Unit 3 - Atoms to Power - Interactive Notebook

Name:

Word Wall	Unit 2 Learning Tracker	Unit Opener	Task Set 1
Task Set 2	Task Set 3		

Word Wall:

Term	Definition	Example	Picture
Proton			
Neutron			
Electron			
Isotope			
Ion			
Chemical properties			
Atomic radius			
Electronegativity			
Ionization energy			

Unit 2 Learning Tracker:

Atoms and Periodic Table: Uses models of the atom to describe how valence electrons determine the patterns of the periodic table and the properties of the elements.
Anchoring Phenomenon: Different elements have different properties. (Example: Gold is very unreactive while Sodium is highly reactive)
Unit Essential Questions: Why are some elements so reactive and others are not? Why are some common and some rare? Can we predict the properties of elements using the periodic table?

How can we answer the task set EQ?	How does this help us explain the anchoring phenomenon?
TS1 EQ: Why is gold so valuable?	_____ *helps us explain...*
Response:	
TS2 EQ: What makes a nucleus stable versus unstable?	
Response:	
TS3 EQ: Why are Alkali metals so reactive?	
Response:	
TS4 EQ: How can we predict the properties of elements?	
Response:	
Unit Essential Questions: Why are some elements so reactive and others are not? Why are some common and some rare? Can we predict the properties of elements using the periodic table?	
Response to Unit Essential Question:	

Unit Opener: Why is gold so valuable? (Slides)

Gold was used as a currency in many ancient cultures (and still is today!)

Mayan gold medallion

Egyptian Statue

Spanish gold coin

But… Why gold? What's so special about it?

Below is a quartz rock with a vein of gold:  Gold in quartz taken from from corbisimages.com	What do you **notice**? What do you **wonder**?
The elements in the picture above are gold, silicon and oxygen. Below are pictures of the pure elements. (image from https://wallpaperjam.com/view/elements-periodic-table-14638)  Oxygen silicon gold	Which still look like pure elements instead of compounds (elements that have reacted and stayed together)? Explain what you see.
Watch this video. What Makes Gold So Valuable? (3:34 min)	What did you **notice**? What do you **wonder**?

What are your precious items?	Why are those items precious? What are those items made of?
Look at the image on the left and compare to the video connected to the image on the right   Gold in water sodium in water Public Domain Image, source: Christopher S. Baird.	What is the difference between sodium and gold?
How would you respond to someone who said “why is gold valuable anyway”?	

Reflect:

- Can you answer the Task Set Essential Question: **Why is gold so valuable?** *Make sure you’ve recorded your response above on the Unit 2 Learning Tracker.*

Task Set 1: Periodic table card sort

Links for this activity: Create a Table Slides Initial Element Sort Jamboard

Provide the link to your copy of the Jamboard pages here:

Initial sort:

On the Jamboard:

1. Arrange Be (Beryllium), Mg (Magnesium), Ca (Calcium), and Sr (Strontium) and in a vertical column (group) from the lowest number to the highest number.
2. List 3 patterns that you see either trends or something that they all have in common.
3. Next, explain what the pattern is and support it with evidence from the cards.

Sentence starter for the pattern and explanation with evidence

When I look at the data, I see that *insert pattern or trend here*. The reason I see this trend/pattern is *evidence 1 (element & data)* and *evidence 2 (element & data)*.

Pattern	Explanation with evidence
1.	
2.	
3.	

<u>Second sort:</u>

Groups have been made with other elements from the periodic table using one of your patterns you listed above.

1. Arrange these groups in a logical order from left to right.
2. Explain how you arranged your groups

Sentence starter for looking at the whole table:

When I look at the data, I see that *insert pattern or trend here*. The reason I see this trend/pattern is *evidence 1 (element & data)* and *evidence 2 (element & data)*.

Talk with your classmates or people in your breakout group to determine what the order should be. Once they are in this order, what additional patterns do you see?

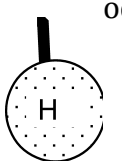
1.

2.

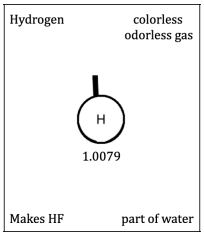
3.

