

From Particles to Properties: Chemistry Concepts with Water Models



Presenter:

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3D Molecular Designs Science Educator

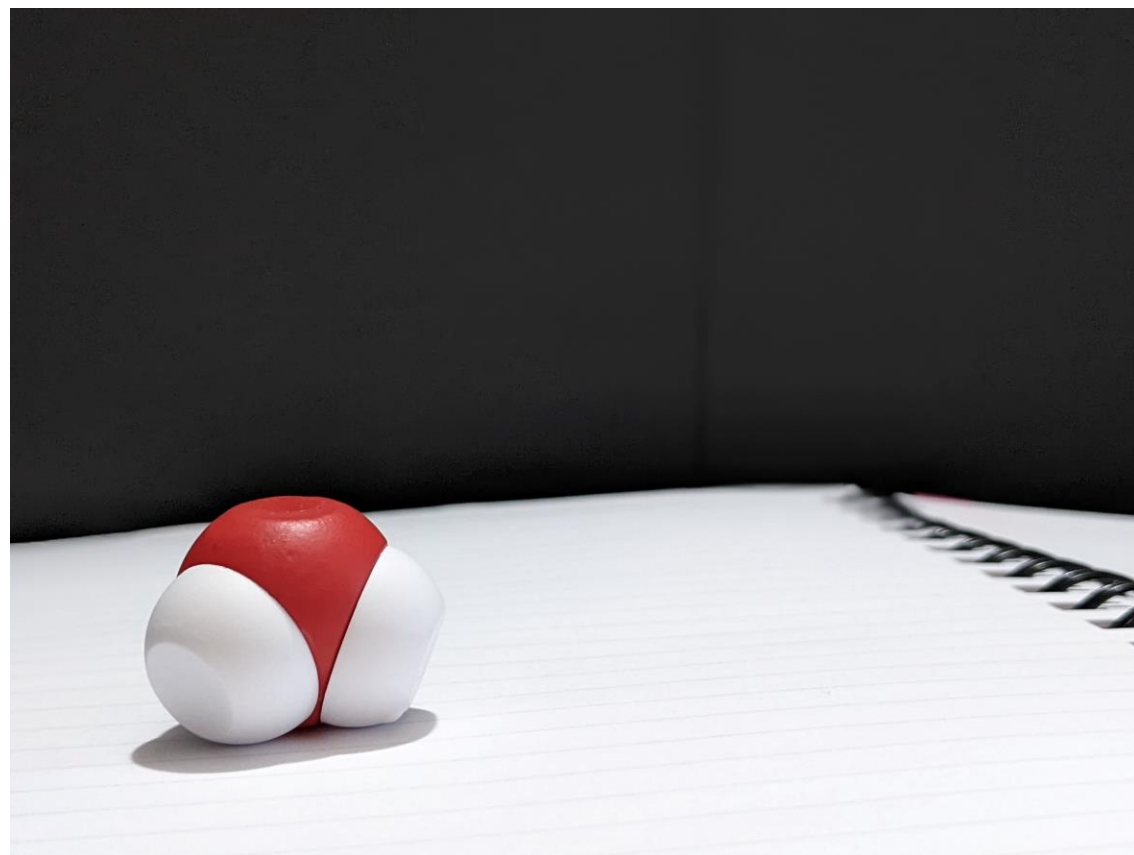


Workshop Learning Goals

- Learn strategies for using hands on models to explain structure-function relationships.
- Use models to compare the structure of water at the macroscopic level (the bulk scale) to infer the strength of electrical forces between particles (NGSS HS-PS1-3).
- Explore how models can be used to describe the atomic composition of simple molecules and extended structures (NGSS MS-PS1-1).
- Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved (NGSS 5-PS1-2)
- Have fun!



