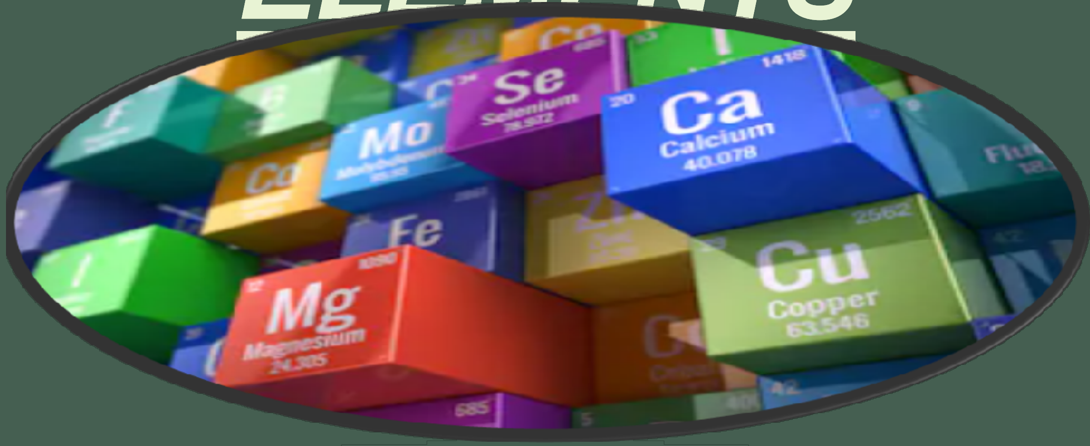
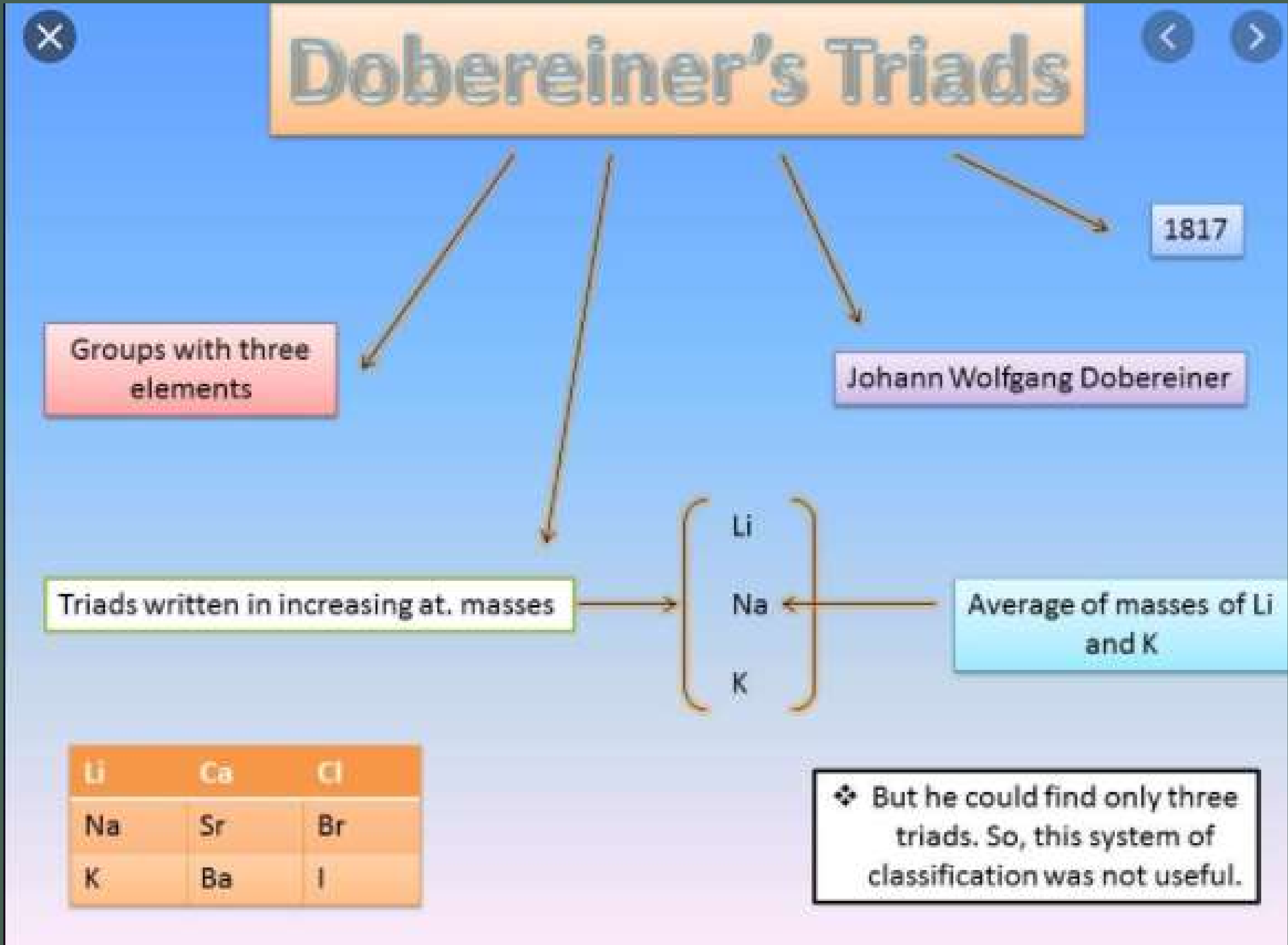
PERIODIC CLASSIFICATION OF ELEMENTS



