

Unit 6 Worksheet 1

Element Properties & The Periodic Table

Examine one of Mendeleev's first Periodic Tables, published in the main German chemistry periodical of the time, *Zeitschrift für Chemie*¹. The English translation starts on the right.

German Article:

Ueber die Beziehungen der Eigenschaften zu den Atomgewichten der Elemente. Von D. Mendelejeff. — Ordnet man Elemente nach zunehmenden Atomgewichten in verticale Reihen so, dass die Horizontalreihen analoge Elemente enthalten, wieder nach zunehmendem Atomgewicht geordnet, so erhält man folgende Zusammenstellung, aus der sich einige allgemeinere Folgerungen ableiten lassen.

		Ti = 50	Zr = 90	? = 180
		V = 51	Nb = 94	Ta = 182
		Cr = 52	Mo = 96	W = 186
		Mn = 55	Rh = 104,4	Pt = 197,4
		Fe = 56	Ru = 104,4	Ir = 198
	Ni =	Co = 59	Pd = 106,6	Os = 199
		Cu = 63,4	Ag = 108	Hg = 200
H = 1		Zn = 65,2	Cd = 112	
Be = 9,4	Mg = 24	? = 68	Ur = 116	Au = 197?
B = 11	Al = 27,4	? = 70	Sn = 118	
C = 12	Si = 28	As = 75	Sb = 122	Bi = 210?
N = 14	P = 31	Se = 79,4	Te = 128?	
O = 16	S = 32	Br = 80	J = 127	
F = 19	Cl = 35,5	Rb = 85,4	Cs = 133	Tl = 204
Li = 7	Na = 23	Ka = 40	Ba = 137	Pb = 207
		? = 45	Ce = 92	
		?Er = 56	La = 94	
		?Yt = 60	Di = 95	
		?In = 75,6	Th = 118?	

1. Die nach der Größe des Atomgewichts geordneten Elemente zeigen eine stufenweise Abänderung in den Eigenschaften.
2. Chemisch-analoge Elemente haben entweder übereinstimmende Atomgewichte (Pt, Ir, Os), oder letztere nehmen gleichviel zu (K, Rb, Cs).
3. Das Anordnen nach den Atomgewichten entspricht der *Werthigkeit* der Elemente und bis zu einem gewissen Grade der Verschiedenheit im chemischen Verhalten, z. B. Li, Be, B, C, N, O, F.
4. Die in der Natur verbreitetsten Elemente haben *kleine* Atomgewichte

Translation continued...

4. The commonest elements have small atomic weights.
5. The value of the atomic weight determines the character of the element.
6. There are unknown elements to discover eg elements similar to Al and Si with atomic weights in range 65-75.
7. The atomic weights of some elements may be changed from knowing the properties of neighbouring elements. Thus the atomic weight of Te must be in range 123-126. It cannot be 128.
8. Some typical properties of an element can be predicted from its atomic weight.

The current organization of the periodic table is based off of many of the repeating, or periodic, properties that Mendeleev noticed and used to organize his table. For this activity, color/label as indicated on the following page and answer questions in the space provided. Sections 4.8 to 4.9 in the textbook are an excellent resource for this activity. Coloring equipment that may be used includes the markers, crayons, or colored pencils provided. Write neatly and organize your labels for an excellent finished product!

¹ Source info: <http://www.rsc.org/education/teachers/learnnet/periodictable/pre16/develop/mendeleev.htm>