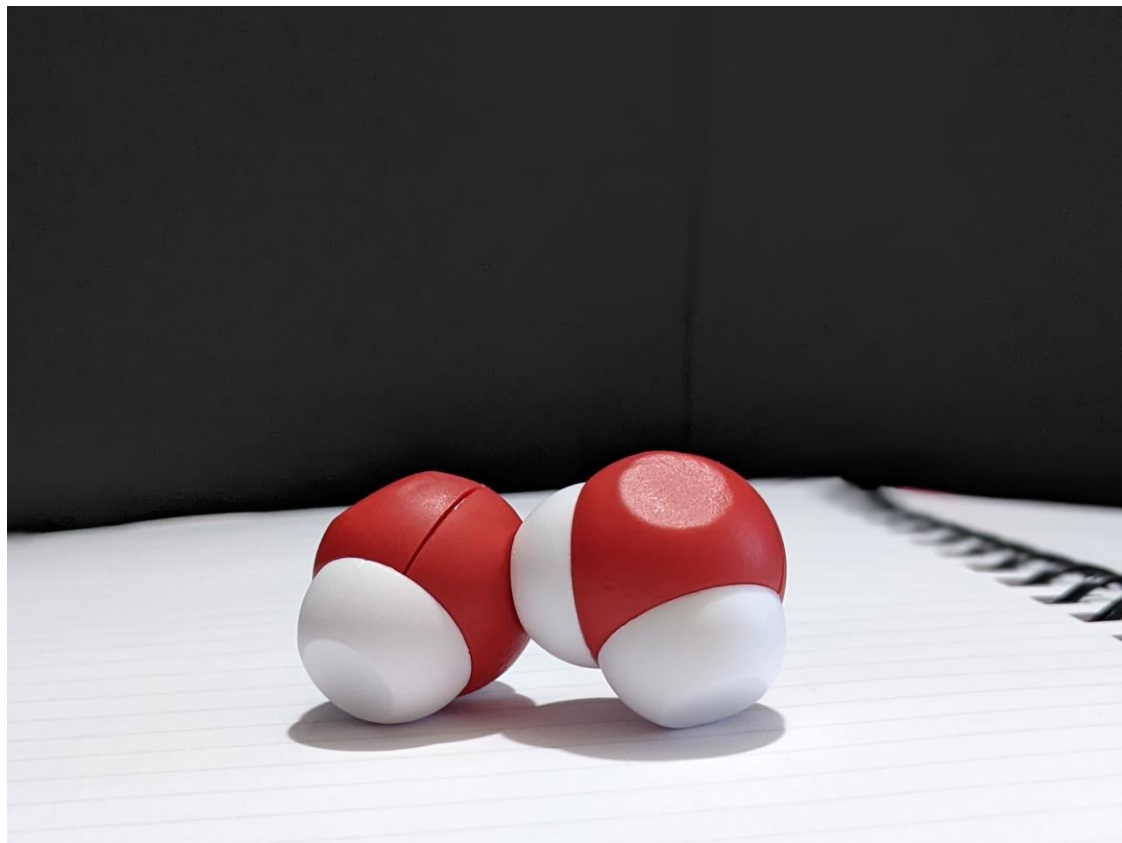




I notice

I wonder

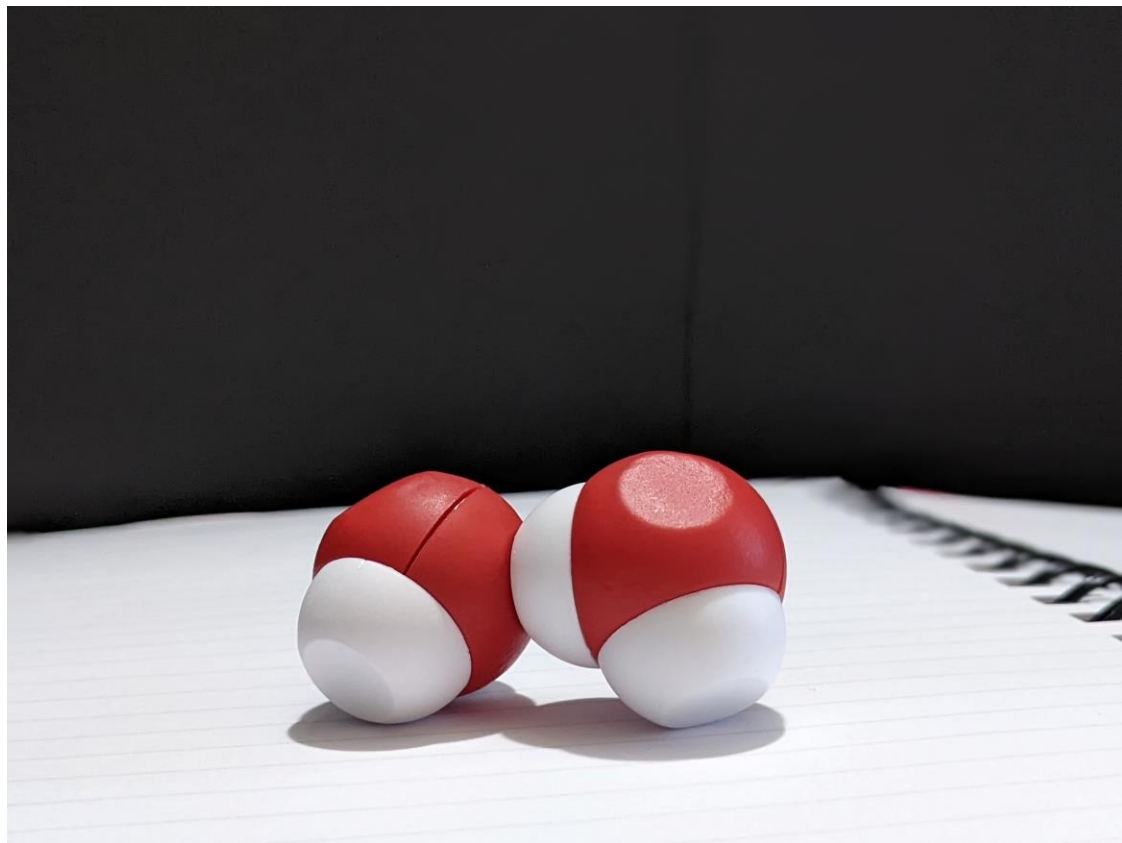




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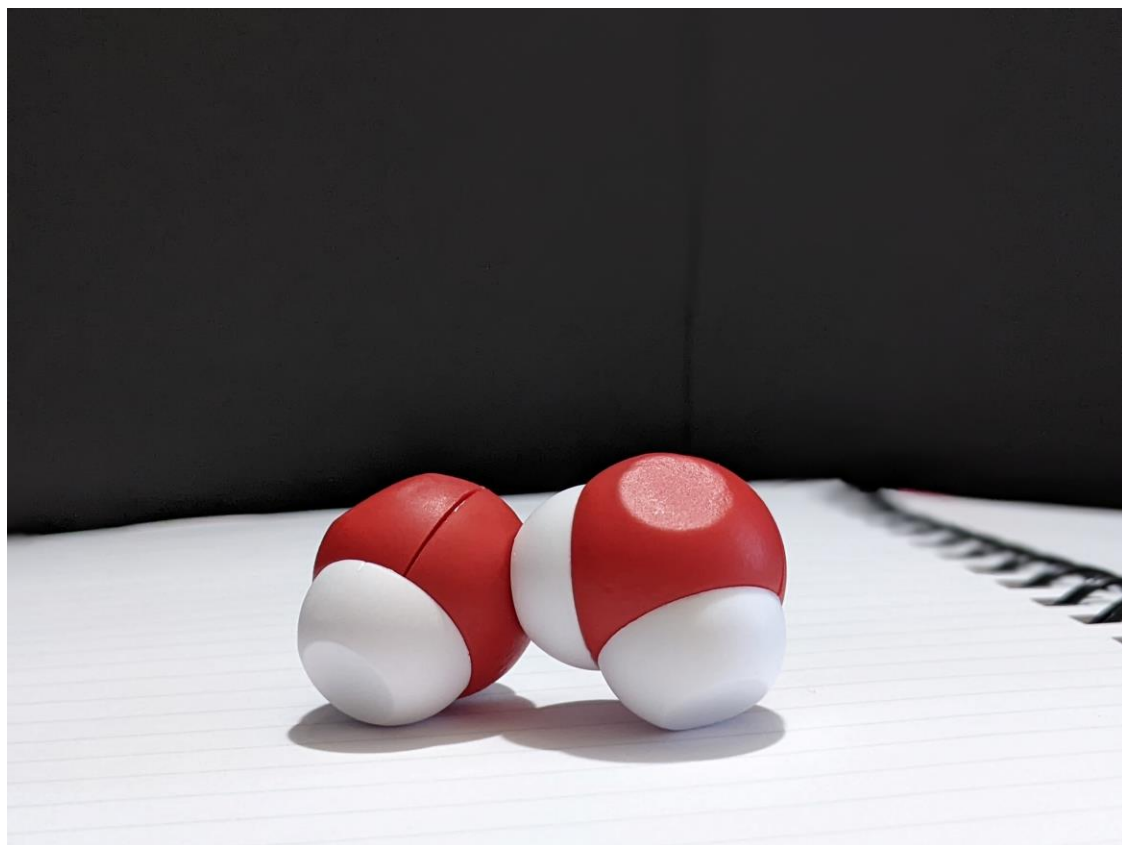




What patterns do you see?

What questions do you have?

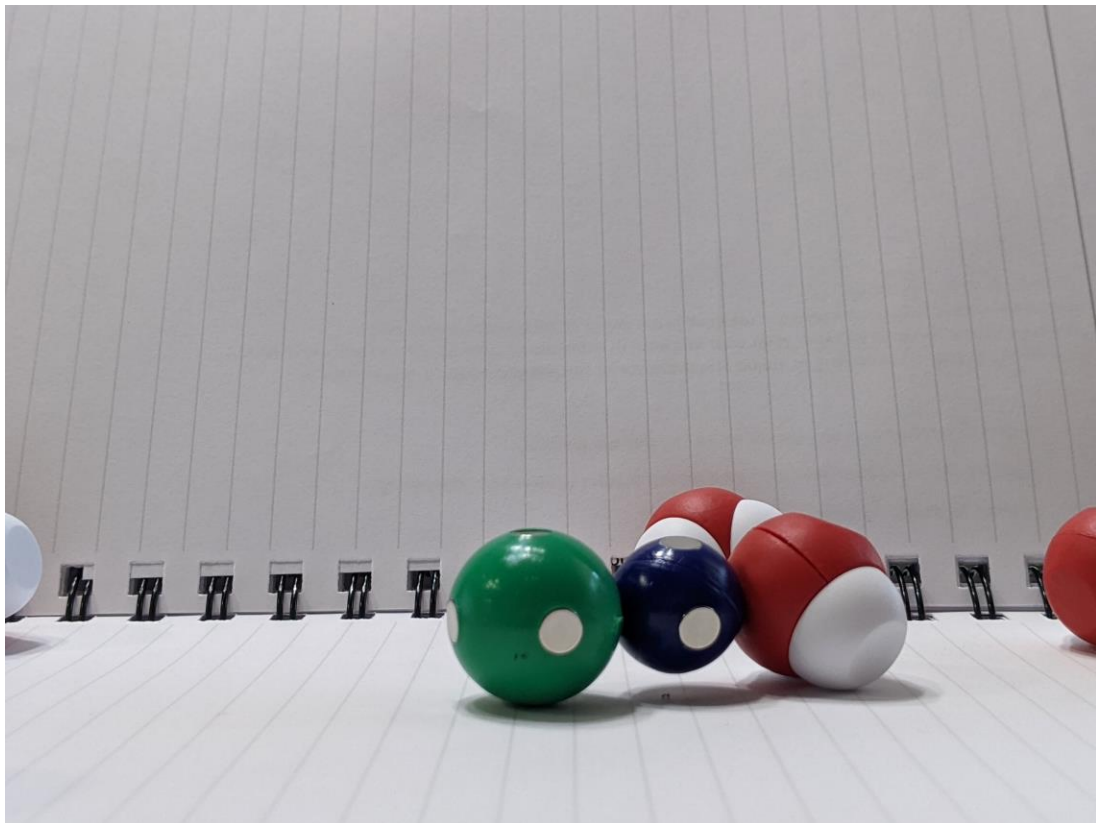




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Notice	Wonder
2 white atoms	Why is the molecule bent?
1 red atom	
atoms are @ an angle	
white sticks to red	
red repels red	
white repels white	

