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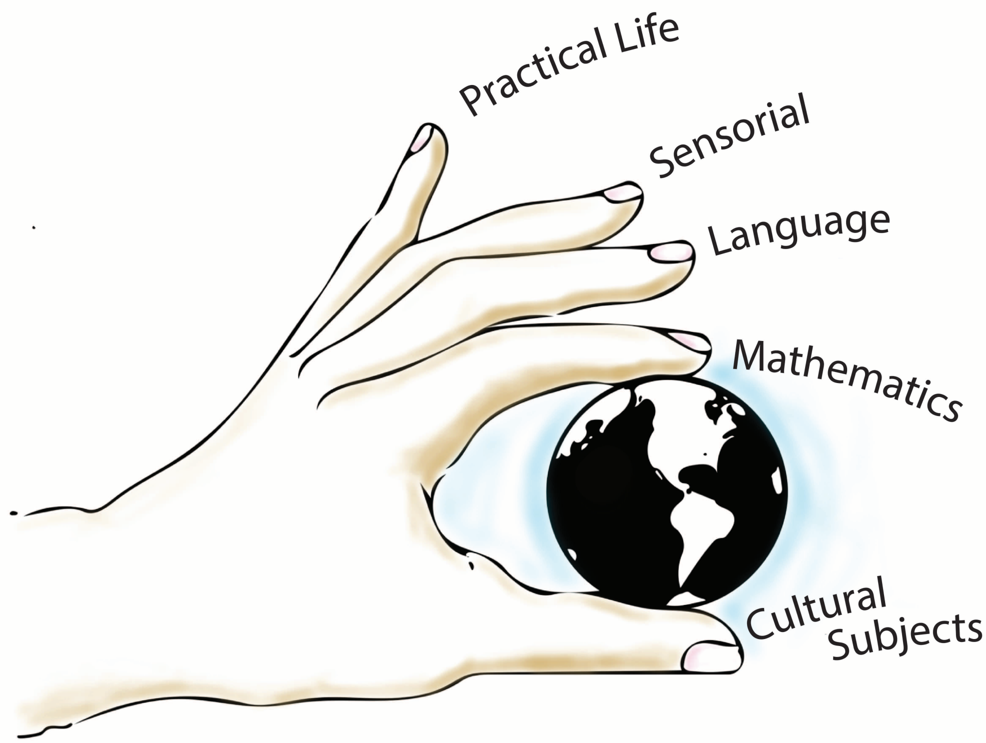

Chemistry

Elementary

Teacher Manual and Lesson Prep Materials

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MEI, Inc Chemistry Elementary

Table of Contents

The Periodic Table

Purposes

To understand the classification of chemical elements
To become familiar with the names and symbols of elements
To be aware of electron arrangement in shells and protons in the nucleus of atoms
To learn about the arrangement of groups and periods in the Periodic Table
To develop understanding of atomic numbers and atomic weights

Preliminary Exercises

Work with language materials which reinforce pronunciation
Experience with other classification materials

Materials

Information booklet about the Periodic Table
Booklet about atoms
Control for Periodic Table with atomic number, name and symbol of each element
Periodic Table with atomic number and name of element only, separate symbol cards
Periodic Table for periods with separate horizontal strips for each period
Periodic Table for groups with separate vertical strips for each group

Procedure 1

1. Invite a child to read the information booklet, then to place the symbols for elements on the Periodic Table using the control as a guide.

Procedure 2

1. Invite the child to place the first group or column of elements on the Periodic Table, then to remove it before placing the second. Have the child continue to place the groups, always removing one before placing the next.

Procedure 3

1. Invite the child to place the first period or row of elements on the Periodic Table, then to remove it before placing the second. Have the child continue to place the periods, always removing one before placing the next.

Control of Error

Control Periodic Table
Color of groups

Directions for Preparation of Periodic Table

Control Periodic Table

1. Using a red colored pencil, color all symbols for gases red. (H, N, 0, F, Cl, He, Ne, Ar, Kr, Xe, Rn)

2. Using a blue colored pencil, color mercury (Hg) blue.

3. Using a gray colored pencil, color IA, the first column at the left, gray, starting with hydrogen at the top.

4. Using a light green colored pencil, color IIA, the second column at the left, light green.

5. Moving to the far right column, color column VIII light orange around the red symbols.

6. Color the section light blue to the left of the orange column VIII and to the right of the heavy black line. (B, C, N, 0, F, Si, P, S, Cl, As, Se, Br, Te, I and At will be in the blue area.)

7. To the left of the light blue section color the section pink which includes Al, Ga, Ge, In, Sn, Sb, Tl, Pb, Bi, Po.

8. Color all the remaining background gold or yellow, being very careful NOT to color the symbols so that they will remain white.

9. Cut off the footers on a paper cutter. Trim the edge of the pages to the left of Ni, Pb, Pt, Gd and Cm.

10. Using a glue stick, overlap the right pages just trimmed over the left pages and press to adhere.

11. Cut the bottom of the Lanthanide-Actinide series pages so that a one inch border remains.

12. Using a glue stick, attach the Lanthanide-Actinide series page to the remaining part of the Periodic Table so that there is about a one inch space between the two parts of the table. Be sure to align the cerium (Ce) space on the Lathanide-Actinide series exactly beneath the Rutherfordium(Rf) space on the main body of the table.

13. Mount the Periodic Table on poster board, thin plywood or an artist's canvas board.

14. Laminate.

Movable Symbols for Mute Periodic Table

1. Copy the symbols for all the elements onto white cover stock.

2. Color the symbols as for the Periodic Table: red for gases, blue for mercury.

3. Color the background of the symbols according to directions given for the Periodic Table.

4. Laminate and cut each symbol on the dividing lines.

5. Place in a container labeled Symbols for Periodic Table.

Mute Periodic Table

1. Color the mute periodic table exactly as the control.

2. Cut and adhere the Periodic Table as before to give one large mute periodic table.

3. Mount on the same kind of material as used for the control Periodic Table.

4. Laminate.

MEI, Inc. **Chemistry** **Elementary**

Material ______________________________ Number of pages

Atoms

Atoms are particles of matter too small to be seen under a regular microscope. They are the smallest possible part of any element that can be identified as that element. Atoms of one element are always the same.