WOLFGANG DOBEREINER

DOBEREINRS LAW OF TRAIDS


Dobereiner's Triads
1817
Groups with three elements
Johann Wolfgang Dobereiner
Triads written in increasing at. masses
Li
Na
K
Average of masses of Li and K
Li Ca Cl
Na Sr Br
K Ba I
❖ But he could find only three triads. So, this system of classification was not useful.

DOBEREINER'S TRIADS

	ELEMENTS	SYMBOL	ATOMIC MASS
1	Lithium	Li	6.9
	Sodium	Na	23
	potassium	K	39
2	Calcium	Ca	40.1
	Strontium	Sr	87.6
	Barium	Ba	137.3
3	Chlorine	Cl	35.5
	Bromine	Br	79.9
	Iodine	I	126.9
4	Sulphur	S	32
	Selemium	Se	79
	Tellurium	Te	128

CALCULATION OF ATOMIC MASS OF MIDDLE ELEMENT

Set I		Set II		Set-III	
Element	Atomic mass	Element	Atomic mass	Element	Atomic mass
Calcium	40	Lithium	7	Chlorine	35.5
Strontium	87.5	Sodium	23	Bromine	80
Barium	137	Potassium	39	Iodine	127
Average of the atomic masses of calcium and barium $= \frac{40+137}{2} = 88.5$		Average of the atomic masses of lithium and potassium $= \frac{7+39}{2} = 23$		Average of the atomic masses of chlorine and iodine $= \frac{35.5+127}{2} = 81.2$	
Atomic mass of strontium = 87.5		Atomic mass of sodium = 23		Atomic mass of bromine = 80	

Limitations of Dobereiner Law of Triads

a) All the then known elements could not be arranged in the form of triads.

b) The law failed for very low mass or for very high mass elements. In case of F, Cl, Br, the atomic mass of Cl is not an arithmetic mean of atomic masses of F and Br.

c) As the techniques improved for measuring atomic masses accurately, the law was unable to remain strictly valid.

