

Student Exploration: Periodic Trends

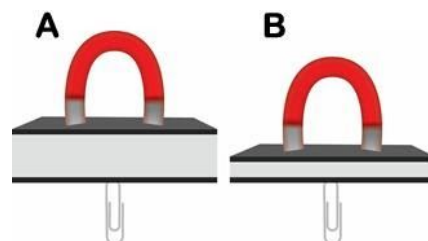
Directions: Follow the instructions to go through the simulation. Respond to the questions and prompts in the orange boxes.

Vocabulary: atomic radius, electron affinity, electron cloud, energy level, group, ion, ionization energy, metal, nonmetal, nucleus, period, periodic trends, picometer, valence electron

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. On the image at right, the two magnets are the same. Which paper clip would be harder to remove?

b



2. Which magnet would be most likely to attract additional paper clips?

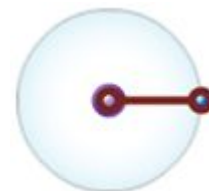
b

3. What is the relationship between the thickness of the book and the ability of the magnet to hold on to and attract paper clips?

the thicker the book The ability of the magnet to hold onto and attract paper clips decreases

Gizmo Warm-up

Just as the thickness of a book changes how strongly a magnet attracts a paper clip, the size of an atom determines how strongly the **nucleus** attracts electrons. In the *Periodic Trends* Gizmo, you will explore this relationship and how it affects the properties of different elements.



The **atomic radius** is a measure of the size of the **electron cloud**, or the region where electrons can be found. To begin, check that **H** (hydrogen) is selected in **Group 1** on the left. Turn on **Show ruler**. To measure the radius, drag one end of the ruler to the proton in the nucleus and the other end to the electron. Click **Save radius** to record the value.


1. What is the radius of hydrogen?

53 p.m.

Notice that the radius is measured in **picometers** (pm). A picometer is one trillionth of a meter.

2. On the right side of the Gizmo, select **Li**. Connect the right side of the ruler to the outermost electron, or **valence electron**. What is the radius of lithium?

167 p.m.

Activity A: Atomic radius	Get the Gizmo ready: <ul style="list-style-type: none"> Check that Atomic radius is selected from the drop-down menu. 	
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Question: What factors affect the radius of an atom?

1. Predict: How do you think the radius of an atom will change as you move down a **group** (vertical column) in the periodic table?

it would get larger

2. Collect data: Use the ruler to measure the atomic radii of the group 1 elements. As you do so, count the **energy levels** (shown as rings of electrons) in each atom. Record in the table.

Element	H	Li	Na	K	Rb	Cs
Number of energy levels	1	2	3	4	5	6
Atomic radius (pm)	53pm	167 pm.	190 p.m.	243pm	265pm	290pm

3. Observe: What happens to the radius as you move down group 1?

it increases

4. Explore: Turn off **Show ruler**. Select **Li**, and then select **Be**. Observe the radii of the elements in group 2. Then look at other groups. What pattern do you see?

the radii keeps increasing as you go down the groups

5. Draw a conclusion: In general, what is the effect of the number of energy levels on the radius of an atom?

the more energy levels there are, the greater the radius of the atom is

6. Predict: How do you think the radius of an atom will change as you move across a **period** (horizontal row) in the periodic table?

I think it will decrease

7. Collect data: Beginning with **Na**, record the number of energy levels, number of protons, and atomic radius for each element in period 3.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Number of energy levels	3	3	3	3	3	3	3	3
Number of protons	11	12	13	14	15	16	17	18
Atomic radius (pm)	190p m	144p m	118p m	111p m	98pm	88pm	79pm	71pm