1

Atoms are composed of **subatomic protons, neutrons** and **electrons.** Neutrons have no charge so they are electrically neutral. Protons have a positive charge. Each electron has a negative charge. Usually, an atom has the same number of protons in its nucleus as electrons outside the nucleus. Therefore, the atom is neutral and has no electrical charge itself.

2

The weight of atoms varies, but the size is about the same. The heaviest atom which occurs naturally is plutonium. The lightest is hydrogen. An atom of plutonium is more than 200 times the weight of hydrogen, but its diameter is only three times greater.

3

Protons and neutrons are packed into the center of the atom to form the **nucleus.** Almost all the mass or weight of the atom is in the nucleus. An atomic nucleus is most stable when all its shells are filled to capacity.

4

Protons and neutrons can only occupy discrete energy levels or **shells** within the nucleus. Protons and neutrons fill separate shells. Shells fill from inside out, from low to high energy in progression up the periodic table.

5

The outer shell of the nucleus has particles with the most energy. The outermost shell fills according to "magic numbers" of 2, 8, 20, 28, 50 and 82. These numbers indicate the total number of protons or neutrons.

6

Oxygen has 8 protons and 8 neutrons in its nucleus. Lead has 82 protons and 126 neutrons in its nucleus. These are examples of stable elements because there are "magic numbers" of both protons and electrons

7

Electrons move around the outside of the nucleus at incredible speeds. There is no regular pattern to their movement. In a millionth of a second, an electron has gone around the nucleus a billion times.

8

Electrons are arranged in layers called **shells** around the nucleus. The positive charge of the protons in the nucleus attract the negative charge of the speeding electrons. This keeps the electrons within the atom.

9

Electrons located in the shells closest to the nucleus have the least energy. Those in the outer shells farthest from the nucleus have the most energy.

10

The seven shells surrounding the nucleus are numbered. Each shell is able to hold only a certain number of electrons.

11

Shell one is nearest the nucleus and can hold not more than 2 electrons.

Shell two can hold 8 electrons.

Shell three can hold 18 electrons.

Shell four can hold 32 electrons.

Shell five can hold 50 electrons but it is never completely filled.

Shell six can hold 72 electrons but it is never completely filled.

Shell seven can hold 98 electrons but it is never completely filled.

The Periodic Table

A chemical element is a basic substance which cannot be reduced by chemical means into simpler substances. An element is composed of only one kind of atom. There are 103 elements recognized by the International Union of Pure and Applied Chemistry. Most elements do not appear in pure form but in combination with other elements, forming compounds. To obtain pure elements, compounds must be reduced.

1

In ancient times, twelve chemical elements were recognized: antimony, arsenic, bismuth, carbon, copper, gold, iron, lead, mercury, silver, sulfur, tin . However, the fact that these were elements was unknown. Between 1557 and 1925, seventy- six new elements were discovered. Twenty-one more new elements have been discovered since 1937. In the past thirty years, some scientists claim to have created artificially six new elements, as yet to be officially accepted. Only minute quantities have been created and the life of these artificial elements is extremely short.

2

Some elements' names were taken from Greek or Latin words. Those elements artificially created were named in honor of individuals or of places. A symbol has been assigned to each element and is used as an abbreviation for the element's name. The symbol may be the first letter (8 for boron), the first two letters (Br for bromine) or the first combined with another letter of the element's name (Zn for zinc). Some symbols are abbreviations of ancient words for the element such as Pb for plumbum, the Latin word for lead.

3

Similarities among certain elements such as chlorine, bromine and iodine, were discovered by Dobereiner, a German chemist, about 1828. Newlands, an English chemist, proposed the "law of octaves" in 1864. He found that the change in the number of electrons in inert gases was eight or a multiple of eight. In the same year, Meyer, a German chemist, proposed a periodic table of the elements based on previous discoveries.

4

Atomic weight is a number representing the weight of one atom of an element as compared with a number representing the weight of one atom of carbon 12. When elements with similar properties were arranged in order of increasing atomic weight, they appeared at regular intervals. This was the basis for the periodic table. Later, chemists discovered that listing elements according to their electronic structure instead of atomic weight produced a more accurate periodic table.

5

Also in 1864 a more complete Periodic Table of the known 63 elements was composed by Mendeleev, a Russian. He predicted the existence and properties of elements unknown in his time. When these elements were discovered later and their properties confirmed, the Periodic Table was accepted . It remains the most important single generalization in the field of chemistry.

6

Every atom consists of a **nucleus** composed of **protons** and **neutrons** with **electrons** orbiting the nucleus. The electrons orbit at different levels or **shells.** There is no electrical charge on the atom as a whole because the number of electrons is the same as the number of protons.The first shell of electrons around a nucleus has a maximum of two electrons; the second shell has eight; the third shell has eighteen; the fourth shell has thirty-two. Elements with similar electron configurations have similar properties.

7

Atomic number indicates the number of protons in the nucleus. The elements are arranged according to increasing atomic number in the Periodic Table.

8

Horizontal rows on the Periodic Table are called **periods.** The elements are arranged horizontally in order of their increasing mass. The properties of the elements change in systematic way.

9

Vertical columns on the Periodic Table are called **groups.** There are eighteen groups. Elements within a group have related physical and chemical properties. For example, in Group I, the alkali metals, are lithium, sodium, potassium, rubidium, cesium and francium. In Group SA, the Noble Gases, are helium, neon, argon, krypton, xenon, radon.

