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Periodic Table of Elements Investigation: Predict the Unknown Elements

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| http://www.chemistry.co.nz/_framed/mendeleev.jpg |
| **Figure 1.** Dmitri Mendeleev used his periodic table to predict the properties of unknown elements.  Image found using Google Image Search: “Dmitri Mendeleev” |

**Introduction: Patterns** are an important part of science. They exist all around us and are often a key part in our understanding of scientific concepts. One of the greatest tools in science, the **periodic table of the elements**, is based on patterns.

Certain **elements** such as iron, lead, sulfur, tin, and zinc have been known since ancient times. By the mid-1800’s, scientists had knowledge of a large number of elements, but had trouble seeing them as anything but individual and unrelated things. Each element seemed to have its own unique set of **properties** and characteristics. Over the years, various scientists tried, with minimal success, to find patterns in those properties and organize the elements based on their characteristics.

**Dmitri Mendeleev** was a Russian chemistry professor in the late 1860’s who struggled with the idea of how to organize the elements in a way that made sense. In an attempt to help his students learn about all of the elements and understand how they worked together, he wrote down everything he knew about each element on a separate card; then he tried various arrangements of the cards according to similarities in the properties of the elements. What Mendeleev ended up with was the first version of our modern **periodic table**.

The thing that made Mendeleev’s system so great, aside from organizing the elements based on their properties, was its ability to **predict** the existence of yet-undiscovered elements *AND* the properties they would have!

**Your Task:** Follow in Mendeleev’s footsteps by creating a periodic table that not only shows patterns among known elements but also has the ability to predict the existence and properties of unknown elements.

**Guiding Question:** ***What are the properties of the two missing (unknown) elements?***

**Materials:** You may use any of the following materials during your investigation.

* Element Cards
* Graph paper (to keep track of your table) *tip: you may want to use your phone to take pictures of your table as you work*
* The Back of This Paper (to keep track of your ideas and write down patterns you see)

**Getting Started:** You will be given element cards that contain information about a group of elements. However, ***two elements that should be part of the group will be missing***. Search for similarities or patterns in the characteristics of the elements on the cards. (*Note: You are only being given about 1/3 of the periodic table, not the whole thing.*)

Try arranging the cards on your table so that ***elements are grouped according to their properties***. Look for ways to show ***multiple patterns*** within your table (in rows and columns), and ***find places where missing elements might fit in***. Then, use your table to ***predict the properties of the missing elements***.

* How will you keep track of your ideas? How will you show the patterns within your table?

**Reminders & Background Information:**

* ***Protons*** and ***neutrons*** are in the ***nucleus***. Protons have a positive charge, neutrons have no charge. Protons and neutrons are responsible for most (basically all) of the mass of the atom. Protons and Neutrons both have a mass of 1 a.m.u. (atomic mass unit).
* ***Electrons*** orbit the nucleus in the **electron cloud**. They have a negative charge and contribute an insignificant amount of mass (almost none) to the atom. ***Valence electrons*** are the electrons furthest from the nucleus that determine the chemical characteristics (bonding properties) of elements.
* ***Elements*** are the most basic form of matter. **Each element is made of a specific type of atom, determined by the number of protons in the nucleus.** The number of neutrons and electrons may vary, causing atoms to become **isotopes** (different numbers of neutrons) or **ions** (gained or lost electrons).