

# Warm-Up

1. What is the periodic table?
2. Who invented it?
3. How does the periodic table organize the elements?
4. Why did Mendeleev leave empty spaces when he constructed his periodic table?

# Chemistry Notes: The Periodic Table

# Every element has its own unique symbol.

- For some elements the symbol is simply the first letter of the element's name.
  - Examples: Hydrogen = H, Sulfur = S, Carbon = C
- Symbols for other elements use the first letter plus one other letter of the element's name. The first letter is CAPITALIZED and the second letter is not.
  - Examples: Aluminum = Al, Platinum = Pt, cadmium = Cd
- The origins of some symbols are not as obvious. Some elements have symbols that refer to the element's name in latin.
  - Examples: gold = Au, lead = Pb, copper = Cu

# The Father of the Periodic Table—Dimitri Mendeleev

- Mendeleev was the first scientist to notice the relationship between the elements
  - Arranged his periodic table by atomic mass
  - Said properties of unknown elements could be predicted by the properties of elements around the missing element
  - Predicted Aluminum (Al)
- It was later discovered that the periodic nature of the elements was associated with atomic number, not atomic mass
  - Periodic means patterns

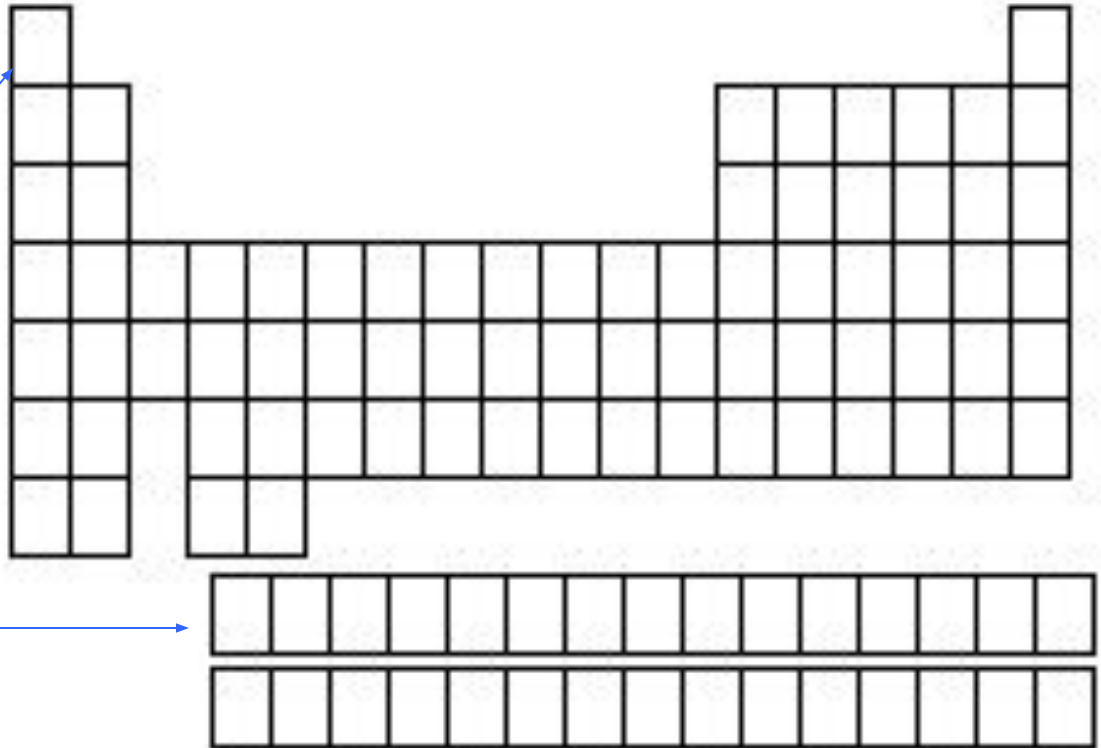
# The Periodic Table

- Column (up and down)=  
Group or Family

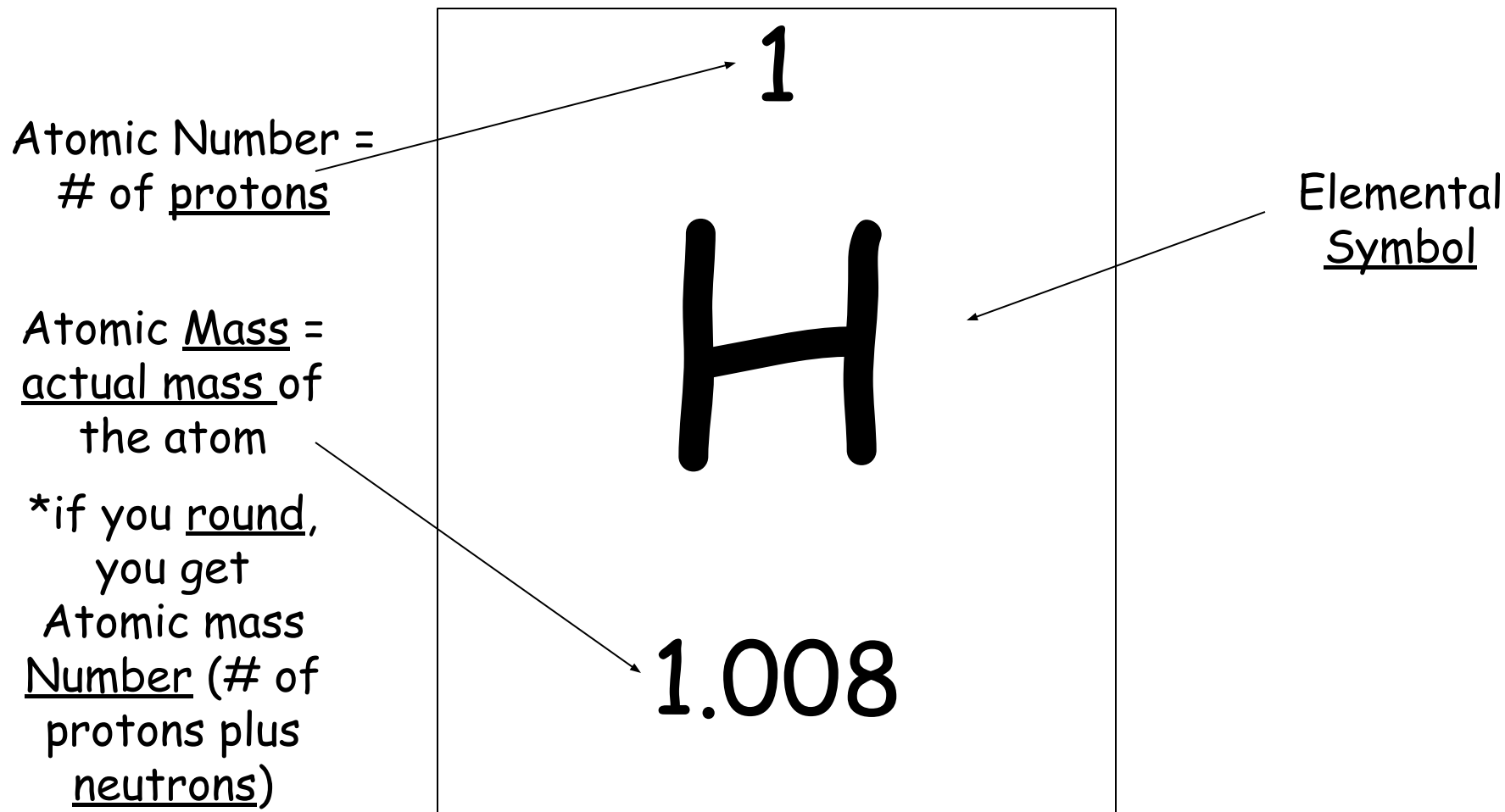
- 18 columns on the  
Periodic Table

- Row (side to side)=  
Period

- 7 rows on the Periodic  
Table



# What does the information in the box tell me?



# Types of Elements: Metals

- On the left side of the periodic table
- Properties:
  - Good conductors of electricity and heat
  - Shiny in appearance (metallic!)
  - Malleable: able to be molded or re-shaped
  - Ductile: able to be stretched into wire or hammered very thin (think: Aluminum foil)
  - These are general properties; individual properties of metals will vary. Some will be better conductors or more ductile than others!

