Collisions Lesson Plan

VSEPR Theory

Time: 1 -2 class periods

Lesson Description

In this lesson, students will use Collisions to explore molecular geometry and VSEPR Theory.

Key Essential Questions

1. What is the VSEPR Theory?
2. How does the number of electron domains & lone pairs of a central atom affect molecular shape?

Learning Outcomes

Students will be able to determine the shape of molecular compounds using VSEPR Theory.

Prior Student Knowledge Expected

Atoms can covalently bond together to form molecular compounds.

Lesson Materials

- Individual student access to Collisions on tablet, Chromebook, or computer.
- Projector / display of teacher screen
- Accompanying student resources (attached)

Standards Alignment

NGSS Alignment		
Science & Enginnering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Developing and using models • Construcing explanations and designing solutions	• HS-PS-2. Construct and revise an explanation for the outcome of a simple chemical rection based on the outermost electron states of atoms, trends int he periodic table, and knowledge of the partterns of chemical properties.	• Structure and Function

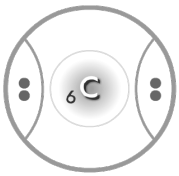
PART 1: Explore (15 minutes)

This is an inquiry-driven activity where students will build molecules in the Covalent Bonding Sandbox to begin to explore VSEPR Theory and molecular geometry. Prior to starting this lesson, students should have already completed Levels 1 -7 in the Covalent Bonding Game.

A student worksheet for this activity can be found on PAGE 5.

Direct students to log into Collisions with their individual username and password, enter the Covalent Bonding Sandbox and follow the prompt below,

Your goal is to build 3 unique molecules in the Covalent Bonding Sandbox.

	Molecule 1	**Molecule 2**	**Molecule 3**
Include carbon with this domain structure in your molecule.			
Draw your molecule.			

Answer the following questions after you build your molecules:

1. *What is different about each of the carbon atoms in each molecule?*
2. *How many 'electron domains' does each carbon atom have?*
3. *Now build H_2O. Which center carbon atom (Molecule 1, 2 or 3?) is the oxygen most similar to and why?*

PART 2: Explain (15 minutes)

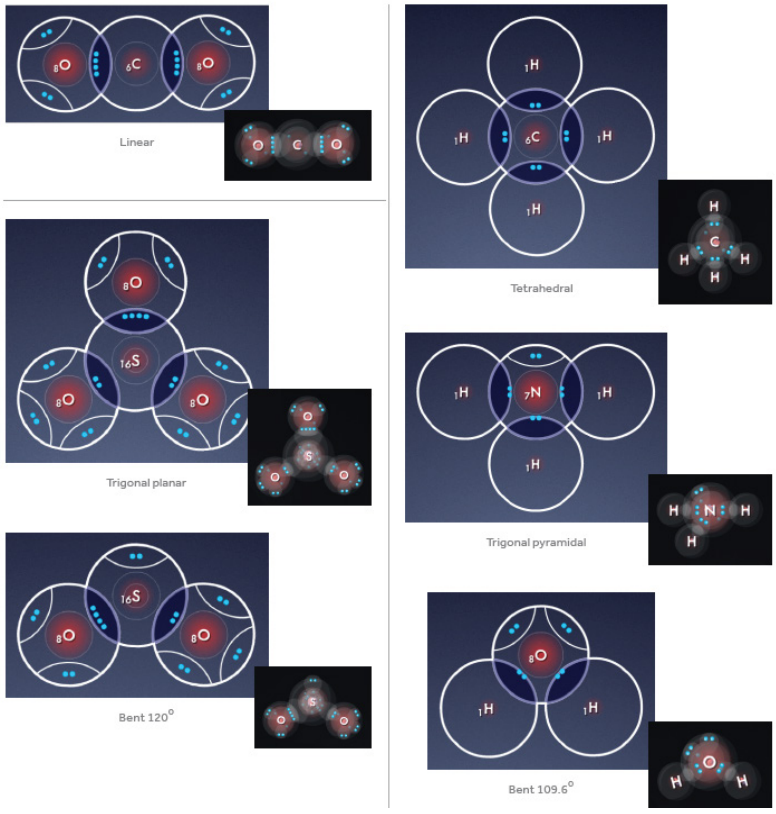
Explain to students that the shape of covalently bonding molecules can be predicted through using the **VSEPR Theory**. The VSEPR Theory states that molecules will assume arrangements that minimize the repulsion between the electron pairs around the central atom.

As a class (or demonstration), build each example below in the Covalent Bonding Sandbox and complete the table with your students.

A blank student note-taking sheet can be found on PAGE 6.

