

Chapter 4

The Periodic Table

- Is a list of elements arranged so that it demonstrates trends in their physical and chemical properties.

History of The Periodic Table

1.1 Periodic Table

Learning Outcomes

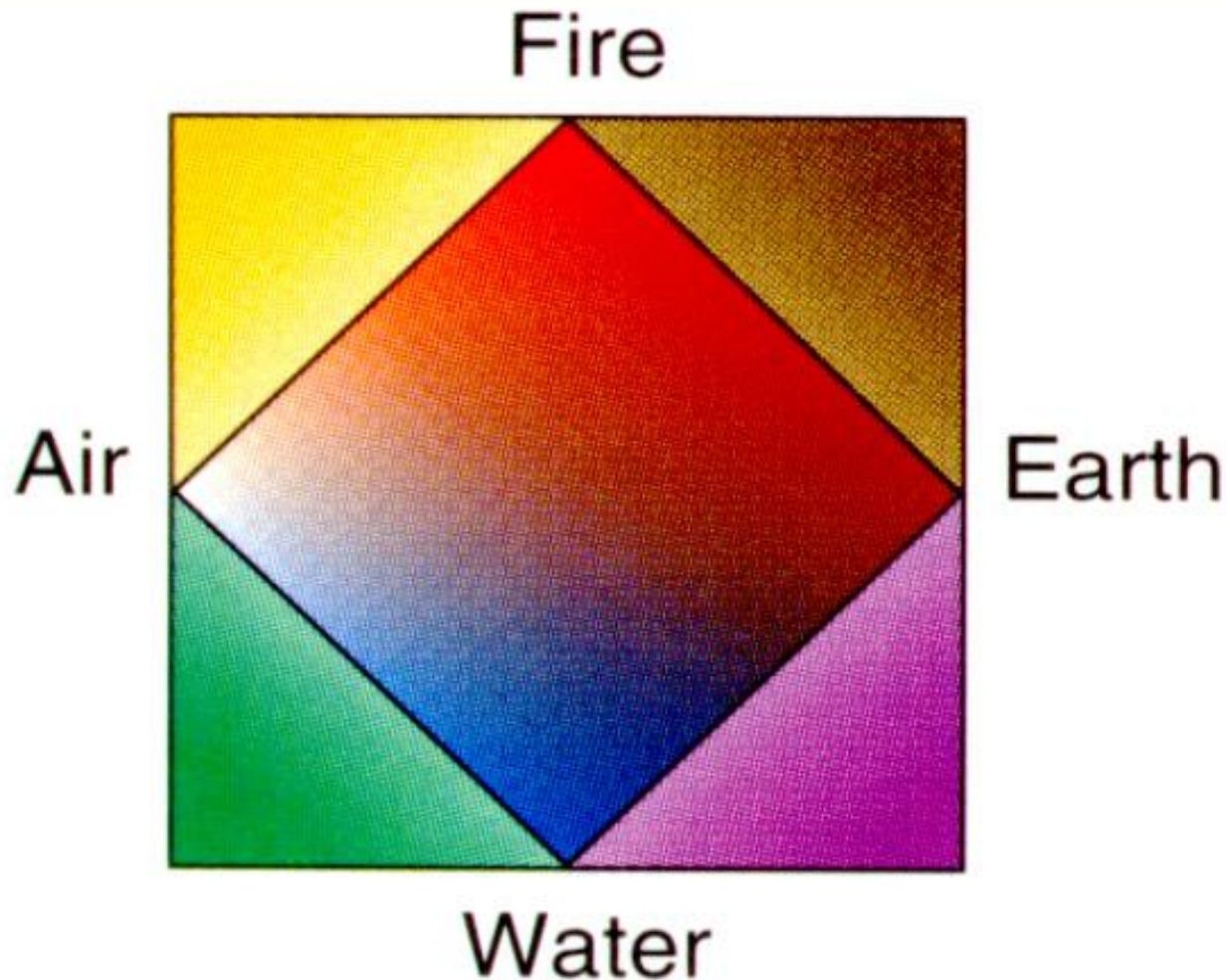
- History of the idea of elements,
- The contributions of the Greeks, Boyle, Davy, Dobereiner, Newlands, Mendeleev and Moseley.

*The Greeks

- Four element theory
- Earth, Air, Fire and water.
- (also added love, strife, mercury and alchemy)



Greek Periodic Table



*Robert Boyle

- Defined element as
- **Element** is a substance that cannot be split up into simpler substances by chemical means.



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- Defn:
- **An element is a substance made up of only one type of atom.**
- Defn:
- **A compound** is formed when 2 or more elements combine chemically.

