

Name _____

Unit 4: Periodic Table

Period _____

- | | |
|-----------------------------------|---------------------------------|
| 1. History of the Periodic Table | 4. Identifying Group Properties |
| 2. Language of the Periodic Table | 5. Identifying Periodic Trends |
| 3. Identifying Types of Elements | |

Unit 4 Vocabulary.....Due Test Day

Word	Definition
Mendeleev	
Noble Gas	
Malleable	
Period	
Group	
Metalloid	
Atomic Radius	
Ionic Radius	
Ionization Energy	
Electronegativity	
Allotrope	

Select ELEMENT SYMBOLS from the periodic table and write them on your board! Only use each element ONCE!
Match your selections to the elements called!

ELEMENT BINGO

		Free Space		

Essential Question: Why is it the “Periodic” Table?

Periodic → Periodic Law → Periodic Table

- Periodic** means to occurs at _____ intervals
- Periodic Law:** The physical and chemical properties of the elements are periodic
By atomic number!
- Periodic Table of Elements:** arranged by _____ and shows patterns in
repeated or similar physical and chemical properties!

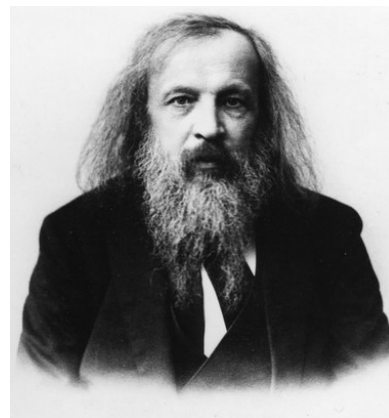
Skill1: History of the Periodic Table

Element:

- A pure substance - one kind of _____
- Cannot be _____ into simpler substances
- 90 occur naturally on earth
- 25 were synthesized (made) by scientists

Dmitri Mendeleev (1860s)

- Referred to as the _____ of the Period _____
- Grouped elements according to _____



Mendeleev's Predictions

- Mendeleev's Table had missing elements or "gaps," BUT he was able to predict the characteristics of these missing elements because of _____.

"Ekasilicon" Prediction

Germanium Actual

Date Predicted	1871	Date Discovered	1886
Atomic Mass	72	Atomic Mass	72.6
Density	5.5 g/cm ³	Density	5.47 g/cm ³
Bonding Power	4	Bonding Power	4
Color	Dark Gray	Color	Grayish White

Notice how Mendeleev's predictions (orange column) were very accurate when compared to Germanium's actual characteristics (green column)

Henry Mosely (1914): The Dawn of the Modern Age

- Rearranged the elements by _____
- He determined # protons = atomic #
- 4. Determined how we **NOW** view the periodic table!



Language of the Periodic Table: Groups!

Group or Family: Each column of the _____ on the periodic Table.

How many groups
(families)
are on the
Periodic Table

	1												13	14	15	16	17	18
1	1 H 1.008												2 He 4.003					
2	3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.001	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
3	11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948
4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.87	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
5	37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.4	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.904	54 Xe 131.29
6	55 Cs 132.905	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226)	103 Lr (262)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 Ds (269)	111 Rg (272)	112 Uub (285)	113 Uut (284)	114 Uuq (289)	115 Uup (288)	116 Uuh (292)	117 Uus (288)	118 Uuo (289)

	57	58	59	60	61	62	63	64	65	66	67	68	69	70
★ Lanthanides	La 138.905	Ce 140.116	Pr 140.908	Nd 144.24	Pm (145)	Sm 150.36	Eu 151.964	Gd 157.25	Tb 158.925	Dy 162.50	Ho 164.930	Er 167.26	Tm 168.934	Yb 173.04
★★ Actinides	89 Ac (227)	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)

FROM TOP TO BOTTOM OR BOTTOM TO THE TOP

Group (Family) Properties:

- Eighteen groups (numbered from left to right)
- Atomic # and masses _____.
- Atoms in same group have _____
- Exceptions: d block and f block
- Similar _____ properties
BECAUSE THEY HAVE THE SAME NUMBER OF _____

Practice:

- Which sequence of atomic numbers represents elements, which have similar chemical properties?