1. Metallic elements are known for their ability to conduct electricity as solids. Most of the known elements are metals, and almost all the metals are solids (can you find the exception?). Identify a few metals you are familiar with on the periodic table.
 - a) Using a specific color, outline all the metals on the periodic table.
 - b) What general claim can you make about where elements that share metallic properties are located on the periodic table?
2. Non-metal elements can easily be identified as substances that do NOT conduct electricity. These show greater range in properties such as boiling and melting points, as some are solid at room temperature, while others are liquids and gases.
 - a) Using a different color outline the non-metals outline all the non- metals on the periodic table
 - b) What general claim can you make about where elements that share non-metallic properties are located on the periodic table?
3. The elements in between the metals and non-metals are often referred to as semi-metals, or metalloids, as they vary in properties, sharing some of metals, and others of non-metals. On your periodic table, outline the elements that are semi-metals. Add a key at the bottom of your periodic table to explain your color scheme.
 - a) Using a different color outline the semi-metals.
 - b) With a bold pen or black marker, draw in the stair-step line separating the metals from the non-metals. Notice all elements that border this line are considered semi-metals with the exception of aluminum and polonium. (Mnemonic device: AlPo (like the dog food)).
4. The periodic properties of elements can also be considered according to the rows and columns.
 - a) A column is called a _____ or _____. Above each column, label the groups using the American numbering system (i.e. 1A, 2A, etc.). See page 99 in your text for more information.
 - b) Another system is used to number the groups. Above the numbers you just wrote for each column (group), label the groups again using the International Union of Pure and Applied Chemistry (IUPAC) scheme. See page 99 in your text for more information. (Both numbering schemes are currently used.)
 - c) A row is called a _____. To the left of the periodic table, number the first 7 rows from 1-7. Notice the 2 rows beneath the table, to the left of the appropriate rows, label the lanthanide series and then the actinide series, named for the first element in the row.
5. Some of the families in the periodic table are so similar in their chemical and physical properties that they are given special names. Using appropriate references, label the 4 columns that contain the alkali metals, the alkaline earth metals, the halogens, and the noble gases. These are the most common “families” that we will reference.
6. Recall that we have evidence that some elements exist as diatomic molecules rather than individual atoms in when they are not compounded to other elements. Add a stripe or some other appropriate indicating key to identify the elements (H₂, N₂, O₂, F₂, Cl₂, Br₂, and I₂) that exist as diatomic molecules. (Mnemonic device: Br I N Cl H O F – pronounced Brinklehoff)
7. Notice how a block of metals seems to separate the left two columns from the six columns on the right. These metals show variation in their properties and are often referred to as the transition metals. The other groups (1A-8A) are considered “main group”. Add a statement at the bottom of the periodic table about which groups or families are considered part of the main group elements, transition metal elements, and inner transition metal elements.

Unit 4 Worksheet 3 – Periodic Table: Getting to know you

Directions: Color/label as indicated below. **Sections 3.4 and 6.1** in the textbook are an excellent resource for this activity. Coloring equipment that may be used includes the markers, crayons, or colored pencils provided. *Write neatly and organize your labels for an excellent finished product!*

1. Using a different color for each, outline the metals, nonmetals, and metalloids (semi-metals) on your periodic table. Add a key at the bottom of your periodic table to explain your color scheme.
2. With a bold pen or black marker, draw in the stair-step line separating the metals from the non-metals. Notice all elements that touch this line are considered semi-metals with the exception of aluminum and polonium. (Mnemonic device: AlPo (like the dog food)).
3. The periodic table gained its name because the elements in a single column have *similar properties*. A column is called a _____ or _____.
A row is called a _____.
4. To the left of the periodic table, number the first 7 rows (periods) from 1-7.
5. To the left of the appropriate periods (rows), label the lanthanides and then the actinides.
6. Above each column (group), label the groups using the American numbering system (i.e. 1A, 2A, etc.). See page 156-157 in your text for more information.
7. Another system is used to number the groups. Above the numbers you just wrote for each column (group), label the groups again using the International Union of Pure and Applied Chemistry (IUPAC) scheme. See page 154 in your text for more information. (Both numbering schemes are currently used.)
8. Now label the 4 columns that contain the alkali metals, the alkaline earth metals, the halogens, and the noble gases. These are the most common “families” that we will reference. (see pg 158)
9. Add a stripe or some other appropriate indicating key to identify the elements (H_2 , N_2 , F_2 , O_2 , I_2 , Cl_2 , and Br_2) that exist as diatomic molecules at $25^\circ C$. (Mnemonic device: Br I N Cl H O F – pronounced Brinklehoff)
10. Add a statement at the bottom of the periodic table about which groups or families are considered part of the main group elements, transition metal elements, and inner transition metal elements. (see pg 154)

★ Great Periodic Table Web Resources:

www.aip.org/history/curie/periodic.htm (a great historical account of the periodic table)

www.chemicalelements.com/

www.chemicool.com/

www.webelements.com