10

Group (1) IA	(2) IIA	(3) IIIA	(4) IVA	(5) VA	(6) VIA	(7) VIIA	(8)	(9) VIIIA
1 H Hydrogen								
3 Li Lithium	4 Be Beryllium							
11 Na Sodium	12 Mg Magnesium							
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium
55 Cs Cesium	56 Ba Barium	57 La Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium
87 Fr Francium	88 Ra Radium	89 Ac Actinium	104 Rf (Rutherfordium)	105 Db (Dubnium)	106 Sg (Seaborgium)	107 Bh (Bohrioum)	108 Hs (Hassium)	109 Mt (Meitnerlum)

(10) I	(11) 1B	(12)11B	(13)	(14)IVB	(15)VB	(16)VIB	(17)VIIB	(18) VIII
								2 He Helium
			111B 5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
			1 3 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
110 Uun (Ununnilium)	111 Rg Roentgenium	112 Cn Copernicium						

58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Prometheium	62 Sm Samarium	63 Eu Europium
90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium

64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

Group (1) IA	(2) IIA	(3) IIIA	(4) IVA	(5) VA	(6) VIA	(7) VIIA	(8)	(9) VIIIA-
1 Hydrogen								
3 Lithium	4 Beryllium							
11 Sodium	12 Magnesium							
19 Potassium	20 Calcium	21 Scandium	22 Titanium	23 Vanadium	24 Chromium	25 Manganese	26 Iron	27 Cobalt
37 Rubidium	38 Strontium	39 Yttrium	40 Zirconium	41 Niobium	42 Molybdenum	43 Technetium	44 Ruthenium	45 Rhodium
55 Cesium	56 Barium	57 Lanthanum	72 Hafnium	73 Tantalum	74 Tungsten	75 Rhenium	76 Osmium	77 Iridium
87 Francium	88 Radium	89 Actinium	104 (Rutherfordium)	105 (Dubnium)	106 (Seaborgium)	107 (Bohrioum)	108 (Hassium)	109 (Meitnerium)

 Chemistry Elementary Periodic Table Diagram

(10)	(11) 1B	(12)11B	(13) 111B	(14)1VB	(15)VB	(16)VIB	(17)VIIB	(18) VIII
								2 Helium
			5 Boron	6 Carbon	7 Nitrogen	8 Oxygen	9 Fluorine	10 Neon
			13 Aluminum	14 Silicon	1 5 Phosphorus	16 Sulfur	17 Chlorine	18 Argon
28 Nickel	29 Copper	30 Zinc	31 Gallium	32 Germanium	33 Arsenic	34 Selenium	35 Bromine	36 Krypton
46 Palladium	47 Silver	48 Cadmium	49 Indium	50 Tin	51 Antimony	52 Tellurium	53 Iodine	54 Xenon
78 Platinum	79 Gold	80 Mercury	81 Thallium	82 Lead	83 Bismuth	84 Polonium	85 Astatine	86 Radon
110 (Ununnilium)	1 1 1 Roentgenium	112 Copernicium						

58 Cerium	59 Praseodymium	60 Neodymium	61 Promethium	62 Samarium	63 Europium
90 Thorium	91 Protactinium	92 Uranium	93 Neptunium	94 Plutonium	95 Americium

64 Gadolinium	65 Terbium	66 Dysprosium	67 Holmium	68 Erbium	69 Thulium	70 Ytterbium	71 Lutetium
96 Curium	97 Berkelium	98 Californium	99 Einsteinium	100 Fermium	101 Mendelevium	102 Nobelium	103 Lawrencium

H								
Li	Be							
Na	Mg							
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf

								He
			B	C	N	O	F	Ne
			Al	Si	P	S	Cl	Ar
Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Uun								
Ho	Er	Tm	Yb	Lu				
Es	Fm	Md	No	Lr				

29

2
8
18
1

Cu

Copper

63.54

29

2
8
18
1

Cu

Copper

63.54

29

2
8
18
1

Cu

Copper

63.54

29

2
8
18
1

Cu

Copper

63.54

Element Data

Chemical Symbol

Element Name

Number of electrons in each shell

Atomic Weight

Atomic Number

Element ________________

______ **atomic weight**
(round to nearest whole)

—____ **atomic number**
(number of protons)

______ **number of neutrons**

Determine the number of electrons and electron shells by referring to the Periodic Table

Element ________________

______ **atomic weight**
(round to nearest whole)

—____ **atomic number**
(number of protons)

______ **number of neutrons**

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(number of protons)

______ **number of neutrons**

Determine the number of electrons and electron shells by referring to the Periodic Table

Chemistry

Radioactivity

If the nucleus of an atom changes naturally, it is said to be **radioactive.** Radiation is given off when a nucleus changes. Radiation is energy composed of **alpha or beta particles** or **gamma rays.** If the number of protons and neutrons in the atom's nucleus changes, alpha or beta radiation results. The atom becomes transformed to a different element by transmutation or by radioactive decay. For example, uranium (238) loses an alpha particle and becomes thorium (234).

1

Alpha particles are composed of two protons and two neutrons. They have a positive electrical charge.

2

Beta particles are composed of electrons When a neutron in the nucleus of an atom changes to a proton, an electron and an **antineutrino** are emitted.

3

When a proton in the nucleus of an atom changes to a neutron, a **positron** and a **neutrino** are emitted.

4

Gamma rays are emitted as **photons** from the nucleus. This occurs to rid the nucleus of excess energy which was not carried off by alpha or beta emissions. Gamma rays travel at the speed of light.

5

Radioactive atoms are all those elements heavier than bismuth. Uranium and radium are well-known radioactive elements. Isotopes of lighter elements may be radioactive. Radioactive isotopes can be created in a laboratory by bombarding atoms with subatomic particles.

6

Quantum states are the energy levels of the movement of electrons. Electrons normally move only in certain **quantized orbits** each of which has a given value of energy.

7

Ground state is the condition when all electrons of the atom are at the lowest energy level.

8

Photons are produced when electrons are caused to jump from their orbit to another orbit, either lower or higher. This **excited state** can be produced by heating the element. Radiant energy is emitted in the form of photons which are given off when the jump is to a lower orbit. Photons may be seen as visible light. Photons are absorbed when the jump is from a lower to a higher orbit.

9

Light is a stream of individual photon particles which also have wave properties.

10

Protons and neutrons are composed of even tinier particles known as **quarks.** Carriers of strong force called **gluons** join quarks together. These are not observable. There is indirect evidence that quarks exist. Electrons do not appear to be composed of smaller particles.

11

Ions

Ions are formed when atoms gain or lose electrons. **Ionization** is the process whereby ions are formed. When an atom loses electrons, it becomes **a positive ion.**

1

When an atom gains electrons, it becomes a **negative ion.**

2

An atom can gain or lose electrons by chemical reactions or by colliding with an electron or another atom. Ions can be produced by radiation from X rays, gamma rays and light.

3

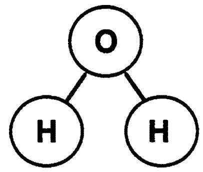
Ions in liquids or gases are in constant motion, as are neutral atoms and molecules. This is known as random or Brownian movement.

