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LAW OF TRIADS

- An early chemical classification system stating that elements with similar properties could be grouped into triads, where the atomic mass of the middle element was the average of the first and third.

Johann Wolfgang Dobereiner

- A German chemist who noticed that some elements liked to hang out in groups of three and called those "triads".
  - The elements in a triad shared similar physical & chemical properties.
    - The middle element's atomic mass was roughly the average of the other two.
  - Ex. : Calcium, Strontium, and Barium
  - Ca - atomic mass: 40.1
  - Sr - atomic mass: 87.6
  - Ba - atomic mass: 137.3
  - formula: ave. = (e1 + e3)/2
  - ave = (40.1+137.3)/2
  - ave = 177.4 / 2
  - ave =88.7
  - The average of the two elements correspond to 88.7, which is almost equal to the atomic mass of Strontium.
  - The Law of Triads doesn't work perfectly for all elements

LAW OF OCTAVES

- John Newland(British Chemist) saw a pattern that when he arranged elements known at that time (1864) by increasing atomic mass.
- Every eight elements (like going up and down eight piano keys), elements with similar properties showed up again.

PERIODIC LAW

- Proposed by Dmitri Mendeleev & Lothar Meyer individually

MENDELEEV

- Found that the properties of elements were related to atomic mass in a periodic way.
- He observed that elements were arranged in the increasing order of atomic mass and there was the periodic occurrence of elements with similar properties.

- According to this observation, he formulated a periodic law which states;
  "The properties of elements are the periodic function of their atomic masses."
  - Ex. : Li (6.94) < Na (22.99) < K (39.10) < Rb (85.47) < Cs (132.91)
    -> Li (174 °C) > Na (97.8 °C) > K (63.7 °C)> Rb (38.9 °C) > Cs (28.5 °C)

- Therefore, there is a trend existing between elements in a group. In this example, it can be said that: The melting points decrease us the atomic mass increases.

HENRY G.J MOSELEY

- In 1913, Henry G.J. Moseley performed experiments that led to the discovery of the atomic number.
- With Moseley's contribution the Revised Periodic Law can be stated as:

Similar properties recur periodically when elements are arranged according to increasing atomic number.

- Atomic numbers, not weights, determine the factor of chemical properties.

ELECTRON CONFIGURATION

> Distribution of electrons

TERMS

> Electron Cloud: Where electrons are most likely to be found
> Probability: chance
> Energy levels: Represent fixed distances from the nucleus where electrons exist.
> Orbitals: Regions around the nucleus.
> Valence electrons: Electrons that can be found on the outermost energy level.
> Valence shell: The outermost energy level.

AUFBAU's PRINCIPLE

It guides the order in which electrons fill atomic orbitals in ground-state atoms. Electrons occupy the lowest-energy orbitals available before filling higher-energy ones.

1. Fillm from lowest to highest energy
   - Electrons occupy orbitals in increasing energy order.
2. Pauli exclusion principle limits occupancy
   - Any single atomic orbital can hold at most two electrons, and they must have opposite spins.
3. Hund's rule for degenerate orbitals
   - For orbitals of equal energy (degenerate, e.g., the three 2p orbitals), place one electron in each orbital with parallel

- For orbitals of equal energy (degenerate, e.g., the three 2p orbitals), place one electron in each orbital with parallel spins before pairing.

4. Subshell energy shifts in multi-electron atoms
   - Subshell energy ordering depends on electron shielding and penetration; as n increases the energy spacing and ordering can change
5. Exceptions due to electron correlation and stability (particularly for transition metals)
   - Some atoms deviate from the simple Aufbau order to achieve lower-energy configurations (especially half-filled or fully filled subshell stability).

s-sharp: 2e

p-principle: 3e

d-diffuse: 10e

f-fundamental: 14e

EARTH's LAYERS

1. Inner Core: It is the solid layer of the planet under immense pressure at the center of the Earth.
2. Outer Core: The liquid layer hot enough to be molten.
3. Mantle: The thickest layer that makes up most of the Earth. Can be divided into upper and lower mantle.
4. Crust: Outermost solid rock layer of the Earth

Types of crust:

Continental Crust: Made up of plains, mountain ranges, and a variety of geological features.

- made of granite rocks
- thicker(~30-70km) & less denser(2.7g/cm^3)
- older
- continental shelf(nearshore), coastal plains, mountain ranges(folded), rift valleys(continental rifting), and continental islands

Oceanic Crust: Underwater volcanic activity, deep-sea trenches, and mid-ocean ridges are characteristics of this type of crust, which resides beneath the ocean basins.

- composed of basaltic rocks
- thinner(~5-10km) & denser (2.9-3.0g/cm^3)
- generally younger
- mid-ocean ridge, abyssal plain, trenches, submarine volcanoes, island arcs

CONTINENTAL CRUST

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CONTINENTAL CRUST

Volcanoes vs. Mountains

Mountains: Elevated landforms formed mainly by tectonic uplift, folding, faulting, or long-term erosion resistance.

