

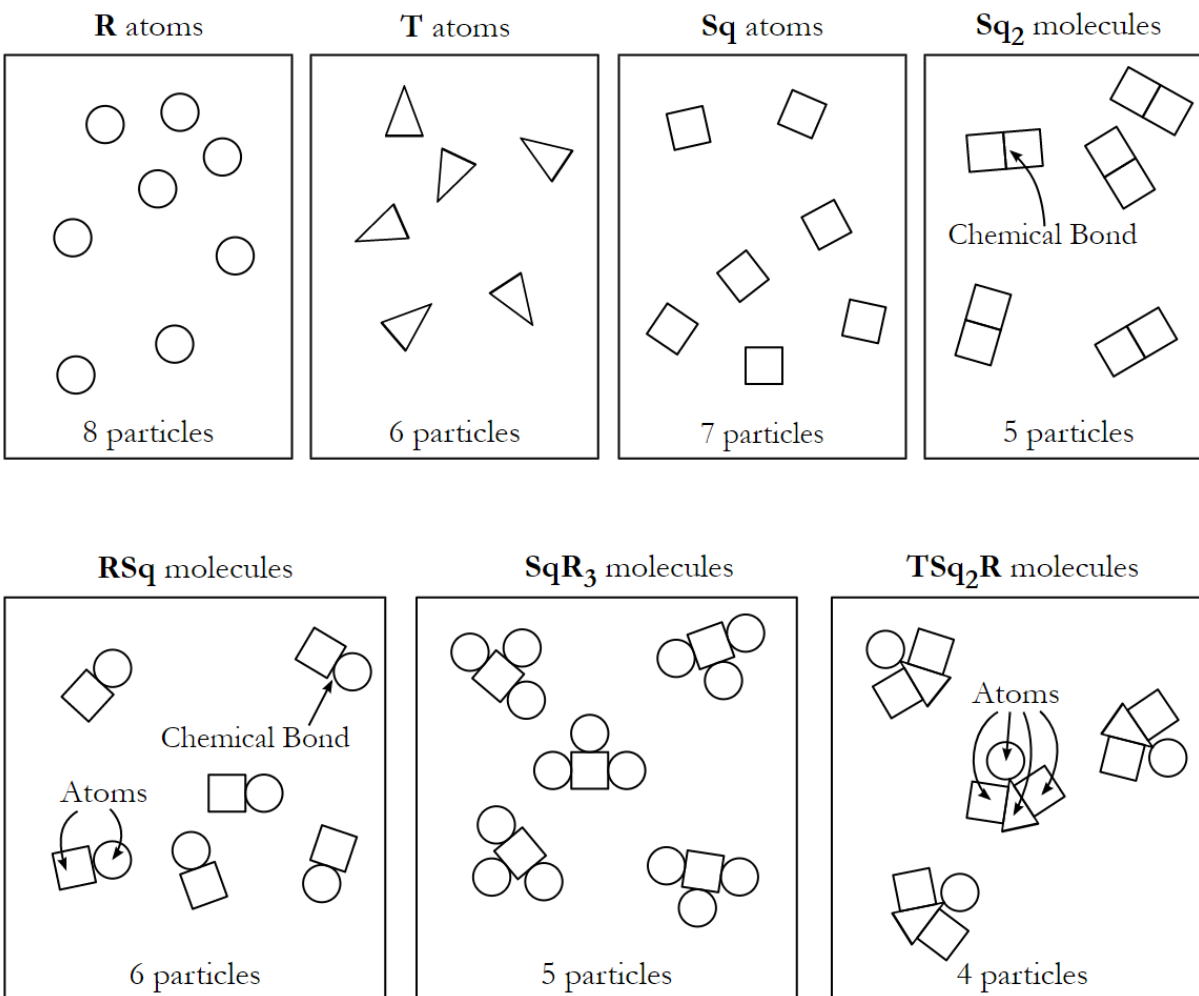
Building Blocks of the Stuff Around Us

Why?

Look at the things in this room. They are all matter. If we look at these things with a microscope, can we see the individual pieces they are made of? No, the building blocks of matter are too small to see. However, it is often useful to imagine them. In this activity we will explore different names that we use for the smallest pieces of matter. We will also explore how those smallest pieces are put together.

As you work through the following questions, be sure to follow your team role(s).

Model 1 – Particles, Atoms, and Molecules



Use the information in Model 1 to answer questions 1 – 13.

Reach agreement with your team before writing down your consensus answers.

1. Look closely at Model 1. There are three different types of building blocks (atoms). **Draw** the shapes that are used to show the three types of atoms.

2. In Model 1 we also use letters to label the three types of atoms.
Draw the correct shape beside each letter or letters.

T

R

Sq

Read This!

Look at the **letter** or **letters in bold** above each box in Model 1. These letters are a code that tells us what types of atoms are present. They also tell us how many of the atoms are present.

3. Look carefully at the box with the **RSq** code.
- Draw one molecule of **RSq**.
 - How many total atoms** are in one molecule of **RSq**?
4. Draw one molecule of the substance with the **TSq₂R** code.
- How many Sq** atoms are in a molecule of **TSq₂R**?
 - How many total atoms** are in a molecule of **TSq₂R**?



Check your answers to questions 3 and 4 with your teacher before you continue.

