Atomic Structure

Atomic Structure

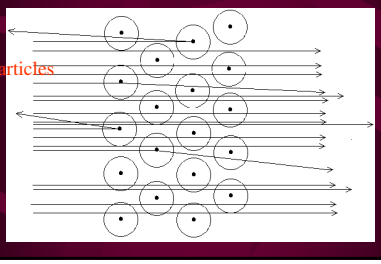
- As we said……
- Atoms are made up of Protons (P^+), Neutrons(N^0) and Electrons (E^-)

	Charge(e)	Relative Mass	Location
Protons	1	1	In Nucleus
Neutrons	0	1	In Nucleus
Electrons	-1	0.0005	Outside Nucleus

History of the atom

- The Rutherford Experiment.

Alpha Particles



The Elements

- Another Definition:
- _____
  - A substance made of atoms which all contain the same number of protons (P^+).

It's all about electrons

- The number of electrons in an atom is the same as the number of protons.
- Electrons are arranged in orbits around the nucleus.

It's all about electrons

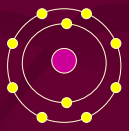
- _____ _____
  - The arrangement of electrons in an atom

It's all about electrons

- Each orbit can only hold a certain number of electrons.
  - The first orbit can hold only _____ electrons.

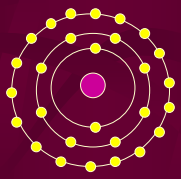
It's all about electrons

- Each orbit can only hold a certain number of electrons.
  - The second orbit can hold _____ electrons.



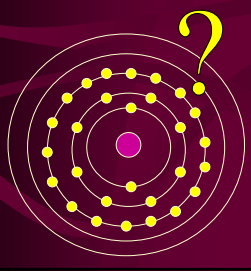
It's all about electrons

- Each orbit can only hold a certain number of electrons.
  - The third orbit can hold _____ electrons.



It's all about electrons

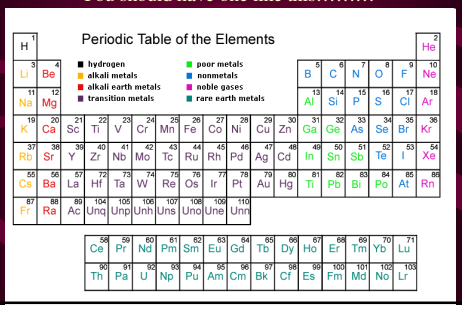
- I am not going to keep drawing dots!



Shell	Electrons
1	2
2	8
3	18
4	___
5	___
6	___

The Periodic Table

You should have one like this……

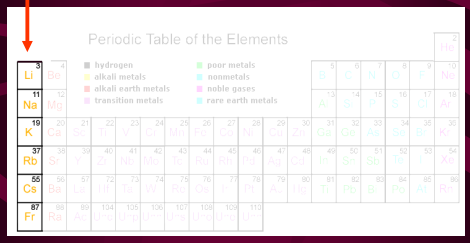


The Periodic Table

- On the periodic table, elements are arranged in groups and periods
  - Groups are arranged vertically
  - Periods are horizontal.

The Periodic Table

Let's look at group 1



The Periodic Table

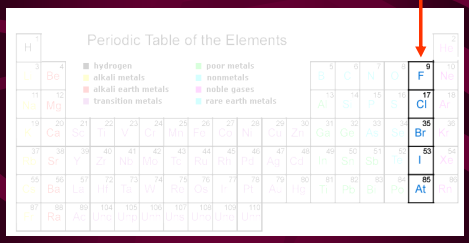
- In group 1, all the elements have just _____ electron in their outer orbit. Even Hydrogen although for this discussion I have removed it.
  - Elements with similar arrangements of electrons in their outer orbit behave in a similar way
  - Hydrogen is sort of its own group

The Periodic Table

- Since all the elements in group 1 have only one electron in their outer orbit they all have similar properties. They are all reactive metals.
- They are often called _____ Metals

The Periodic Table

Now let's look at group 7 or 17

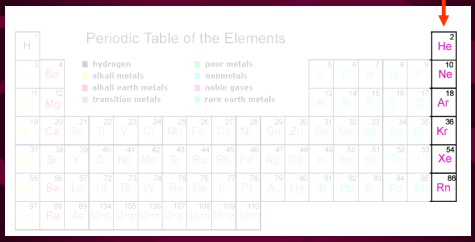


The Periodic Table

- In group 7 (17), all the elements have seven electrons in their outer orbit.
- Group 7 (17) elements all behave in very similar ways.
- They are called the _____

