

The Periodic Table

Periodic Table of the Elements

* Lanthanide Series

* Actinide Series

Elements are like a collection

As more and more elements were discovered it became more important to organize and classify them

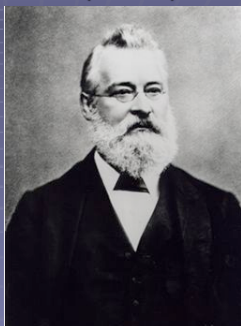
The Basics

- What does periodic mean?
 - Having or marked by repeated cycles
 - What things in our everyday life do we notice as cyclic or periodic?
- What are some of the patterns you notice on the periodic table?
- There are many important people who played a key role in organizing the elements in such an intricate fashion...

Between the late 1700's and mid 1800's scientists, using mostly atomic spectroscopy, doubled the number of known elements.

John Newlands (1864)

- In 1865, English chemist John Newlands presented another way to classify and organize the 62 elements known at the time



Newlands placed the elements in order of increasing atomic mass. He noticed that the properties of the eighth element were like those of the first, the ninth like those of the second, and so on....

Newlands' Arranged Elements in Octaves:

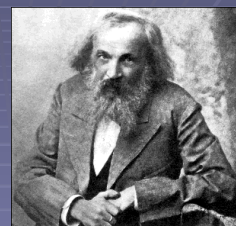
- He called this repeating pattern of every eight elements.....
- THE LAW OF OCTAVES
- After the eight notes of the musical scale



- The Law of octaves was not readily accepted b/c it did not work with all elements
- Newlands law was also criticized b/c the use of the word octave was considered very “unscientific”
- The important thing was that Newland recognized that properties of elements were repeated

Dmitri Mendeleev (1869)

- Russian chemist demonstrated connection between atomic mass and elemental properties
- Noticed (like Newlands) that when elements were put in order of atomic mass there was a periodic repetition of their elemental properties
- Arranged elements in order of increasing atomic mass into columns with similar properties
- This was the first periodic table



This is the earliest version, from his notebook of Dmitri Ivanovich Mendeleev's Periodic Table of the Elements.

At the bottom, he makes a really sheet of the elements, with the atomic weights as they were then known. He copies them out as he finds them in.

The most beautiful thing about this Table is obvious: all the coming out. This is something that of us can do...

Robert Hoffmann

				Ti	50	Zr	90		?
				V	51	Nb	91		Ta
				Cr	52	Mo	92		182
				Mn	53	Rh	93		186
				Fe	54	Ru	94		187
				Ni	55	Pd	95		188
				Cu	56	Ag	96		189
				Zn	57	Cd	97		190
				Al	58	In	98		191
				Si	59	Sn	99		192
				P	60	Sb	100		193
				S	61	Te	101		194
				Cl	62	I	102		195
				Br	63	At	103		196
				K	64	Rb	104		197
				Ca	65	Sr	105		198
				Sc	66	Y	106		199
				Ti	67	Zr	107		200
				V	68	Nb	108		201
				Cr	69	Mo	109		202
				Mn	70	Rh	110		203
				Fe	71	Ru	111		204
				Ni	72	Pd	112		205
				Cu	73	Ag	113		206
				Zn	74	Cd	114		207
				Al	75	In	115		208
				Si	76	Sn	116		209
				P	77	Sb	117		210
				S	78	Te	118		211
				Cl	79	I	119		212
				Br	80	At	120		213
				K	81	Rb	121		214
				Ca	82	Sr	122		215
				Sc	83	Y	123		216
				Ti	84	Zr	124		217
				V	85	Nb	125		218
				Cr	86	Mo	126		219
				Mn	87	Rh	127		220
				Fe	88	Ru	128		221
				Ni	89	Pd	129		222
				Cu	90	Ag	130		223
				Zn	91	Cd	131		224
				Al	92	In	132		225
				Si	93	Sn	133		226
				P	94	Sb	134		227
				S	95	Te	135		228
				Cl	96	I	136		229
				Br	97	At	137		230
				K	98	Rb	138		231
				Ca	99	Sr	139		232
				Sc	100	Y	140		233
				Ti	101	Zr	141		234
				V	102	Nb	142		235
				Cr	103	Mo	143		236
				Mn	104	Rh	144		237
				Fe	105	Ru	145		238
				Ni	106	Pd	146		239
				Cu	107	Ag	147		240
				Zn	108	Cd	148		241
				Al	109	In	149		242
				Si	110	Sn	150		243
				P	111	Sb	151		244
				S	112	Te	152		245
				Cl	113	I	153		246
				Br	114	At	154		

T a b e l l e II.

Reihen	Gruppe I. R ⁰	Gruppe II. R ⁰	Gruppe III. R ⁰	Gruppe IV. R ⁰	Gruppe V. R ⁰	Gruppe VI. R ⁰	Gruppe VII. R ⁰	Gruppe VIII. R ⁰
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	(Ca=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	Yt=88	Zr=90	Ni=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	Th=138	—=140	—	—	—	—
9	(—)	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	—
12	—	—	—	—	—	—	—	—

- Mendeleev's table was widely accepted because it predicted the existence and properties of undiscovered elements
- He also left blank spaces on the table for elements not yet discovered.
- Predicted properties of yet to be discovered elements such as scandium, gallium, and germanium

But there were problems...

- As new elements were discovered and atomic masses were more accurately determined, some elements with different properties were grouped together

Henry Moseley (1913)

- English Chemist
- Figured out the problem with Mendeleev's Table
- What did Moseley Discover before?
 - Atoms of each element contain unique number of protons in their nuclei
- He arranged elements in order of increasing *atomic number* and not increasing atomic mass



Problem Solved!

- Moseley's arrangement solved the problems with Mendeleev's table
- His arrangement resulted in clear periodic patterns of properties
- Lead to **Periodic Law**:
 - Statement that there is a periodic repetition of chemical and physical properties of the elements when they are arranged in increasing atomic number