Science and Life

- How did science start?

CHEMISTS in the ANTIQUE AGE

- Chemistry has always existed. The formation of the Earth and the development of life involved many chemical processes. In ancient times, many of the items discovered through **trial and error** by humans to meet the basic needs of the people.

- Sheltering
- Medicine
- Clothing
- Protection

- After producing fire, ancient men started to construct tools to make their lives easier. They made:
- Clothes from the leather of the animals
- Weapons from metals.
- Dyes.
- Medicines from the plants and animal products.
- Pots from the sand and metals.
- Perfumes and detergents

An Alchemy Recap

The People, Places and Discoveries

- **What is Alchemy?**
  (key words: philosophy – goals- cure- diseases- prolonging – infinitely)

- (A form of medieval speculative thought
- A combination of philosophy, science and magic
- It laid the foundation for chemistry)
- ALCHEMY is a speculative philosophy with the goals of transmutation of cheap metals such as iron and lead to gold. Alchemists are also looking for a universal cure for diseases and a way of prolonging life infinitely
- An ALCHEMIST is a person who deals with alchemy theoretically and practically.

The Goals of Alchemy

Philosopher's Stone: a stone to make everything gold.(A tool that would allow the transmutation of cheap metals into gold)

Elixir of life: immortality. (ab-ı hayat)
Foundation of youth: cure diseases.

Alchemy is not a science because:

Alchemists used **trial and error method.**

Alchemists didn't use experimentation method.

Alchemy is only a mystical philosophy which is based on spiritual transformations with the help of intrinsic powers rather than physical scientific information.

Contributions of Alchemy to Chemistry

- Although alchemy is not considered a science, alchemists were the first chemists. Their subscription in the birth of chemistry cannot be ignored. Their contributions were:
- **1.** Alchemists developed many laboratory equipments (glassware such as alembic).
- **2.** Alchemists discovered many mineral acids. Such as:
- H_2SO_4 = Sulfuric acid.
- HCl = Hydrochloric acid.
- HNO_3 = Nitric acid.

- **3.** They discovered some elements such as mercury, lead and antimony.
- **4.** They discovered gun powder, ink,alumn(şap), soda, soap(oil+soda mixture)many cosmetics, dyes, ceramics, glass, and essences.
- **5.** They discovered many laboratory techniques such as grinding, mixing, heating, dissolving, crystallization, distillation, filtration and extraction.
- **6.** They made many alloys.
- **7.** They developed many cures for the illnesses with plants and mineral stones.

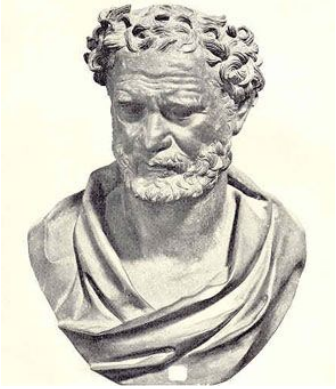
How It All Began

- A very brief timeline
  - Greek Philosophy
  - Egyptian Science
  - Chinese Alchemy
  - Arabic Alchemy

Empedocles (around 450 BC)

- A Greek philosopher.
- He defined elements as the basic building blocks from which all other materials are made.
- He stated that the ratio of these four elements(air,water,earth,fire) affected the properties of matter.

Democritus (460-370 BC)

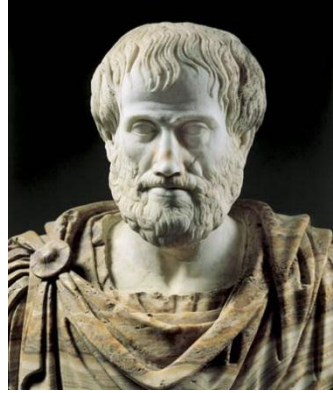


A Greek philosopher

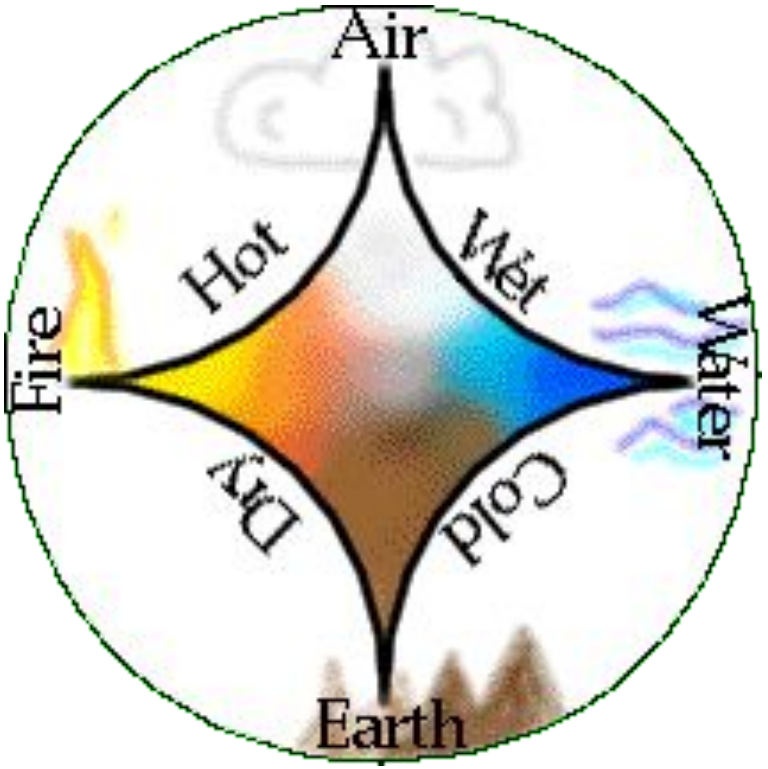
Theory of Matter – all matter is made up of indivisible particles called *atomos* (which means indivisible)

A substance could be changed by rearranging the atoms

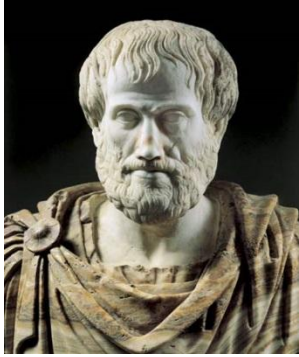
Aristotle (384-322BC)



- Believed that the central part of the universe was comprised of 4 elements
  - Earth
  - Air
  - Water
  - Fire

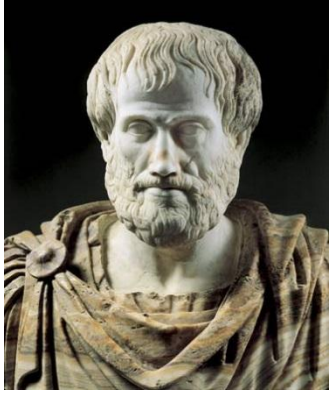


Aristotle



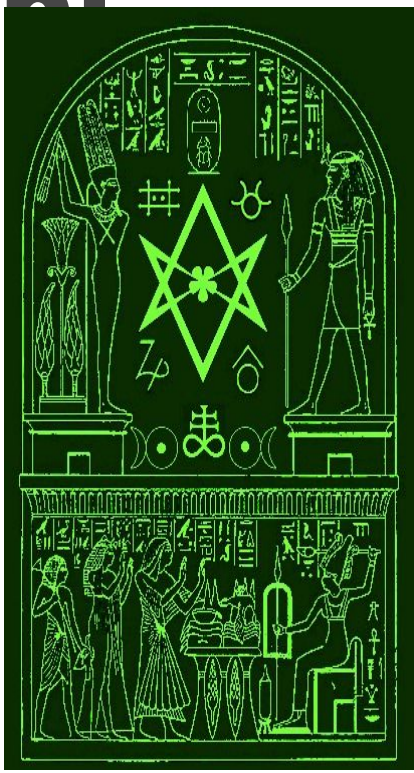
According to Aristotle, matter was composed of four elements: earth, fire, air and water. He classified the four elements with their properties: hot, cold, dry and wet. He was not an "atomist" like Democritus. To change one material into another all that is required is to alter the proportions of each element

