

Pre-Questions

1. What are groups? How are they related to families?
2. Some elements don't exist in nature but the periodic table shows all the elements scientists have confirmed. How many have been confirmed?

PART 1: Trends Related to Atomic Number

3. What is the relationship between atomic number and number of protons?
4. What is the relationship between atomic number and number of neutrons? How does this relationship differ from atomic number and protons?
5. The mass of a single atom of an element is called the atomic mass. The atomic mass depends on the number of protons and neutrons an element has. What is the relationship between atomic number and atomic mass? Why might this be the case?

PART 2: The Periodicity of Element Properties

6. Periodicity is the idea that patterns repeat themselves; on the periodic table that means the elements properties repeat themselves. How do your graphs show “periodicity”? Draw it.
7. How might knowing that properties repeat themselves be useful to a scientist looking for a new element?

PART 3: Unstructured Coding

8. How many elements are radioactive in their common form?
9. Which type of element is the most common- metal, nonmetal, or metalloid? What are the general properties of that type?
10. If an element is naturally occurring, it means it is generated in the universe by processes like supernovae and is believed to be the “normal” building blocks for everything. How many natural elements (“normal building blocks”) are there? The universe has many more types of substances than this number though, how do you think is this possible?
11. What other patterns were you able to find using the Jupyter Notebook?

CODING INSTRUCTIONS

Pre-Questions

The highlighted line without a # in front will be displayed.

```
# The periodic table of elements with symbols, atomic numbers, and atomic masses
Image(url= 'http://www.chem.qmul.ac.uk/iupac/AtWt/table.gif')

# The periodic table of elements color-coded by type of element (metals, nonmetal)
#Image(url= 'https://fthmb.tqn.com/I1J8fd6q-skC40aXr7LkJJN9Bew=/1500x1000/filters

# The periodic table of the elements with elemental families identified
#Image(url= 'http://images.tutorcircle.com/cms/images/44/periodic-table11.PNG')
```

Importing Data into Your Jupyter Notebook

Execute the three blocks of code in this section.

PART 1: Trends Related to Atomic Number

```
ax = data.plot('AtomicNumber', 'NumberofProtons', title="Trends Related to Atomic Number",
ax.set(xlabel="Atomic Number", ylabel="Comparison Factor")
```

Change the highlighted code to answer the comparison question #4 & #5.

PART 2: The Periodicity of Element Properties

```
ax = data.plot('AtomicNumber', 'MeltingPoint', title="Looking for Periodicity of Properties",
ax.set(xlabel="Atomic Number", ylabel="Comparison Factor")
```

Change the highlighted code to one of the following: AtomicRadius, Electronegativity, Density, BoilingPoint, MeltingPoint, or NumberofValence

PART 3: Unstructured Coding

Remember you created an “index” of what you can change in your code. Any changes must EXACTLY match (including capitalization).

```
Index(['AtomicNumber', 'Element', 'Symbol', 'AtomicMass', 'NumberofNeutrons',
'NumberofProtons', 'NumberofElectrons', 'Period', 'Group', 'Phase',
'Radioactive', 'Natural', 'Metal', 'Nonmetal', 'Metalloid', 'Type',
'AtomicRadius', 'Electronegativity', 'FirstIonization', 'Density',
'MeltingPoint', 'BoilingPoint', 'NumberOfIsotopes', 'Discoverer',
'Year', 'SpecificHeat', 'NumberofShells', 'NumberofValence'],
dtype='object')
```

You may alter anything within the coding blocks, editing red text generally yields the results you are interested in. You may change other sections as well. Ask questions and explore. There is code to make a scatterplot, to count how many times something occurs on the periodic table, and to generate your own data table.