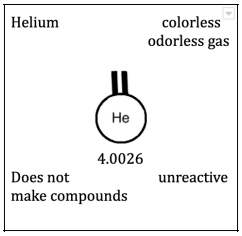
Predicting products of missing elements:

There are 2 missing elements. For each element predict the picture, mass, properties, reactivity and what kind of compound that it makes.

Example element	Missing element 1	Missing element 2
Name Ex: Hydrogen properties ex: colorless odorless gas Picture With mass: example  1.0079 What it makes Ex: Makes HF reactivity: part of water		

To the right are the images for Hydrogen and Helium.
What group do they belong in and why?





What makes them hard to place?

Sentence starter

Choose one of these description/elaboration sentence frames or create your own response:

- _____'s properties suggest that...
- Properties of _____ include _____, which caused _____ because…
- _____ is characterized by distinct properties such as _____, which challenged _____ due to…

Summary of metals vs nonmetals

After your initial brainstorm, check your answers with slide #13.

Type of element	Metal	Nonmetal
Common states of matter (solid, liquid, gas)		
Common colors (grey, colorless, all colors)		
In compounds is it listed 1st or second? Example: NaF the Na is 1st and the F is second		
Place in the periodic table (Left and bottom or top right)		

Task Set 2: What makes a nucleus stable versus unstable?

As we saw in the card sort above, elements are arranged by common properties. Another way that they are arranged is by atomic number, the number of protons in the nucleus. Also residing in the nucleus are the neutrons, the particles that keep the protons from repelling each other. When two protons are moved close to each other they repel since they are both positively charged. The neutron provides a "strong force" to bind them together and essentially "block" them from each other.

1. Open up the Build An Atom PhET and answer the questions below. Click on "net charge", "mass number", and "stable/unstable" to open them before getting started.

What happens to the identity of the atom when the number of protons are changed?	
Sometimes the nucleus shakes. How can you make it stop shaking?	
What changes when electrons are added to an atom?	
Where do the electrons reside on the atom?	
Where do the protons and neutrons reside?	

Which particle does not change whether the nucleus shakes or not?	

Notice that each atom of Be has four protons in the nucleus, which defines it as Beryllium. What differs between them is the number of neutrons. These are two isotopes of Beryllium: two atoms of the same element that differ in their number of neutrons. In the image on the right, the ratio of protons to neutrons is not adequate to keep the nucleus stable. There are four neutrons. In the image on the left, the nucleus is stable and there are five neutrons. For this particular element, the nucleus is stable when there are five neutrons and four protons. This ratio varies by element, and more drastically as the atoms get larger. When an atom's nucleus is unstable, the atom is radioactive and its nucleus is likely to break apart.

Notice also that the net charge on the two atoms is the same; the number of protons is the same as the number of electrons. Protons with a positive charge and electrons with a negative charge cancel one another out, and the net charge is zero. If the number of protons and electrons were not the same, there would be a net charge and the atom would be called an ion.

For practice, use the words "proton", "neutron", and "electron" to complete the sentences below:

The _____ and the _____ impact whether the *nucleus* is stable or unstable. The number of _____ indicates the identity of the element. Whether an atom is charged or neutral depends on the balance between the _____ (positive charges) and the _____ (negative charges).

2. After completing the Build An Atom activity, complete the table below. Place an "x" in each of the columns where the subatomic particle is relevant to the type of particle indicated.

Particle	Protons	Neutrons	Electrons
A neutral atom			
A stable nucleus			
An ion			
An isotope			

Let's explore ions in more detail. We know that ions are when an atom has a net charge, when the protons ≠ the electrons. How do we know what charge an atom will become? How many more or fewer electrons will an atom have?

3. Draw the Bohr model of the elements in row 2 of the periodic table.

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Colum 8
Row 2	**Li**	**Be**	**B**	**C**	**N**	**O**	**F**	**Ne**
#protons|#electrons	3|3							
2. Bohr Model (Insert Google drawing)								
3. Gain or Lose electrons? How many?								
4. # protons | #electrons								
5. Resulting Charge								

#1: record the number of protons and electrons for a neutral atom of each of the elements in the table.
#2: Thinking about the way atoms were depicted in the PhET, draw a model for each atom using the rule that only two electrons can be in the first ring, eight in the second, and eight in the third.