Aristotle



- Aristotle's theory ruled for 2000 years because:
  - It was comprehensive
  - It was based on common sense
  - It was accepted and taught by the church

Alchemy in Ancient Egypt



Egyptian' contribution to chemistry

- Producing tools for make up, building.
- Dyeing clothes and painting surfaces.
- Decoration.
- Ornamentation.
- Mummification.
- Processing metals for living
- They prepared some alloys.
- Developed many adhensive (such as albümin, gelatin, glue)

In Ancient Rome

In the Hellenistic (primary Greek or Roman) cultures, there are also some practices for alchemy and chemistry:

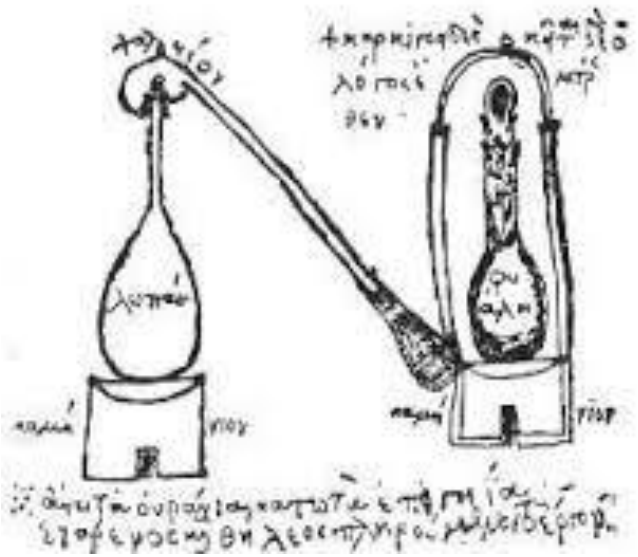
- They developed some techniques such as distillation.
- They tried to find endless life.
- Zosimos tried transmutation other metals into gold.

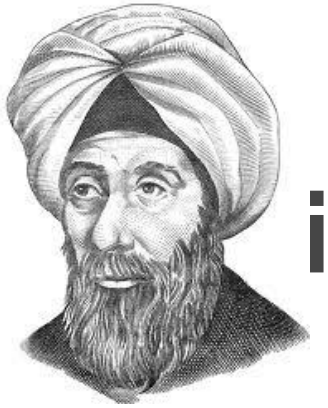
Chinese Alchemy

- Its main focus was medicine
  - Black Powder (greatest contribution – achieved)
    - used in fireworks and cannons
    - Gunpowder: China → Japan → Arab World → Europe

Arabic Alchemy

Arabic alchemy was dominated by Jabir Ibn Hayyan (Geber) and Al-Razi



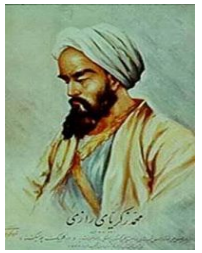


Jabir Ibn Hayyan & Al-i

Born in 721, was either Arab or Persian.

- He was Islamic philosopher, alchemist, astronomer and physicist.
- He was known as the father of Arab chemistry
- Known as first experimental chemist.
- He created a number of practical applications for chemistry.
- Invented distillation and discovered various acids. For example; sulfuric and nitric acids.
- He developed **AQUA REGIA** that dissolves gold.(3 volumes HCl+ 1 volume HNO_3

- **Al – Razi** wrote two books outlining his views of matter, equipment, tools and chemical operations related to pharmacy.



- He proved toxicity of arsenic.
- He developed "**AQUA VITAE**(a concentrated solution of ethyl alcohol)".
- He developed many laboratory equipments.
- He distilled petroleum.
- He produced antiseptics.

He developed many chemical processes such as sublimation

Ibn Sina:

He was concentrated on medicine.

He developed many healing methods with different drugs.

In his book, “the Book of Healing”, he discussed the philosophy of science and described the early scientific method.

He used distillation method to produce essential oils.

He classified inorganic substances as sulfurs, lapides, metals and salts.

EL - BIRUNI

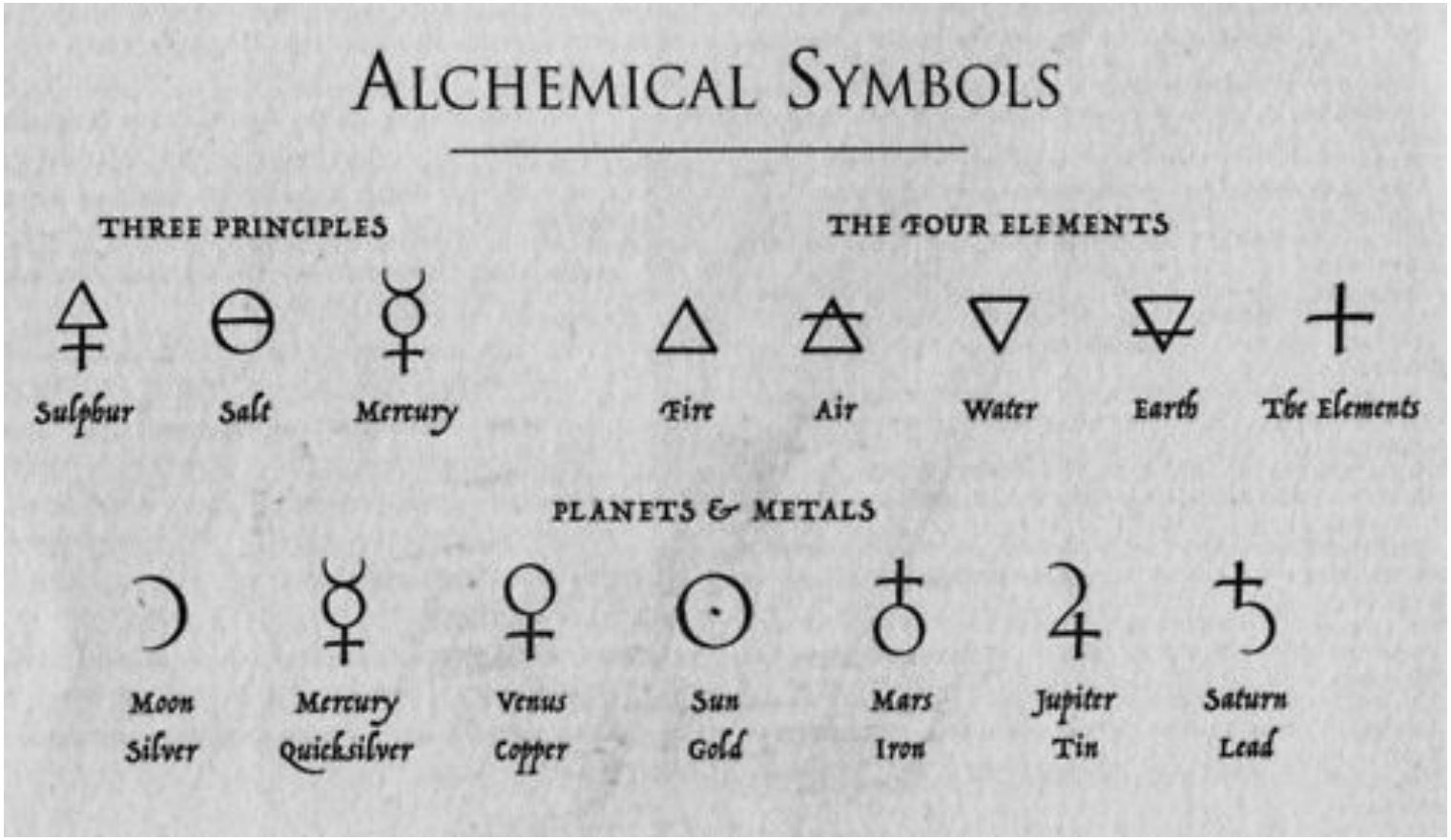
In his work “Kitâbü’l-Camahir fi Mârifeti’l-Cevâhir” (on the properties of the ores), Biruni determined the densities of 23 solids and six liquids very close to their present values.

