History of the Periodic Table Reading Assignment
Chemistry

Name: ___________________________

Date: _____________ Hour: _________

Developing the Periodic Table (*Merrill Chemistry*, Glencoe McGraw-Hill, 1995, pp. 138-141)

Early in the nineteenth century, scientists began to seek ways to classify the elements. One attempt at classification was by Johann Döbereiner, a German chemist, in 1817. Döbereiner found that the properties of the metals calcium, barium, and strontium were very similar. He also noted that the atomic mass of strontium was about midway between those of calcium and barium. He grouped these elements into what he termed a triad. Later, Döbereiner found several other groups of three elements with similar properties. In each case, the second element had an atomic mass about halfway between those of the first and third elements in the triad.

In chemistry, what is a triad? ____

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In 1863, John Newlands, an English chemist, suggested another classification. He arranged the elements in order of their increasing atomic masses. He noted that there appeared to be a repetition of similar properties every eighth element. Therefore, he placed seven elements in each group. He then arranged the 49 elements known at the time into seven groups of seven each. Newlands referred to his arrangement as the law of octaves because the same properties repeated every eight elements.

Just six years after Newlands' proposal, Dmitri Mendeleev, a Russian chemist, proposed a similar idea. He suggested, as had Newlands, that the properties of the elements were a function of their atomic masses. However, Mendeleev believed that similar properties occurred after periods (horizontal rows) that could vary in length. Although he placed seven elements each in his first two periods, he placed seventeen elements each in the next two.

How was Mendeleev's arrangement of the elements different from Newlands's? ______________________

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In the 1860s, Mendeleev and the German chemist Lothar Meyer, each working alone, made an eight-column table of the elements. However, Mendeleev had to leave some blank spots in order to group all the elements with similar properties in the same column. To explain these blank spots, Mendeleev suggested there must be other elements that had not yet been discovered. On the basis of his arrangement, Mendeleev predicted the properties and atomic masses of several elements that were unknown at the time. One of the blank spaces in Mendeleev's table was below silicon. Mendeleev assumed such an element existed but had not yet been discovered. Today the missing elements have been discovered, and Mendeleev's predictions have been found to be very nearly correct.

Reihen	Gruppe I. — R^2O	Gruppe II. — RO	Gruppe III. — R^2O^3	Gruppe IV. RH^4 RO^2	Gruppe V. RH^3 R^2O^5	Gruppe VI. RH^2 RO^3	Gruppe VII. RH R^2O^7	Gruppe VIII. — RO^4
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

Why did Mendeleev leave blank spots in his table? ____

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How was Mendeleev able to predict the properties of undiscovered elements? ______________________

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In Mendeleev's table, the elements were arranged in order of their increasing atomic masses. The table showed that the properties of the elements are repeated in an orderly way. Such a repeating pattern is periodic. Mendeleev stated that the properties of the elements are a periodic function of their atomic masses. This statement was called the periodic law.

There was a problem with Mendeleev's table of elements. If the elements were arranged according to increasing atomic masses, tellurium and iodine seemed to be in the wrong columns. Their properties were different from those of other elements in the same column but were similar to those of elements in adjacent columns. Switching their positions put them in the columns where they belonged, according to their properties. If the switch were made, Mendeleev's assumption that the properties of the elements were a periodic function of their atomic masses would be wrong. Mendeleev assumed that the atomic masses of these two elements had been poorly measured, and he placed these two elements according to their properties. He thought that new mass measurements would prove his hypothesis to be correct. However, new measurements simply confirmed the original masses.

What was wrong with Mendeleev's table of the elements? ______________________________________

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What did Mendeleev think was the cause of the problem? ______________________________________

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Soon, new elements were discovered, and two other pairs showed the same kind of reversal. Cobalt and nickel were known by Mendeleev, but their atomic masses had not been accurately measured. When such a determination was made, it was found that their positions in the table were also reversed. When argon was discovered, the atomic mass was found to be greater than that of potassium. If argon and potassium were put in the table on the basis of atomic masses, their positions would have been reversed.

What six elements were reversed on Mendeleev's table? ______________________________________

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Henry Moseley found the reason for these apparent exceptions to Mendeleev's periodic law. Moseley's X-ray experiments, in 1913, showed that the nucleus of each element has an integral positive charge, the atomic number. Iodine, nickel, and potassium have greater atomic numbers than do tellurium, cobalt, and argon, respectively. As a result of Moseley's work, the periodic law was revised. It now has as its basis the atomic numbers of the elements instead of the atomic masses. The modern statement of the periodic law is the properties of the elements are a periodic function of their atomic numbers.

After Henry Moseley's experiments, how are the elements on the periodic table now arranged? ________

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