The Periodic Table

OK, now group 0 (or 18)

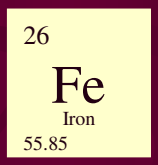


The Periodic Table

- In the last group, the elements all have 8 electrons in the outer orbits. These elements are very unreactive.
- Also called _____ _____

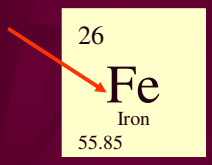
The Periodic Table

- Start by drawing this……



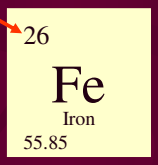
The Periodic Table

- Element Name and Symbol
  - In this case. Fe is the symbol for the element Iron



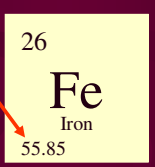
The Periodic Table

- Atomic Number
  - The number of protons an atom contains.



The Periodic Table

- Mass Number
  - The total number of protons and neutrons



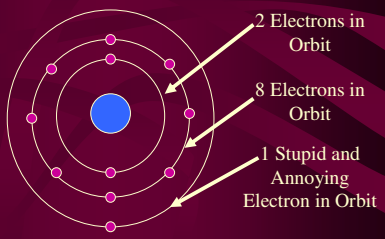
Ionic Bonding

Ionic Bonding

- As we have said, electron and their orbits are very important to the behavior of an atom.
- For example……

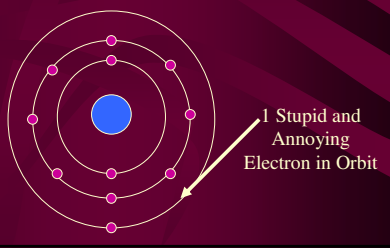
Ionic Bonding

- Sodium



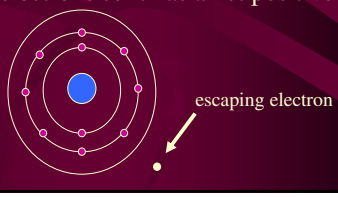
Ionic Bonding

That one Stupid and annoying Electron in its outer orbit makes sodium unstable and reactive.



Ionic Bonding

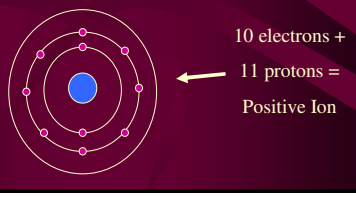
Sodium (Na) really wants to shed the electron so that it has a full outer orbit. When Na does shed the electron, Na has one more proton than electrons so it has a net positive charge…



Ionic Bonding

When Na looses its outer electron it becomes and ion.

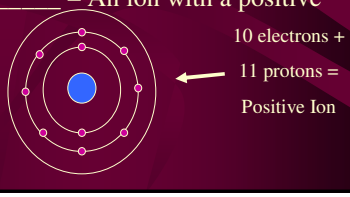
Ion – An atom with an overall electrical charge



Ionic Bonding

In this case, we have more protons than electrons so the net charge is positive, so it is called…..

_____ – An ion with a positive charge

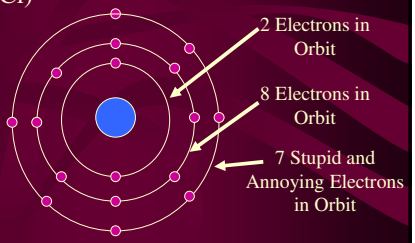


Ionic Bonding

- Now let's look at the other form of ion. For example…..
- Chlorine (Cl)

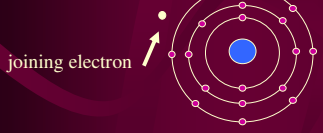
Ionic Bonding

- Chlorine (Cl)



Ionic Bonding

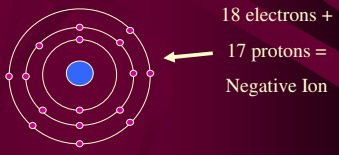
Chlorine (Cl) really wants to gain an electron so that it has a full outer orbit. When Cl does gain an electron, Cl has one fewer protons than electrons so it has a net negative charge…



Ionic Bonding

In this case, we have less protons than electrons so the net charge is negative, so it is called…..