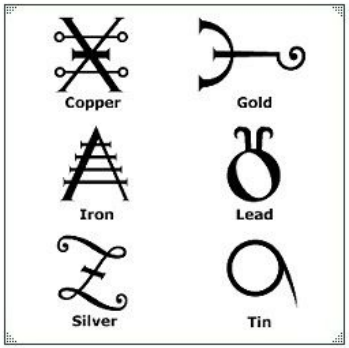
“Kitabu’s Saydane”, written on medicinal herbs and some medicines, he writes about how three thousand or so plants are used and how they are used.

Major Contributions from Alchemists

- Lab Techniques
  - Distillation, filtration, crystallization, evaporation, extraction and coagulation
- Medicines
  - Experimental drugs and synthetic drugs used to cure ailments and illnesses
- Lab Tools and Supplies
  - Mineral acids, alcohols, glassware
- Symbolic Language of Chemistry
  - Symbols for chemicals and lab procedures

Symbols in Alchemy





Paracelsus (1493-1541)

"Stop making gold," he taught ***"instead find medicines."***

- "discover new medicines rather than making gold"

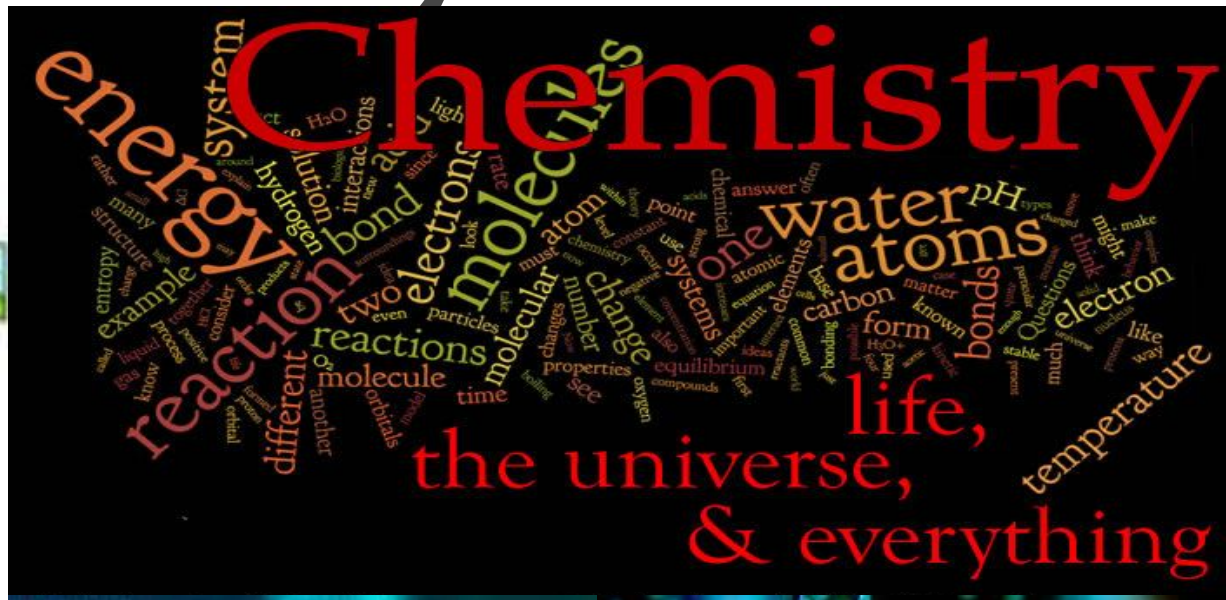
Robert Boyle1627 - 1691)

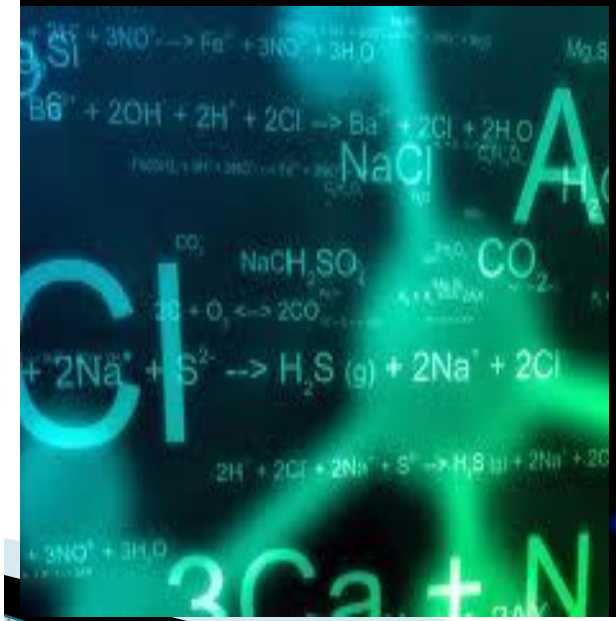
Robert Boyle redefined an element **as <u>"a substance that could not be broken down into simpler substances</u>**." He separated chemistry from alchemy and introduced experimental methods..

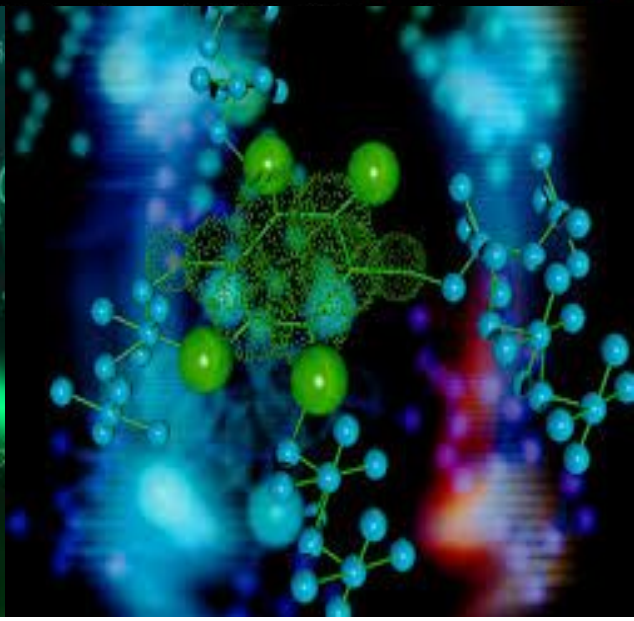
Antoine-Laurent Lavoisier
(1743-1794)

- He believed that mass was conserved through chemical reactions
- The Law of Conservation of Mass
- Discovered the “composition” of many compounds containing oxygen.