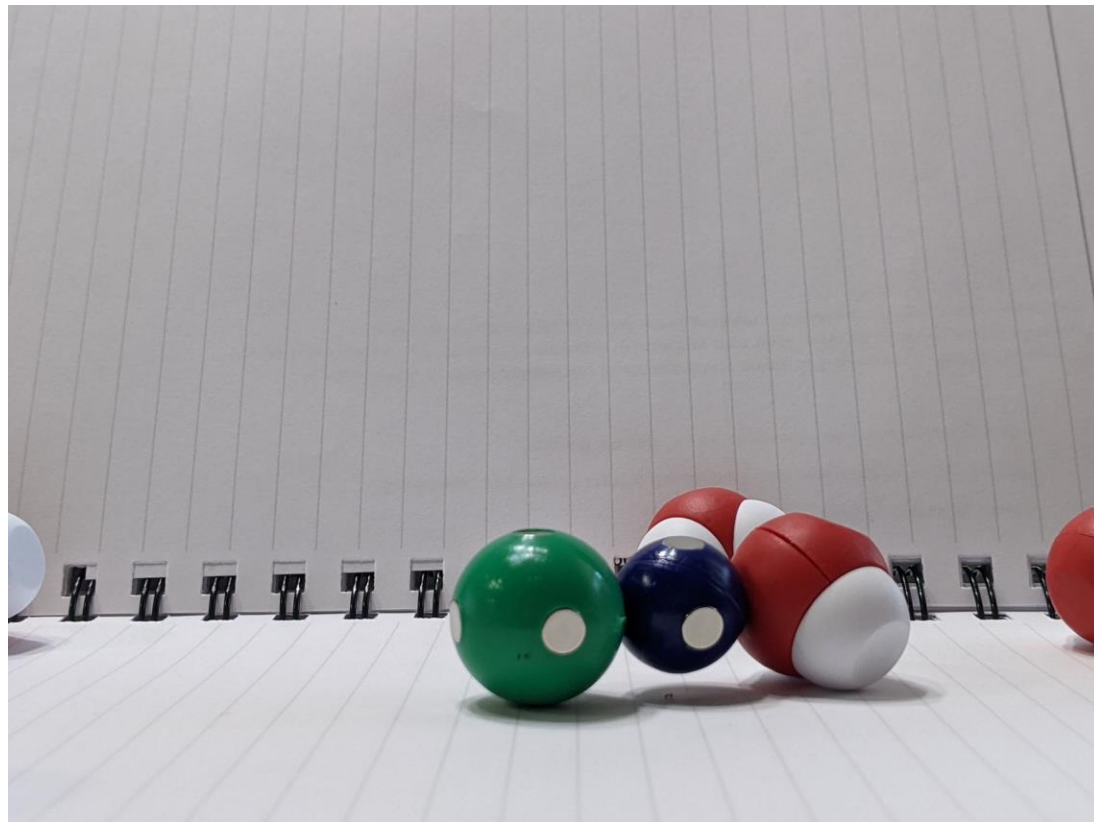




What patterns do you see?

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One green atom
One blue atom

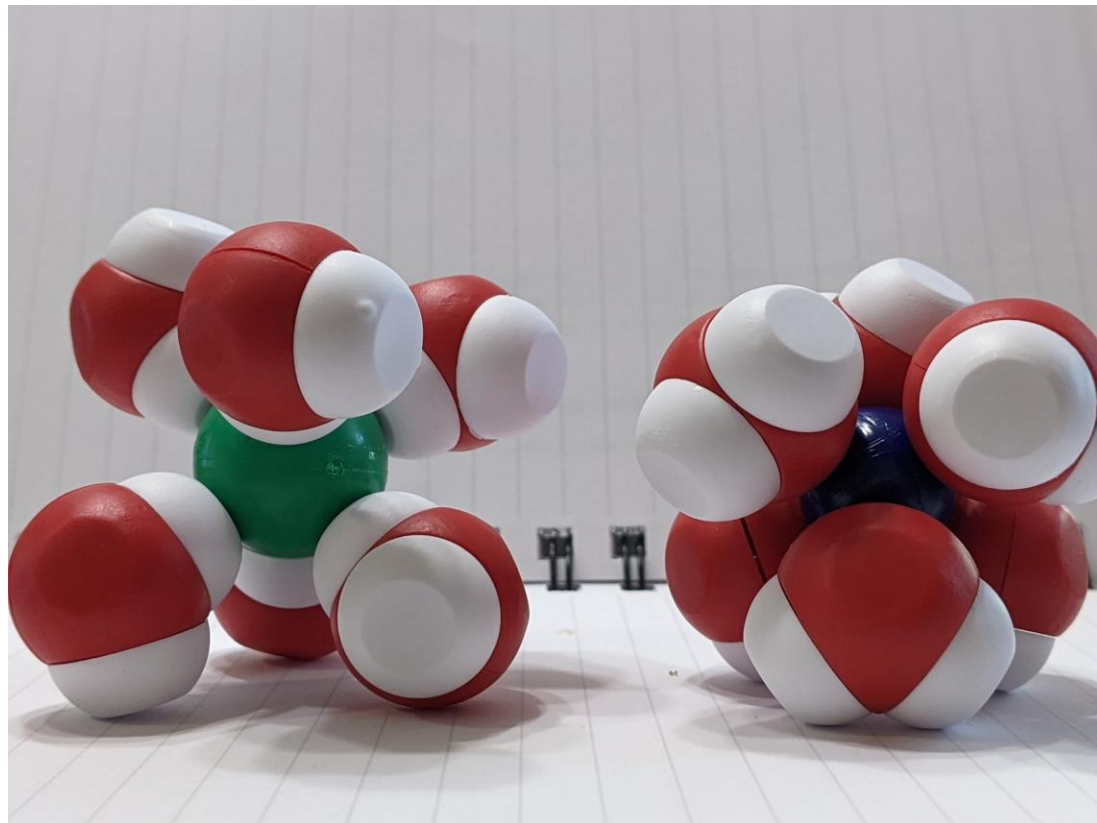
Blue interacts with red
at 6 places, but
not white.

Green interacts
with white at
6 places, but not
red.

The blue &
green are
attracted to
each other.

Why does the different parts
of the water molecule
interact differently with
the blue & green.