# of electron domains around center atom	Example	# of bonded domains	# of lone pairs	Molecular Shape	Bond Angle
2 electron domains	CO_2	2	0	Linear	180°
3 electron domains	SO_3	3	0	Trigonal planar	120°
	SO_2	2	1	Bent	~120°
4 electron domains	CH_4	4	0	Tetrahedral	~109.5°
	NH_3	3	1	Trigonal pyramidal	~109.5°
	H_2O	2	2	Bent	~109.5°

Reminder: The Collisions Covalent Bonding Game Guide includes the following image that you can share with your students as well.



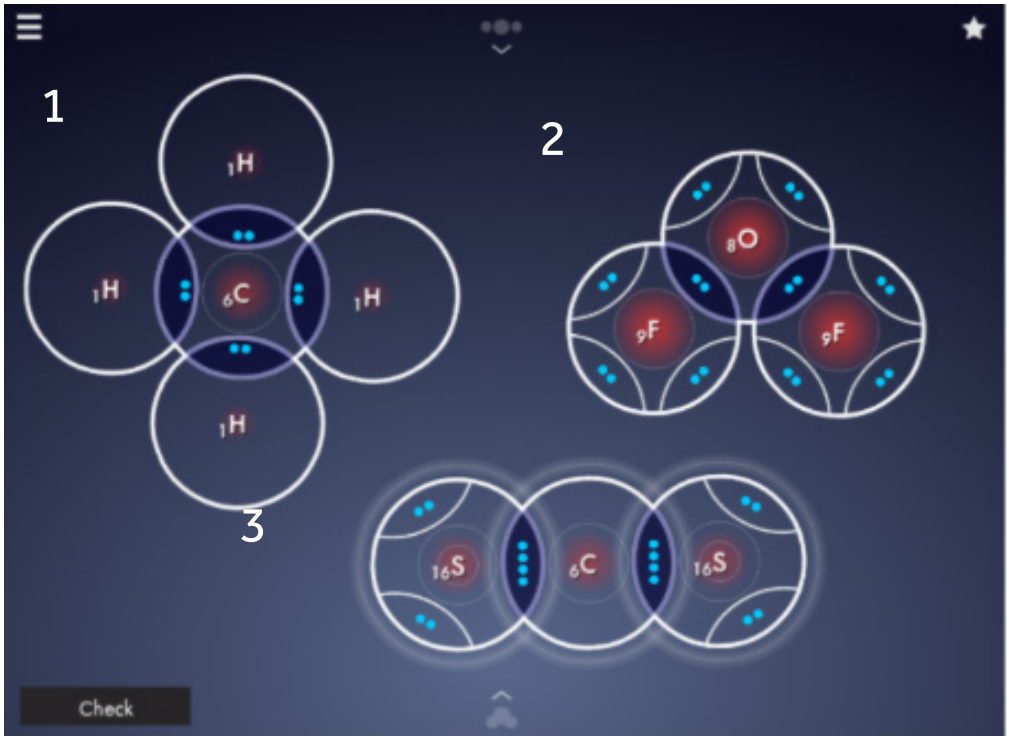
PART 3: Exend (30 minutes)

To continue practicing / reviewing VSEPR Theory and molecular shape, assign the Covalent Bonding Sandbox Analysis Activity on Molecular Geometry.

This can be found at https://www.playmadagames.com/teacher-resources/. Once here, navigate to the Covalent Bonding resources and open **Sandbox Activity: Molecular Geometry.**

PART 4: Evaluate (5 minutes)

Project the below image and have students answer the following questions on a separate sheet of paper (or create your own molecules in the Covalent Bonding Sandbox).



Using the image above, determine the following for Molecule #1, #2, and #3.

a) Total electron domains around central atom
b) # of lone pairs
c) # of bonded domains
d) Molecular shape
e) Bond angle

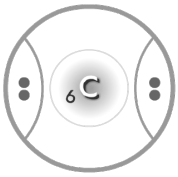
Molecular Shape Explore

VSEPR THEORY

Name: _____

DIRECTIONS: Complete the following activity as an introduction to today's topic: VSEPR Theory and molecular geometry.

Part 1: In the Covalent Bonding Sandbox, create 3 unique molecules based on the directions below.

	Molecule 1	Molecule 2	Molecule 3
Include carbon with this domain structure in your molecule.			
Draw your molecule.			

Part 2: Using the information from Part 1, answer the following questions:

1. What is different about each of the carbon atoms in each molecule?

2. How many 'electron domains' does each carbon atom have?

3. Now build H_2O. Which center carbon atom (Molecule 1, 2 or 3?) is the oxygen most similar to and why?

Molecular Shape Notes

# of electron domains around center atom	Example	Draw it	# of bonded domains	# of lone pairs	Molecular Shape	Bond Angle
2 electron domains	CO_2					
3 electron domains	SO_3					
	SO_2					
4 electron domains	CH_4					
	NH_3					
	H_2O					