The Periodic Table

Chapter 5

Organizing the Elements

Section 5.1

Key Ideas

- How did Mendeleev arrange the elements in his periodic table?
- How are the elements arranged in the modern PT?

Quick Activity

- One way to organize a large group of objects is to arrange them into groups of similar objects. This is how scientists organize all of the many elements. Practice the skill of categorizing by arranging the magazines listed below into similar groups. **(Groups of 3)**

Calling All Girls	Homeopathic Medicine	Modern Housekeeping
Computer World	Sports and Scores	Easy Car Repairs
Beautiful Homes	Calling All Boys	The Health Newsletter
Auto Racing	All About Computing	Football Stories
The Healthy Man	Home Decorating	Read Aloud Stories
Sporting Times	Classic Cars	Building a Web Site
Child's Play	The Healthy Woman	Home Makers Magazine
Family Computing	Golf for Everyone	The Sports Car Story
Beautiful Homes	Nursery Rhymes	Good Nutrition
Car Trends	How to Use the Internet	Tennis Tips

Quick Activity Questions

- What criteria did you use to group the magazines?
- Could you arrange the magazines into groups, could you sort the material further to make it even more organized?

Recognizing a Pattern!

- *How did Mendeleev arrange the elements in his periodic table?*
- Mendeleev arranged his periodic table by increasing _____
- Then he noticed the elements properties started to line up periodically.

What does that mean?

Recognizing a Pattern!

- In fact, he did such a great job he was able to predict _____ future elements would be placed AND their _____!
- As you can see, he was pretty close to getting everything wright for Germanium
- Although most elements fit his PT, there were a few that did not ☹

Properties of Germanium

	Mendeleev's prediction	Actual property
Atomic mass	70	72.6
Density*	5.5 g/cm³	5.3 g/cm³
Appearance	Dark gray metal	Gray metalloid
Melting point*	High	937 °C

*at room temperature and pressure

Recognizing a Pattern!

- Mendeleev recognized that some of the elements did not seem to be in the correct spots.
- He noticed if he _____ a few the properties lined up better but then the _____ were not in the correct order.
- He determined it must be because of _____ in the _____(human error)

Changing the Arrangement

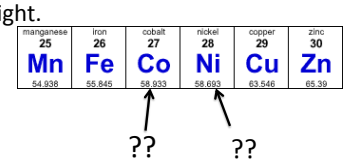
- *How are the elements arranged in the modern PT?*
- The modern PT is organized according to increasing _____.

Changing the Arrangement

- _____ came along about 40 years later and rearranged _____ PT.
- He arranged it by _____ instead of _____
  - Only a few elements changed spots but the ones that did change helped "fix" what was wrong
  - It moved the elements _____ thought were in the _____ places

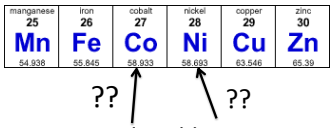
Improving the Periodic Table

- On Mendeleev's table, the atomic mass gradually _____ from left to right. If you look at the modern periodic table, you will see several examples, such as _____ and _____, where the mass _____ from left to right.

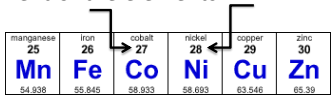


Improving the Periodic Table

On Mendeleev's table, the atomic mass gradually _____ from left to right.



The current periodic table uses _____ arrangement of the elements.



Changing the Arrangement

- The modern PT has over _____ elements!
- The elements in the PT have a _____ _____.

- _____ **:** the law that states that the repeating chemical and physical properties of elements change periodically with the atomic numbers of the elements

Quick Activity

- Get into a group of 2
- Open your books to page 148
- Now, you will chose an element and your partner will have to identify the **atomic number, average atomic mass, chemical symbol, and chemical name.**
- Only give **1** of the above piece of info.
- You have 3 minutes… GO

Changing the Arrangement

- Elements become less _____ as you go across the _____.
- The periods increase as you from _____ to _____
  - Period _____
- A period is a _____ in the PT
  - It goes from _____
  - Example: Ca, Mg, Al, Si, P, S, Cl, Ar (Period _____)

Changing the Arrangement

- Elements in groups have _____ properties
- A _____**(or** _____**)** is a column on the PT
- The groups _____ as you go left to right
  - 1, 2, 3…17, 18
- A group (or family) on the PT goes from _____ to _____
  - Example: Be, Mg, Ca, Sr, Ba, Ra (group ____)

Quick Activity

- Get into a group of 2
- Open your books to page 148
- Now, you will chose an element and tell your partner the location of the element using it's period and group
- You have 3 minutes… GO

Assignment

- EOSQ (1-3,5,6)
- 5.1 CR
- TON 5.2

Exploring the Periodic Table

Section 5.2

Key Ideas

- **Why** do elements within a group of the periodic table have similar chemical properties?
- **What** happens to an atom that gains or loses electrons?
- **What** are the three main categories of elements?

