# Atomic Interactions PhET Exploration

Go to the Atomic Interactions PhET: https://phet.colorado.edu/en/simulation/atomic-interactions

First, play with the SIM – explore it, and look at what information you can gain.

Click on Forces, then Attractive/Repulsive to show the arrows.

Use the PhET to answer all of the questions below. You can zoom in or out on the graph as necessary to help you make some comparisons between bonds.

**Part 1: Exploring the force arrows and shape of the graph**

Click on "custom attraction". Slide the atomic diameter and interaction strength slowly back and forth to get a feel for how the graph and the force arrows will change with adjustments.

1. Start with the atom diameter being as large as possible and interaction strength being as weak as possible.
    a. What size are the force arrows in the middle of the atoms? (choose one)

        Small medium large

    b. Where does the line begin on the graph? (choose one)

        Close to the y-axis At a distance from the y-axis

        Why is this?

2. Now make the atom diameter as small as possible and keep the interaction strength as weak as possible.
    a. How did the force arrows change? Why is this?

    b. How did the line move on the graph? Why?

3. Now keep the atom diameter as small as possible and make the interaction strength as strong as possible.
    a. How did the force arrows change? Why is this?

    b. How did the shape of the graph change? Why?

4. Now make the atom diameter as large as possible and keep the interaction strength as strong as possible.
    a. How did the force arrows change? Why is this?
    b. How did the line move on the graph? Why?

**Part 2: Applying the graph to a bond in nature**

5. Start with Argon-argon.
    a. First, drag the atoms SLOWLY together

i. What happened to the force arrows as you move the atoms closer together?

ii. In what direction did the blue point on the graph move as you brought the atoms closer together?

iii. What happens if you pull the two atoms as close together as possible? Why is this? Justify in terms of the forces at play.

b. Now, SLOWLY pull the atoms apart.
   i. What happened to the force arrows as you pulled the atoms apart?

   ii. In what direction did the blue point on the graph move as you pulled the atoms apart?

   iii. What correlation do you see between the shape of the graph and the size of the arrow as you move the atoms apart?

c. At what point on the graph would you call this bond "stable"? What does the model of the two atoms look like/do at this point?

**Part 3: Comparing elements**

6. Which of the bonds is the strongest? Thinking about what you know about bonding, why is this the case?

7. Which of the bonds is the weakest? Thinking about what you know about bonding, why is this the case?

8. Which bond is the longest (has the most distance between the atoms)? Explain the reason for this in terms of atomic structure.

9. Which bond is the shortest? Explain the reason for this in terms of atomic structure.

10. Use Coulomb's law to explain the impact that both distance between atoms and electrostatic forces of electrons have on the bond strength and length as demonstrated in this activity.