A) 19, 23, 30, 36	C) 9, 16, 33, 50
B) 3, 12, 21, 40	D) 4, 12, 38, 88
- Which two elements have the most similar chemical properties?

A) Aluminum and Barium	C) Nickel and Phosphorous
B) Chlorine and Sulfur	D) Sodium and Potassium

Skill 3: Identifying Types of Elements

Metals, Groups 1-Zig Zag

Location	Chemical Prop.	Physical Prop.
Left of "zig zag" or "staircase"	Few electrons in VALENCE shell (outer shell)	Ductile Malleable
Does NOT include Hydrogen	Lose electrons easily ☹	Good _____
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> What metal is NOT solid at Room Temperature? _____ </div>	POSITIVE charge (Cations)	Shiny
	Ex: Ca^{2+}	Solid at room temp!

Ductile: Can be drawn into thin _____. (Characteristic of metals—think copper!)

Alloy: A metal made by _____ two or more metallic elements, especially to give greater strength or resistance to corrosion. Ex: Bronze or Steel

Non-Metals:

Location	Chemical Prop.	Physical Prop.
Right of "staircase"	Almost full, or totally full _____	NOT Ductile NOT malleable Not good conductors (insulators)
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> What non-metal is liquid at 273K? </div>	Tend to _____ electrons to form negative ions (anions).	Variety of phases of matter!
	Ex: F^{-1}	Diatomic elements are all non-metals!

Allotrope: Two forms of the same element—Different _____ pattern yield different physical properties i.e. diamond and graphite!

Diatomic: Non-metals that naturally exist in _____. BrINClHOFl!

Metalloids:

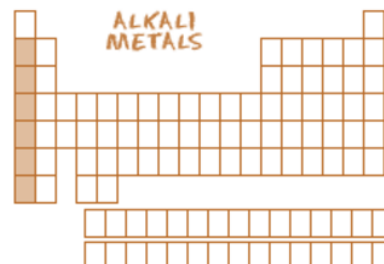
Location	Chemical Prop.	Physical Prop.
Touch the "Staircase"	Most have half full valence shell	Have properties of _____ AND non-_____
	Make anions OR cations depending on their environment	No predictable pattern of properties!

Skill 4: Identifying Group Properties

Group 1: Alkali Metals

- _____ is NOT included in this group!
- Valence Electrons:**
 - Each member has _____ in the outermost shell.
- Characteristics:**
 - Shiny and the most reactive metal group. They are also very soft and malleable.

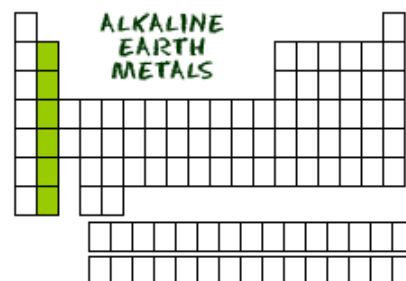
Color Orange



Group 2: Alkaline Earth Metals

- Location:**
 - In the _____ group, this is the second most reactive family of elements in the periodic table.
- Valence Electrons:**
 - Each of them has _____ electrons in their outer shell.
- Characteristics:**
 - Shiny, soft and malleable.

Color Green



Transition Metals: Groups 3-12

- Location:**
 - Transition metals are located in the _____ of the table.
- Valence Electrons:**
 - Have multiple _____ states and variable numbers of valence electrons.
- Characteristics:**
 - Compared to the alkali metals, transition metals have _____ densities, have _____ melting and boiling points, are strong and _____ and are less _____ with oxygen and water.
 - Transition metals often form _____ compounds and solutions.

Color Yellow

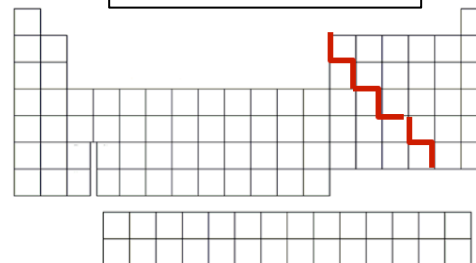


Misc. Group 13-16

- Metalloids are elements _____ the staircase.