The Role of Electrons

- Why do elements within a group of the periodic table have _____ chemical properties?
- It because of the _____!

The Role of the Electrons

- We learned about the “s”, and “p” sublevels, this is where they come into play
- Remember that when a sublevel is full, the electrons move to the next sublevel

- Examples on board
  - H, He, Li, C, Mg

The Role of Electrons

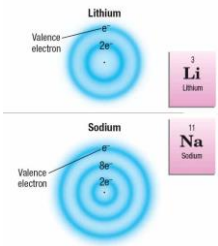
- Remember… in a neutral atom, the number of _____ = the number of _____

- So, the number of electrons _____ as go _____ the PT and _____ the PT

- But, what causes the chemical properties are the _____ electrons

The Role of Electrons

- Remember… Valence electrons are the electrons located on the _____ shell of an atom or ion



The Role of Electrons

- The number of valence electron is the same for an entire group

Group #	1	2	13	14	15	16	17	18
# V Electrons								

Remember…

- There are 2 ways to remember this…
- Groups 1 and 2 = the # of valence electrons
- Groups 13-18 = group # - 10

- OR

This is how I remember it…

1, 2, Skip, 3, 4, 5, 6, 7, 8

Click

The Role of the Electrons

- So, as you go down a group on the PT, the elements have the same _____ _____ and this is what determines their _____ _____
- The elements do have different numbers of protons, so the properties are not _____ alike, but they are _____

Ion Formation

- *What happens to an atom that gains or loses electrons?*
- If an electron is _____ or _____, the atom now has a _____ and is called an _____

Ion Formation

- _____ is great!
- Atoms strive for a full outer shell, which happens to be _____ (most of the time)
- They will gain or lose electrons to get to the _____ outer shell
- They can move _____ or _____ to get there.

Ion Formation

- For groups 1-3, it is easier to _____ electrons to get to a full shell
  - This produces _____ ions
    - They have less _____ than _____
- Examples:
  - Ca
  - Li

Ion Formation

- Groups 15-18 tend to _____ electrons
  - This results in a _____ ion
    - They have more _____ than _____
- Examples
  - F
  - N

Quick Activity

- In groups of 2, answer the following questions

When the following atoms gain or lose electrons, they will from an ion with a charge of….

Mg	lead
O	Si
Ba	S
Tin	Sr

You have 3 minutes… GO

Ion Formation

- Writing an _____
  - You write the chemical symbol with the charge as a _____
- Examples

  Li^{+1} Be^{+2} F^{-1}
- Notice how there is _____ a number after the _____

How are Elements Classified?

- *What are the 3 main categories of elements?*
- Elements are either _____, _____, or _____(_____)

How are Elements Classified?

- Elements in each category have similar properties.
- _____ **:** an element that is shiny and that conducts heat and electricity well
- _____ : an element that conducts heat and electricity poorly
- _____(or _____): an element or compound that conducts electric current better than an insulator does but not as well as a conductor does

How are Elements Classified?

- Show the regions on the PT

Assignment

- EOSQ (1-3, 6, 7)
- 5.2 Worksheet
- TON 5.3

Families of Elements

Section 5.3

Key Ideas

- What does each element family have in common?
- What are the families of metals?
- What are some of the families of nonmetals?
- What are semiconductors (metalloids)?

Classifying Elements Further

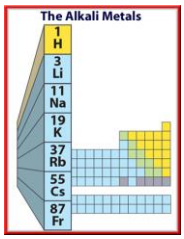
- *What does each element family have in common?*
- Generally, elements in the same family have the same number of _____.