# Types of Elements: Nonmetals

- Elements on the right side of the periodic table.
- Properties are opposite those of metals.
  - Usually poor conductors of heat and electricity
  - Not shiny, malleable, or ductile
- Most are gases



# Types of Elements: Metalloids

- Found touching the “stair-step line” (see next slide)
- Have properties of both metals and non-metals.
- Most common metalloid is silicon, which is the second most common element in the Earth’s crust.

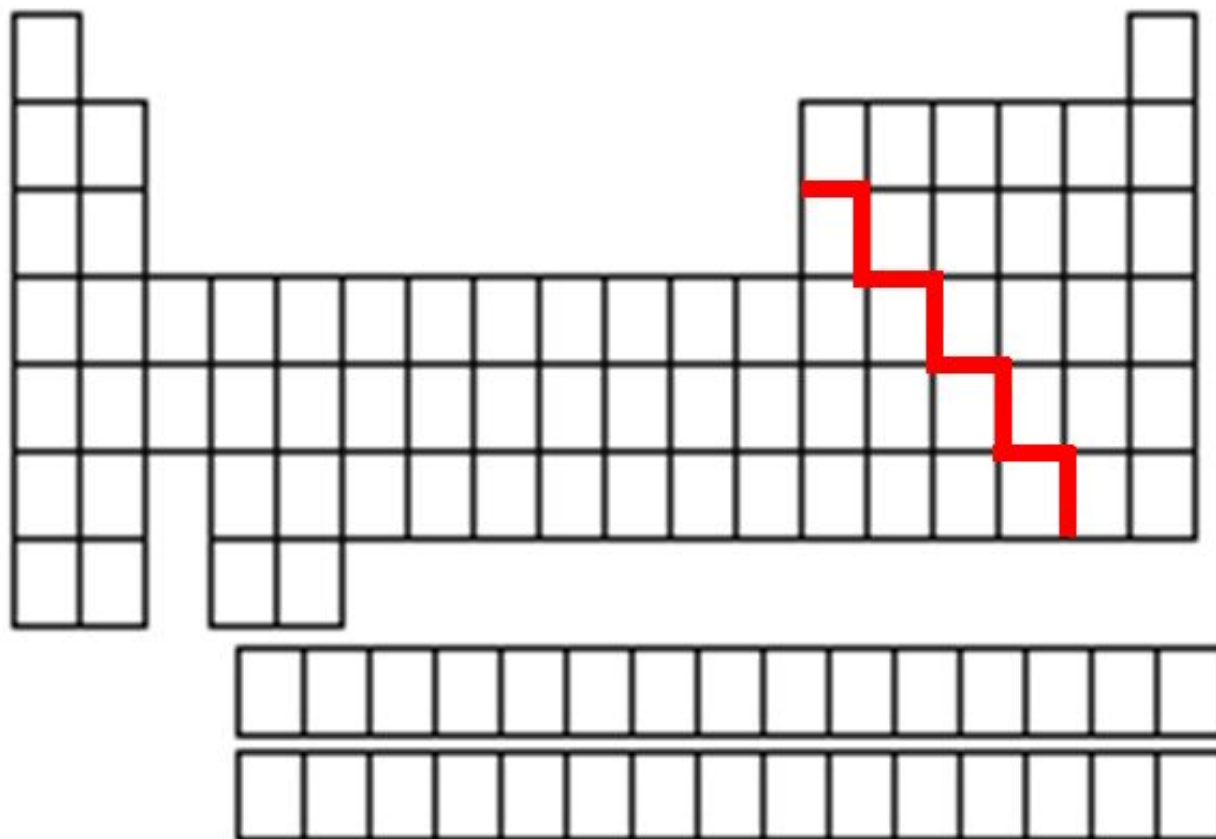
# Metals, Nonmetals, and Metalloids

- Only nonmetal on the metal side

- Nonmetals are on the right of the stair-step

- Metals are to the left of the stair-step

- Metalloids touch the stair-step



# Valence Electrons and Reactivity

- Valence electrons are the electrons farthest from the nucleus. Atoms have different numbers of valence electrons.
- Reactivity: how likely an atom is to interact (react) with other atoms. Some elements are very reactive, while others almost never react.