How do we determine the state of matter at STP?

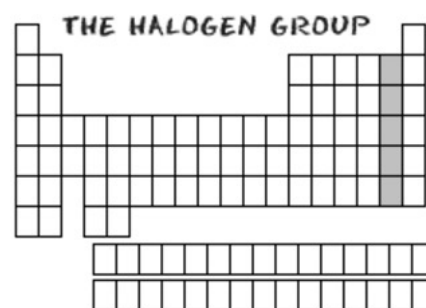
Highlight the Staircase



Group 17: Halogens

- Location:**
 - In the _____ group, beginning with _____.
- Valence Electrons:**
 - Each of them has _____ electrons in their outer shell. This make _____ one of the most reactive elements on the table.
- Characteristics:**
 - _____ is the most reactive in the group.
 - Several are _____ (BrINClHOFl)
 - Contain various phases of matter.

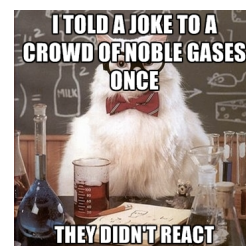
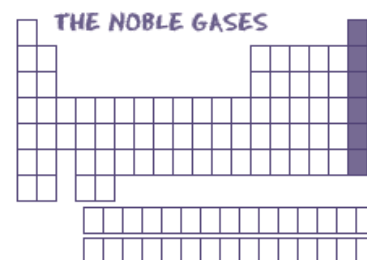
Color Black/Gray



Noble Gases, Group 18

- Location:**
 - Noble gases are the group _____ elements
- Valence Electrons:**
 - Each noble gas has a full _____ shells, which makes them very _____ elements,
- Characteristics:**
 - They are also called the inert or _____ gases...do not react!
 - Light bulbs are filled with _____
 - Are in the _____ phase of matter at STP

Color Purple



Skill 5: Identify Trends in the Periodic Table

The Periodic Table is a map of the elements. There are many patterns or trends on the periodic table. Let's look and see what we can find!

Periods: (Horizontal)

1. Look at Na to Ar to answer the following questions.
(Choose increases, decreases, or remains the same.)
2. The atomic # (Increases, decreases, or remains the same.)
3. The # of protons _____
4. The # of valence electrons _____
5. The # of principle energy levels _____
6. All elements in the same period have the same _____

What effect does increasing the number of protons have on electrons?

Groups: (Vertical)

Look at H to Fr to answer the following questions.
(Choose increases, decreases, or remains the same.)

1. The atomic # (increases, decreases, or remains the same.)
2. The # of protons _____
3. The # of valence electrons _____
4. The # of principle energy levels _____
5. All elements in the same group have the same _____ and therefore react similarly.

Shielding:

Answer:

1. Which element would be expected to have chemical and physical properties closest to those of fluorine?
a. Fe B) Cl C) S D) Ne
2. Chlorine and bromine have very similar chemical properties. This is best explained by the fact that both elements
A) have equal number of protons and electrons.
B) are gases.
C) are in period 3 of the Periodic Table.
D) have the same number of valence electrons.

Teacher Check!

Atomic Radii:

The atomic radius (or radii) is the distance from the center of the nucleus to the outer edge of the atom.

The atomic radius is affected by 2 things: the number of _____ and the attraction between _____ and electrons.

Periods: (Examine the elements in period 3)

Na: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

Si: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

Cl: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

The radius

_____ (increases or decreases) as you go across a period due to **an increase in the number of PROTONS in nucleus pulling electrons closer**

Does this agree with the understanding we have about increasing number of protons?

Groups: (Examine the elements in group 1)

Li: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

K: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

Cs: Radius _____
of principle energy levels _____
of protons _____
of electrons _____

The radius

_____ (increases or decreases) as you go down a group due to **more energy levels (shells of electrons)**

Teacher Check!

