

Types of covalent bond:

1-Single covalent bond: It is the bond which arises between two nonmetal atoms, where each atom shares the other atom with one electron.

2-Double covalent bond: It is the bond which arises between two nonmetal atoms, where each atom shares the other atom with two electrons.

3-Triple covalent bond: It is the bond which arises between two nonmetal atoms, where each atom shares the other atom with three electrons.

Ionic bond	Covalent bond
- Formed due to: Electrical attraction Between two different elements (metal "positive ion"- nonmetal "negative ion") to form compound.	- Formed due to: sharing of one pair of electrons or more Between: - two similar nonmetal atoms to form: molecule. - two different nonmetal atoms to form: compound.

Chemical Combination

* **Valency:** It is the number of electrons that atom loses, gains or shares during a chemical reaction.

Valency of Metals		
Monovalent	Divalent	Trivalent
- Lithium (Li) - Sodium (Na) - Potassium (K) - Silver (Ag)	- Mercury (Hg) - Magnesium (Mg) - Calcium (Ca) - Lead (Pb)	- Aluminum (Al) - Gold (Au)
- Copper (Cu): Monovalent - Divalent - Iron (Fe): - Divalent (Ferrous) - Trivalent (Ferric)		

Valency of Nonmetals			
Monovalent	Divalent	Trivalent	Tetravalent
- Hydrogen (H) - Bromine (Br) - Fluorine (F)	- Chlorine (Cl) - Iodine (I)	- Oxygen (O) - Nitrogen (N) - Phosphorus (P)	- Carbon (C)

- **Sulphur (S):** Divalent – Tetravalent – Hexavalent
- Nitrogen (N) – Phosphorus (P): Trivalent

* **Atomic group:** set of atoms (of different elements) joined together behave like (1) atom during chemical reaction.

Valency of Atomic Group		
Monovalent	Divalent	Trivalent
- Hydroxide (OH) - Nitrate (NO ₃) - Nitrite (NO ₂) - Ammonium (NH ₄) - Bicarbonate (HCO ₃)	- Carbonate (CO ₃) - Sulphate (SO ₄)	- Phosphate (PO ₄)

* **Chemical formula:** It is a formula that represents the number and types of the atoms in a molecule.

Compound	Chemical formula	Compound	Chemical formula	Compound	Chemical formula
Sodium Chloride	NaCl	Aluminium Sulphate	$Al_2(SO_4)_3$	Magnesium Hydroxide	$Mg(OH)_2$
Sodium Nitrate	$NaNO_3$	Aluminium Carbonate	$Al_2(CO_3)_3$	Magnesium Sulphate	$MgSO_4$
Sodium sulphate	Na_2SO_4	Aluminum Oxide	Al_2O_3	Hydrogen Chloride	HCl
Sodium Hydroxide	NaOH	Water	H_2O	Calcium Carbonate	$CaCO_3$
Sodium Carbonate	Na_2CO_3	Copper Carbonate	$CuCO_3$	Calcium Sulphate	$CaSO_4$
Sodium Oxide	Na_2O	Carbon Dioxide	CO_2	Calcium Oxide	CaO

* **Types of Compounds:**

Acids	Bases
They are substances which dissociate in water producing positive hydrogen ions (H^+).	They are substances which dissociate in water producing negative hydroxide ions (OH^-).
The symbol of acids begins with H.	The symbol of alkalis ends with OH.
They have sour taste.	They have bitter taste.
They change color of litmus paper into red: Due to presence of hydrogen ions (H^+).	They change color of litmus paper into blue: Due to presence of hydroxide ions (OH^-).
Ex: Hydrochloric acid (HCl) – Sulphoric acid (H_2SO_4)	Ex: Sodium Hydroxide (NaOH) -

Oxides: They are compounds resulted from combination between oxygen and element which is metal or nonmetal.

Metal oxides	Nonmetal oxide
Formed from combination of oxygen with metal.	Formed from combination of oxygen with nonmetal.
Sodium oxide (Na_2O) - Calcium Oxide (CaO) – (Al_2O_3).	Carbon dioxide (CO_2) – Sulphur trioxide (SO_3).

* **Salts:** Compounds resulted from combination of positive ion (or atomic group) with negative atomic group (or ion except O_2).