# The Groups/Families of the Periodic Table

- Elements on the periodic table can be grouped into families (or groups) based on their chemical properties.
    - We call them "families" because the elements in each family are "related."
  - Each family has a specific name to differentiate it from the other families in the periodic table.
  - Elements in each family react differently with other elements.
- Periodic Table of the Elements

The periodic table is displayed with elements color-coded by groups: Group I (orange), Group II (blue), Groups III-VII (purple), Group VIII (green), Group IX (yellow), Group X (pink), Group XI (light blue), Group XII (dark blue), Group XIII (light green), Group XIV (medium green), Group XV (dark green), Group XVI (brown), Group XVII (tan), Group XVIII (grey), and Lanthanides/Actinides (red). The title 'Periodic Table of the Elements' is centered above the main body of the table.

# Periodic Table of the Elements

1 H																	2 He	
3 Li	4 Be																	10 Ne
11 Na	12 Mg																	18 Ar
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	
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	
55 Cs	56 Ba	57 La	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	
87 Fr	88 Ra	89 Ac	104 Rf	105 Ha	106 106	107 107	108 108	109 109	110 110									

\* Lanthanide Series

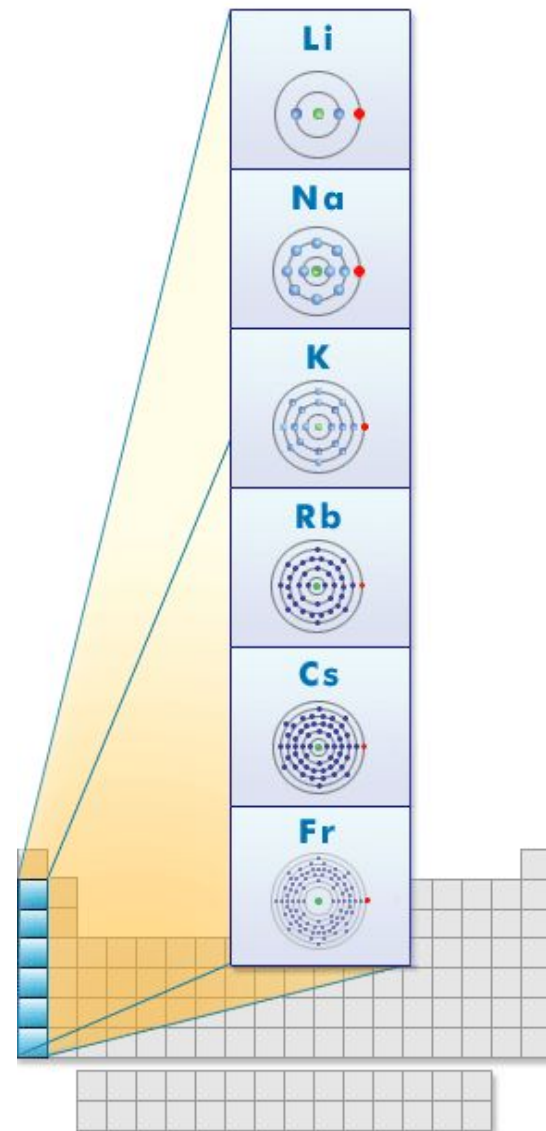
58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
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+ Actinide Series

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
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# Group 1: the Alkali Metals

- Hydrogen is NOT part of this family!!!
- Most reactive metals on the PT
  - Reactive: how likely an atom is to interact with other atoms
- Rarely found free (by themselves) in nature
- Form ions with a charge of +1, have 1 valence electron
- Soft and silvery, shiny
- Very reactive, esp. with water
- Conduct electricity