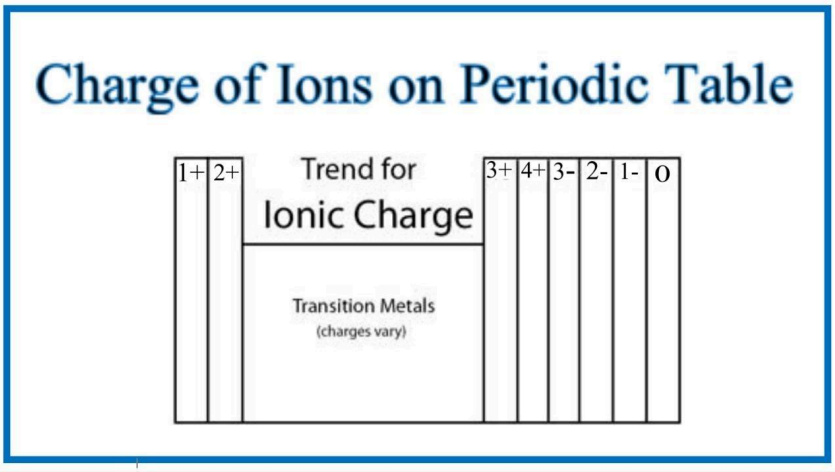
Notice now that all of the atoms, except one, have rings that are partially filled. This makes the atom “unhappy” and its mission becomes completing the outermost ring, the valence shell. The atom can either gain or lose electrons to accomplish this. Whether it gains or loses depends on which is easier for the atom. For example, consider Lithium. It has one electron in its valence shell. It can either lose that one electron, making the inner ring the valence shell (it is complete), or it can gain seven electrons to complete the shell. It is easier to lose one than to gain seven electrons.

#3: decide whether the atom will gain or lose electrons, and how many.
#4: record how many protons and electrons it has once it has gained/lost

To determine the resulting charge, compare the number of protons (+) to the number of electrons (-). Since Lithium will lose one electron, it will have 3 protons, but only 2 electrons. 3 + (-2) = +1, the resulting charge is a +1.

#5: determine the resulting charge

Once we get the hang of this process, it is easy to see whether an atom will gain or lose electrons when seeing a Bohr model. However, having to draw out a Bohr model each time is tedious. The image below shows us the pattern for determining charge by looking at the periodic table.



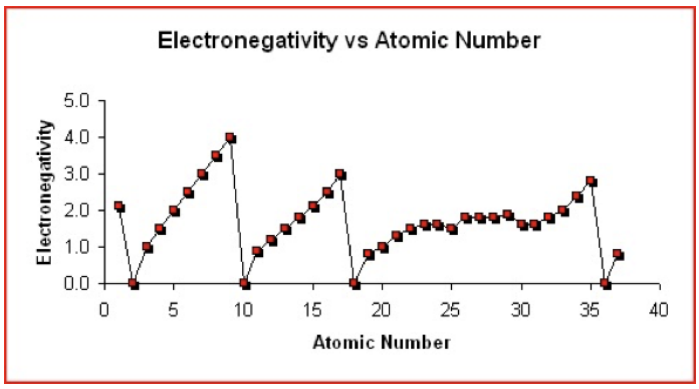
Reflect:

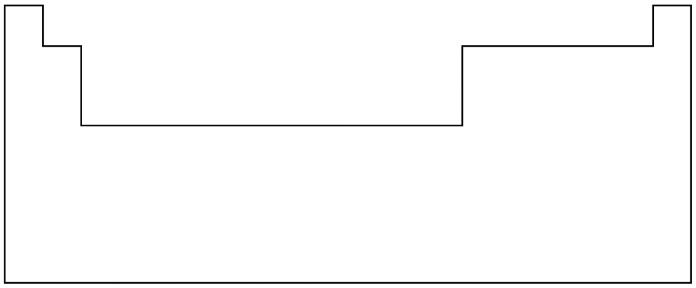
- Which vocabulary terms can you complete now?