4

Chemistry

Molecules

Atoms bond together in definite ways to produce molecules. Electrons are shared among different atoms.



Water H_2O

1

Valence is the term for the number of electrons transferred or shared.

Positive valence is the term used if the atom loses electrons to other atoms.

Negative valence is the term used if the atom gains electrons from other atoms.

2

A **chemical formula** indicates the number of each kind of atom in the molecule.

$C_{12}H_{22}O_{11}$ (sugar) has
12 carbon atoms,
22 hydrogen atoms and
11 oxygen atoms.

3

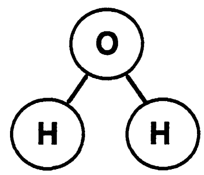
If a molecule is composed of two atoms, it is known as **a diatomic molecule.**

A hydrogen molecule, H_2, has two atoms of hydrogen.

H–H

If the molecule has three atoms, it is **triatomic.**

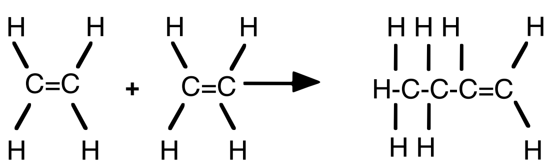
A water molecule, H_2O, has one atom of oxygen and two atoms of hydrogen for a total of three atoms.



Water H_2O

Small molecules may combine with each other to form a larger molecule. This is known as **polymerization.**

Molecules of ethylene combine to form polyethylene.



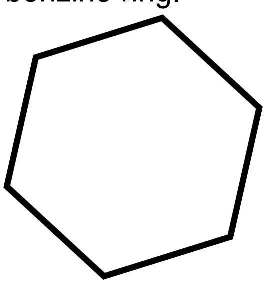
ethylene ethylene polyethylene

Molecular weight indicates how much a molecule weighs. By adding together the atomic weights of all the atoms in a molecule, molecular weight is determined. The molecular weight of water is 18 because the atomic weight of oxygen is 16 and the atomic weight of hydrogen is 1. There are two atoms of hydrogen in water, $\mathbf{H_2O}$, so two times 1 equals two which is added to 16 to give the molecular weight, 18, of water.

The forces that keep molecules together are known as the **Van der Waals forces.** When a solid is heated, the molecules *move* more quickly. The Van der Waals forces are unable to keep the molecules together, so the solid becomes a liquid.

When some gases are subjected to extremely low temperatures, the Van der Waals forces attract the molecules so that the gas becomes a liquid.

Bonds between atoms give a particular geometric shape to the molecule. Long spiral chains are characteristic of protein molecules. Organic compounds may take the shape of a hexagon which is known as the benzine ring.



Scientists have several techniques for learning about molecules. One is to observe the **spectrum** of emitted or absorbed light. There is a characteristic spectrum for *every* kind of molecule.

Another procedure uses an **electron microscope** to get a picture of molecules.

A third method, **X-ray diffraction,** can give information about size, shape and arrangement of molecules in solids. Neutrons or electrons can be beamed through solids. By observing the **diffraction** of the beam, information is gathered about the molecular structure.

An **electron microscope** may be used to get a picture of molecules

12

X-ray diffraction can give information about size, shape and arrangement of molecules in solids.

13

Neutrons or electrons can be beamed through solids. By observing the **diffraction** of the beam, information is gathered about the molecular structure.

14

Valence

The original definition of **valence** was the number of hydrogen atoms which can combine with each atom of any other element. In the formula for water, H_2O , one atom of oxygen combines with two atoms of hydrogen. Oxygen has a valence of two because two atoms of hydrogen combine with one atom of oxygen.

1

A second definition of valence relates to the charges of **ionized atoms.** The valence of sodium is one because a sodium ion has one positive charge. When the electrons around the nucleus of an atom are removed, **positive ions** are produced. The electrons lost from one atom join other atoms, making them **negative ions.**

2

Earth's atmosphere has a layer of ions known as the **ionosphere.** Other ions are trapped in Earth's magnetic field as part of the **Van Allen belt.**

3

Because the total charge of all the positive ions is the same as the total charge of all the negative ions, ionic solids, liquids and most gases are **electrically neutral.** Ions in liquids and gases are in constant motion in any direction. This is known as **random motion or Brownian motion.**

4

A third definition of valence is related to **chemical links or bonds** between atoms. Carbon has a valence of four because a carbon atom usually forms four bonds with other atoms.

5

Some atoms are able to combine in many ways . These have several valences. Valences of 2, 4 and 6 are present in sulfur because it can form two, four or six bonds with other atoms.

6

7

Compounds

Elements combine to form molecules which are the components of compounds. The combination of atoms to form molecules occurs only in a specific way.

Example:

$$Na + Cl \rightarrow NaCl$$

Sodium + Chlorine - Sodium Chloride

1

A compound always has the same molecular composition which gives it unique properties. It can be a solid, a liquid or a gas. Some compounds, such as water, may occur as a liquid in its natural state, as a solid when frozen and as a gas when heated to form steam.

2

One of the two types of compounds is called **organic.** All organic compounds contain carbon atoms. Organic compounds occur in living matter. The plants and animals eaten by humans contain organic compounds.

3

Some organic compounds display the characteristics of both liquids and solids. These are known as **liquid crystals.**

4

Inorganic compounds are the second type. Rocks and minerals are examples of inorganic compounds.

5

There are millions of compounds. Many occur naturally, many are manufactured and others are produced by living organisms.

6

Chemistry

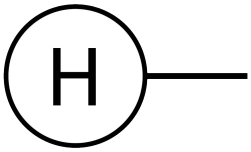
Mixtures

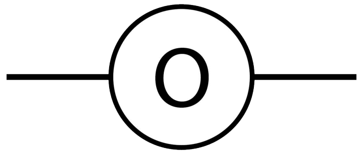
Although a mixture is composed of different atoms, it does not have the same composition by weight.

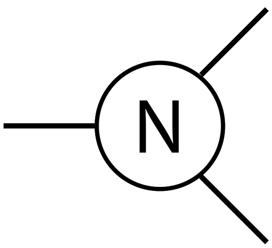
1

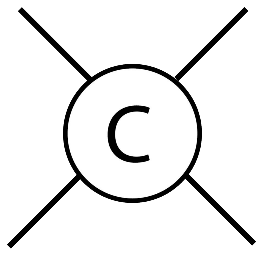
A mixture can be easily separated into its component parts because there was no chemical reaction to form a compound. Each component retains its own properties.