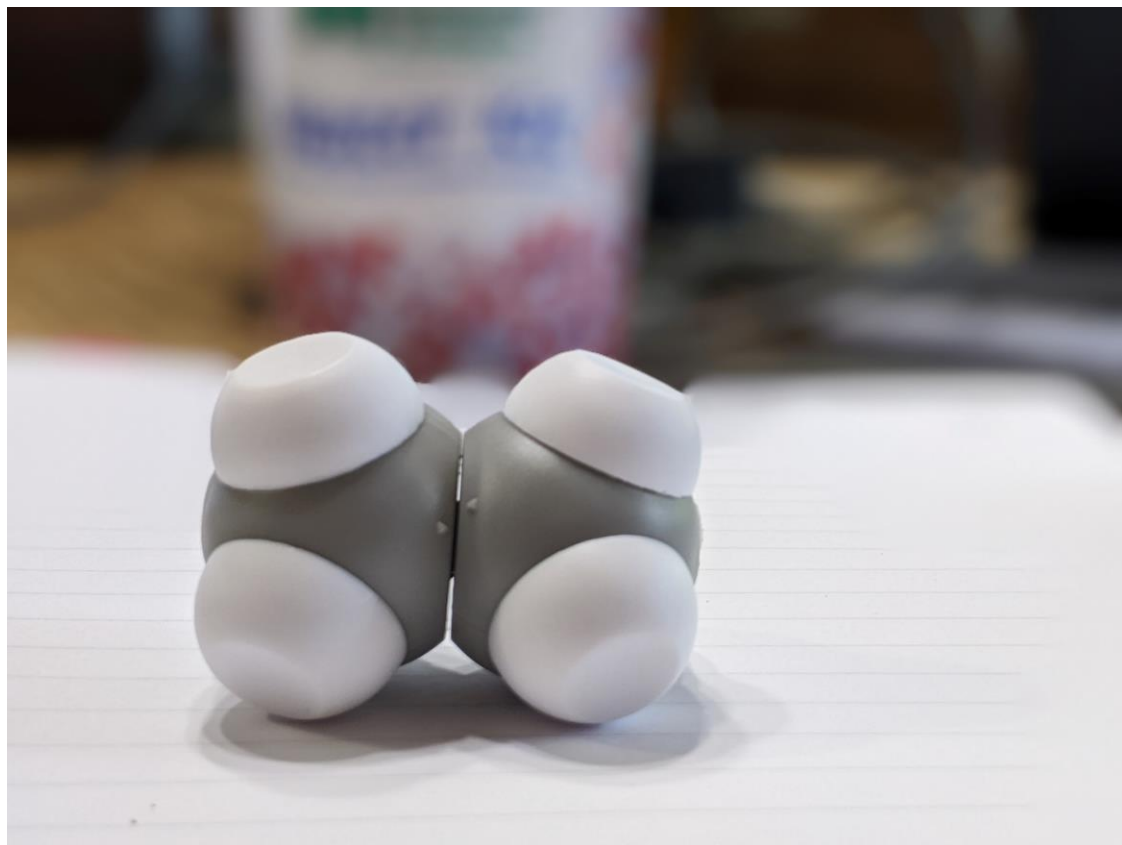
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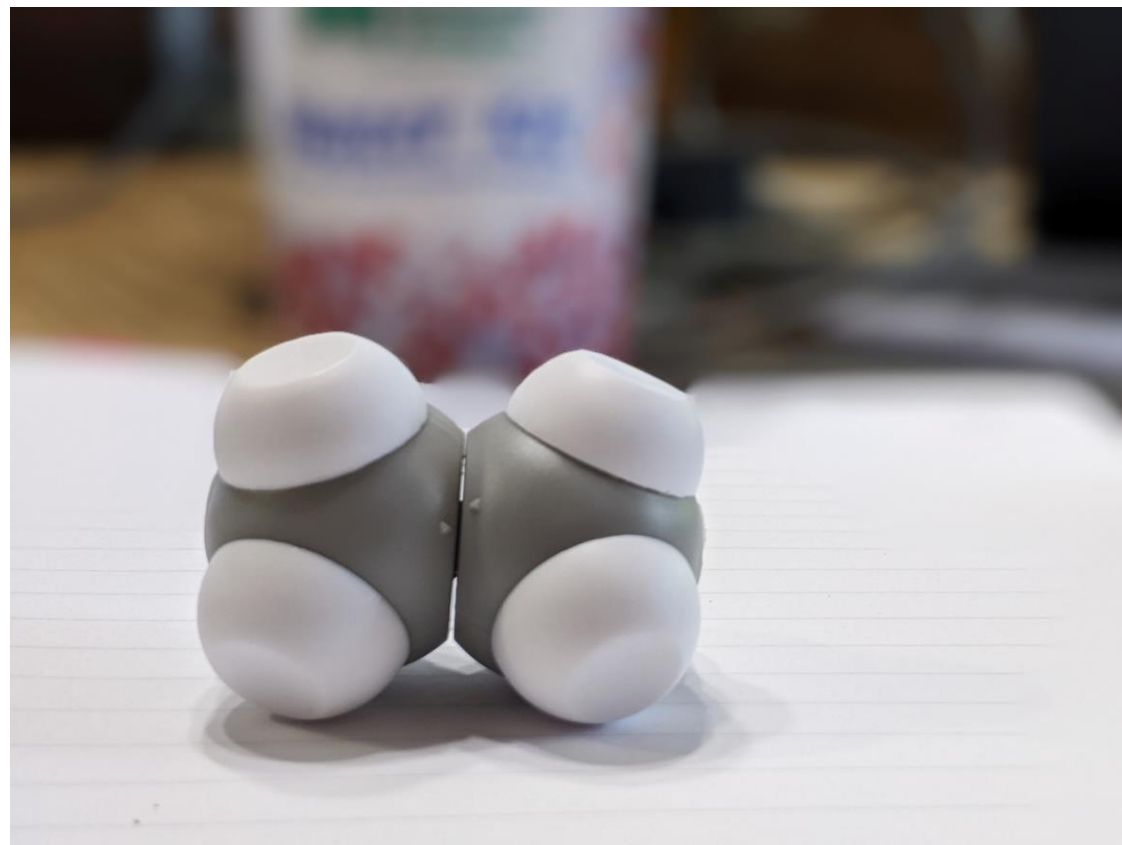
Why do the different parts
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What patterns do you see?

What questions do you have?





There are two
grey atoms &
six white atoms.
Nothing sticks to
this molecule.

Why don't water and
NaCl stick to the molecule?

Comparing Types of Forces	COVALENT BONDING	IONIC BONDING	HYDROGEN BONDING
What is it?	Formed when two atoms share a bond within one molecule, can be partially charged or without charge.	Complete transfer of electrons between two atoms resulting in one that is positively charged, and one negatively charged.	A weak attraction of a hydrogen atom that is covalently bound to a more electronegative “donor” atom or group.
How is it represented by the model?	The plastic post connecting the oxygen and the hydrogen in water	The magnet in the sodium atom connecting to the magnet of chlorine atom	The hydrogen of one water molecule attracted to the oxygen of another water molecule
Type of force	Intramolecular Force	Intramolecular Force	Intermolecular Force



Alcohol	Observations in Lab	Modeling
Methanol		
Ethanol		
Butanol		
Octanol		



What is going on in this beaker at the molecular scale?



Alcohol	Observations in Lab	Modeling
Methanol		
Ethanol		
Butanol		
Octanol		



What is going on in this beaker at the molecular scale?



