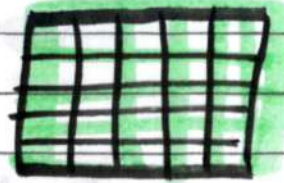


Periodic



ORDER OUT OF CHAOS

Dobereiner Triads



- 1817 Johann Wolfgang Dobereiner
- German Physist

! e = elements

Discovery

→ arrange elements with similar properties into groups with 3-e each.
↓ ↑ mass order

TRIADS

| Group A element | Atomic mass | Group B element | Atomic mass | Group C elements | Atomic mass |
|-----------------|-------------|-----------------|-------------|------------------|-------------|
| Li | 6.9 | Ca | 40.1 | Cl | 35.5 |
| Na | 23.0 | Sr | 87.6 | Br | 79.9 |
| K | 39.0 | Ba | 137.3 | I | 126.9 |

- Calculation :- Importance:

$$E_1 > E_2 > E_3 \quad [\text{atomic mass}]$$

$$\frac{E_1 + E_3}{2} = E_2$$

- Drawback:

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Triads ~~3~~

Newlands Law of Octaves



- 1866 - John Newland
- English scientist

Discovery

- arranged elements in ↑ A.M & found it was ~ similar to law of octaves.
- every 8th E ~ 1st E.

PROPERTIES

| sa (do) | rc (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 | — | — |

Drawbacks

- applicable only upto Ca
- assumed - only 56 total elements do; no more could fit in
- adjusted 2 elements in same slot to fit elements - placed Co & Ni in same slot
- put in column of F, Cl, Br but Co & Ni - no similar properties.
- unlike elements - same column
- similar property elements placed far apart
- ~~str~~ Fe ~ Co & Ni = placed far

Mendeleev's Periodic Table



- Dmitri Ivanovich Mendeleev
- Russian chemist
- 63 elements known

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• Discovery

1. examined relationship b/w A.M & chemical & physical properties.



2. concentrated - compounds formed by elements with Oxygen & Hydrogen.

∴ ↑ reactive & form compounds with most E.

3. took formulae of Oxides & Hydrides formed by an element - Basis

4. arranged 63 elements in ↑ order A.M

found - period recurrence - of E - with similar PHYSICAL & CHEMICAL properties.

GROUP - vertical column - 8

PERIOD - horizontal rows - 6

5. Periodic Law

“the properties of elements are the periodic function of their atomic masses”

Limitations :

1. Hydrogen Position :

electronic configuration

ALALI METALS

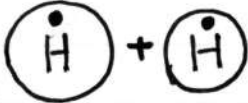
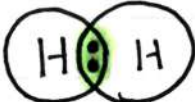
H + halogen / O₂ / S
→ ∞ compounds

| COMPOUND OF H | COMPOUND OF Na |
|------------------|-------------------|
| HCl | NaCl |
| H ₂ O | Na ₂ O |
| H ₂ S | Na ₂ S |

Na₂O - basic

HALOGENS

diatomic
H + M / NM → Covalent

H₂O - neutral Cl₂O₇ - acidic

2. Isotope Position :

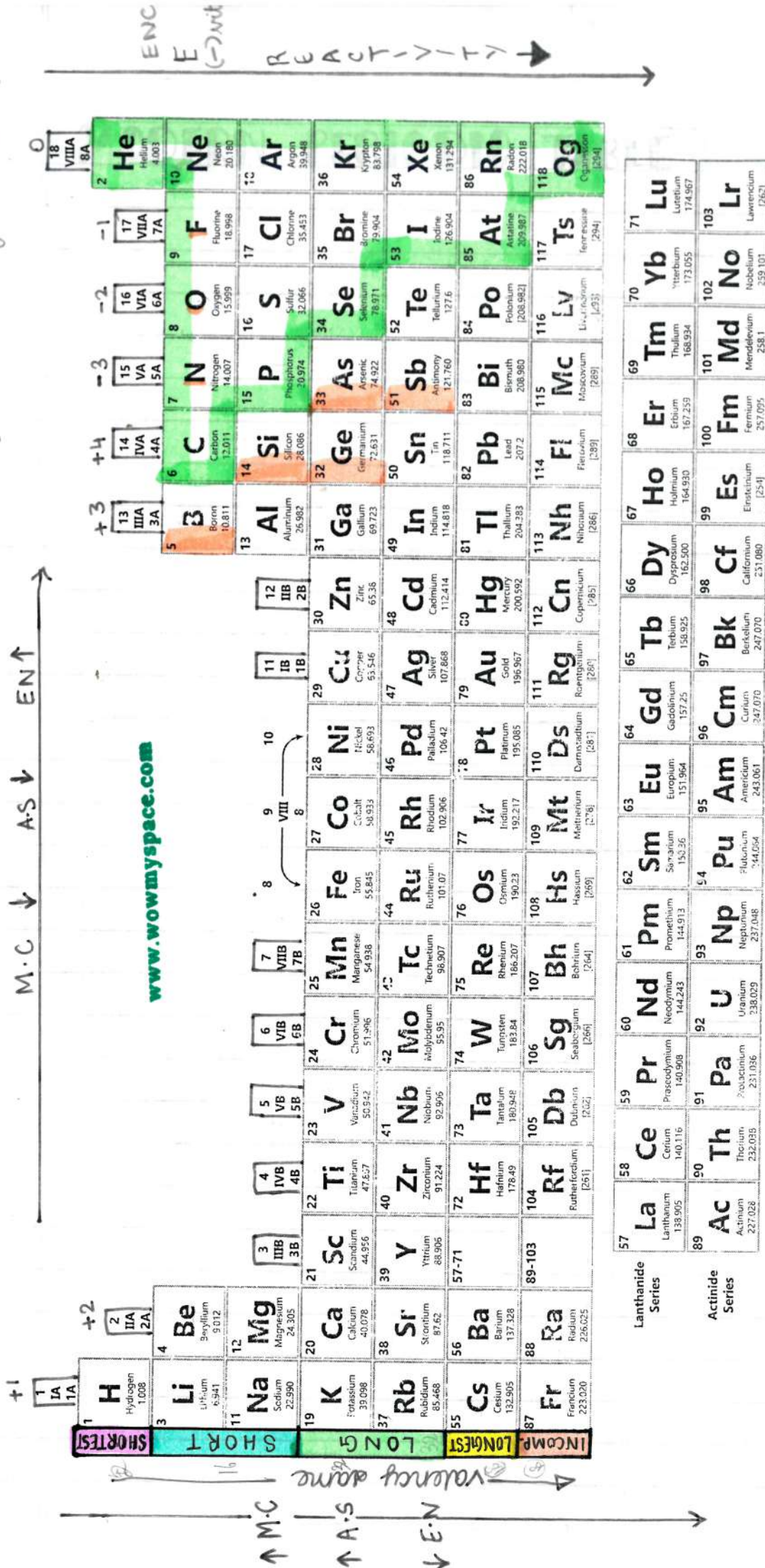
- Isotope = 2⁺ elements with similar chemical properties but different A.M.
can't be placed in same slot.
NO PLACE [Cl-35, Cl-37]