NEWLANDS LAW OF OCTAVES

The Periodic Table

- 1863
- John Newlands creates the Law of Octaves
- It states that every 8th element in order of increasing atomic mass should have similar properties.
- This works for some smaller atoms, but does not work as atoms become progressively larger

Newlands' Arranged Elements in Octaves:

H	F	Cl	Co/Ni	Br	Pd	I	Pt/Ir
Li	Na	K	Cu	Rb	Ag	Cs	Tl
G	Mg	Ca	Zn	Sr	Cd	Ba/V	Pb
Bo	Al	Cr	Y	Ce/La	U	Ta	Th
C	Si	Ti	In	Zn	Sn	W	Hg
N	P	Mn	As	Di/Mo	Sb	Nb	Bi
O	S	Fe	Se	Ro/Ru	Te	Au	Os

Newlands' Law of Octaves

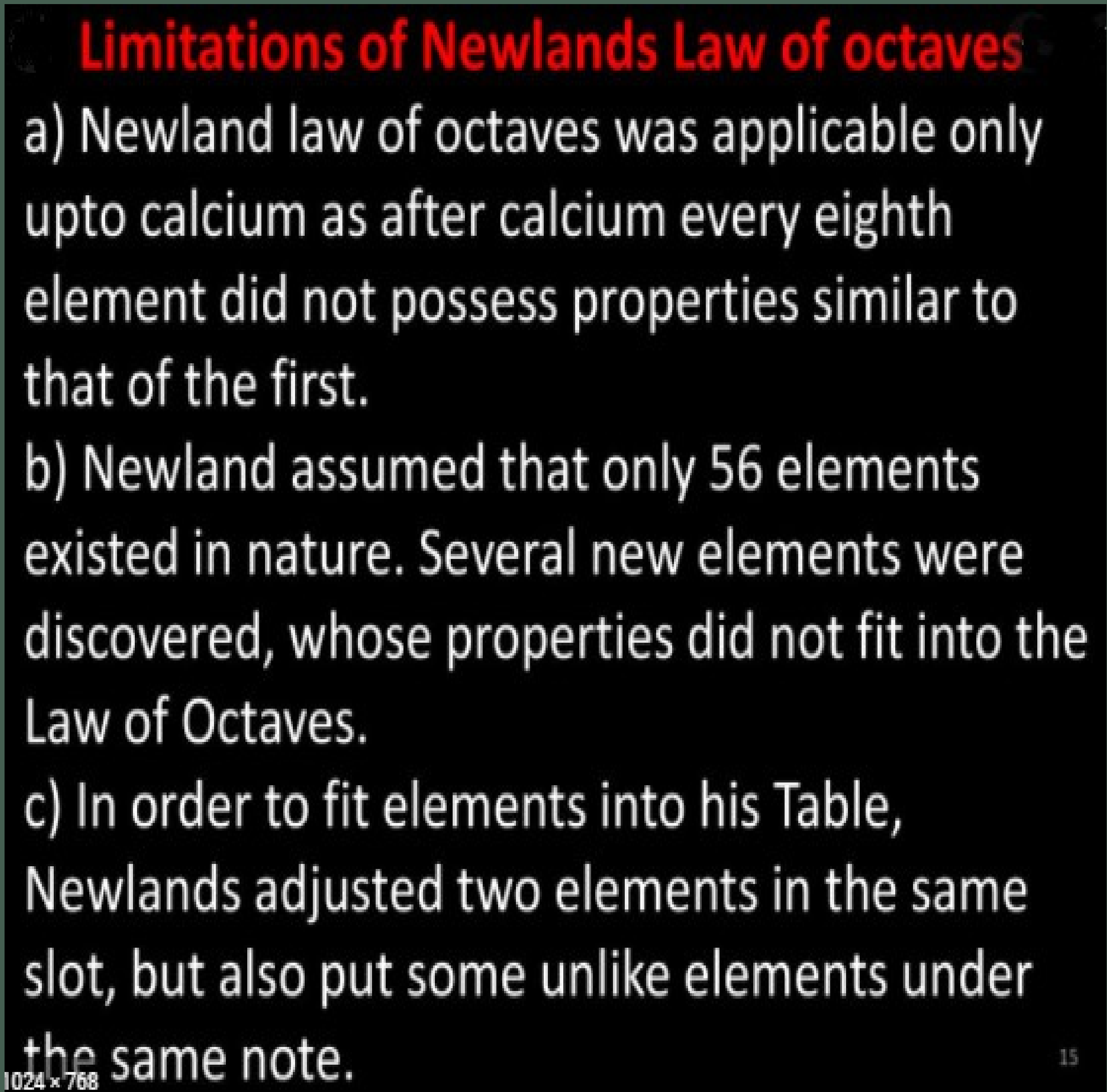
When the elements are arranged in order of increasing atomic masses then every eighth element has properties similar to that of the first element.

