid** is a state of matter in which particles are further apart and faster-moving than in a solid and easily move past each other.
- A **gas** is a state of matter in which particles are very far apart, move faster than in a liquid, and are very disorderly.
- A **solid** is a state of matter in which particles have an orderly arrangement, are close together, and are vibrating in place.

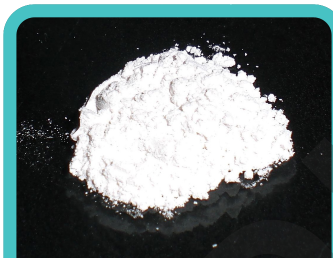
Interesting Ions

Later in Activity 2, you will be dissolving a solid, rather than a liquid, in water. The solid you will be dissolving is sodium chloride, which you probably know from everyday life as table salt.

When used in chemistry, the term "salt" is a general term for a certain type of substance, not just sodium chloride. A **salt** is an ionic compound made of positively charged and negatively charged ions, resulting in no overall charge. An **ion** is an atom or molecule with an electrical charge. Positively charged ions are called **cations**, and negatively charged ions are called **anions.**

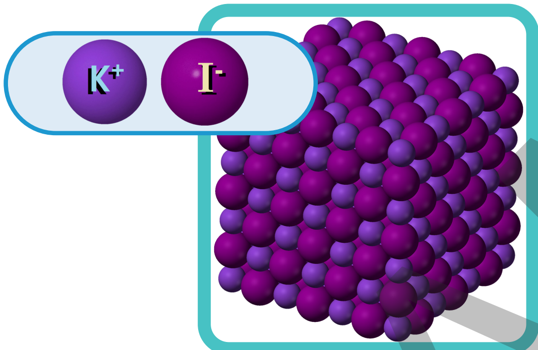
Salts often form in orderly crystal structures, as shown in these examples.

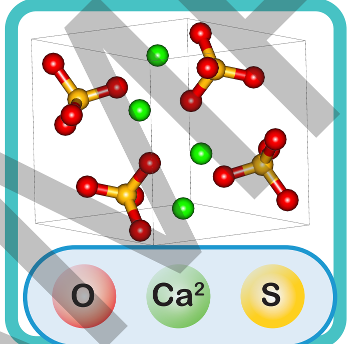
Potassium iodide
KI

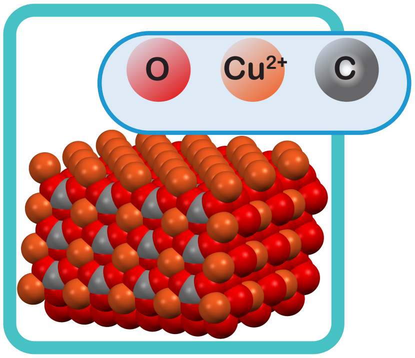


Calcium sulfate
$CaSO_4$

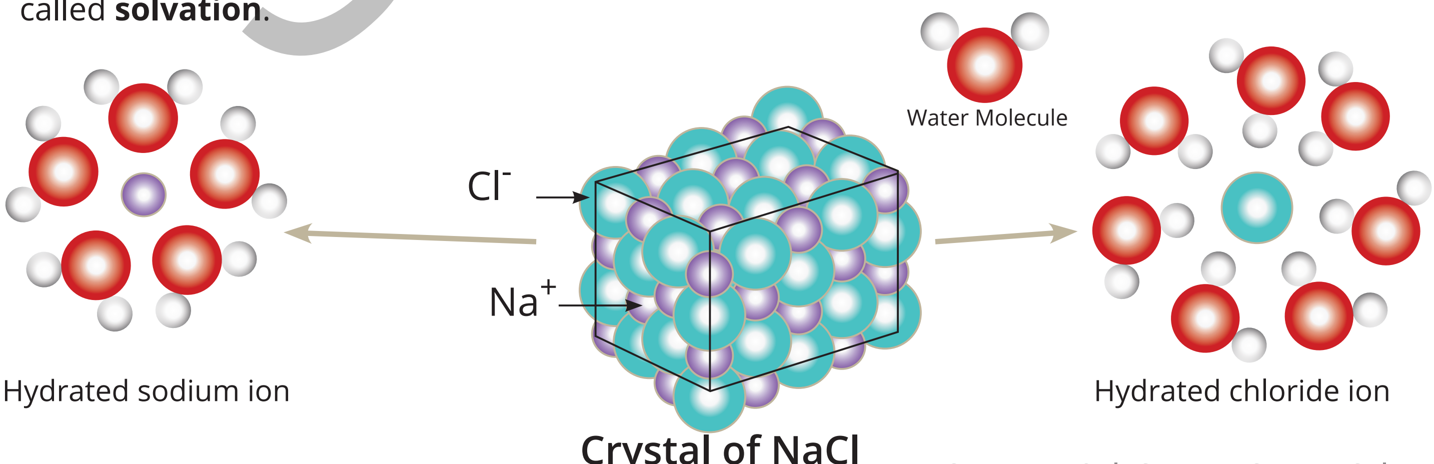
Copper (II) carbonate
$CuCO_3$







Most (but not all) salts dissolve easily in water to form solutions because water is a polar molecule. Water has one end that is partially electrically positive and another end that is partially electrically negative. The positive and negative ions of the salts are strongly attracted to the partially positive and partially negative poles of the water molecules, and the salt breaks into its respective ions as they are surrounded by water molecules. This is called **solvation**.



ACTIVITY 3

LOWER THE POINT

In the previous activity, you saw that adding different salts to water changes the solution's boiling point. Can salts also change the freezing point of solutions?

LEARNING GOALS:

✓ I can describe the formation, properties, and behaviors of solutions at the bulk scale and explain them at a particle level.

9 STOP THE FREEZE

In this section, you will make more salty solutions and find out how long each solution takes to freeze. The time required to freeze is directly correlated with the melting point (and freezing point) of each solution. The longer a solution is in the freezer, the more thermal energy is transferred from the solution to the surroundings in the freezer. This means the solution's temperature decreases more when it is in the freezer for a longer time until the temperatures of the solutions and the inside of the freezer are equal.

WHAT YOU NEED:

FROM THE KIT:

- 6 plastic graduated cups
- 21 salt packets
- Aluminum sulfate
- Calcium chloride
- Gloves, pair
- Graduated cylinder
- Ice cube tray
- Stir rod
- Thermometer

OTHER ITEMS:

- Freezer
- Stopwatch or smartphone timer app
- Water

WHAT TO DO:

Make the same solutions as you did in Make Some Solutions in Activity 2, using the same procedure:

1. Put on the gloves and safety glasses. Use the graduated cylinder to measure 2.33 mL (2.33 cm3) of calcium chloride into one of the plastic graduated cups. Stir and set aside. Rinse the stir rod.

LAUNCH

SCIENCE UNLOCKED

Contact us at: www.homesciencetools.com/customer-service/

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Kit	SU-SALTST
Instructions	IN-SALTSTS
Revision Date	7/2022