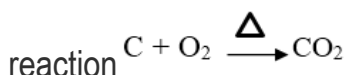
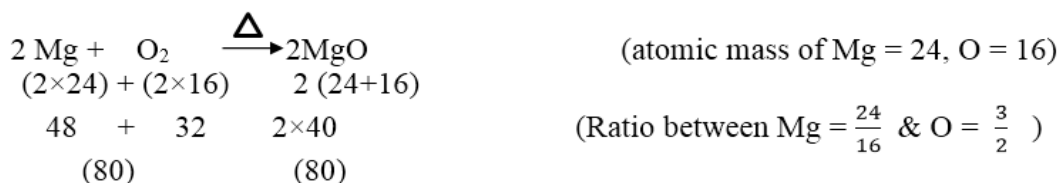
* **Mineral salts:**

Salts dissolved (soluble) in water		Salts undissolved (insoluble) in water
Sodium chloride (NaCl)	Sodium sulphide (Na_2S)	Silver chloride (AgCl)
Potassium sulphate (K_2SO_4)	Calcium nitrate [$Ca(NO_3)_2$]	Lead iodide (PbI_2)
Magnesium carbonate ($MgCO_3$)		Lead sulphate ($PbSO_4$)

- **Chemical Reaction** Process that involves breaking the existing bonds in the reactant molecules and forming new bonds in the products.
- *** Chemical Equation:** Set of symbols and chemical formulae representing the reactants and products molecules in the chemical reaction and it represents the conditions of the reaction.

- **G.R *Chemical Equation must be balanced:**

number of atoms entering reaction = number of atoms resulting from

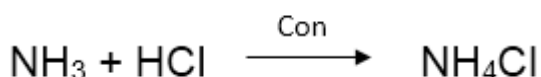


- *** Law of constant ratios:** Chemical compound is formed from combination of its elements by constant weight ratios.
- *** Types of chemical reactions:**
- *** Direct combination reactions:** Reactions which involve a combination of two substances to form a new compound.
 - 1- Combination of an element with another element.
 - 2- Combination of a compound with a compound.
 - 3- Combination of an element with a compound.

Combination of an element with another element:

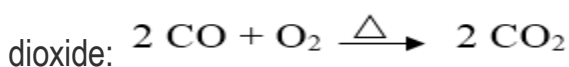
Combination of two nonmetal elements	Combination of a metal with a nonmetal
* Carbon joins Oxygen forming Carbon dioxide: $\text{C} + \text{O}_2 \xrightarrow{\Delta} \text{CO}_2$	* Magnesium joins Oxygen forming Magnesium dioxide. $2 \text{ Mg} + \text{O}_2 \xrightarrow{\Delta} 2 \text{ MgO}$
* Hydrogen joins Chlorine forming Hydrogen chloride: $\text{H}_2 + \text{Cl}_2 \longrightarrow 2 \text{ HCl}$	

- **2- Combination of a compound with a compound:**
- Ammonia joins Hydrochloric acid forming ammonium chloride: rod wet with ammonia placed close to tube contains concentrated hydrochloric acid- white fumes (cloud) of ammonia chloride are formed.

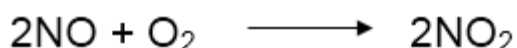


- **3- Combination of an element with a compound:**

- * Carbon dioxide (compound) reacts with Oxygen (element) producing carbon



- * Nitrogen monoxide (compound) reacts with Oxygen (element) producing Nitrogen dioxide:



- * **Chemical reaction in our life**
- * **importance of Chemical reaction:** used in industries as: Medicines – Fertilizer – Fuel – Plastics.
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- * **Negative – bad effects of Chemical reaction:**
- **1- Fuel burning:** producing:
 - **A- Carbon dioxide (CO₂):** acts as green house: as it allow pass of sunrays to earth and never let them return back.
 - **B- Carbon monoxide (CO):**
 - **Causes:** Headache – Fainting – Sever stomach aches and may lead to death.
- **2- Sulphur oxides:[Sulphur dioxide (SO₂) - Sulphur trioxide (SO₃)]**
 - They are acidic gases causes: Respiratory system problems – Building corrosion.
- **3- Nitrogen dioxides: [Nitric oxide (NO) – Nitrogen dioxide (NO₂): resulted at the time of lightning.**
 - They are: acidic gases – Poisonous – Affect the nervous system and the eye.
- **4- Burning of Coal and Cellulose fibers: as paper – Cigarettes cause air pollution and lung cancer.**

* **Force:** It's an effect attempts to change the object's phase from being static to motion or vice versa or attempts to change the direction of motion.

Measuring unit of force: Newton.

* **Universal Forces in Nature:**

* **Attraction force:** between Earth and objects.