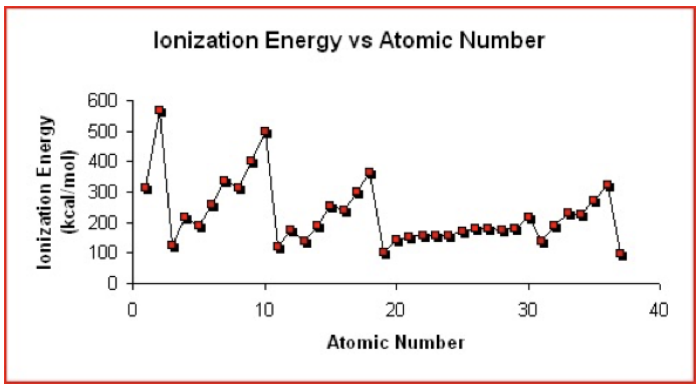
- Answer the Task Set 2 essential question.

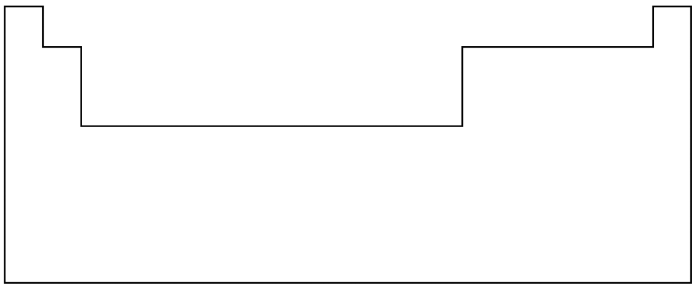
Task Set 3: How do we predict the properties of elements?

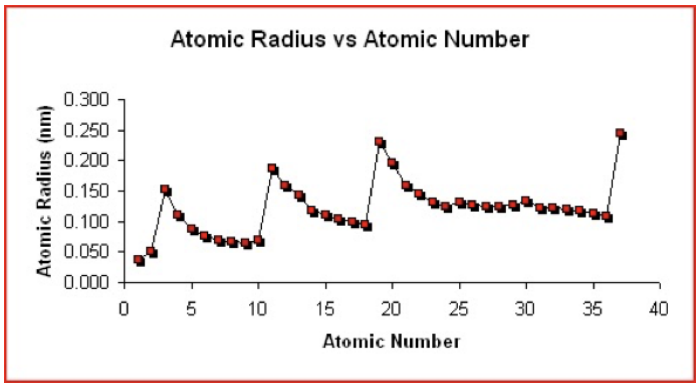
To be able to predict properties of elements, we need to understand the patterns both across a row and within a column. See the graphs below and in the periodic table next to it, draw one arrow in the horizontal direction and one arrow in the vertical direction, both pointing in the direction of increasing value.

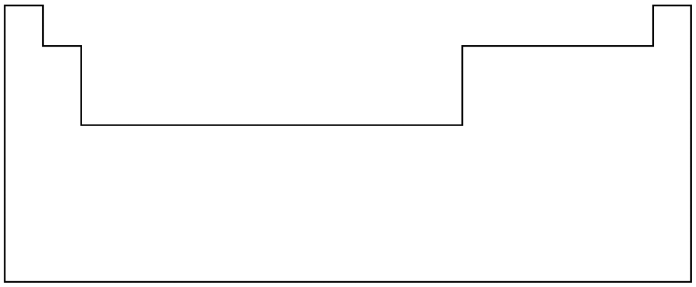












Using these arrows, make a prediction about each of the pairs of elements below:

Electronegativity - the ability to attract electrons
Arrange the following elements in order of increasing electronegativity. Fr, O, K, Se

_____<_____<_____<_____

Ionization Energy - the energy required to remove a valence electron
For each set of elements circle the one with the larger ionization energy

a. _____ Na or O
b. _____ Be or Ba
c. _____ Ar or F
d. _____ Cu or Ra
e. _____ I or Ne
f. _____ K or V
g. _____ Ca or Fr
h. _____ W or Se

Atomic Radius - distance from the nucleus center to the valence ring
For each set of elements, circle the one with the smaller atomic radius

a. _____ Li or K
b. _____ Ca or Ni
c. _____ Ga or B
d. _____ O or C
e. _____ Cl or Br
f. _____ Be or Ba
g. _____ Si or S
h. _____ Fe or Au

Reflect:

- Complete all remaining vocabulary terms.
- Complete all remaining essential questions in the unit tracker.