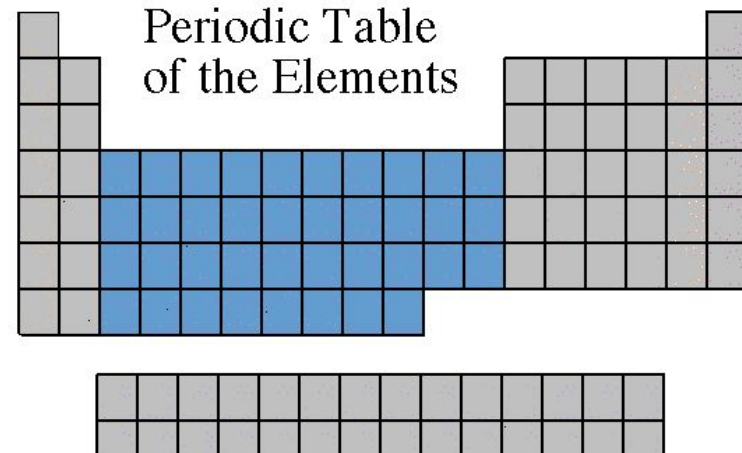
# Group 2: the Alkaline Earth Metals

- Still quite reactive
- Form ions with a charge of +2, have 2 valence electrons
- White, silvery, and malleable
- Conduct electricity

ALKALINE  
EARTH  
METALS

# Groups 3-12: Transition Metals

- Found freely and in compounds in nature
- Form ions with a charge of usually +2 but can vary—usually 2 valence electrons
- Almost all are solids at room temp (except Mercury, Hg, is a liquid)
- Good conductors of heat and electricity.



# Group 13: Boron Family

- Named after the first element in the group (at the top of the column), Boron
- Form ions with a charge of +3, have 3 valence electrons

Periodic Table  
of the Elements



# Group 14: The Carbon Family

- Contains elements that can form unusual bonds (carbon and silicon)
- Form ions with a charge of +4 or -4, have 4 valence electrons

Periodic Table  
of the Elements

# Group 15: the Nitrogen Family

- Form ions with a charge of -3, have 5 valence electrons

Periodic Table  
of the Elements

# Group 16: The Oxygen Family

- Also known as the chalcogens
- Form ions with a charge of -2, have 6 valence electrons

Periodic Table  
of the Elements

The diagram shows a simplified periodic table with a grid of cells. The main body of the table is 7 rows high. The first row has 2 cells on the left and 2 on the right. The second row has 2 cells on the left and 4 on the right. The third through sixth rows each have 18 cells in the middle. The seventh row has 14 cells. A single column of 7 blue cells is located in the sixth column from the right, representing Group 16. Below the main table is a separate row of 14 cells, representing the lanthanide and actinide series.

# Group 17: the Halogens

- Most reactive nonmetals
- Form ions with a charge of -1, have 7 valence electrons

# THE HALOGEN GROUP

A simplified periodic table diagram. The main body is a grid of 18 columns and 7 rows. The first two columns on the left are partially filled: the first column has 7 cells, and the second column has 6 cells. The last two columns on the right are also partially filled: the 17th column has 7 cells, and the 18th column has 6 cells. The 17th column, representing the halogen group, is highlighted in yellow. Below the main grid are two additional rows of 18 cells each, representing the lanthanide and actinide series.