What is chemistry?







2.1 The Fundamental Disciplines of Chemistry

Analytical chemistry is a branch of chemistry which performs analysis, identification, separation and quantification of components and composition of natural and man-made materials.

Biochemistry is a branch of chemistry involving the study of materials and processes that occur in living things.

Organic chemistry is a branch of chemistry which is known as the study of carbon compounds

Inorganic chemistry is a sub-field of chemistry which deals with structure, composition and behavior of inorganic compounds.

Physical chemistry is the study of the fundamental physical principles that govern the way that atoms, subatomic particles, molecules, and other chemical systems behave.

Polymer chemistry is a discipline that deals with long chemical chains. These long chemical chains are called polymers or macromolecules.

Industrial chemistry is concerned with using chemical and physical processes to transform raw materials into products that are beneficial to humanity

Six major branches of Chemistry

https://quizlet.com/6483467/six-major-branches-of-chemistry-flash-cards/

2.2 Application Areas of Chemistry Disciplines(chemistry at work)

Chemistry in Fertilizer Processing

A fertilizer is a plant nutrient added to a soil to increase its yield. Fertilizers are made of natural and artificial chemicals. natural fertilizer is not enough in the world

Chemistry In Petrochemistry

Petrochemistry is the study of the transmution of crude oil(petroleum) to useable products. Chemists distill petroleum

Chemistry in Purification Process

Water purification is a process of removing unwanted materials from water to produce drinking water.

- **Chemistry in Processing of Hardwood**

- Wood is composed of cellulose and once raw wood is obtained, it is processed to be used in different areas. Such as paper,
- **Chemistry in Medicine Processing**
- Medicinal chemıstry: Medicinal chemistry is the application of chemical research techniques to the synthesis of pharmaceuticals.

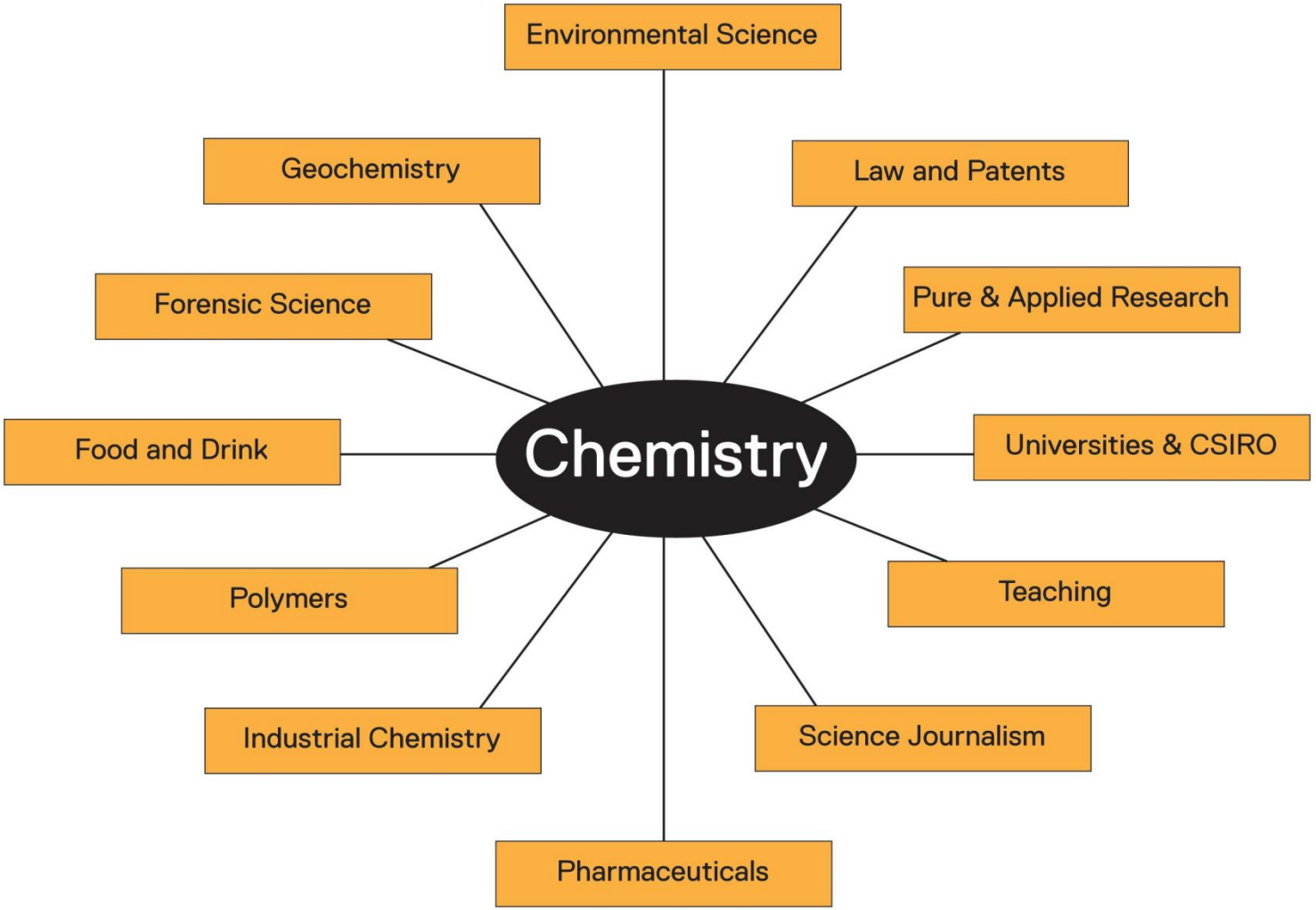
- **Chemistry in Textile-Dyeing Process**
- Textile chemistry: Textile chemistry is a highly specialized field that applies the principles of chemistry to the production of textiles, such as those used in clothing, furniture, tire yarn and air bags.
- It is the job of chemists to develop the right dyeing material for each type of clothing

Environmental chemistry: Environmental chemists try to understand how chemicals move through the environment and their effects on human health and the environment itself.

