

Molecule Design Challenge

Challenge

How do you keep electron clouds that repel each other still attached to an atom?
How are electrons used to predict the shape of the molecule?
How does electronegativity affect the shape of the molecule?

Requirements (what you must do)

1. The molecule chosen must be one of the following:

	Central Atom	Unshared Pairs of Electrons On Central Atom	Bond Angle	Atom Color
CO ₂	C	0	180 °	Carbon - black
CH ₄	C	0	109.5 °	Hydrogen - white
H ₂ S	S	2	109.5 °	Oxygen - red
NH ₃	N	1	107 °	Sulfur - yellow
SO ₂	S	1	120 °	Beryllium - green
BeH ₂	Be	0	180 °	
H ₂ O	O	2	104.5 °	

2. Your model needs to depict the molecule accurately, using the correct bond angles, unshared pairs of electrons, and atom color.
3. Atomic Radii must be proportional.
4. Molecule name must be clearly visible.
5. Bond angles must be clearly labeled.
6. The model should be creative and original.

Restraints (what you can't do)

1. The model can be no larger than 1 m x 1 m and no smaller than 15 cm x 15 cm.
2. The model needs to stand on its own.
3. Your group must bring their own materials.

Team members and Roles

Team Member	Role	Materials Responsible for
	Visionary (Big Picture)	
	Equalizer	
	Skeptic	

Planning Phase

Individually make a bulleted list to identify all of the molecule facts. When looking at your molecule keep in mind the problem you need to solve.

Brainstorming Phase

Using GoogleDraw individually draw your design, and be sure to indicate the description and materials you plan to use with approximate cost.

As a team you will choose the best product design and your process design. Be sure each member of your team knows what they are responsible to bring for the construction phase.

Before you begin Construction Phase get teacher approval: _____

Design/Construction Phase

Build your design. During construction you may decide you need additional materials or that your design needs to change. This is ok – just make a new sketch and revise your materials list.

Testing Phase

Each team will test their design and process. If your design and process were unsuccessful, redesign and test again. Continue until you are happy with your solution. Be sure to watch the tests of the other teams and observe how their different designs worked.

Use GoogleDraw to draw your Final PRODUCT (make sure to label your sketch including total cost)

Evaluation Phase #1

Evaluate your teams' results and present your findings to the class. *As you answer each question, be sure to cite aspects of your model that support this answer.*

1. How do you keep electron clouds that repel each other still stay attached to an atom?
2. How are electrons used to predict the shape of the molecule?
3. How does electronegativity affect the shape of the molecule?

How sure were you of your answers? (circle one)

Basically Guessed				Sure						Very Sure
1	2	3	4	5	6	7	8	9	10	

Teacher Stamp _____

Redesign/Construction Phase #1

Redesign your molecule using the PhET simulation *Molecule Shapes 1.1.11* (https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html).

During construction, you may decide that your original design needs to be changed based on what you observe in the simulation. That is ok- just make a new sketch, make changes to your original design, and revise your materials list.

Evaluation Phase #2

Evaluate your teams' results and present your findings to the class.

As you answer each question, be sure to cite aspects of your model that support this answer.

1. How do you keep electron clouds that repel each other still stay attached to an atom?
2. How are electrons used to predict the shape of the molecule?
3. How does electronegativity affect the shape of the molecule?

How sure were you of your answers? (circle one)

Basically Guessed

Sure

Very Sure

1

2

3

4

5

6

7

8

9

10

Teacher Stamp _____

ReDesign/Construction Phase #2

Redesign your molecule using the provided ball and stick model of your molecule. During construction you may decide that your original design needs to be changed based on the redesign ball and stick model. This is ok – just make a new sketch, make changes to your original design, and revise your materials list.

Evaluation Phase #3

Evaluate your teams' results and present your findings to the class.
As you answer each question, be sure to cite aspects of your model that support this answer.

1. How do you keep electron clouds that repel each other still stay attached to an atom?
2. How are electrons used to predict the shape of the molecule?
3. How does electronegativity affect the shape of the molecule?
4. Why should I choose your molecule design?

How sure were you of your answers? (circle one)

Basically Guessed Sure Very Sure
1 2 3 4 5 6 7 8 9 10

Teacher Stamp _____

Share the Solution

Each team will CREATE a Google Slide presentation. The presentation should display the STEPS (phases) of your DESIGN process (be as detailed as possible). You will be graded on your portion.

Each team will make a video on FlipGrid outlining the engineering design process of their molecule.