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# Inquiry-Based Chemistry Games

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## What is your role?

- 1 Chemistry or Science Teacher
- 2 Non-science teacher
- 3 Administrator
- 4 Other

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## Which common games have you used in class? (Jeopardy, BINGO, etc)

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## Purpose of this session

- Define inquiry and look at some components of inquiry based learning
- Engage in an example of how a common game can be used as a tool for inquiry-based learning

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## Periodic Table Game

- Use to introduce periodic trends
- Prior knowledge: atomic structure
- Some background info needed before game, but game is pretty straightforward

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Periodic table of elements

What is special about the noble gases?

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1. What do elements in the same group have in common?

2. What changes about the *structure of the atom* as you go down the group (top to bottom)?

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1. What do elements in the same period have in common?

2. What changes about the *structure of the atom* as you go across the period (left to right)?

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## Properties of Elements

- We will look at 3 properties in today's game

Properties of Selected Elements

Atomic Number	Symbol	Name	First Ionization Energy (kJ/mol)	Electronegativity	Melting Point (K)	Boiling Point (K)	Density** (g/cm <sup>3</sup> )	Atomic Radius (pm)
1	H	hydrogen	1312	2.1	14	20	0.00009	37
2	He	helium	2372	—	1	4	0.000179	32
3	Li	lithium	520	1.0	454	1620	0.534	155
4	Be	beryllium	900	1.6	1551	3243	1.8477	112
5	B	boron	801	2.0	2573	3931	2.340	98

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## Atomic Radius

- A measure of the size of an atom

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## Electronegativity

- A measure of an atom's ability to gain or attract electrons
- Can be thought of as an atom's desire or greediness for electrons

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## Ionization Energy

- The amount of energy required to remove an electron from the outermost shell of an atom
- A measure of an atom's ability to lose an electron and form a cation

This image depicts an atom losing an electron. The ionization energy is the energy required to accomplish this.

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### Practice: Looking up Values for these Properties & Interpreting Meaning

- Look up the atomic radius for Magnesium and Calcium. Which one has a greater atomic radius?

Mg 140      Ca 174

Ca atom is larger than Mg atom



### Practice: Looking up Values for these Properties & Interpreting Meaning

- Look up the electronegativity for Magnesium and Calcium. Which one has a greater electronegativity?

Mg 1.3      Ca 1.0

It's easier for Mg to gain electrons than Ca



### Practice: Looking up Values for these Properties & Interpreting Meaning

- Look up the ionization energy for Magnesium and Calcium. Which one has a greater ionization energy?

Mg 738      Ca 590

It's harder for Mg to lose electrons than Ca (requires more energy to remove electron)



### Periodic Table War

Round	Property to Compare	Your element and its value from the <i>reference table</i>	Order of elements (from smallest to largest value)	Winner (greatest value)
1	Atomic Radius			
2	Electronegativity			
3	Ionization Energy			



### Post-Game Questions

**Questions:** Based on the values you filled in the game table, answer the following questions (each question matches with the corresponding round number):

1. Round 1:

- Place your elements in order of increasing atomic number in the boxes provided.
- In general, what happens to atomic radius as you compare elements going down a group (top to bottom)?
- Based on what you know about the structure of an atom and the definition for atomic radius, why do you think this occurs?



### Periodic Table War: Reflect

- How was this activity structured?
- What was the focus of the activity?
- How would you describe the students' involvement or role in the game?
- How is this different from how you would normally introduce periodic trends?



*Inquiry promotes analytical thinking, knowledge generation & application, and construction of meaning*



## Benefits of Games

- Especially useful in middle & high school when school traditionally moves away from play
- Combine course content with opportunities to practice different skills in low-stakes, engaging environment
- Work on teamwork, problem-solving and leadership, and peer-to-peer instruction



## Concerns with Games

- Don't have the technology or team of designers to create fancy games
- May take too much time away from classroom learning, especially if rules also need to be learned



## Accessible Strategies for Game-Based Instruction

- Keep the game simple, familiar, and with clear rules
- Modify an existing game and tweak one aspect to target a specific learning outcome



## Your Turn!

- Pick a topic you teach that involves:
- Recognizing/identifying a pattern
  - Collecting/obtaining a specific number
  - Maintaining a specific number