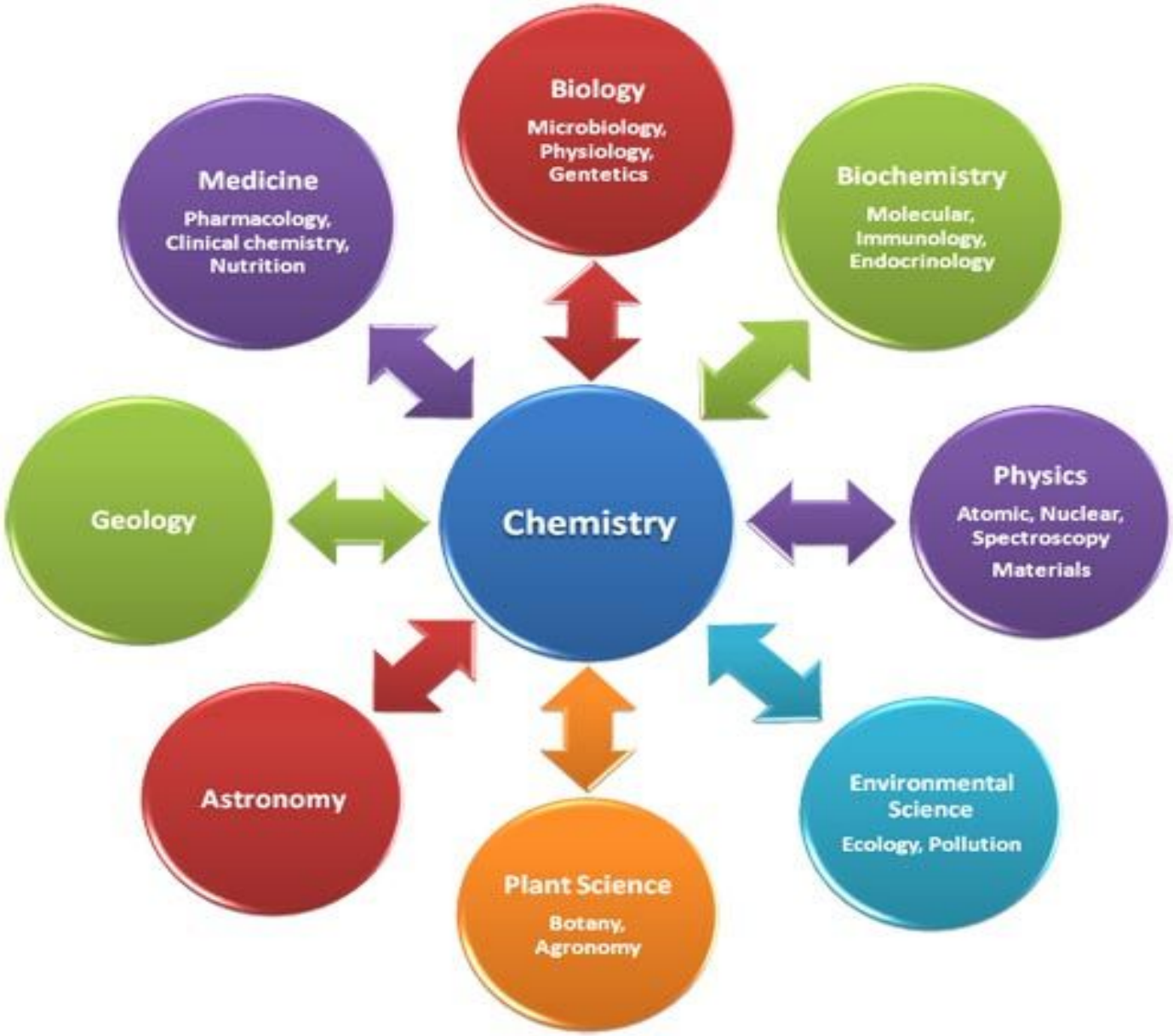
OTHER USES OF CHEMISTRY

- Chemistry is also used for detecting the doping materials in the body of the sportsmen.They also analyze poisons and explosives .In detecting the criminals, chemical analysis is used. Once an event occurs, chemists analyses the environment for the blood stains, hair or other living liquids in order to state the genetical password of the criminal. This area of chemistry is **criminal chemistry.**

Where a chemistry major can lead you



Where a chemistry major can lead you



CHEMISTRY RELATED OCCUPATIONS

Chemical Engineering: Chemical engineering is all about turning raw materials into useful, everyday products. The clothes we wear, the food and drink we consume and the energy we use all depend upon chemical engineering.

Chemist: A chemist is a scientist who researches and experiments with the properties of chemical substances. They measure the effects of chemical compounds in various situations and study inter-chemical reactions.

Metallurgical Engineering: Metallurgical engineering involves the study, innovation, design, implementation, and improvement of processes that transform mineral resources and metals into useful products that improve the quality of our lives

Pharmacology: Pharmacology is the science of drug action on biological systems. It involves chemical properties, biological effects and therapeutic uses of drugs. It is a science that is basic not only to medicine, but also to pharmacy, nursing, dentistry and veterinary medicine

Chemistry Teacher: A chemistry teacher teaches high school students about chemicals. chemistry teachers facilitate student learning and understanding of chemistry through guided inquiry, direct instruction, investigations, problem solving, and discussion.

Symbolic Language of Elements

- Do we use any symbols in our life?
- Why do we need symbols?
- Why do we use international symbols?
- Do you know any symbol about science?
- Why do scientists use symbols?
- What is the importance of symbolic language?

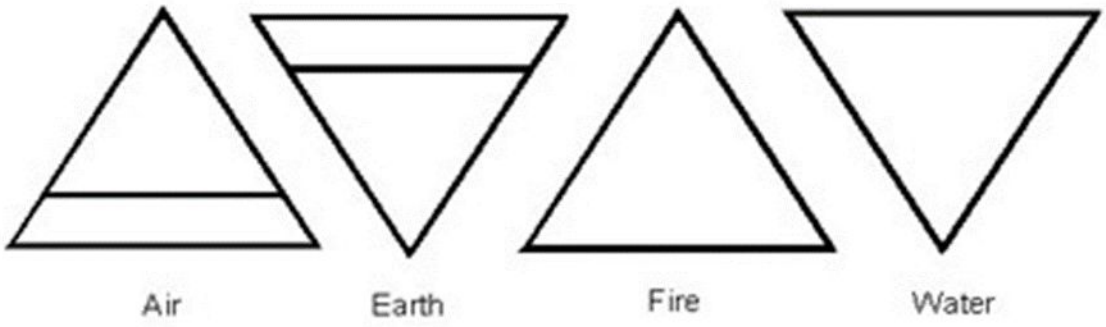
ELEMENTS AND COMPOUNDS

The Historical Development of the Symbolic Language of Chemistry

The modern symbols used to represent the chemical elements consist of one or two letters from the element's name. Historically, symbols were not always like this.

Empedocles at around 450 BC.

- Fire: Triangle points up
- Water: Triangle points down
- Air: Triangle points up with a horizontal line through center of triangle
- Earth: Triangle points down with a horizontal line through center of triangle

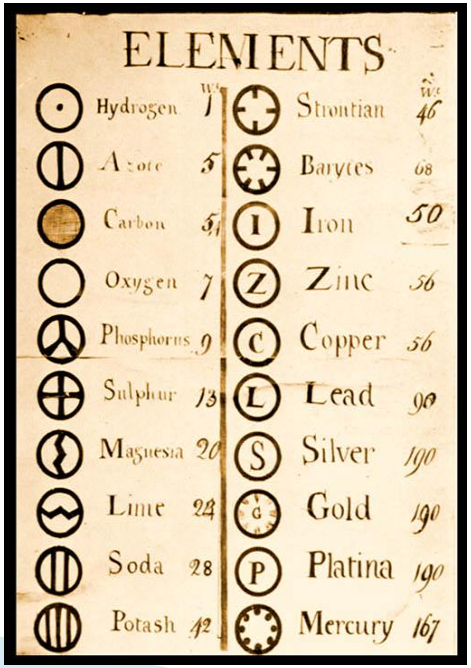


There were often many symbols for an element. For a time, the astronomical symbols of the planets were used to denote the elements

☉	☽	☿	♀	♂	♃	♄
Sol Sun Ruler of Gold	**Luna** Moon Ruler of Silver	**Mercurius** Mercury Ruler of Quicksilver	**Venus** Ruler of Copper	**Mars** Ruler of Iron	**Jupiter** Ruler of Tin	**Saturnus** Ruler of Lead

DALTON

He used circles with markings to represent the various individual atoms. He used circles with dots, lines, crosses and shading in them. he put letters in the circles to represent the elements.