- Earth attracts objects to its center by force called "Object's weight" which increases by increase of the object's mass

* **Object's weight:** ability of earth to attract that object to its center. Or: It's the force of Earth's gravity on the object.

• **Object's center of gravity:** It's point at the center of object at which the force of gravity affects the object.

$$\begin{array}{l} \text{Object's weight (W) = Object's mass (m) \times Earth's gravity acceleration (g)} \\ \text{Newton} \qquad \qquad \qquad \text{Kg} \qquad \qquad \qquad 10 \text{ m/s}^2 \end{array}$$

1- **Electromagnet:** It changes the electric energy into magnetic energy.

Uses of Electromagnet: electric bells – electric winches (used in lifting scrap iron and cars).

2- **Electric generator (Dynamo):** It changes the mechanical energy into electric energy.

3- **Electric motor:** It converts the electric energy into mechanical energy.
(motor in fan- blinder- washing machine).

• **Strong Nuclear forces:** used in: Producing electricity - Military purposes (wars)

• **Weak Nuclear forces:** used in: Medicine – Scientific researches – Industry.

Inertia:

It's a property of object has to resist the change of its phase unless an external force acted on it.

• **Passengers are rushed back** when the car move suddenly

• **Passengers are rushed forward:** when the car stop suddenly

- Coin falls inside the cup: due to its inertia force
- Inertia makes object resist the change of its rest or motion state.
- **Technological application on Inertia:**

-G.R **Using safety belts in cars:** to stop inertia to keep passengers safe

- **Friction force:** It's resistant force originate between the object in motion and the medium touching it.
- **Benefit of Friction force** : prevent slipping – help in car motion or stopping – help in match burn
- **Harms of Friction force:** make machine erosion – great loss in mechanical energy – decrease performance of machines
- **Motion:** It's the change in position in space as time passes.

Relative motion: the change in object's position as time passes relative to another object or fixed point.

Application	Observation
Two cars move in the same direction with the same speed	Two cars stop moving
Two cars in the same direction but one is faster	The other car moves back(in opposite direction)
Two cars moves in an opposite direction and one of them faster	The other car moves with high speed

Types of Motion:

1. **Transitional motion:** It's motion in which object's position is changed relative to a fixed point from initial to final position as time passes.

Ex: Person – Car - Train

- **G.R:** Transitional motion is a relative motion:

B. it's change of an object's position as time passes relative to another object.

1. **Periodic motion:** It's the motion which is regularly repeated in equal periods of time.

Ex: Vibrating motion (simple pendulum) – **Circular motion** (fan arms) – **Wave motion** (stone in water).

1. **Wave motion:**

Mechanical waves	Electromagnetic waves
Produced by vibration of medium particles	Accompanied by electromagnetic forces
Need a medium to transfer through	Spread in all media and free space
Speed is relatively low (sound speed 340m/s)	Speed is very high (light speed is 300 million m/s)

Ex: Sound waves – water waves	Light waves – X-rays – Radio waves – Ultra violet – Infra red
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Lightning and Thunder

- **G.R:** We see Lightning before hearing thunder: As Light speed is greater than sound speed
- G.R-** We receive sunlight but don't hear solar explosions:
 - B. Light travel through space but the sound need medium.

Technological applications of mechanical waves:

1- Used in examining and curing sets for human body (Ultrasonic waves – Sonar).

2 – Musical instruments:

a – **Stringed musical instruments:** Violin – Lute – Guitar.

b – **Pneumatic musical instruments:** Flute – Reed pipe.

3 – Amplifiers an distributing sets.

Technological applications of electromagnetic waves:

Electromagnetic waves	Application
Ultra violet rays	Sterilize surgical operation rooms: B. they've property of killing microbes
X rays	- Photographing bones to detect bones fractures - Examining mineral raws and showing errors, pores and cracks.
Gamma rays	In medical purposes: to treat and discovering some swellings
Visible light	Used in: Photographic cameras – Television cameras – Data show.
Infra red rays	Used in: Night vision - Remote sets – Cooking food: B. they've heat effect

1. **Displacement:** It's the distance which an object moves in a certain direction.

1. **Speed:** It's the displacement covered by an object in a unit time.

Types of Speed:

Regular speed: a velocity which body move **equal** distances every second

Irregular speed: a speed which body move **unequal** distances every second

Stars: They're big-sized bodies emit enormous amount of heat and light.

- **G.R:** Stars appear small although they're big-sized: **B. they are very far away from us.**

- **Light year:** It's the distance covered by light in one year and it = 9.467×10^{12} km.