Group number	Number of valence electrons	Name of family
Group 1	1	alkali metals
Group 2	2	alkaline-earth metals
Groups 3–12	varied	transition metals
Group 17	7	halogens
Group 18	8*	noble gases

*except helium, which has two electrons

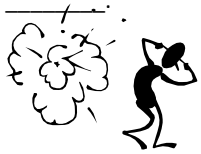
Alkali Metals

- The elements in **Group 1** of the periodic table are the _____. **(except H)**
- Group 1 metals are shiny, _____, and _____.
- They are also _____ conductors of heat and electricity. However, they are softer than most other metals.



Alkali Metals

- The alkali metals are the _____ reactive of all the metals. They react rapidly, sometimes violently, with oxygen and water.
- Alkali metals _____ occur in nature in their elemental form and are stored in substances that are unreactive, such as an _____.



Alkali Metals

- Each atom of an alkali metal has _____ electron in its outer energy level.
- This electron is _____ when an alkali metal combines with another atom.
- As a result, the alkali metal becomes a _____ charged ion in a compound such as sodium chloride.

Alkali Metals

Ex. Sodium

Sodium has 11 protons and 11 electrons

If sodium gives up the 1 valence electron, it now has 11 protons and 10 electrons

One more proton than electron gives the sodium Ion a +1 charge

Alkali Metals

- Alkali metals and their compounds have many uses.
- The operation of some photocells depends upon rubidium or cesium compounds.
- _____, the last element in Group 1, is extremely rare and radioactive.

Another name for group 1 is…

A. Alkaline Earth Metals
B. Alkali Metals
C. Transition Metals
D. All of the above
E. None of the above

Alkali Metals form a _____ charge.

A. -1
B. -2
C. +2
D. +1
E. None of the above

Alkali Metals are stored in oil because

A. It is cheaper than other fluids
B. Oil and alkali metals don't react
C. Alkali metal react with oxygen
D. None of the above
E. More than 1 of the above

Alkali metals tend to accept electrons

1. True
2. False

All elements in group 1 are alkali metals

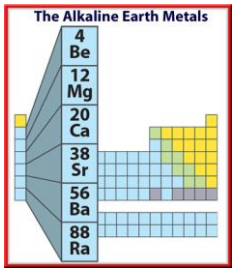
1. Yes
2. No

Demo

- Li, Na, K
- What do you think will happen with Rb? Cs?
- Video
- Video

Alkaline Earth Metals

- Each atom of an alkaline earth metal has _____ electrons in its outer energy level.



Alkaline Earth Metals

- The alkaline earth metals make up Group _____ of the periodic table.
- In general, alkaline-earth metals are _____, _____, _____, and have _____ melting points than alkali metals.

Alkaline Earth Metals

Ex. Be

Beryllium has 4 protons and 4 electrons

If Beryllium gives up both valence electrons it now has 4 protons and 2 electrons

Beryllium now has a +2 charge

It has 2 more protons than electrons

Alkaline Earth Metals

- Magnesium metal is one of the metals used to produce the brilliant _____ color in fireworks.
- Compounds of strontium produce the bright _____ flashes.

The Alkali Earth Metals and Your Body

- Calcium is seldom used as a free metal, but its compounds are needed for life.
- Calcium phosphate in your bones helps make them strong.

Alkaline Earth Metals are found in group…

A. 1
B. 2
C. 3
D. 3-12
E. None of the above

Alkaline Earth Metals form a _____ charge.

A. -1
B. -2
C. +2
D. +1
E. None of the above

All elements in group 2 are metals

1. Yes
2. No

Transition Metals (elements)

- **Transition elements** are those elements in Groups _____ through _____ in the periodic table.
- They are called transition elements because they are considered to be elements in transition between Groups 1 and 2 and Groups 13 through 18.

Transition Metals (elements)

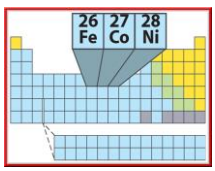
- Transition elements are familiar because they often occur in nature as _____ elements.
- With the exception of _____, transition metals are harder, more dense, and have _____ melting points than alkali metals and alkaline-earth metals.
- They are also _____ reactive, but they can form _____ ions

Transition Metals

- Some of these metals can from multiple ions
- For example:
  - Cu^{+1}, Cu^{+2}, Sn^{+2}, Sn^{+4}
- These different ions produce different compounds
  - Cu_2O vs CuO

Transition Metals (elements)

- The first elements in Groups 8, 9, and 10—iron, cobalt, and nickel — form a unique cluster of transition elements.
- These three sometimes are called the _____.
- All three elements are used in the process to create steel and other metal mixtures.