About ten years later, in Sweden, **Berzelius suggested just using letters to represent atoms of each element** .These are the symbols that we use today.

System for Determining Symbols of the Elements

- **1.** The symbols of the most common elements, mainly nonmetals, use the first letter of their English name.

Examples:

Hydrogen: H, Boron : B,

Carbon: C, Nitrogen : N,

Oxygen: O, Fluorine : F

, Phosphorous : P, **Sulfur:** S

, Iodine: I

2. If the name of the element has the same initial letter as another element, then the symbol uses the first and second letters of their English name.

Examples: **Helium**:He,

Beryllium : Be,

Neon : Ne

3. If the first two letters of the element name are the same as another element, then the symbol consists of the first letter and the first consonant of the English name that they do not have in common.

Examples:

Magnesium has the symbol Mg (First letter and first consonant)

Manganese has the symbol Mn

Chlorine has the symbol Cl (First letter and first consonant NOT in common)

*Chro*mium has the symbol Cr

4. Some symbols are based on the old name or Latin name of the element. There are eleven elements:

Sodium (Na): : natrium	**Antimony (Sb): stibium** **eski**	**Potassium (K): kalium**
Iron (Fe): ferrum	**Gold (Au): aurum**	**Copper (Cu): cuprum**
Mercury (Hg): hydrargyrum eski	**Silver (Ag): argentum**	**Tin (Sn): stannum** **eski**

Symbolic Language of Elements

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Periodic Table Key

X	X	X	X
Synthetic Elements	Liquids or melt at close to room temp.	Solids	Gases

Alkali Metals	Alkali Earth Metals	Transition Metals	Other Metals	Metalloids	Other Non Metals	Halogens	Noble Gases	Lanthanides & Actinides

2 Elements and Symbols of Elements

All substances are made up of matter and the fundamental unit of matter is the atom. The atom constitutes the smallest particle of an element. An atom consists of two main parts. Firstly a nucleus in which protons, having a positive charge, and neutrons no charge, is tightly bound together. Secondly, surrounding the nucleus, are one or more electrons in shells, each of which has an associated energy level. The number of electrons is always equal to the number of protons, so the atom has no resultant charge

An element is a substance made up of atoms of one kind.

An element:

- consists of only one kind of atom,
- cannot be broken down into a simpler type of matter by either physical or chemical means, and
- can exist as either atoms (e.g. argon) or molecules (e.g., nitrogen).

Elements can be classified in to 3 groups

Monatomic Element: Elements occur in the form of single atoms that are not bound to other atoms. For example; Gold (Au), copper (Cu) and noble gases (helium, neon, argon, krypton, xenon and radon) etc…

Diatomic Element: An element exists as a molecule made up of two atoms. For example; Nitrogen, oxygen, hydrogen, brome and chlorine in nature are diatomic elements.

Polyatomic element: An element exists as a molecule made up of three or more atoms. For example; ozone (0_3) and sulfur (S_8) are polyatomic elements.

Element	Symbol	Element	Symbol
Hydrogen	H	**Helium**	He
Lithium	Li	**Beryllium**	Be
Boron	B	**Carbon**	C
Nitrogen	N	**Oxygen**	O
Fluorine	F	**Neon**	Ne
Sodium	Na	**Magnesium**	Mg
Aluminum	Al	**Silicon**	Si
Phosphorous	P	**Sulfur**	S
Chlorine	Cl	**argon**	Ar
Potassium	K	**Calcium**	Ca
Chromium	Cr	**Manganese**	Mn
Iron	Fe	**Cobalt**	Co
Nickel	Ni	**Copper**	Cu
Zinc	Zn	**Bromine**	Br
Silver	Ag	**Tin**	Sn
Iodine	I	**Barium**	Ba
Gold	Au	**Mercury**	Hg
Lead	Pb	**Cadmium**	Cd

Molecule: A molecule is formed when atoms of the same or different elements combine. A molecule is the smallest particle of a substance that can normally exist independently.

Examples:

- Two atoms of oxygen combine to form a molecule of oxygen [O_2].
- One atom of carbon combines with two atoms of oxygen to form a molecule of carbon dioxide [CO_2].

A compound is a pure substance formed when two or more chemical elements are chemically bonded together. Formula is the group of symbols that shows elements and number of elements in a compound

- consists of atoms of two or more different elements ***bound together***,
- can be broken down into a simpler type of matter (elements) by chemical means (but not by physical means),
- has properties that are different from its component elements, and
- always contains the same ratio of its component atoms.

Nomenclature of compounds

When compounds are named, some rules should be taken into consideration. If a compound consists of two elements, then it should be called with its elements' names. If a compound consists of two more elements, then it should be called with a special name. Some of the compounds that consist of two more compounds have special parts called as roots.

Root Formula	Root Name
OH^-	Hydroxide
NO_3^-	Nitrate
SO_4^{2-}	Sulfate
CO_3^{2-}	Carbonate
PO_4^{3-}	Phosphate

For the nomenclature of this type of compounds, firstly, the elements name that bonds to the root is called and then root's name should be called.

Formula	Compound Name	Common Name of Compounds
H_2O	Dihydrogen monoxide	Water
HCl	Hydrogen chloride	Hydro chloric acid tuz ruhu
H_2SO_4	Hydrogen sulfate	Sulfuric acid
HNO_3	Hydrogen nitrate	Nitric acid(kezzap)
NaCl	Sodium chloride	Table salt
CaO	Calcium oxide	Unhydrated lime
CH_3COOH	Ethanoic acid	Acid of vinegar (acetic acid)
NaOH	Sodium hydroxide	Sud Caustic soda
KNO_3	Potassium nitrate	Saltpetre(güherçile)
$CaCO_3$	Calcium carbonate	Limestone

General Rules

1. Firstly, the symbol of the cation (metal) is written and the symbol of the anion (non metal) is written last.
2. The sum of the charges in the compound must be equal to zero. Therefore, the subscripts are written to cancel out of the charges on cation and anion.
3. If more than one polyatomic ion is present in the formula, it is embedded in parenthesis and number of polyatomic ion is written as a subscript to the right of the final bracket.

Example: Write the formula of the compound formed between

a) $_{12}Mg$ and $_{17}Cl$

a) $_{20}Ca$ and $_{8}O$

a) Na^{+} and PO_4^{3-} ions

CATION

Cation

When a neutral atom loses an electron, it forms a positively charged atoms or molecules

Na^{+} , Ca^{+2} , NH_4^{+}

Monoatomic ion

Polyatomic ion

ANION

Anion

When a neutral atom gains an electron, It forms negatively charged atoms or molecules

O^{-2} , F^{-} , SO_4^{-2}

Monoatomic

Polyatomic

Charge of Some Elements

Metal Ions

You know that elements metal or non metal to name the co

Lithium	Li^{+}	Magnesium	Mg^{2+}
Beryllium	Be^{2+}	Aluminum	Al^{3+}
Boron	B^{3+}	Potassium	K^{+}
Sodium	Na^{+}	Calcium	Ca^{2+}
Zinc	Zn^{2+}	Cadmium	Cd^{2+}
47Silver	Ag^{+}	Barium	Ba^{2+}

Metal Ions (Metals that form more than one ion)

Copper	Cu^{+1}	Cu^{+2}		
Iron	Fe^{+2}	Fe^{+3}		
Manganese	Mn^{+2}	Mn^{+3}	Mn^{+4}	Mn^{+7}
Cobalt	Co^{+2}	Co^{+3}		
Lead	Pb^{+2}	Pb^{+4}		
Mercury	Hg^{+1}	Hg^{+2}	cadmium 2,3,4, 6	
Tin	Sn^{+2}	Sn^{+4}	gold3	nikal

