# Tiny Patterns

Model molecules and repeating structures

**7.PS1.1** "Develop and use models to describe the atomic composition of simple molecules and extended structures."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline the words that tell which atoms or ions belong in each model. Circle the words that tell whether the parts stay separate or form a repeating pattern.

### A Cloud, a Gas, and a Crystal

1. On a cold morning, your warm breath makes a tiny cloud near a bus stop. Some of its water vapor cools into liquid droplets. To show what water is made of, draw one oxygen atom joined to two hydrogen atoms. That group is one water molecule, written $H_2O$. A model can use letters for atoms and lines for connections. Leave space around the group to show that it is a separate molecule, not part of one endless pattern.

2. The same breath contains carbon dioxide gas. Each carbon dioxide molecule has one carbon atom between two oxygen atoms, written $CO_2$. In a bond model, two lines join carbon to each oxygen. Many carbon dioxide molecules can move apart from one another in air. Drawing several groups with gaps between them shows that each group has its own set of atoms. If a model joins every carbon dioxide group into one giant chain, it gives the wrong picture of this gas.

3. Rock salt scattered on an icy sidewalk is different. Its solid crystals contain sodium ions and chloride ions in a repeating three-dimensional arrangement. Each sodium ion has a positive charge, and each chloride ion has a negative charge. A small piece still contains many ions in the pattern, not separate sodium chloride molecules. The formula NaCl tells you that the crystal has one sodium ion for every chloride ion. To model a section of the crystal, alternate labeled ions in rows and show that the pattern continues past the edges.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. Describe an atom-and-bond model of one water molecule. Include the number of each kind of atom and which atoms connect.

2. A student joins several carbon dioxide groups into one chain. How should the model change, and what atoms belong in each group?

3. Describe how to arrange and label ions in a model of a small section of rock salt. How would you show that the structure continues?

4. A model of a salt crystal section has three sodium ions and one chloride ion. What is wrong with its ratio, and how could you fix it?

## 3 YOUR TURN

Your own words

Ammonia, $NH_3$, is used to make fertilizer. In the box, model two separate ammonia molecules, each with one nitrogen atom bonded to three hydrogen atoms. Label the atoms, use lines for bonds, and write one sentence explaining why your model shows molecules rather than an extended structure.

ANSWER KEY

# Tiny Patterns

GRADE 7 · 7.PS1.1

## PART 1 · READ AND MARK

Underline the words that tell which atoms or ions belong in each model. Circle the words that tell whether the parts stay separate or form a repeating pattern. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | Describe an atom-and-bond model of one water molecule. Include the number of each kind of atom and which atoms connect. | **One oxygen atom connects to two hydrogen atoms.** |
| 2 | A student joins several carbon dioxide groups into one chain. How should the model change, and what atoms belong in each group? | **Separate the groups with gaps. Each group has one carbon atom between two oxygen atoms, with two bond lines from carbon to each oxygen.** |
| 3 | Describe how to arrange and label ions in a model of a small section of rock salt. How would you show that the structure continues? | **Alternate labeled sodium and chloride ions in rows, with equal numbers of each. Show the pattern continuing past the edges rather than ending as separate pairs.** |
| 4 | A model of a salt crystal section has three sodium ions and one chloride ion. What is wrong with its ratio, and how could you fix it? | **The ratio should be one sodium ion for every chloride ion. Add two chloride ions or remove two sodium ions.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

Molecule 1: H-N(H)-H Molecule 2: H-N(H)-H
A gap separates the two groups, and no bond joins one group to the other.

For the ammonia model, accept any layout with two unconnected groups, each containing one labeled nitrogen bonded to three labeled hydrogens. For salt, accept a written description of a repeating pattern that has equal numbers of sodium and chloride ions.