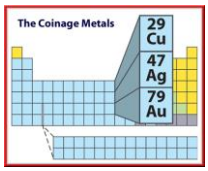


Transition Metals (elements)

- Iron — the main component of steel — is the most widely used of all metals.
- _____ is added to some metals to give them strength.

Transition Metals (elements)

- Copper, silver, and gold — the three elements in Group 11—are so stable that they can be found as free elements in nature.
- These metals were once used widely to make _____.
- For this reason, they are known as the _____.



Transition Metals (elements)

- _____ often is used in electrical wiring because of its superior ability to conduct electricity and its relatively low cost.

Transition Metals (elements)

- _____ is a silvery, liquid metal — the only metal that is a liquid at room temperature.
- It is used in _____, _____, _____, and _____.
- _____ is poisonous and can accumulate in the body.
- _____ is not used in thermometers and thermostats anymore because it is poisonous.

Which of the following are NOT part of the triad?

A. Ni
B. Cu
C. Fe
D. All of the above
E. None of the above

Copper is used in wire because it is cheap.

1. True
2. False

Which are usually found uncombined in nature?

A. Alkali metals
B. Alkaline earth metals
C. Transition metals
D. None of the above
E. More than 1 of the above

Which of the following ARE coinage metals?

A. Ag
B. Ni
C. Pt
D. None of the above
E. More than 1 of the above

Mercury is used in thermometers because it is…

A. Cheap
B. A liquid
C. Poisonous
D. None of the above
E. More than 1 of the above

Quick Lab

- Page 160 in your book
- Groups of 2
- You have 20 minutes
  - Instead of creating a spreadsheet, create a data table
  - Include the equation you are using at the bottom of the data table

Nonmetals

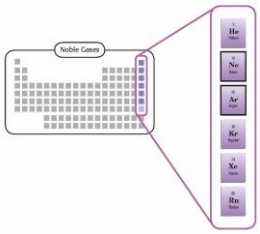
- *What are some of the families of nonmetals?*
- They are the _____ and _____.
  - Group 17
  - Group18

Nonmetals

- _____ are elements that usually are gases or brittle solids at room temperature.
- All nonmetals (except for _____) are found on the _____ side of the periodic table

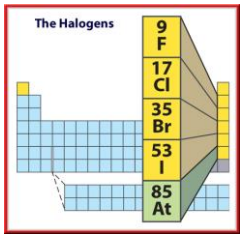
Nobel Gases

- The _____ are in Group 18.
- They exist as single atoms instead of as molecules.
- They are inert, or unreactive, because their s and p orbitals are filled. In general, they do not form ions or compounds.



The Halogens

- Halogen lights contain small amounts of _____ or _____.
- These elements, as well as fluorine, chlorine, and astatine, are called _____ and are in Group 17.



The Halogens

- Because an atom of a halogen has _____ electrons in its outer energy level, only _____ electron is needed to complete this energy level.
- If a halogen _____ an electron from a metal, an ionic compound, called a _____ is formed.

Nonmetals

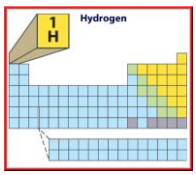
- Examples:
- Sulfur – smells like rotten eggs
- Carbon – graphite, diamonds, carbon fiber, carbohydrates, oil, natural gas
- Nitrogen – In the air, nitous oxide
- Oxygen – Air, Ozone, most things you eat

Semiconductors (metalloids)

- *What are semiconductors?*
- These are elements that can conduct electricity and heat under _____ conditions
- They are located _____ the stair step line

Hydrogen

- If you could count all the atoms in the universe, you would find that about _____ percent of them are hydrogen.
- When water is broken down into its elements, hydrogen becomes a gas made up of diatomic molecules.



Hydrogen

- Hydrogen is _____ reactive.
- A hydrogen atom has a _____ electron, which the atom shares when it combines with other nonmetals.
- Hydrogen can gain an electron when it combines with _____ and _____ metals.

Assignment

- EOSQ (1, 2, 4, 5)
- 5.3 CR