- **D in km = d in light year x 9.467×10^{12}**

- **D in light year = d in km $\div 9.467 \times 10^{12}$**

- **Galaxies:** Big units form universe.

- **Our Galaxy is:** The milky way galaxy.

- **Telescopes:** Identify the celestial bodies.
- **The kinds of telescopes:** Reflecting – Refracting.
- **The Solar System:** consists of.

The Sun:

1. It's the star of our solar
2. Biggest body in our Solar
3. Lies the center of solar.

- **The Eight Planets:** Spherical opaque bodies revolve around sun in (oval) paths

Inner Planets	Outer Planets
Mercury – Venus – Earth – Mars	Jupiter – Saturn – Uranus – Neptune
Small in size	Big
High density: As they consist of solid bodies.	Low density: As they consist of gaseous elements.
Have a few number of moons	Have large number of moons
Their gravitational is small.	Their gravitational is large.

- **All planets have Atmosphere:** except Mercury.
- **All planets have moons:** except Mercury and Venus.
- **Outer planets consist of:** Helium and Hydrogen as solidified gases
- **Isaac Newton:** discovered Earth's Gravity.

Gravity depend on: 1- The mass of each object. 2- The distance between them.

Jupiter has largest gravity **Mars** has smallest gravity
Earth has largest gravity in inner planets – largest mass and density

- **Moons:** They're small planets revolve around planets.
- **Asteroids:** They're rocky celestial bodies that revolve the sun in the region of the wanderer asteroids.
- **The asteroids belt :** It's a region separates inner planets from outer planets.
- **Meteors:** luminous arrows that can be seen in the sky due to completely burning in earth's atmosphere.
- **Meteorites:** The remaining part of the rocky masses without burning that falls on the earth's surface.
- **Comets:** They're masses of (rocks, ice and solidified gases) that revolve around the sun in more elongated oval paths. It consist of: head – tail.

- **Most famous Comet "Halley"** takes 76 years around sun.

The sun occupies the centre of the solar system.

- **The distance between earth& sun is about 150 million Kms**

- **The earth is the third planet regarding the distance from the sun, while it is the fourth order regarding to volume**

- **Q. Describe the shape of the earth at the poles& equator:**

The Earth is a spherical object and has slight **flat** at two poles and **indented** at equator
The tropical radius is about 22 Km larger than the polar radius.

- **Earth is the biggest mass (planet) in the inner planets**

- **G.R** Concerning the volume, the Earth occupies the fourth order.

- **B. Earth is bigger than the inner planets**

- **Atmosphere:** A mixture of gases that surround the Earth

- **G.R** The presence of a white colour surrounds the planet Earth.

- **B. Earth surrounded by atmosphere**

- **Importance of atmosphere:**

1. Keep temperature suitable to Earth
2. It has ozone layer which protect us from harmful sunrays
3. It helps in burning of meteors and meteorites
4. All weather phenomena (wind-rains) occurs in it
5. It has important gases as ($O_2 - N_2 - CO_2$)

- **G.R** The great extension of atmosphere in space is important for Earth's life

- **Because, it helps in complete burning of meteors and decrease speed of meteorites**

Earth's hydrosphere

- **Water represents 71% of the Earth surface**

- **The salty water represents 97% , while the fresh water is about 3%**

- **Ground water exists in the pores and cracks of rocks**

Importance of water

1. Plant use it in photosynthesis process
2. Keep body temperature constant
3. It form blood and help in digestion process
4. Keep temperature suitable for man
5. 50% of organisms live in water

- **G.R** Temperature on Earth's surface suits the life of living organisms.

- **B. Earth is in third order far from the sun makes temperature suitable for life**

G.R Steadfastness of the hydrosphere on the Earth surface

Keeping the Earth surrounded with the atmosphere

Constancy and Steadfastness of objects and organisms on Earth's surface

Because, Earth has a force of gravity

G.R The planet Earth is suitable for life.

Because, it has water, gravity, atmosphere, suitable temperature and atmospheric pressure

The suitable atmospheric pressure is about 76 Cm Hg.

Q. Write the importance of:

Carbon dioxide gas. It is used in photosynthesis process.

Ozone layer. It is used to protect us from the harmful ultraviolet rays.

Oxygen. It is used in respiration process and burning process.

Nitrogen gas. It is used in forming proteins

Hydrosphere. It is used drinking, washing and food digestion.

G.R The inner part of Earth was a molten form

Due to high temperature

Q. How the Earth layers formed ?

Heavy metals have more density (iron and nickel) move towards Earth center while lighter components have low density move upward

* **The layers of the earth** are crust, mantle & core.