# Group 18: The Noble Gases (Inert Gases)

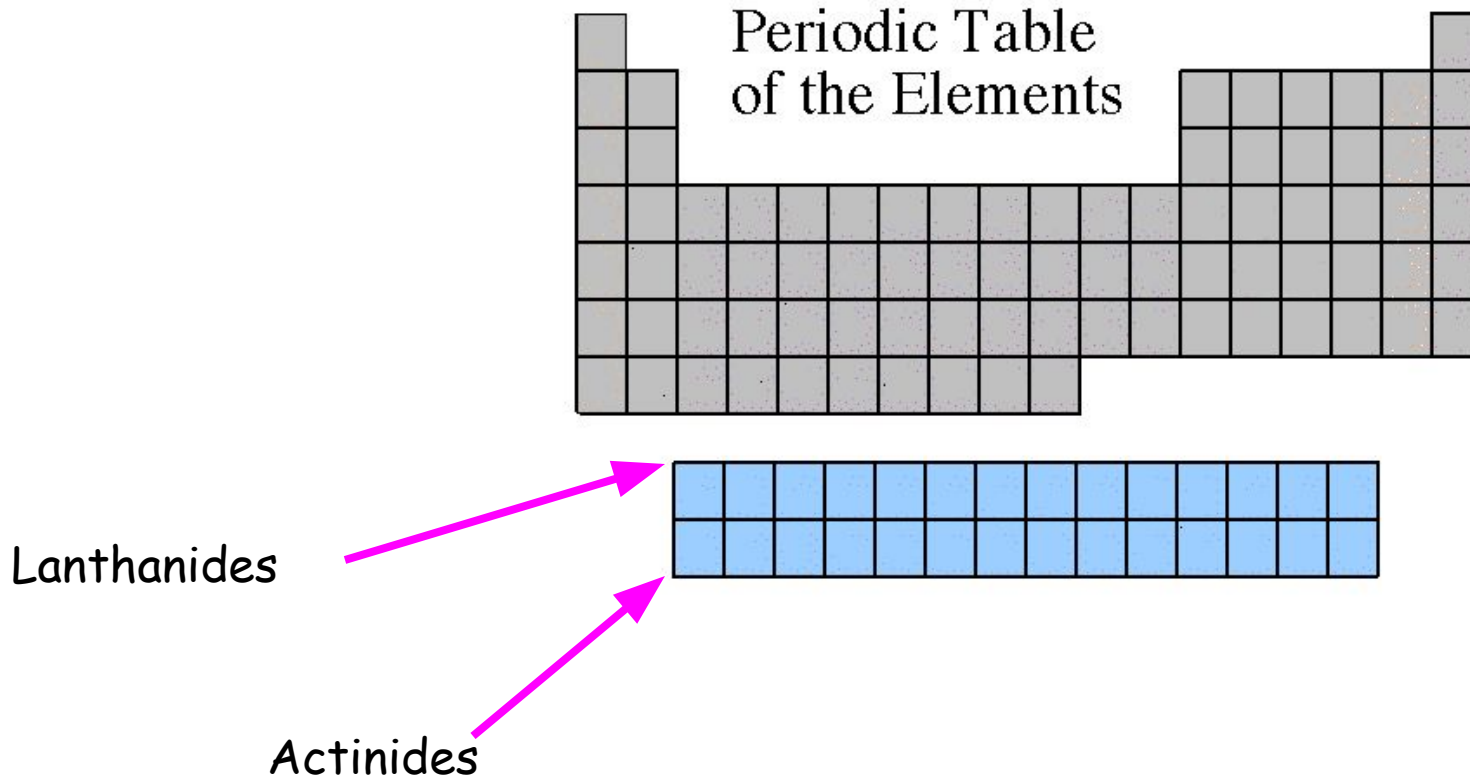
- Nonreactive
- Do not form ions! Charge is 0, have either 2 or 8 valence electrons
- All are gases

THE INERT GASES  
(NOBLE GASES)

The diagram shows a periodic table with the noble gas column (Group 18) highlighted in red. The noble gases are located in the last column of the periodic table, including Helium, Neon, Argon, Krypton, Xenon, and Radon. The noble gases are located in the last column of the periodic table, including Helium, Neon, Argon, Krypton, Xenon, and Radon.

# Rare Earth Metals

- Some are Radioactive
- The rare earths are silver, silvery-white, or gray metals.
- Conduct electricity



# Trends in the Periodic Table

- Atomic size decreases as you move from left to right across the table. Atomic size increases as you move from top to bottom of the table.
- The density of an element increases from top to bottom. The element Osmium has the highest known density.
- The most reactive elements are groups 1 and 17. The least reactive elements are in group 18.