- They may have no opening for magma

Volcanoes: Landforms created by repeated extrusion of magma, ash, and volcanic gases through an opening (vent).

- Subset of Mountains

Plate Interactions and Volcano Formation

Convergent plate boundaries (subduction zones): Oceanic plate sinks under another plate; water lowers melting point of mantle, producing magma

- volcanic arcs (ex: the Andes, Ring of Fire).

Divergent plate boundaries (mid-ocean ridges/rift zones): Plates pull apart, decompression melting forms basaltic magma

- fissure eruptions and shield volcanoes (oceanic ridges, Iceland).

Hotspots (intraplate): Mantle plumes produce magma that rises through the plate

- chains of volcanoes (e.g., Hawaii).

Transform boundaries: Generally do not produce volcanism directly, but local extension can create small volcanic activity.

RELATE TYPES OF VOLCANOES TO THE PROCESS OF VOLCANIC FORMATION

Shield volcanoes: Form from low-viscosity, fluid basaltic lava that flows long distances, building broad, gently sloping profiles

- typical at hotspots and some divergent settings.
  - Mauna Loa in Hawaii

Cinder cones: Form from ejected pyroclasts (scoria) that fall close to the vent, creating small steep-sided cones

- often as parasitic vents on larger volcanoes or in fissure fields.
  - Mount Iriga in Camarines Sur
  - Paricutin in Mexico

Stratovolcano (composite): conical, steep slopes

- alternating lava and pyroclastics
- explosive potential
  - Mount St. Helens
  - Mount Mayon in Albay
  - Mount Fuji in Japan

CLASSIFY VOLCANOES BY MAJOR CHARACTERISTICS

Cinder cone (scoria cone): Built from tephra

- small (tens to a few hundred meters)
- steep sides
- short-lived eruptions

Lava dome (plug dome): Formed by viscous lava
- rounded & steep
- frequently associated with explosive activity when domes collapse

Stratovolcano (composite): Alternating lava and pyroclastics
- conical
- steep slopes
- explosive potential

Caldera systems: very large depressions formed by massive explosive eruptions and collapse
- may host subsequent volcanic activity (e.g., Yellowstone)

Shield: Have a large footprint
- broad
- low slope
- basaltic lava
- effusive (non-explosive) eruptions

TYPE OF VOLCANO	TECTONIC SETTING	SIZE AND SHAPE	MAGMA AND ERUPTION CHARACTERISTICS
Shield Volcano	Most are at the mantle plumes; some are on spreading ridges.	Large not steep	Magma is almost always mafic, and eruptions are typically effusive.
Cinder Cone	Some form on the flanks of larger volcanoes	Small and steep	Most are mafic and form from the gas-rich early stages of a shield - or rift-associated eruption
Composite Volcano	Almost all are in the subduction zones	Medium size and moderate steepness	Magma composition varies from felsic to mafic, and from explosive to elusive.

FEATURES	MAGMA

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FEATURES	MAGMA
Location	Beneath the earth's surface
State	Molten rock within the Earth
Temp	Extremely hot (up to 1300°C)
Composition	Silicate minerals, gases, and solids
Movement	Moves through the Earth's crust
Effect	May solidify to form igneous rocks
Occurrence	Found beneath the Earth's surface in magma chambers

FEATURES	LAVA
Location	Above the Earth's surface
State	Molten rock erupted onto the surface
Temp	Remains hot but can cool down
Composition	Similar composition to magma but may contain fewer gases
Movement	Flows on the Earth's

	surface
Effect	Forms volcanic landforms and structures
Occurrence	Erupts during volcanic activity

Types of Volcanic Eruption:

1. Effusive
2. Explosive

Subtypes of Volcanic Eruption:

1. Phreatic : Located in diverging plate boundaries
2. Hawaiian : Located in hotspots
3. Strombolian : Located in diverging or converging plate boundaries
4. Vulcanian : Located in converging plate boundaries
5. Plinian : Located in converging plated boundaries

Classifications of Magma:

Composition	Viscosity	Temperature	Gas Content	Silica Content	Explosiveness
Basaltic Magma	Low	1000°C-1200°C	1-2%	About 50%	Least Explosive
Andesitic Magma	Intermediate	900°C-1000°C	3-4%	About 60%	Intermediate
Rhyolitic	High	750°C-900°C	4-6%	About 70%	Most explosive

Volcanic Hazards that are common in the Philippine active volcanoes

1. Ash Fall: pulverized rocks, sand, gritty and harsh glasses shoot out in the air by volcano.
2. Mud flow: mixture of water, molten rocks and debris flowing down from the side of volcano to the ground. It is also called as Lahar.
3. Lava flow: streams of molten rocks and other fragmented materials emitted by erupting volcano.
4. Pyroclastic flow: fast moving hot mixtures of gas, ash, and molten rocks moving away from the volcano to the ground.