The crust The light outer layer of the earth.

Thickness 8 – 50 km

The mantleThe middle rocky layer of the earth that lies between crust& core

Thickness 2885 km

The core The inner layer of the earth.

Outer core	Inner core
1. It is a layer of molten metals. 2. It's thickness is about 2270 Km.	1. It is a solid layer rich in iron and nickel. 2. It's thickness is about 1216 Km.

Rocks A natural solid material exists in the earth's crust& is formed of a group of minerals.

Types of rocks 1- Igneous rocks. 2- Sedimentary rocks. 3- Metamorphic rocks.

First: Igneous rocks: Rocks Formed from the molten matter (magma or lava).

Examples: Granite. - Basalt.

P.O.C	Plutonic igneous rocks	Volcanic igneous rocks
Size of crystals	Large	Small
Texture	Coarse – rough	smooth
Holes	Absent	Present
Ex.	Granite	basalt

P.O.C	Granite rock	Basalt rock
Kind	Plutonic igneous rocks	Volcanic igneous rocks
Colour	Pink or grey	Dark
Components	Can be see by eye	Cannot be see by eye
Minerals forming them	Quartz – feldspar – mica	Olivine – feldspar – pyroxene
Found in	Sinai	El Fayoum

• **Second: Sedimentary rocks.**

They are rocks which are formed from the fragments & decomposed of other rocks.

• **The formation of sedimentary rocks:**

• **By 3 steps:** Erosion. - Transportation. - Sedimentation.

• **Examples** Sandstones. - Limestone.

P.O.C	Sandstones	Limestone
Colour	Yellow	White
Texture	Coarse – rough	smooth
Minerals forming them	Quartz – feldspar – mica	Mineral calcite
Reaction with dil. Hydrochloric acid (HCl)	No reaction	It makes effervescence due to CO ₂ gas evolved

• **Third: Metamorphic rocks.**

The rocks formed from igneous or sedimentary rocks under **high temperature or pressure** .

• **Example** Such as: **Marble** (produced from conversion of **limestone**)

• **1st Earthquakes:**

1. Egypt is considered as one of the countries that less exposed to earthquakes.
2. But in 1992, Egypt was exposed to an intermediate earthquake, its intensity was 5.9 on the Richter magnitude scale, it caused material harms & loss in spirits.

<u>Earthquakes:</u> Rapid & successive shaking of the ground, take place one after the other.
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Causes of earthquake

Sliding of rocks (fault)

The volcanoes: due to the movement of molten materials & trapped gases.

Fault : fracture in earth crust

Seismograph: apparatus used in recording Earthquakes intensity and time of duration

Seismogram : zigzag line produced by earthquake record

Richter scale: scale used for measure earthquake intensity

Harms of Earthquake

1. Great losses in people & building.
2. Roads destroy.
3. Make great fires.

4. **Tsunami waves**: destructive waves due to earthquake

• **Benefits of earthquake**: By studying the seismic waves to know **the earth internal structure**.

• **Safety precautions of earthquake**:

• Sit under hard table – go far from building – remain inside the car – cut gas and water

• **Earthquake consequences** : danger shakes follow earthquake and less in strength

• **The Volcano**: It is opening in earth's crust which permits the passage of(Lava) & poison gases

• **Volcanic vent**: An opening lies at the top of the volcano.

• **The pipe or neck**: A cylindrical cavity reaches earth's surface with interior

• **The cone**: The body of the volcano.

* **The materials ejected during the volcanic eruptions**:

1. Fragmented materials.

• **Volcanic ashes**: the more fine sized Fragmented materials ejected from volcano

2. Lava & Lava flows.

3. Volcanic gases(Water vapour & the oxides of Carbon, Nitrogen& Sulphur)

• **Harms of Volcanoes :**

1. Lava flows destruct whole towns & villages.

2. The poisoning gases & dust spread into far places.

3. Fires in the neighboring places & forests.

• **Benefits of Volcanoes :**

1. The thermal energy resulted is used to produce electricity.

2. The formation of more fertile soil.

3. It forms new islands in seas, increases the land areas & produces valuable rocks.

Safety precautions from volcanoes

1- Near areas must evacuated from people

2- We must know wind direction (To avoid poison gases)

G.R 1- Volcanic ashes cover areas far away from volcano.

B. it small parts rush with high pressure

2- The rushing of molten materials at high speed

Due to decrease pressure on it

3- Earth shaking occur by earthquake

B. seismic waves spread through crust