5. Can a **particle** be made of **exactly one atom**?
 Describe evidence from Model 1 that supports your answer.
6. Can a **particle** be made of more than one atom of **only one type**?
 Describe evidence from Model 1 that supports your answer.
7. Look at the **RSq** and **Sq₂** molecules in Model 1. Look closely at the places where atoms stick together to form a molecule. What is the name of that sticking place?



8. Write a one sentence definition of the term **molecule**.

A molecule is _____

9. Look closely at Model 1.


a. Can a **particle** be made of **different types of atoms**?

Describe evidence from Model 1 that supports your answer.

b. Can a **particle** be a molecule?

Describe evidence from Model 1 that supports your answer.

10. Fill in the table for each particle by using information from Model 1. One row has been completed for you.

Particle Code	Drawing of one particle	Total # of atoms in 1 particle	How many atoms are there in one particle?		
			# of R	# of Sq	# of T
R					
T					
Sq ₂					
RSq		2	1	1	0
SqR ₃					
TSq ₂ R					



Check your answer with your teacher before you continue.

11. Create one reasonable drawing for substance **R₂SqT₃**. There are many possible correct drawings. Be sure you show the **correct number of each type of atom**.

12. Draw one particle of each substance in the table below. Use the shapes of atoms from Model 1.

There are many possible correct drawings. Be sure you include the correct number of each type of atom. Circle the type of particle under each drawing.

T₃	T₂R	RT₃SqT
Atom Molecule	Atom Molecule	Atom Molecule

Read This!

Scientists use the term **formula** to describe the codes in Model 1. We use the term **particle drawing** for substances that really exist in the world around us.



13. Fill in the table below to demonstrate your understanding of **how molecule particle drawings relate to their formulas**. Use the shapes from the KEY below. There are many possible correct drawings. Be sure you include the correct number of each type of atom.


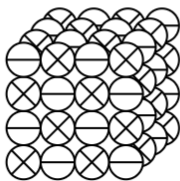
KEY H = ○ O = ⊗ N = ⊕ C = ●

Name of Substance	Water	Ammonia	Methanol	Oxygen Gas
Formula	H₂O	NH₃	CH₃OH	O₂
Particle Drawing				



Check your answer with your teacher before you continue.

Model 2 – Crystals

Name of Substance	Tiniest pieces that are in the substance	Drawing of a small bit of the substance
<p style="text-align: center;">Graphite (pencil lead)</p>	<p style="text-align: center;">● Carbon atom</p>	
<p style="text-align: center;">Sodium Chloride (table salt)</p>	<p style="text-align: center;">⊗ Sodium ion ⊖ Chloride ion</p>	

*Use the information in Model 2 to answer questions 14 – 20.
Reach agreement with your team before writing down your consensus answers.*

14. What is the title of Model 2?
15. Look carefully at Model 2. How many substances are included in the table?
16. Complete the table below. Use information from Model 2. Circle the number of particles.

Substance	Names of the different tiniest pieces that are in the substance	How many of the tiniest pieces make up the substance?
Graphite		<p style="text-align: center;">one a few lots</p>
Table salt		<p style="text-align: center;">one a few lots</p>

17. Can crystals be made of **only one type of tiniest piece**?
Cite evidence from Model 2 to support your answer.

18. Can crystals be made of **more than one type of tiniest pieces**?
Cite evidence from Model 2 to support your answer.



Check your answer with your teacher before you continue.

Read This!

We recall that Model 1 showed that **molecules** are **small numbers of atoms bonded together**.
Molecules can be made from **one type of atom or more than one type of atom**.

19. Look closely at the drawings of a small bit of the crystal substances shown in Model 2.

a. Describe one **difference** between crystals and molecules.
Include evidence from Model 2 and from the **Read This!** box above.

b. Describe one **similarity** between crystals and molecules.
Include evidence from Model 2 and from the **Read This!** box above

c. Describe the pattern you observe in the crystal of **sodium chloride**.

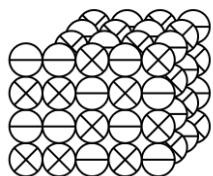
Read This!Crystals are large structures that have a **predictable repeating pattern** of particles.

20. Two students were asked to answer the following question:

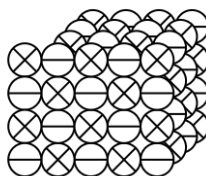
“Add **two sodium ions** and **two chloride ions** to the drawing of **Table Salt**. Draw each ion in a reasonable location.”

a. Here are the students’ answers. Discuss the differences between them with your team.

Student A's answer



Student B's answer



b. Claim: Which student’s answer is better?

c. Justify your claim. Include specific evidence from Model 2 in your explanation.



Check your answer with your teacher before you continue.

What I Still Wonder...

21. Write one additional question you have about atoms, molecules, particles, or crystals.

Extension Questions

22. Draw a reasonable particle diagram for caffeine. It is the active ingredient in coffee and energy drinks. Create a key that shows a different color or pattern for each type of atom.

Be sure your particle drawing matches the key.

Look closely at the symbol for caffeine.

Be sure to include the correct numbers of each type of atom.

KEY H = ○ O = ○ N = ○ C = ○

Name of Substance	Formula	Particle Drawing
Caffeine	$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$	