2

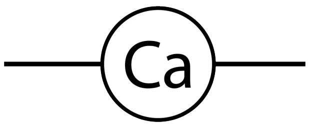


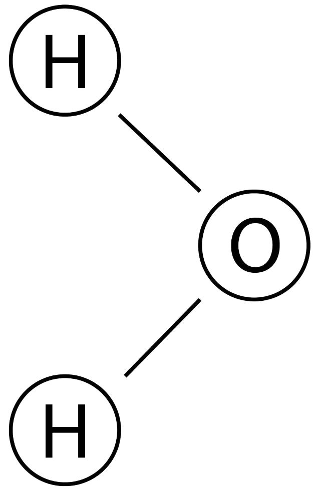


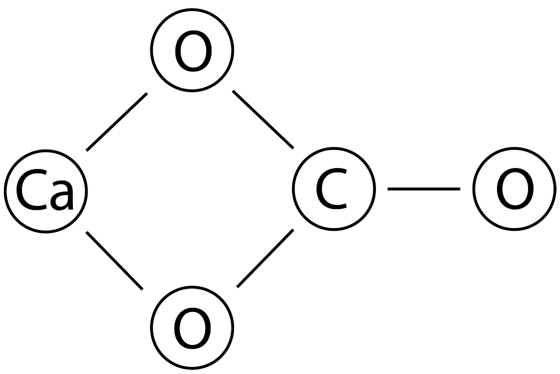


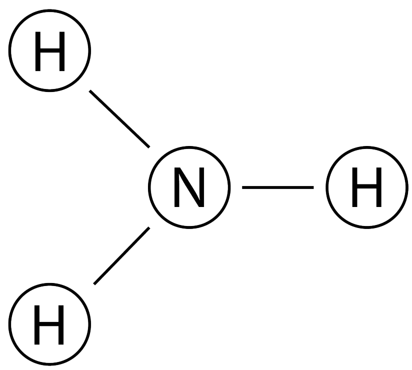


nitrogen valence 3 or 5 carbon valence 4

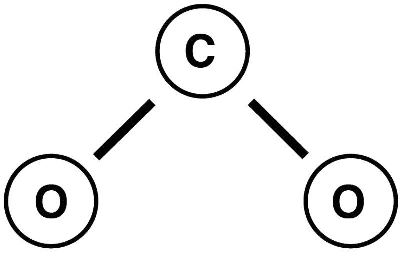


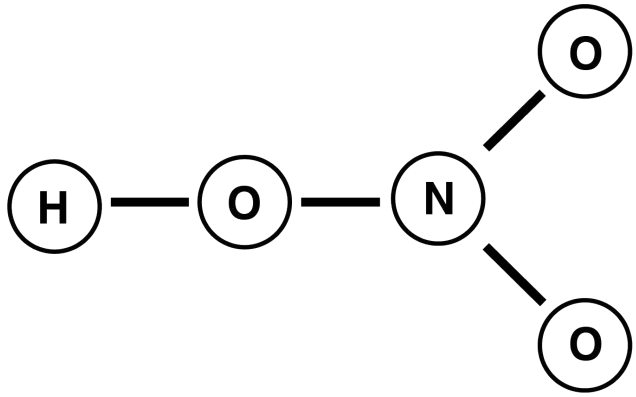


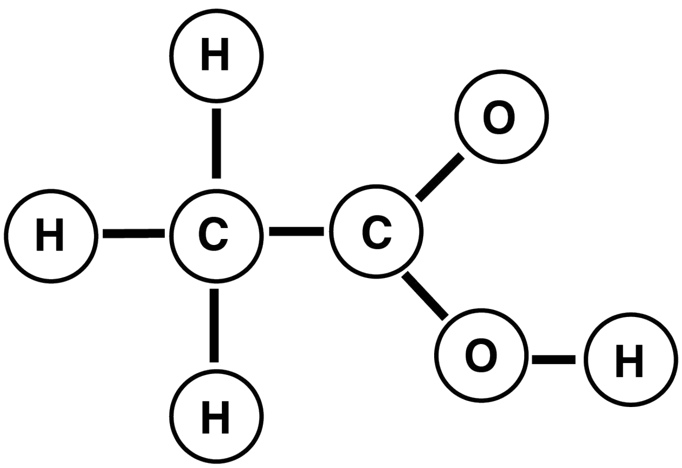


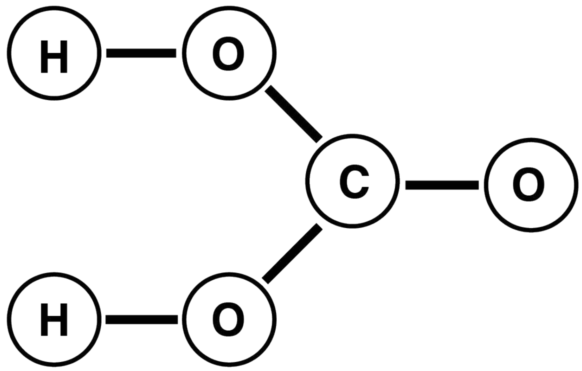


calcium valence 2