3. Uncertainty in Atomic Mass :

A.M didn't increase in regular or constant manner.

Metalloids

ENC = effective nuclear charge
 EN = reactivity = electronegativity



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MODERN PERIODIC TABLE :

1913 - Henry Moseley



showed ATOMIC NUMBER - ↑ fundamental

$A.N > A.M$



physical & chemical properties of elements are a periodic function of ATOMIC NO.

18 = groups

7 = periods

Properties of elements are periodic function of their atomic number.

Groups :

- group ÷ ~~X~~ subgroups
- 1. E - same valence e^-
- 2. - same valency
- 3. no. of shell ↑ as we go down ↓.
- 4. identical chemical properties
- 5. gradual variation - physical property (BP, MP, P)

Periods :

1. E = valance e^- ↑ by 1 unit ∴ A.N ↑ by 1 unit
∴ chemical & changes
3. E - no of shells - same
4. E - chemical property changes.

GN = Group number
VE = Valance electrons

store
67

Position

with electronic configuration of element X

1. Periodic number - number of e^- shells
2. 2 elements have same no. of shell = SAME Period
3. Group number
 $E \leq 2$ valance $e^- \rightarrow GN = \text{no. of } Ve^-$
 $E > 2$ valance $e^- \rightarrow GN = \text{no. of } Ve^- + 10$
4. 2 elements have same valance $e^- =$ SAME group.

Anomalies of Mendeleev

1. fundamental basic - for modern periodic table is ATOMIC NUMBER and ~~ATOMIC MASS~~
2. Isotopes - same atomic number & chemical property
 \therefore placed at 1 single place in same group
3. Hydrogen - unique character - top left corner
4. Justified position of Co & Ni \because Atomic Number
5. Lanthanides & Actinides placed separately bottom

Demerits of MPT

1. Hydrogen - position - resembles 1st & 17th Group
2. Lanthanides & Actinides not part of main body.

TRENDS

Valency

- combining capacity of an atom of an element to acquire noble gas configuration
- Valance $e^- = 1 \rightarrow 4 = \text{Valency}$
Valance $e^- = 5 \rightarrow 8$
 $V = 8 - \text{Valance } e^-$

→ **G**

| grp | 1 | 2 | 13 | 14 | 15 | 16 | 17 | 18 |
|---------|---|---|----|----|----|----|----|----|
| Valency | 1 | 2 | 3 | 4 | 3 | 2 | 1 | 0 |

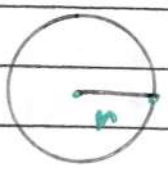


→ **P** [1 → 4 → 0]

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Atomic Size picometers = 10^{-12} m

→ Radii of Atom - Distance b/w centre of Nucleus & outermost shell of an ISOLATED ATOM



$\frac{b}{2} = r$

- no. of shell !! = period number
- **G** A.S ↑ = ↑ no. of shell
- **P** A.S ↓ = ↑ attraction force → come close
= effective nuclear charge ↑

Metallic & Non-Metallic

→ Measure of ease of an element with which an element can donate electrons to other atoms to form a chemical bond.

→ Metals valency 1, 2, 3

- tendency of element to lose e^- .

Electro (+)ve elements

- because of formation of (+)ve ions

→ Non-Metals

- tendency of element to gain e^-

Electro (-)ve elements

- because of formation of (-)ve ions

Valency
 $3 < V$

→ Metalloids / Semi-Metals GERMANIUM! ARSENIC ANTIMONY!
SILICON BORON!

- elements which exhibit the properties of both Metals & Non-Metals.

→ **G** M.C ↑ = effective nuclear charge ↓ farther
N.C ↓

P M.C ↓ = ENC ↑
N.C ↑

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grp 1 - max reactive metals

grp 2 - max reactive non-metals

Electronegativity

→ Tendency of an atom to pull electrons towards itself from a shared pair in a covalent bond.

→ $G = EN \uparrow$

→ $P = EN \downarrow$

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