Unknown Solution	Observations in Lab	Modeling
Methanol		
Ethanol		
Butanol		
Octanol		



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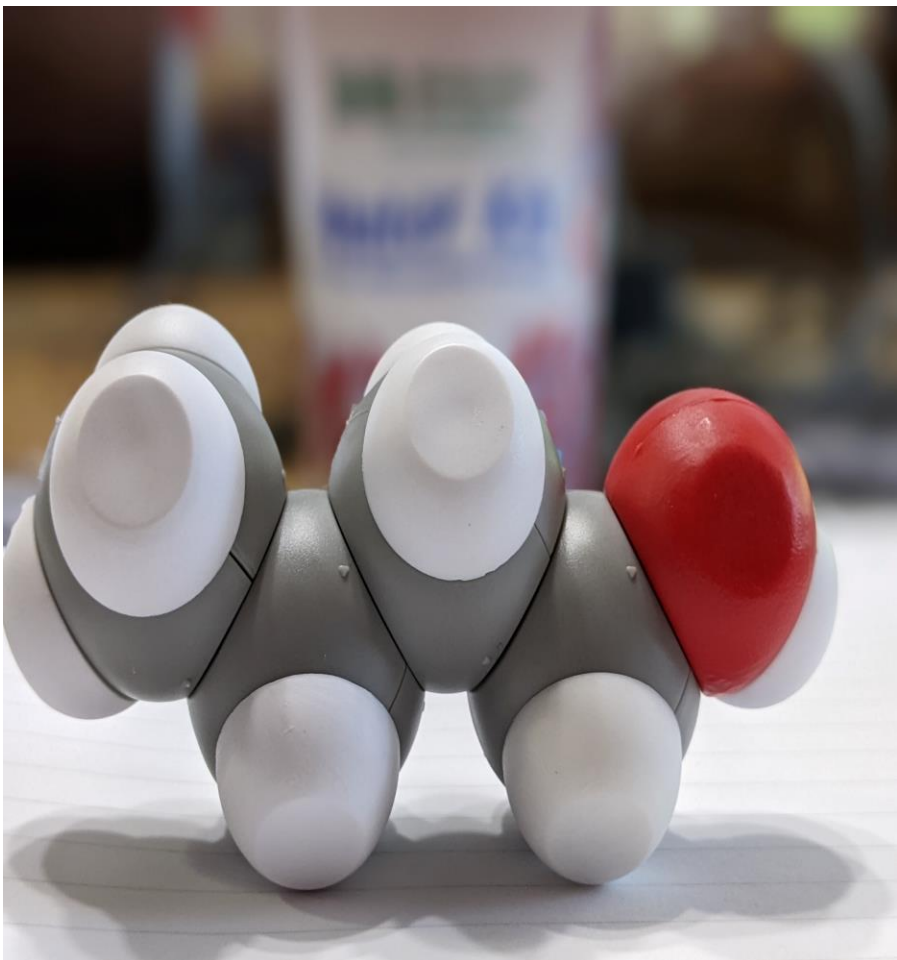
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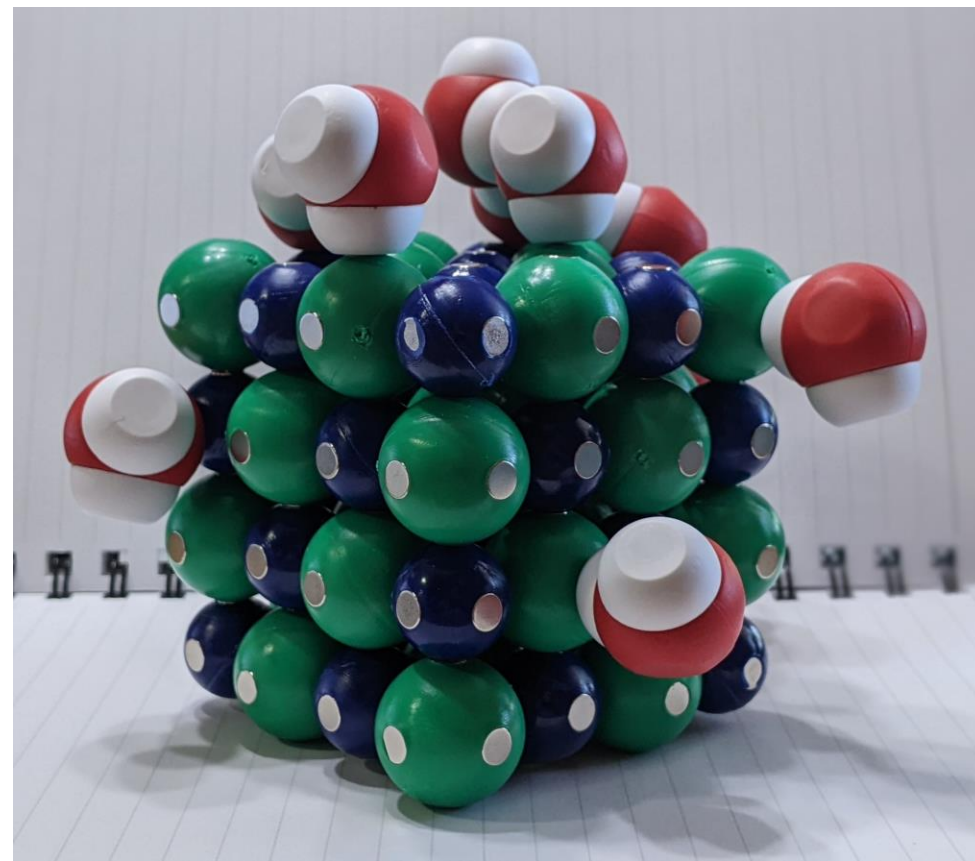


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Assessment Time

Salt dissolves readily in water, but not as well in alcohol. Create a model that explains why using either ethanol or methanol. Contrast that model with the model we did in class of salt dissolving in water. Make a sketch in the space provided and write a short narrative for the sketch. Be sure to label all parts of the sketch.



Additional Assessment Ideas

Create an experiment to compare:

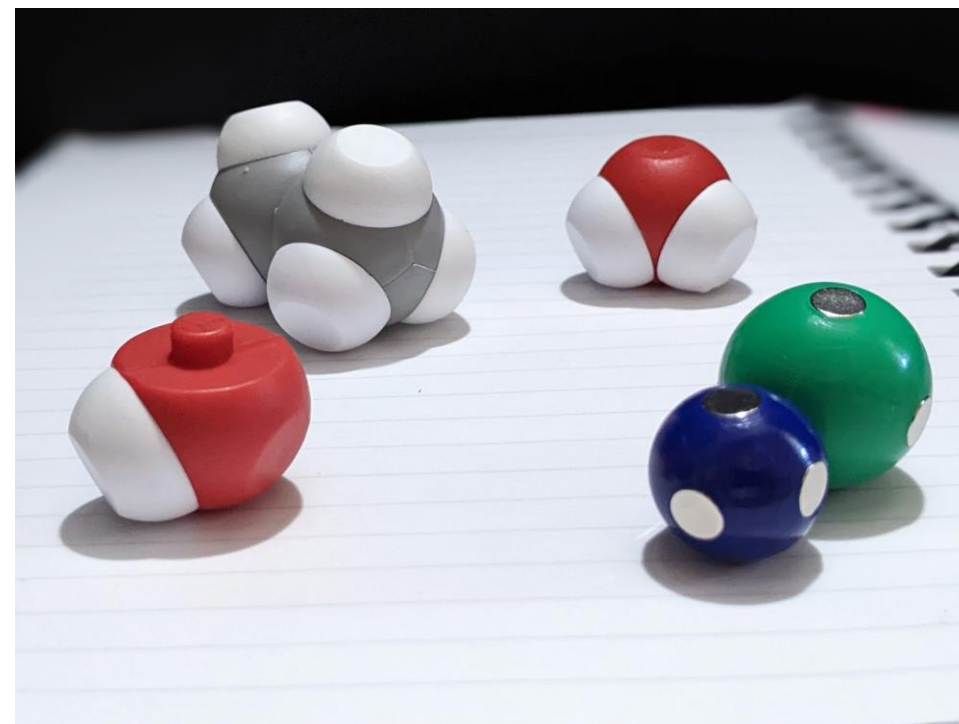
Melting points

Boiling points

Vapor pressures

Surface Tension

Evaporation Rates



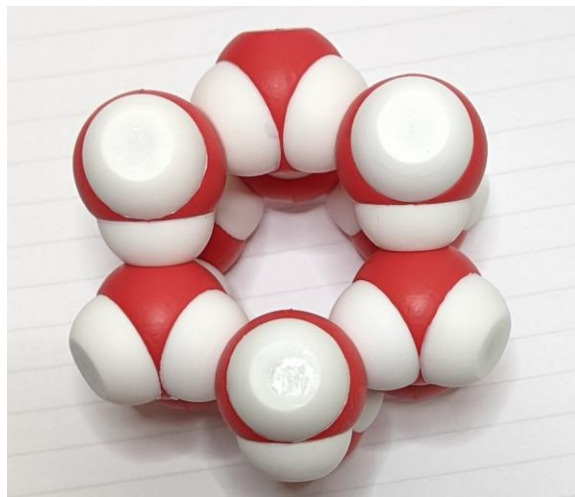
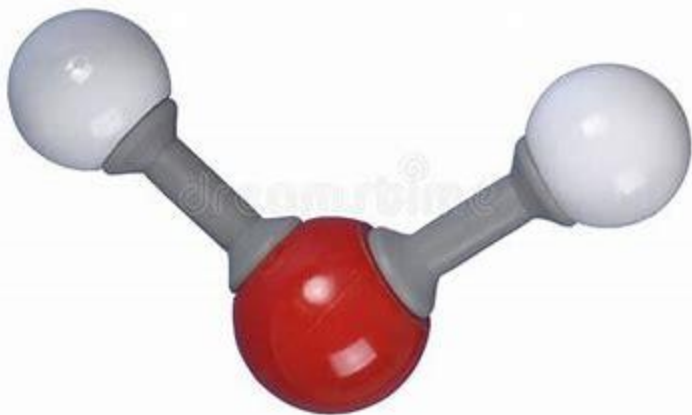
Then model what is occurring at the molecular level.



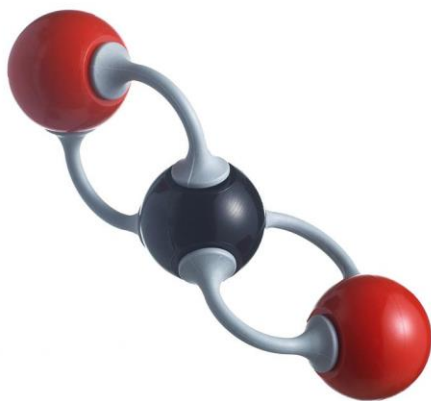
Describe atomic composition of simple molecules and extended structures.

I notice

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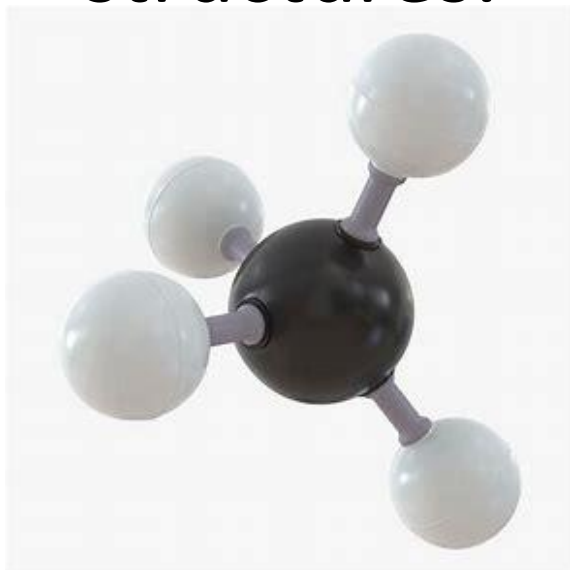


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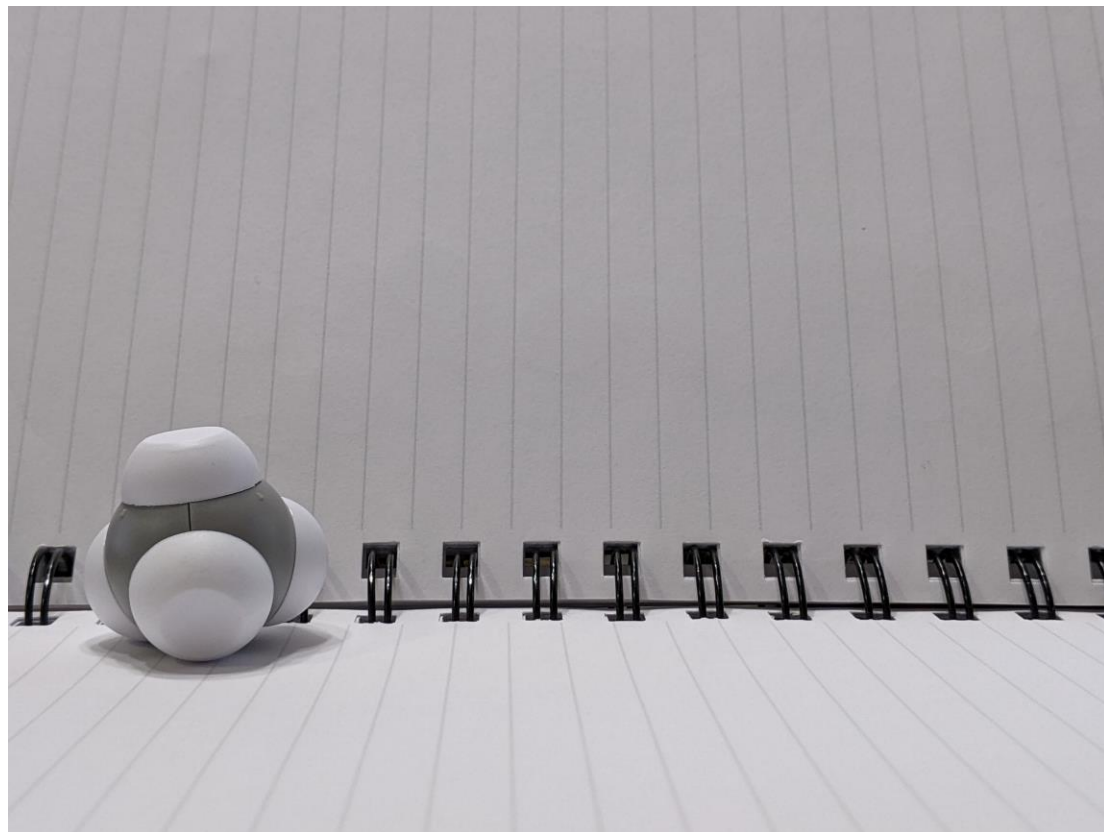
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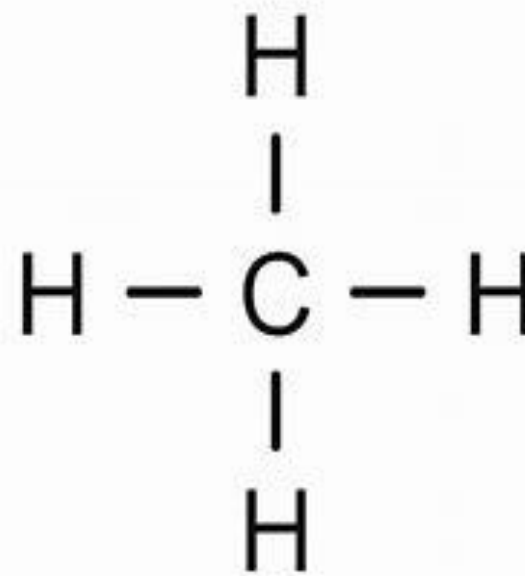
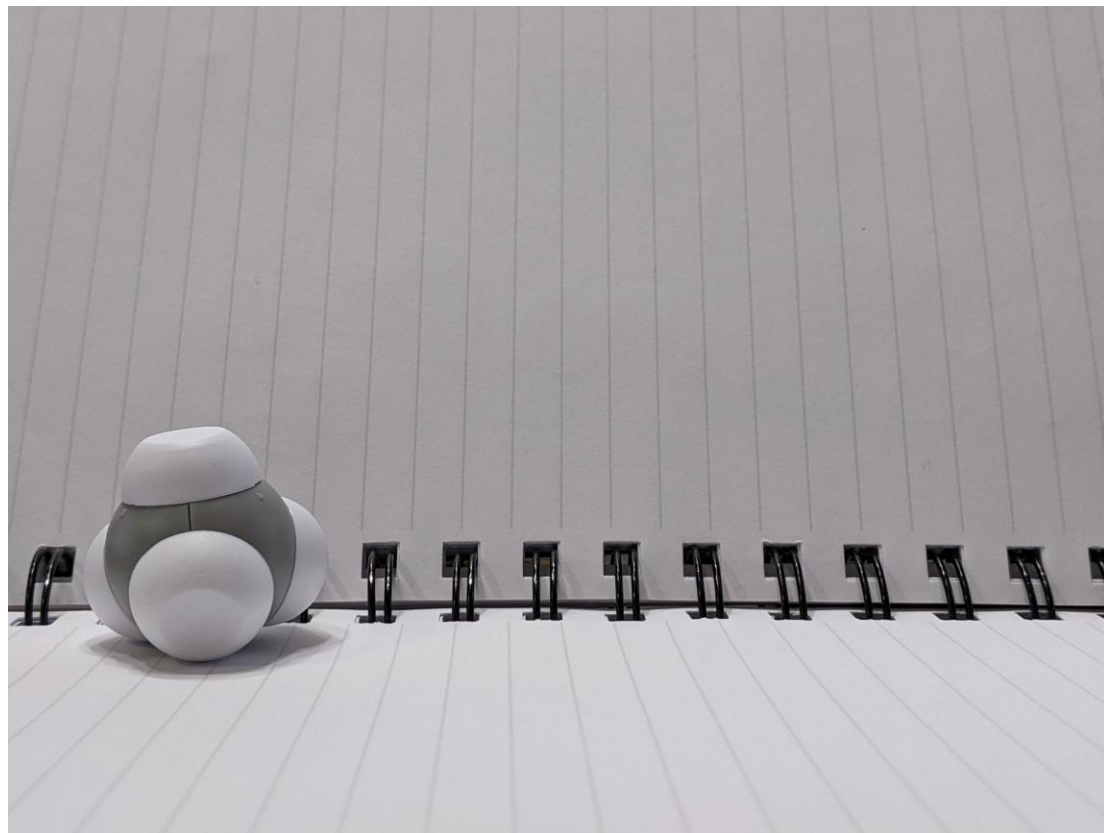