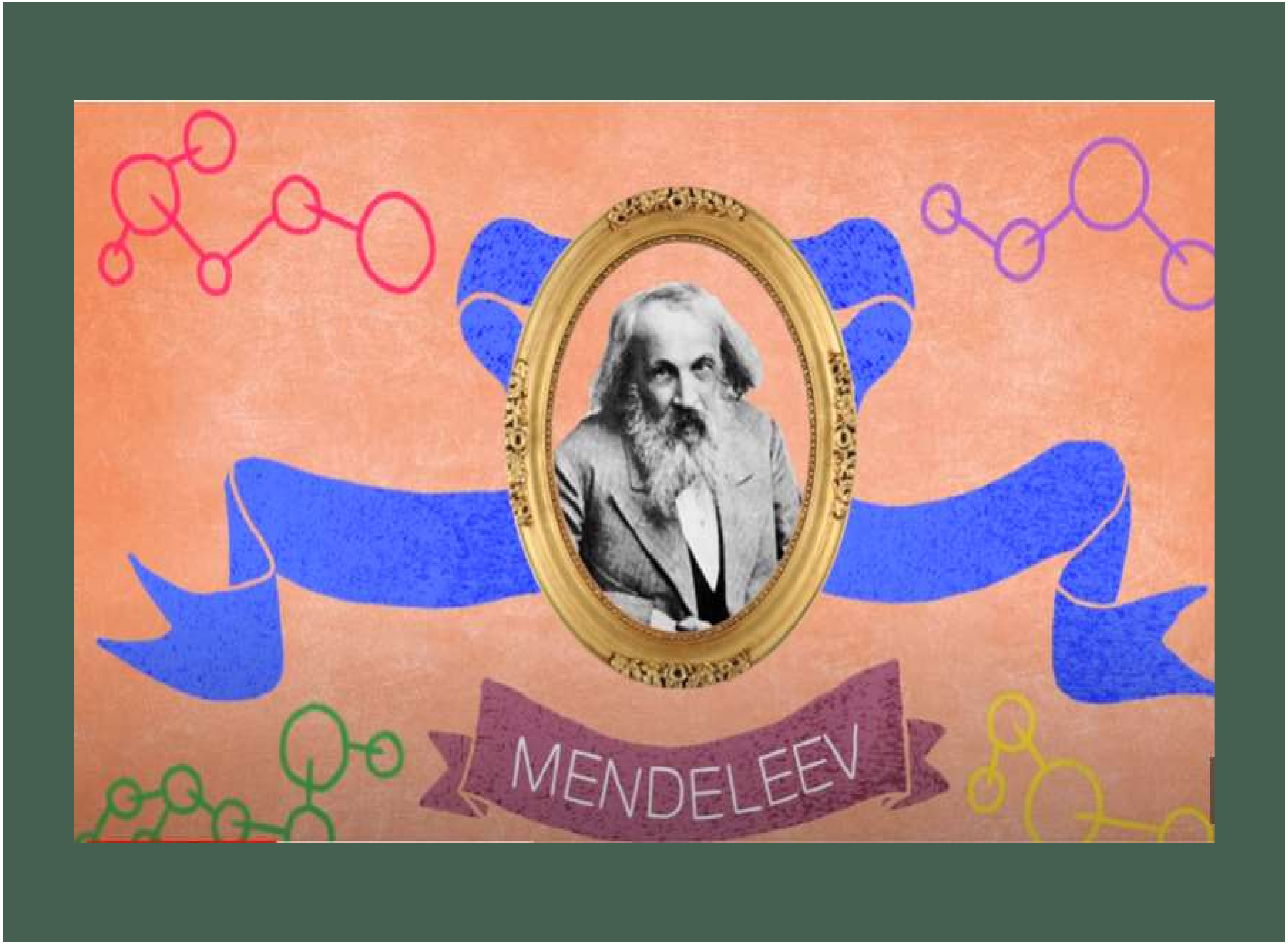
Law of Octaves

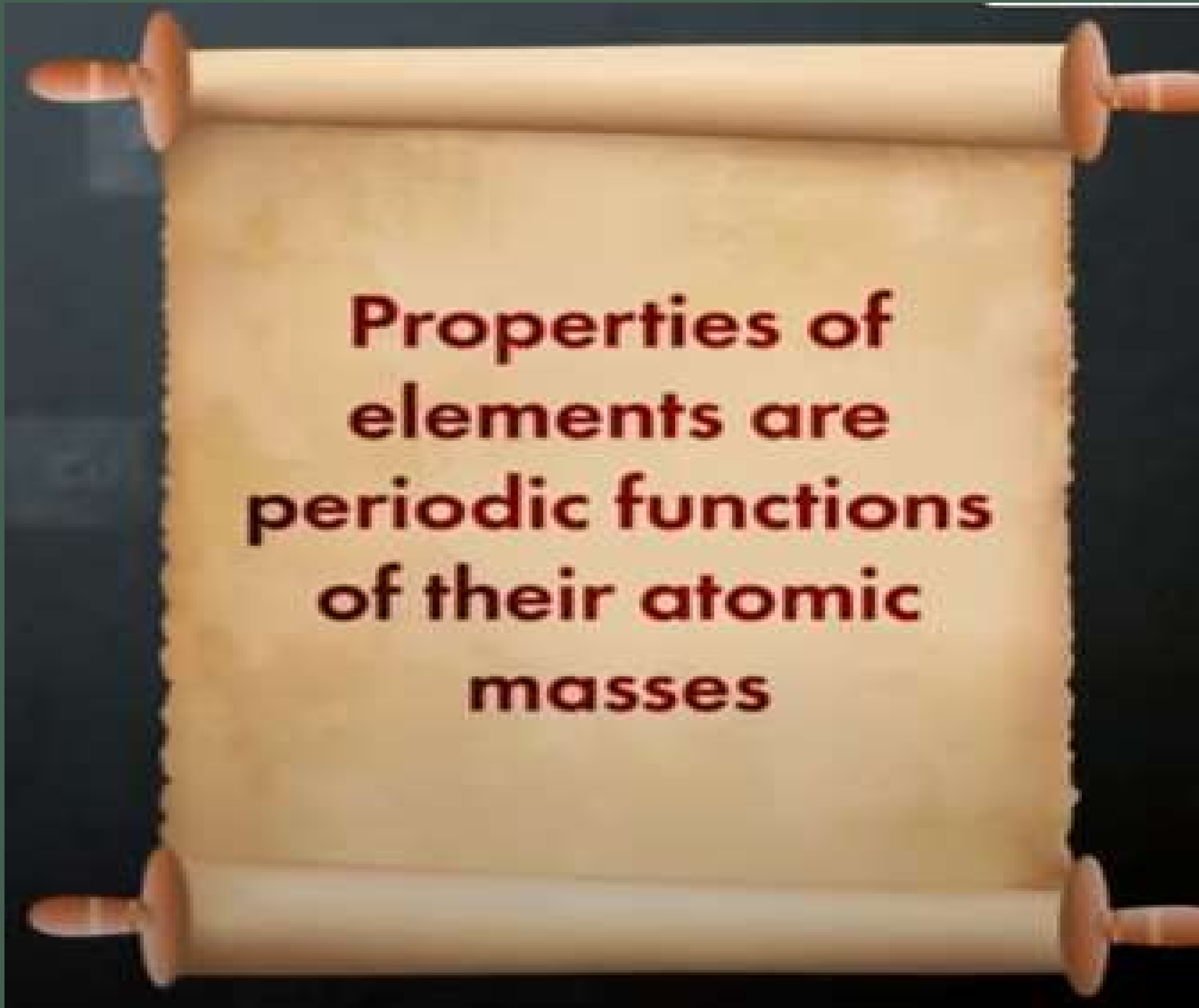
In 1866, John Newlands, an English scientist, arranged the then known elements in the order of increasing atomic masses. He started with the element having the lowest atomic mass (hydrogen) and ended at thorium which was the 56th element. He found that every eighth element had properties similar to that of the first. He compared this to the octaves found in music. Therefore, he called it the 'Law of Octaves'. It is known as 'Newlands' Law of Octaves'. In Newlands' Octaves, the properties of lithium and sodium were found to be the same. Sodium is the eighth element after lithium. Similarly, beryllium and magnesium resemble each other.

sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	—	—

LIMITATIONS OF LAW OF OCTAVES




MENDELEEV


Properties of
elements are
periodic functions
of their atomic
masses

Periodic Table of Elements
based on Mendeleev's Periodic Law

0	I	II	III	IV	V	VI	VII	VIII		
	H 1.01									
He 4.00	Li 6.94	Be 9.01	B 10.8	● C 12.0	N 14.0	O 16.0	F 19.0			
Ne 20.2	Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	● S 32.1	Cl 35.5			
Ar 40.0	K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	● Fe 55.9	Co 58.9	Ni 58.7
	● Cu 63.5	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9			
Kr 83.8	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (99)	Ru 101	Rh 103	Pd 106
	● Ag 108	Cd 112	In 115	● Sn 119	Sb 122	Te 128	I 127			
Xe 131	Ce 133	Ba 137	● La 139	Hf 179	Ta 181	W 184	Re 180	Os 194	Ir 192	Pt 195
	● Au 197	● Hg 201	Ti 204	● Pb 207	Bi 209	Po (210)	At (210)			
Rn (222)	Fr (223)	Ra (226)	● Ac (227)	● Th 232	● Pa (231)	● U 238				

Dobereiner's triads

Known to Mendeleev

● Lanthanide series
● Actinide series
● Known to Ancients

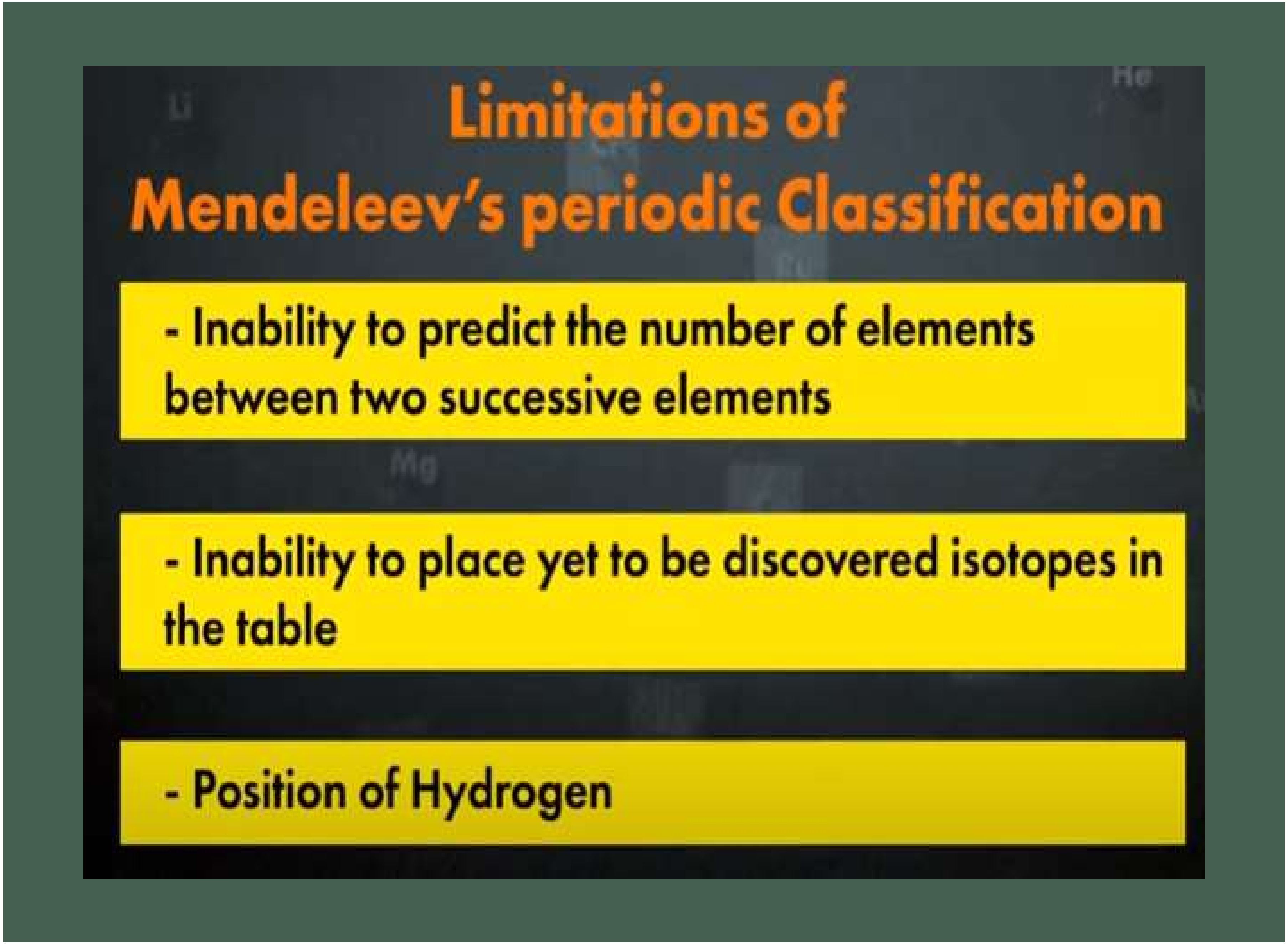

eka-Boron
eka-Aluminium
eka-Silicon
H 1.01
Li 6.94
Be 9.01
B
C 12.0
N 14.01
O 15.99
F 19.0
Na 23.0
Mg 24.3
Al
Si 28.1
P 31.0
S 32.1
Cl 35.5
K 39.1
Ca 40.1
Ti 47.9
V 50.9
Cr 50.2
Mn 54.9