Non Metal Ions

Hydride Ion	H^{-1}	Oxide Ion	O^{-2}
Fluoride Ion	F^{-1}	Sulfide Ion	S^{-2}
Chloride Ion	Cl^{-1}	Nitride Ion	N^{-3}
Bromide Ion	Br^{-1}	Phosphide Ion	P^{-3}
Iodide Ion	I^{-1}		

The important polyatomic anions and cations

Formula	Name	Formula	Name
OH^-	hydroxide	CN^-	cyanide
O_2^{2-}	peroxide	NH_2^-	amide
NO_2^-	nitrite	NO_3^-	nitrate
SO_3^{2-}	sulfite	SO_4^{2-}	sulfate
PO_3^{3-}	phosphite	PO_4^{3-}	phosphate
ClO_2^-	chlorite	ClO_3^-	chlorate
ClO^-	hypochlorite	$C_2H_3O_2^-$	acetate
CO_3^{2-}	carbonate	HCO_3^-	bicarbonate
CrO_4^{2-}	chromate	$Cr_2O_7^{2-}$	dichromate
MnO_4^-	permanganate	MnO_4^{2-}	manganate
HS^-	Hydrogen sulfide	NH_4^+	*ammonium*

anion
(or polyatomic ion)

Example: NaCl

Mg(OH):

- Example: $FeCl_3$:

$CuSO_4$:

Name of the transition metal + (Oxidation number of the transition metal in Roman figures) + Name of the anion (or polyatomic ion)

1. Name the following compounds

a) Na_3PO_4

b) CaS

c) AlN

d) KNO_3

e) $FeMnO_4$

f) $CuCr_2O_7$

g) $Pb(OH)_4$

h) $SnCl_2$

1. **Write the formula of the following ionic compounds**

a) Sodium nitrate

b) Copper (II) hydroxide

c) Calcium phosphate

d) Ammonium chloride

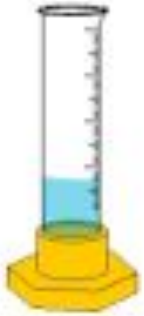
SAFETY IN THE CHEMISTRY LABORATORY 1. Always wear goggles, gloves apron for safety.
2. Never reach across a flame.
3. Immediately notify your teacher if any chemical gets on your skin or clothing to find out what to do to clean it off.
4. Never look directly into a test tube when mixing or heating chemicals.
5. Always point a test tube away from you and others when heating it over a flame or other heat source.

6. Never smell a chemical directly from the container. Wave your hand over the opening of the container and “waft” the fumes towards your nose.
7. Never taste a chemical unless you are instructed by your teacher to do so.
8. Never mix chemicals without your teacher’s permission.
9. Never use broken or chapped glassware.
10. Immediately notify your teacher if you get cut or have another injury when performing an experiment
11.Long hair must be tied back.

beaker

erlenmeyer flask

spatula



graduated cylinder

test tube

test tube holder

crucible

crucible tongs

stand and ring clamp

clay triangle

forceps

wire screen

dropper pipet

utility clamp

pinch clamp

funnel

buret clamp

evaporating dish

watch glass

rubber policeman

Beaker:A wide [illegible] iner used to transp[illegible]e substances.

beaker

erlenmeyer flask

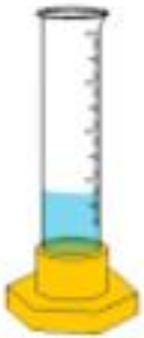
Erlenmeyer Flask : A narrow-mouthed container used to transport, heat or store substances, often used when a stopper is required.

volumetric flask: It is used to measure an exact volume of liquid.

Test tube: Hold or used to mix a small amount of liquid or aqueous chemicals

test tube

Graduated C : Used to measure volu ry precisely

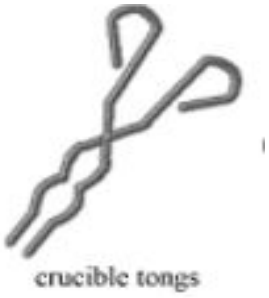


graduated cylinder

Test tube h . . . . . a test tube so yc . . . . . to.
Test tube r . . . . . any test tubes.

Funnel: Used to pour liquids into containers with small openings or to hold filter paper

Tongs: Used to pick up or hold hot objects



Triple Beam Balance: A device to measure the mass of an object or substance.

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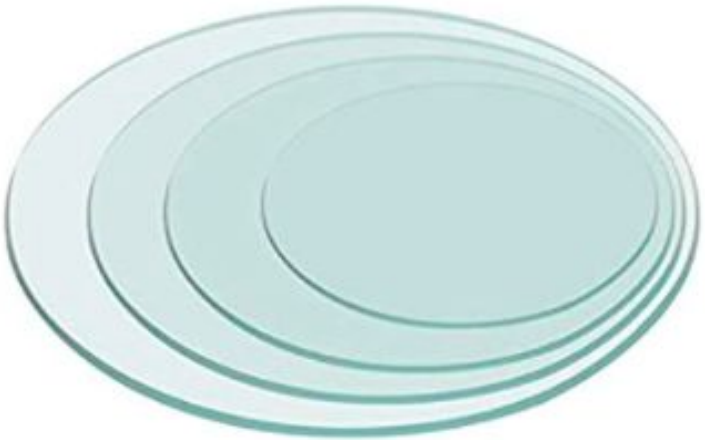
Wacth glass:They can be used for evaporation purposes and also can function as a lid for a beaker. It can hold a small ar solid



Spatulas anc are for scooping sol

Striker: Used to light a Bunsen burner.

Bunsen Burner: Used to heat objects

Ring Clamp: Attaches to a lab stand and used to hold a variety of lab equipment

Eye Dropper: Use[illegible]pense a very small amou[illegible]quid

Evaporating dish: Holds a liquid or aqueous chemical that is being h

Wash bottle:  ash the sides of flask itration.

Lab Coat or Apron: Protects the scientist and the scientist's clothes from hazard or hot chemicals

Pipette: Used to precisely measure a certain volume of liquid or aqueous chemical.

liquid is added or used

separatory funnel : used to separate immis[illegible] liquids.

	Task	Laboratory Equipment
1.	Holding 100 mLof boiling water:	.....
2.	Melting a crystal over a Bunsen Burner:	.....
3.	Pouring 80 mL of acid from one container to another:	.....
4.	Measuring exactly 41 mL of water:	.....
5.	Weighing out 110 grams of sodium chloride:	.....
6.	Keeping 80 grams of a compound from absorbing atmospheric moisture:	.....
7.	Suspending glassware over a Bunsen burner:	.....
8.	Removing chemicals from a reagent bottle:	.....
9.	Keeping the contents of a boiling beaker from splattering:	.....
10.	Mixing two liquids together:	.....