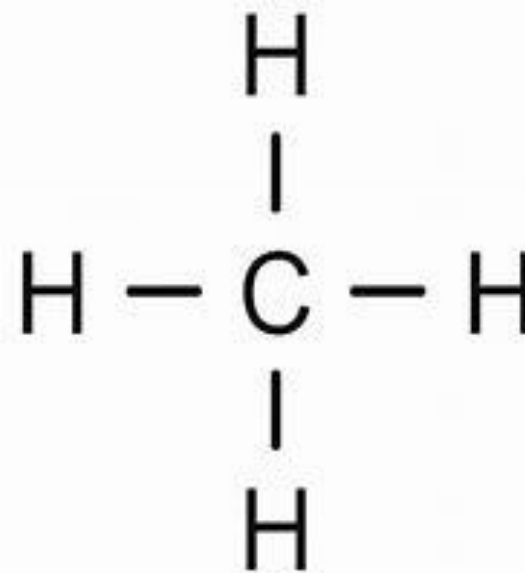
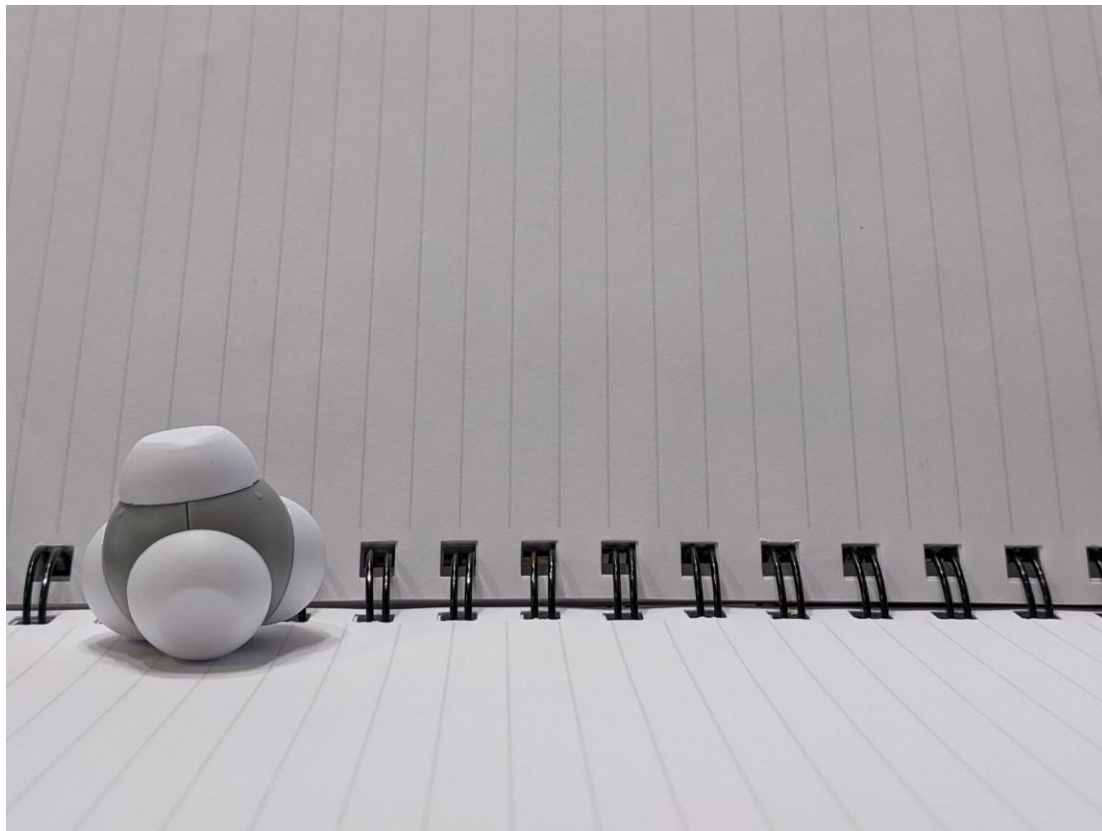
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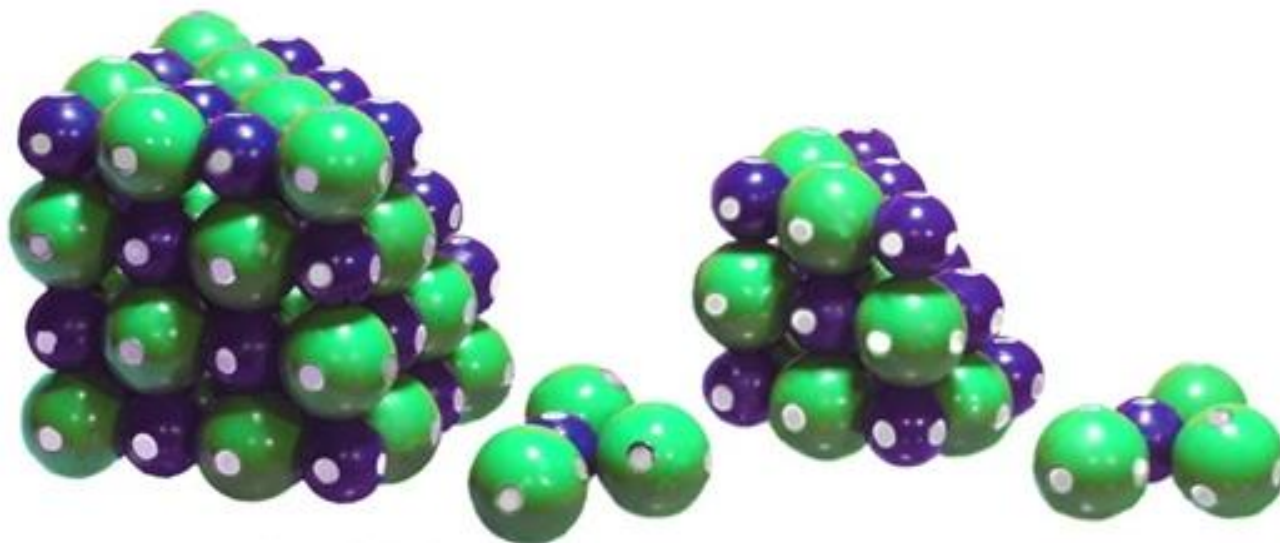
I wonder