Fe 55.9
Co 58.9
Ni 58.7
Cu 63.5
Zn 65.4
As 74.9
Se 79.0
Br 79.9
Rb 85.5
Sr 87.6
Y 88.9
Zr 91.2
Nb 92.9
Mo 95.9
Ru 101
Rh 103
Pd 106
Ag 108
Cd 112
In 115
Sn 118
Sb 122
Te 128
I 127
Ce 133
Ba 137
La 139
Ta 181
W 184
Os 194
Ir 192
Pt 195
Au 197
Hg 201
Tl 204
Pb 207
Bi 209
Th
U

Strengths of Mendeleev's periodic table

- Leaving gaps in the periodic table for yet to be discovered elements

- Provision to accomodate yet to be discovered noble gases

- Ensuring that elements with similar properties stayed together


Limitations of
Mendeleev's periodic Classification
- Inability to predict the number of elements between two successive elements
- Inability to place yet to be discovered isotopes in the table
- Position of Hydrogen

Recap

→ Russian chemist Dmitri Mendeleev arranged elements in based on similar chemical properties.

→ He focussed on how various elements form hydrides and oxides.

→ Mendeleev's Periodic Law states that properties of elements are periodic functions of their atomic masses.

Recap

Achievements of Mendeleev's Periodic Table :

→ Leaving gaps in the periodic table for yet to be discovered elements.

→ Provision to accomodate yet to be discovered noble gases.

→ Ensuring that elements with similar properties stayed together.


THANK YOU