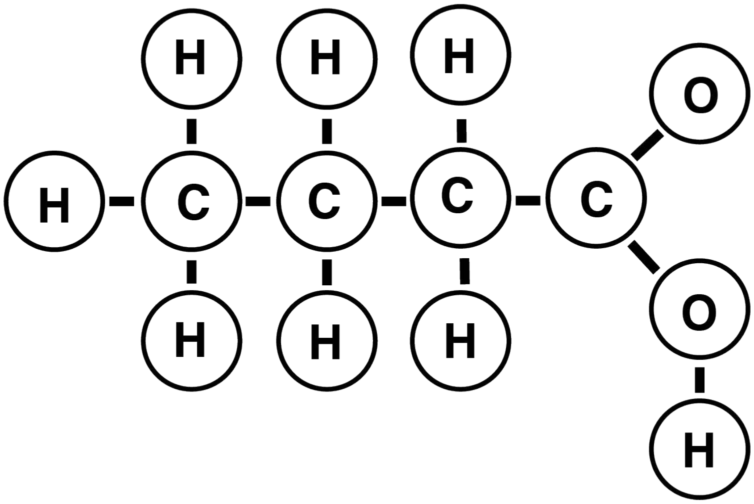


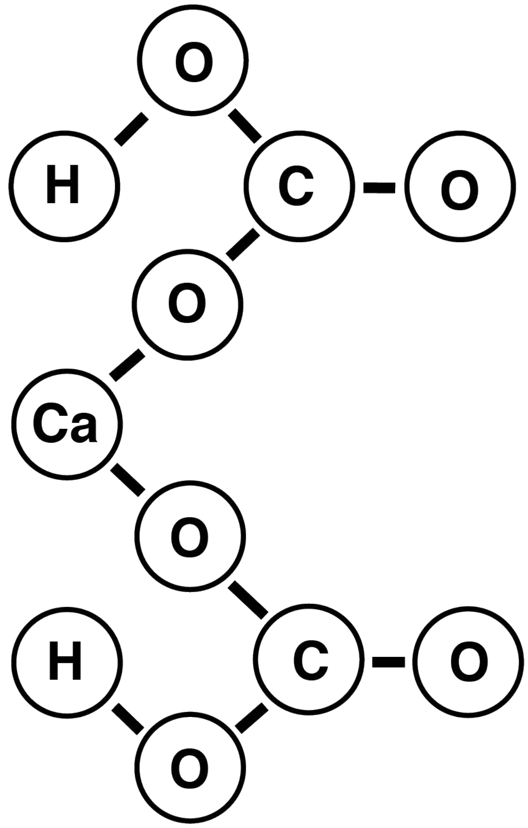




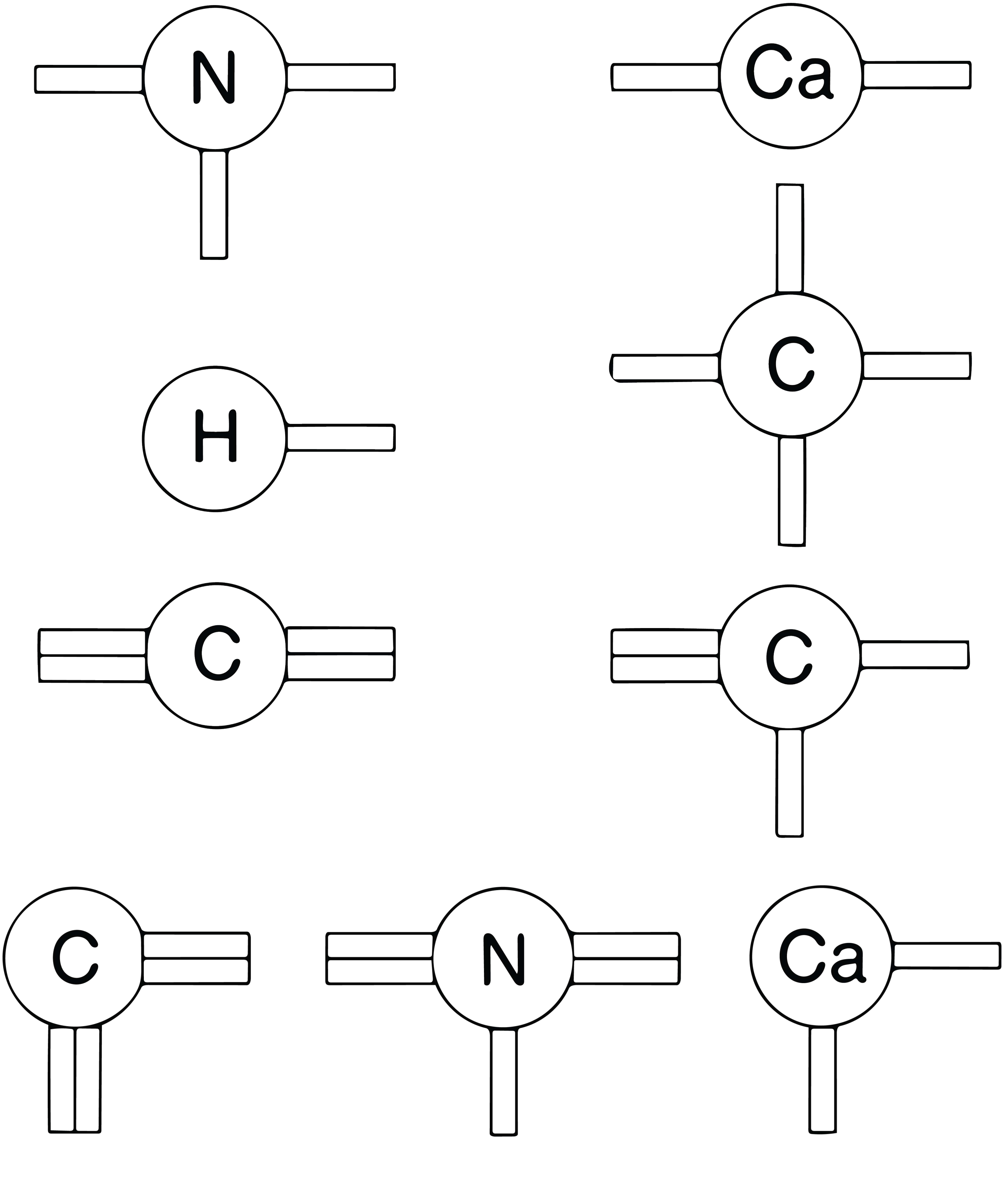


hydrogen **valence 1** **oxygen** **valence 2**





$C_4H_8O_2$	**butyric acid**	H_2O	**water**
$Ca(HCO_3)_2$	**bicarbonate of calcium**	H_2CO_3	**carbonic acid**
$C_2H_4O_2$	**acetic acid**	NH_3	**amonia**
CO_2	**carbon dioxide**	$CaCO_3$	**Calcium carbonate**
HNO_3	**nitric acid**		