1.	Beaker
2.	Crucible
3.	Funnel
4.	Graduated cylinder
5.	Balance

6.	Desiccator
7.	Ring stand
8.	Spatula
9.	Watch glass
10.	Stirring rod

1.	Wash bottle		Used to wash the sides of flask during a titration.
2.	Evaporating dish		Holds a liquid or aqueous chemical that is being heated.
3.	Funnel		Used to accurately and cleanly add one chemical to another or to filter a solid from a liquid solution using filter paper.
4.	Test tube		Hold or used to mix a small amount of liquid or aqueous chemical(s).
5.	Test tube holder		Holds a test tube so you don't have to.
6.	Test tube rack		Holds many test tubes.
7.	Graduated cylinder		Precisely measure the volume of a liquid or aqueous chemical.
8.	Pipette		Used to precisely measure a certain volume of liquid or aqueous chemical.
9.	Erlenmeyer flask		Store liquid or aqueous chemicals.
10.	Rubber stoppers		Seal an Erlenmeyer flask.

1.	
2.	
3.	
4.	
5.	

6.	
7.	
8.	
9.	
10,	

LABORATORY SAFETY SYMBOLS

This is the safety symbol for a biohazard.

This is the hazard symbol for toxic substances.

This sign means you need to wear gloves or other hand protection.

This symbol indicates mandatory use of protective clothing.

CHEMICAL HAZARD SYMBOLS

Flammable

Compressed Gas

Oxidizing

Corrosive

Explosive

Health Hazard

Toxic

Skin Irritant

Environmental Hazard

This symbol or sign indicates the location of a fire extinguisher.

This is the safety symbol for electricity.

This sign tells you respiratory protection is required.

This symbol indicates mandatory use of protective clothing.

4. Match the following symbols with the symbol definition and state what care should be taken.

(a) (b) (c) (d) (e) (f) (g)

	Symbol definition	Care
1.	Oxidizing (....)	....
2.	Corrosive (....)	....
3.	Dangerous for the environment (....)	....
4.	Toxic (....)	....
5.	Flammable (....)	....
6.	Harmful (....)	....
7.	Explosive (....)	....

1-c	In addition to the normal precautions of wearing eye protection, anyone using an oxidizing substance should take care to keep it away from flammable substances, including clothing.
2-e	Anyone using a corrosive substance should wear gloves and eye protection, such as goggles or a face shield.
3-g	To an extent depending on the potential danger, do not dispose of in the drains, soil or the environment. Follow special disposal regulations.
4-d	Anyone who uses a toxic chemical needs to take great care. They should wear gloves and eye protection, and they may wear a mask over their mouth and nose, or handle the chemical in a fume cupboard.
5-a	In addition to the normal precautions of wearing eye protection, anyone using a highly flammable substance should take care to keep it away from flames and sparks, and also from oxidizing substances.
6-b	Anyone using a harmful substance should wear eye protection such as goggles, and they should take care to wash any spills off their skin immediately.
7-f	Explosive substances must be handled very carefully. It is illegal to carry out unauthorised experiments with explosive chemicals.

Naming Formulas of Covalent Compounds

Latin numerals must be learned before naming of covalent compounds

Mono	1	Hexa	6
Di	2	Hepta	7
Tri	3	Octa	8
Tetra	4	Nona	9
Penta	5	Deca	10

General Rule

ımber of the first ɔnmetal in Latin	+	Name of the first nonmetal	+	Number of the second nonmetal in Latin	+	Name of the s nonmetal as an a

CAUTION: If the number of the first nonmetal is one “mono” cannot be written as a rule. But if the number of the second nonmetal is one “mono” is written.

Example: N_2O_5 NO

Exercises:

1. **Name the following covalent compounds**

    a) S_2O_3

    b) PCl_5

    c) N_2O_3

    d) SiF_4

    e) CO

2. **Write the formula of the following covalent compounds**

    a) Tricarbon disulfide

    b) Chlorine dioxide

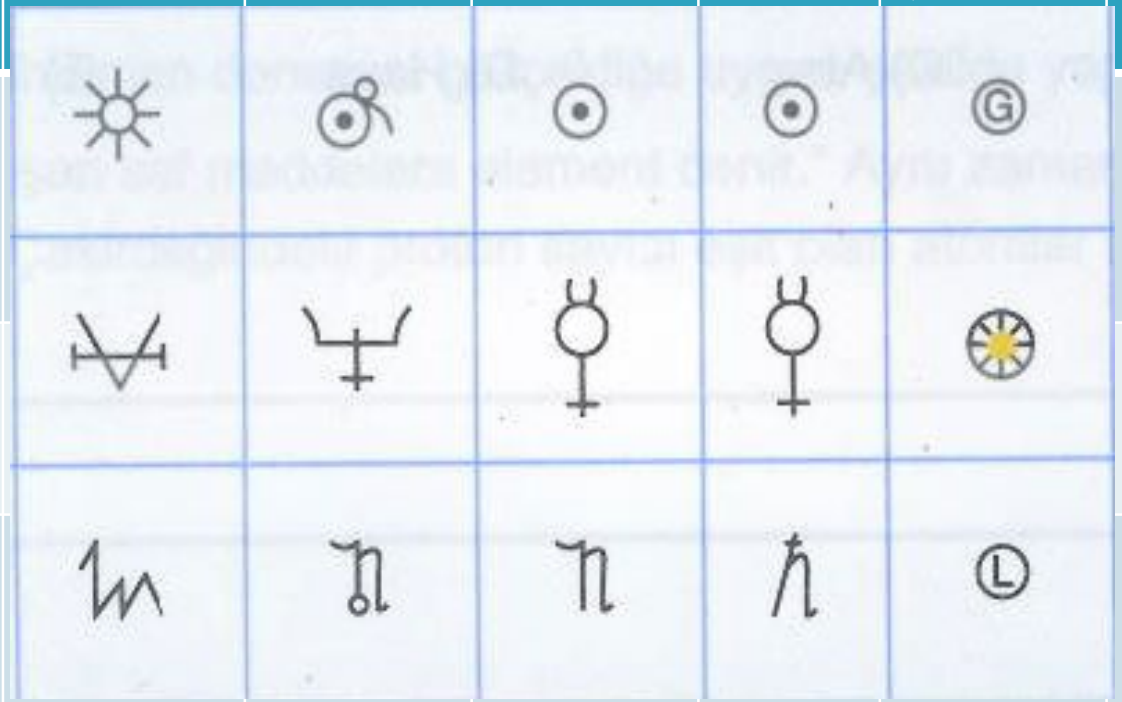
    c) Carbon tetrachloride

    d) Disilicon hexafluoride

    e) Sulfur trioxide

Formula	Common Name
H_2O	Water
NH_3	Ammonia
H_2S	Sulfured hydrogen
CH_3COOH	Winegar, asetic acid
HCl	Spirit of salt(tuz ruhu), Hydrochloric acid
$CaCO_3$	Limestone
NaCl	Table salt
NaOH	Sud coastic soda
KOH	Potas coastic soda
CaO	Slaked lime
$Ca(OH)_2$	Limewater
HNO_3	Nitric acid(kezzap)
H_2SO_4	Oil of vitriol(zaç yağı), sulfuric acid
KNO_3	Saltpeter(güherçile)
$NaHCO_3$	Food soda, Sodium bicarbonate
$NaCO_3.10H_2O$	Washing soda
$KAl(SO_4)_2.12H_2O$	Alumn(şap)
NH_4Cl	Ammonium chloride(nişadır)

Symbolic Language of Elements

	1500s	1600s	1700s	1783	1808 (Dalto	1813 (Berzelius)
Gold						Au (Aurum)
Mercury						Hg (Hy) (Hydrargyrum)
Lead						Pb (P) (Plumbum)

Common elements

- First 20 Elements
- Cr, Mn, Fe, Co, Ni, Cu, Zn, Br, Ag, Sn, I, Ba, Au, Hg, Pb