Does this agree with the understanding we have about shielding?

Electronegativity:

Electronegativity is a measure of an atom's _____ for electrons in a bond with another atom. (0-4 scale)

Fill in the table below for the elements in Period 2 and Group 2 to note the general pattern of values.

Period 2 Elements	Li	Be	B	C	N	O	F
Electronegativity							

In general, as you go **across a period**, electronegativity _____ (increases or decreases)

This is because the number of _____ increases, so attraction to outermost electrons increases. (protons or electron shells)

Group 2 Elements	Electronegativity
Be	
Mg	
Ca	
Sr	
Ba	

In general, as you go **down a group**, electronegativity _____ (increase or decrease)

This is because the number of _____ increases, so attraction to outermost electrons decreases. (protons or electron shells)

____ 1. Of the atoms below, _____ is the most electronegative.

- a. Br
- b. O
- c. Cl
- d. N
- e. F

____ 2. Of the atoms below, _____ is the least electronegative.

- a. Rb
- b. F
- c. Si
- d. Cl
- e. Ca

Teacher Check!

Ionization Energy:

Ionization energy is the amount of energy required to _____ an _____ from an atom in the gaseous state.

Period 2 Elements	Li	Be	B	C	N	O	F
Ionization Energy (kJ/mol)							

In general, as you go **across a period**, ionization energy _____ (increases or decreases)

This is because the number of _____ increases, so attraction to outermost electrons increases. (protons or electron shells)

Group 2 Elements	Ionization Energy (kJ/mol)
Be	
Mg	
Ca	
Sr	
Ba	

*In general, as you go **down a group**, electronegativity and ionization energy _____ (increase or decrease)

This is because the number of _____ increases, so attraction to outermost electrons decreases. (protons or electron shells)

- _____ 1. Of the choices below, which gives the order for first ionization energies?
- Cl > S > Al > Ar > Si
 - Ar > Cl > S > Si > Al
 - Al > Si > S > Cl > Ar
 - Cl > S > Al > Si > Ar
 - S > Si > Cl > Al > Ar
- _____ 2. Of the following atoms, which has the largest first ionization energy?
- Br
 - O
 - C
 - P
 - I

Teacher Check!

Ionic Radius:

A **cation** is a positively charged ion. It has lost electrons, so it has more positive protons than negative electrons.

Draw Bohr diagrams for an atom of Sodium and an ion of Sodium.

Na

Na⁺

Cations will _____ electrons, therefore they will _____ in size in comparison to their atom.

An **anion** is a negatively charged ion. It has gained electron, so it has more negative electron than positive protons.

Draw Bohr diagrams for an atom of Fluorine and an ion of Fluorine.

F

F⁻

Anions will _____ electrons, therefore they will _____ in size in comparison to their atom.

Reactivity:

Reactivity of metals will _____ as you move _____ a group and across a period. Describe one example of this phenomena (Li vs Na) in terms of electrons shells.

Reactivity of non-metals will _____ as you move right in a period and _____ in a group. Describe this phenomena (Br vs F) in terms of electrons.

Practice:

- _____ 1. Atomic radius generally increases as we move _____.
- down a group and from right to left across a period
 - up a group and from left to right across a period
 - up a group and from right to left across a period
 - down a group; the period position has no effect
- _____ 2. Which one of the following atoms has the largest radius?
- O
 - F
 - S
 - Cl
 - Ne
- _____ 3. Which one of the following atoms has the largest radius?
- Sr
 - Ca
 - K
 - Rb
 - Na
- _____ 4. Which one of the following has the smallest radius?
- Na
 - Cl
 - P
 - Br
 - K
- _____ 5. Of the atoms below, _____ is the least electronegative.
- Rb
 - F
 - Si
 - Cl
 - Ca
- _____ 6. Which of the elements below has the largest electronegativity?
- Si
 - Mg
 - P
 - S
 - Na
- _____ 7. Complete the following trends:
In general, as you go across a period in the periodic table from left to right:
- the atomic radius _____;
 - the electronegativity _____; and
 - the first ionization energy _____.