N
Ca
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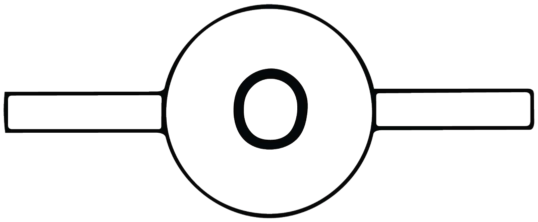
C
N
Ca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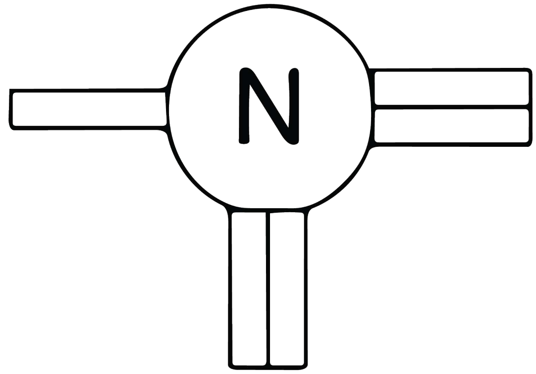
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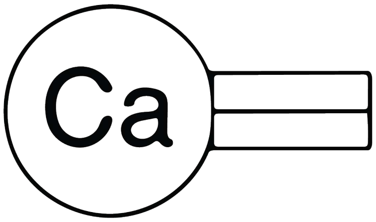
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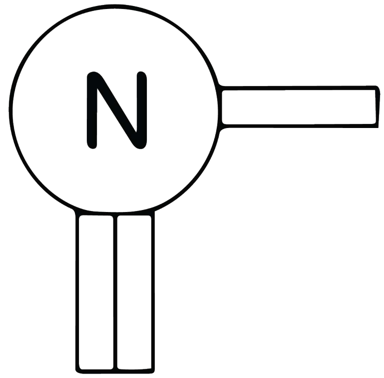
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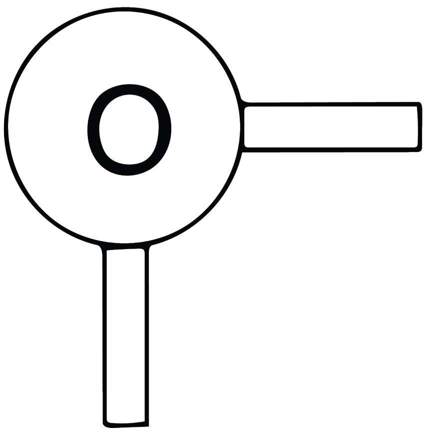
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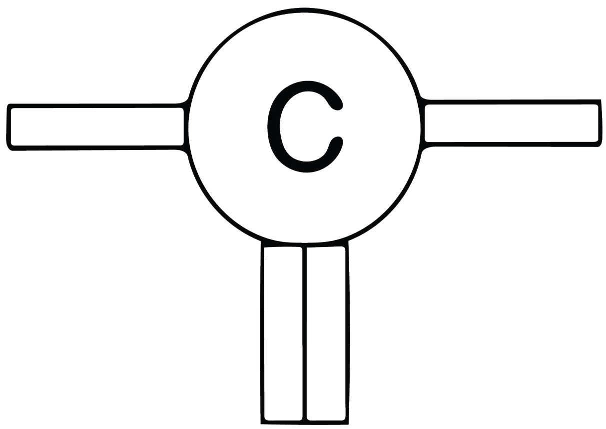
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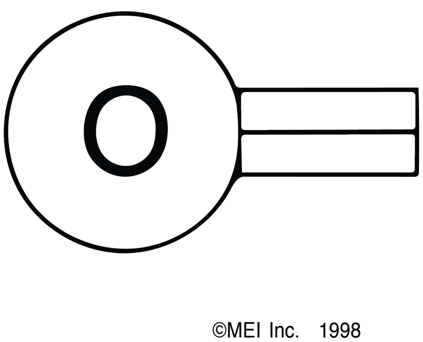
O

Chemistry Definitions

nucleus

neutron

electron

positron

quark

shell

atomic mass unit (amu)

atomic number

subatomic particle

atom

proton

dalton

element

periodic table

mass number

isotopes

radiation

alpha particle

beta particle

gamma rays

photon

ionization

positive ion

negative ion

molecule

diatomic molecule

triatomic molecule

chemical formula

valence

positive valence

negative valence

quantum state

ground state

neutrino

antineutrino

polymerization

molecular weight

Van der Waals force

bond

spectrum

diffraction

compound

organic compound

inorganic compound

liquid crystals

mixture

period

radioactive

extremely tiny particle of matter composed of **protons, neutrons** and **electrons.**

center of the atom consisting of protons and neutrons moving randomly

particle in nucleus of atom having no charge

positively charged particle in nucleus of atom

particle with positive charge having the same mass as an electron

protons, neutrons and electrons which composed the atom

extremely tiny particles which compose protons and neutrons

one of seven layers of electrons moving about the nucleus of an atom number of protons in the nucleus of an atom

term used to express mass number

another term for amu

basic chemical substance composed of only one kind of atom

chart showing arrangement of elements according to atomic number

one of seven rows elements arranged on the periodic table

sum of protons and neutrons in nucleus of an atom

atoms of the same element with different numbers of neutrons in nuclei condition resulting from changes in nucleus of atom

alpha or beta particles or gamma rays emitted when the nucleus of an atom changes

positively charged nuclear particle consisting of two protons and two electrons

composed of electrons produced when a neutron in the nucleus of an atom changes to a proton, a negative electron and an antineutrino

photons emitted during radioactive decay

particle of radiant energy

loss or gain of electrons by atom

atom which has lost electrons

atom which has gained electrons

combination of atoms by sharing or transferring electrons in the outermost shell

molecule composed of two atoms

molecule composed of three atoms

indicates number and kind of each element in a molecule

term for number of electrons transferred or shared in the formation of a molecule

indicates loss of electrons to other atoms

indicates gain of electrons from other atoms energy levels of electron movement

condition when all electrons in an atom are at the lowest energy level

uncharged subatomic particle created by change in nucleus of atom

counterpart of neutrino with a different direction of spin

combination of small molecules to form larger ones

weight of molecule determined by adding atomic weights of atoms composing the molecule

attraction which keeps molecules together

force between atoms which give characteristic geometric shape to molecule emitted or absorbed light characteristic for each kind of molecule