Lavoisier

- Wrote first list of elements containing 33 elements.
- Some later discovered to be mixtures.
- He distinguished between metals and non-metals.



*Humphrey Davy

- Isolated Na, K, Mg, Ca, Ba and Sr by electrolysis



Davy

- Used electrolysis to break down water into hydrogen and oxygen.
- Discovered nitrous oxide (laughing gas) and its anaesthetic effect for toothache.
- Invented a safety lamp for miners- called the Davy lamp.

*Dobereiner

- Classified elements into groups of three elements called triads.
- **A triad**= group of 3 elements with similar chemical properties and the atomic weight of the middle element is the average of the other two.

Chlorine = 35.5, Bromine = 80, Iodine = 127
(average of Cl and I = 81)

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- Other triads were
- Lithium, sodium and potassium
- Calcium, strontium and barium



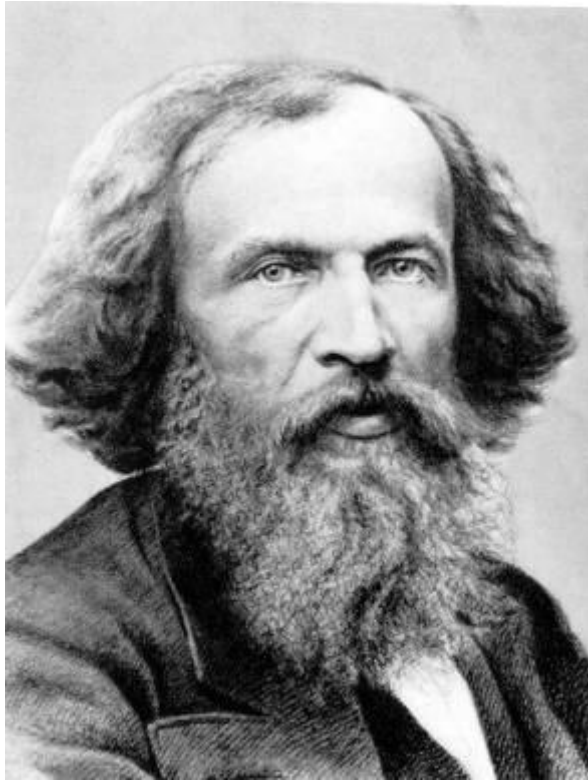
*Newlands

- Arranged the elements in order of atomic weights.
- Found that the properties seemed to repeat every eighth element.
- called this the Law of Octaves
- It only worked for the first 16 elements.

“Law of Octaves” because of its
similarity to musical octaves

Li	Na	K
Be	Mg	Ca
B	Al	?
C	Si	?
N	P	As
O	S	Se
F	Cl	Br

Mendeleev – “father of chemistry”



***Dimitri Mendeleev**

- Arranged the elements in order of increasing atomic weights also, but placed elements with similar properties in same groups.
- He reversed the order of some elements so that they would fit into group with similar chemical properties.
- Eg. He put tellurium (Te) before iodine (I) even though iodine has a smaller atomic weight.

*Mendeleev continued

- Left gaps for undiscovered elements
- He was able to predict properties of these missing elements.
- Periodic Law: properties of the elements vary periodically with their atomic weights

Mendeleev' s Table

THE PERIODIC LAW

Mendelejeff's First Periodic Table (March, 1869)

				Ti	50	Zr	90	?	100
				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
H	1			Cu	63·4	Ag	108	Hg	200
	Be	9·4	Mg	24	Zn	65·2	Cd	112	
	B	11	Al	27	?	68	U	116	Au 197?
	C	12	Si	28	?	70	Sn	118	
	N	14	P	31	As	75	Sb	122	Bi 210?
	O	16	S	32	Se	79·4	Te	128?	
	F	19	Cl	35·5	Br	80	I	127	
Li	7	Na	23	K	39	Rb	85·4	Cs	133
			Ca	40	Sr	87·6	Ba	137	Tl 204
			?	45	Ce	92			Pb 207
			Er?	56	La	94			
			Yt?	60	Di	95			
			In	75·6?	Th	118?			

*Henry Moseley

- Discovered that the nucleus contained a positive charge of definite amount.
- He measured the no.of protons using X-rays and called it the **atomic number**.



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- He arranged the elements in order of increasing atomic number.
- It was no longer necessary to reverse the order of some elements.
- He modified the periodic law, changing atomic weight to atomic number.

***Modern periodic table**

- **Elements are arranged in order of increasing Atomic Number.**
- **There are no gaps.**
- **Noble gases are included.**
- **Transition metals are in a separate block.**