How can this be made into an extended structure?







I notice

I wonder





What do you notice?

What patterns do you see?

How are these complex
structures similar?

How are they different?





I notice

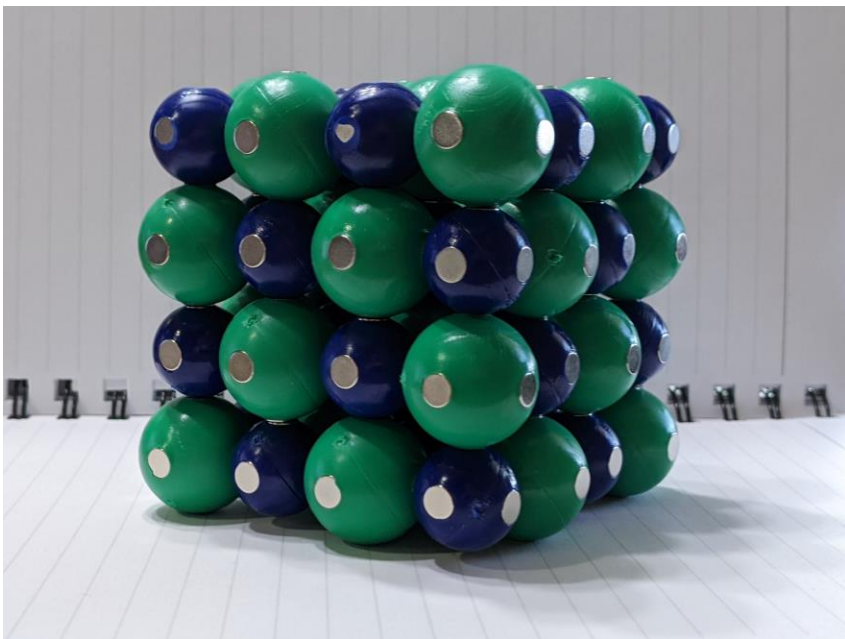
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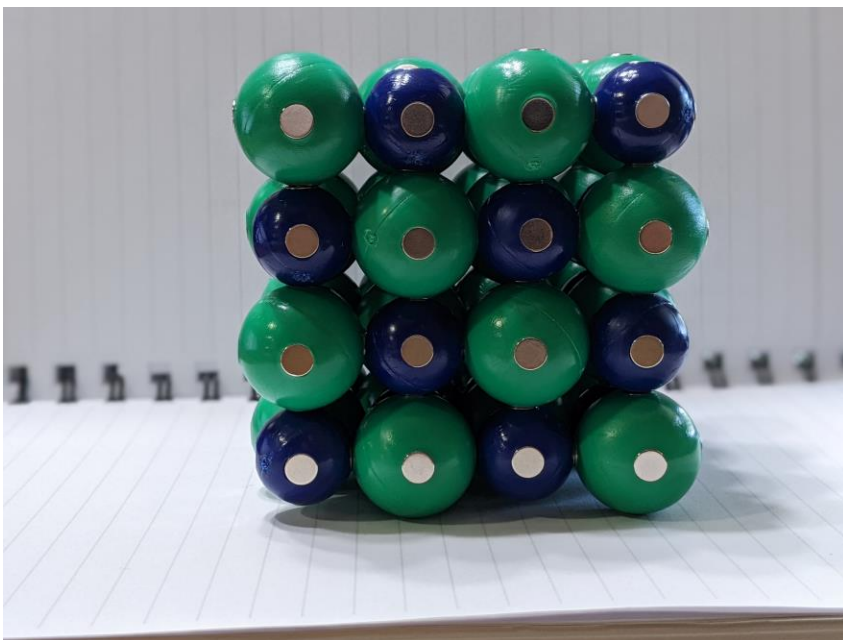
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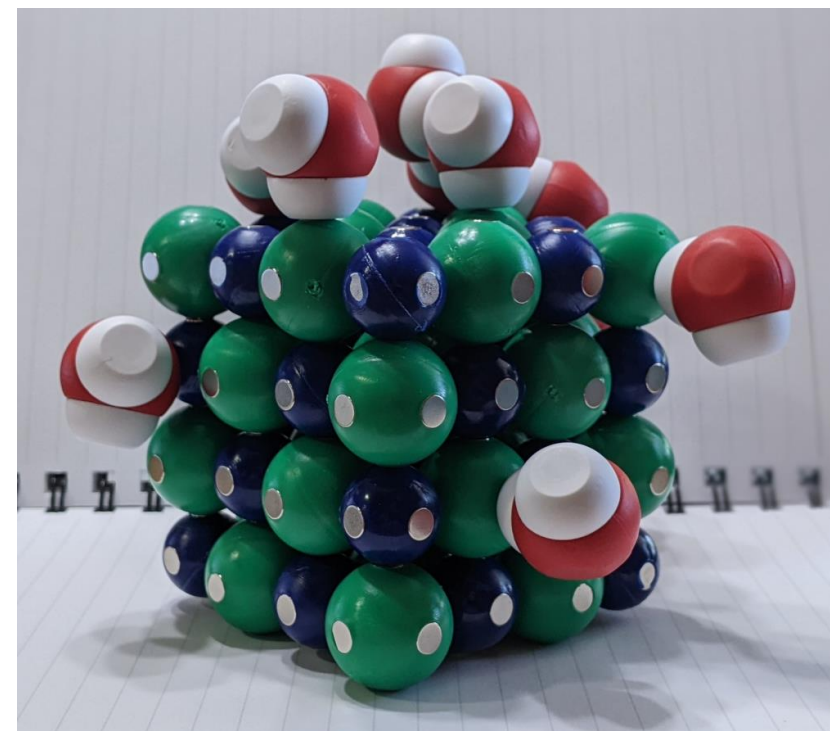
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Challenge Time

How could you use the NaCl lattice and the Water Kit to support that the total weight of matter doesn't change when sodium chloride is dissolved in water?



Workshop NGSS Connections

(and/or other applicable standards)

SEPs	CCCs	DCIs	TEKS
Using Mathematics and Computational Thinking	Scale, Proportion, and Quantity	5-PS1-2	Student Expectation- C.10A
Developing and Using Models	Patterns	MS-PS1-1	Student Expectation- 8.5D
Planning and Carrying Out Investigations		HS-PS1-3	Student Expectation- 5.5C



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