change in beam of neutrons, electrons or X-rays when passed through molecules

substance resulting from combination of elements or atoms to form molecules

compound containing carbon atoms, particularly in living matter

compound not related to organic or living matter

compounds displaying characteristics of both liquids and solids

combination of substances in varying proportions that retain their own properties

negatively charged particle outside the nucleus of an atom

Chemistry Definitions

atom
extremely tiny particle of matter composed of **protons, neutrons** and **electrons.**

nucleus.
center of the atom consisting of protons and neutrons moving randomly

neutron
particle in nucleus of atom having no charge

proton
positively charged particle in nucleus of atom

electron
negatively charged particle out side the nucleus of an atom

positron
particle with positive charge having the same mass as an electron

subatomic particle
protons, neutrons and electrons which composed the atom

quark
extremely tiny particles which compose protons and neutrons

shell
one of seven layers of electrons moving about the nucleus of an atom

atomic number
number of protons in the nucleus of an atom

atomic mass unit (amu)

term used to express mass number

dalton
another term for amu

element
basic chemical substance composed of only one kind of atom

periodic table
chart showing arrangement of elements according to atomic number

period
one of seven rows elements arranged on the periodic table

mass number
sum of protons and neutrons in nucleus of an atom

isotopes
atoms of the same element with different numbers of neutrons in nuclei

radioactive
condition resulting from changes in nucleus of atom

radiation
alpha or beta particles or gamma rays emitted when the nucleus of an atom changes

alpha particle
positively charged nuclear particle consisting of two protons and two electrons

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composed of electrons produced when a neutron in the nucleus of an atom changes to a proton, a negative electron and an antineutrino

gamma rays
photons emitted during radioactive decay

photon
particle of radiant energy

ionization
loss or gain of electrons by atom

positive ion
atom which has lost electrons

negative ion
atom which has gained electrons

molecule
combination of atoms by sharing or transferring electrons in the outermost shell

diatomic molecule
molecule composed of two atoms

triatomic molecule
molecule composed of three atoms

chemical formula
indicates number and kind of each element in a molecule

valence
term for number of electrons transferred or shared in the formation of a molecule

positive valence
indicates loss of electrons to other atoms

negative valence
indicates gain of electrons from other atoms

quantum state
energy levels of electron movement

ground state
condition when all electrons in an atom are at the lowest energy level

neutrino
uncharged subatomic particle created by change in nucleus of atom

antineutrino
counterpart of neutrino with a different direction of spin

polymerization
combination of small molecules to form larger ones

molecular weight
weight of molecule determined by adding atomic weights of atoms composing the molecule

Van der Waals force
attraction which keeps molecules together

bond
force between atoms which give characteristic geometric shape to molecule

spectrum
emitted or absorbed light characteristic for each kind of molecule

diffraction
change in beam of neutrons, electrons or X-rays when passed through molecules

compound
substance resulting from combination of elements or atoms to form molecules

organic compound
compound containing carbon atoms, particularly in living matter

inorganic compound
compound not related to organic or living matter

liquid crystals
compounds displaying characteristics of both liquids and solids

mixture
combination of substances in varying proportions that retain their own properties

Commands for Chemistry

Find the names of elements which were known in ancient times.

What uses did each have?

Most symbols are the first or first and second letters of the name of the element. Some symbols have no resemblance to the name of the element. Find the origins of those symbols.

Make a graph to show the numbers of discoveries of elements according to the country in which the discoverers lived.

Who discovered the most naturally occurring elements and what are they?

Name the classes of elements according to their arrangement in columns.

List the radioactive elements and give uses for as many as possible.

Choose a person from the time line of atomic theory and make a booklet about him/her.

Time lIne of the development of atomic theory

400 B.C.E. Leucippus Greek philosopher
The concept of atomism is first introduced as a philosophical idea.

370 B.C.E. (?) Democritus Greek philosopher
Basic elements of reality are the void with atoms as basic particles.

300 B.C.E. Epicurus Greek philosopher
Meteorological phenomena are caused by motions of atoms.

50 B.C.E. Lucretius Roman poet
One's soul is a cluster of atoms which disperse after death.

1750 Rudjer Boscovich Dalmatian scientist
Atoms are composed of smaller parts.

1803 John Dalton British chemist
Each element has a particular type of atom.

1811 Amedeo Avogadro Italian physicist
The distinction between atoms and molecules leads to the correct determination of the table of atomic weights

1858 Stanialao Cannizarro Italian chemist
Atomic weights are corrected and standardized.

1873 Johannes van der Waals Dutch physicist
Because he formulated an equation for state of gases and liquids, forces which keep molecules together are named for him.

1897 Joseph John Thomson British physicist
Electrons are part of the atom.

1903 Marie and Pierre Curie French physicists
Radium and polonium are discovered.

1905 Albert Einstein German-born physicist
Matter is a form of energy related to mass and is expressed as $E= MC^2$.

1911 Ernest Rutherford British physicist,
The nucleus of atom has electrons moving around it.

1913 Niels Bohr Danish physicist,
Sets of orbits of electrons around a nucleus make up atomic structure.

1924 Louis deBroglie French physicist
Electrons have properties of waves.

1928 Erwin Schrodinger and Wolfgang Pauli, Austria
Max Born and Werner Heisenberg , Germany
Descriptions of electron arrangement in shells of atoms are corrected.

1932 James Chadwick British physicist
Neutrons in the nucleus of atoms are discovered.

1938 Otto Hahn and Fritz Strassmann German radio chemists
Nuclear fission is accomplished by splitting atoms of uranium with neutrons, releasing large amounts of energy and producing barium and krypton.

1945 Enrico Fermi Italian-born physicist
Scientists at University of Chicago under his direction artificially create a chain reaction leading to production of the atomic bomb.

1964 Murray Gell-Mann American physicist
Subatomic particles in neutrons and protons are named quarks.

1974 Albert Ghiorso and Glenn Seaborg American chemists
Element 106 is produced in a laboratory.

1993 University of California scientists
Element 106, seaborgium, is confirmed by replication. It lasts 30 seconds and has been added to the periodic table.

Time line of the development of atomic theory

4008.C.E.	370 B.C. (?)	300 8.C.	508.C.
1750	1897	1903	1905
1803	1811	1858	1873
1924	1928	1932	1938
1945	1964	1974	1993
1911	1913		

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