_____– An ion with a Negative charge



Ionic Bonding

- When the electron jumps from the Na to the Cl, the atoms become Ions. One is cation the other a anion. These two charged atoms then stick together forming a compound.
- _____
  - – A substance which is made of two or more kinds of atoms or ions that have joined together.

Ionic Bonding

- In the case of our Na^+ and Cl^-, the attraction between positive and negative ions is very strong. It is called an Ionic Bond.
- _____ _____
  - – A chemical link between two atoms caused by the electrostatic force between oppositely-charged ions in an ionic compound.

Ionic Bonding

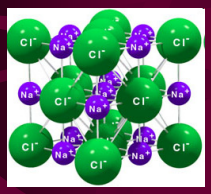
- _____ _____
  - The forces between particles that are caused by their electric charges.
    - Na^+ is a positive ion….cation
    - Cl^- is a negative ion…anion

Ionic Bonding

- When Na^+ and Cl^- get close to each other they arrange themselves into a pattern called a lattice
- _____
  - Organized arrangement of ions

Ionic Bonding

- Lattice



Covalent Bonds

Covalent Bonds

- We already talked about how compounds form when electrons jump from atom to atom creating positive and negative ions. But is there another way??

Covalent Bonds

- Let's look at the compound….BrCl
- Hmmm….how can this be???

Covalent Bonds

- Both Cl and Br have seven outer electons….hmmm
- If both the Cl and the Br pick up one electron they will both become anions…..will that work?
- Can two ions of the same charge stick to each other?

Covalent Bonds

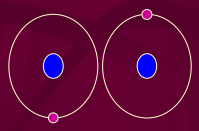
- There is another way…….They can Share.
- Awww ain't that special

Covalent Bonds

- Let's look at Hydrogen (H).
- Hydrogen (H) can not exist in nature as only H….it is too reactive. In its simplest state it is found as H_2

Covalent Bonds

- H_2 does not lose electrons it shares electrons like this.



Covalent Bonds

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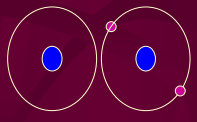
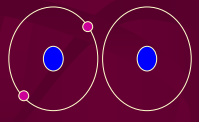


Covalent Bonds

- H_2 does not lose electrons it shares them like this.



Matter

- _____
  - Atoms are always in motion.
  - The amount of motion dictates matters state

The Three States of Matter

- _____
  - Particles are fixed in position but still vibrate
  - A solid is poorly compressed and changes volume only slightly.
  - Particles can not move past each other.

The Three States of Matter

- _____
  - Particles will flow and take the shape of any container.
  - A liquid is poorly compressed and changes volume only slightly.
  - Particles are free to move around each other.

The Three States of Matter

- _____
  - Particles will flow and take the shape of any container.
  - Volume of a gas is dependent of the size of the contained and is easily compressed.
  - Particles are free to move around each other.

The Kinetic Theory ……more proof

- _____
  - The movement of particles form high concentration to low concentration.

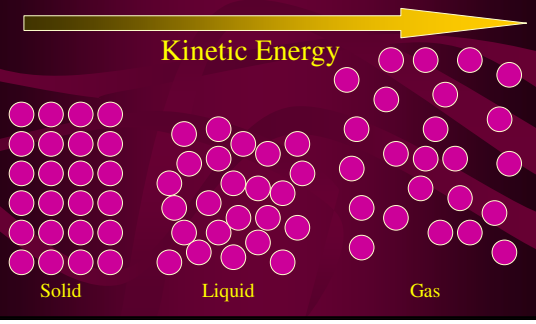
More Kinetic Theory

- _____ -the energy of motion
- Heating a solid causes its particles to vibrate faster, thus kinetic energy increases.
- As kinetic energy increases, particles break away from each other and move more freely. Eventually if the particles of a solid have enough kinetic energy, the solid melts.

More Kinetic Theory

- If you continue to heat, kinetic energy increases even more and the particles move away from each other and the substance turns to gas.

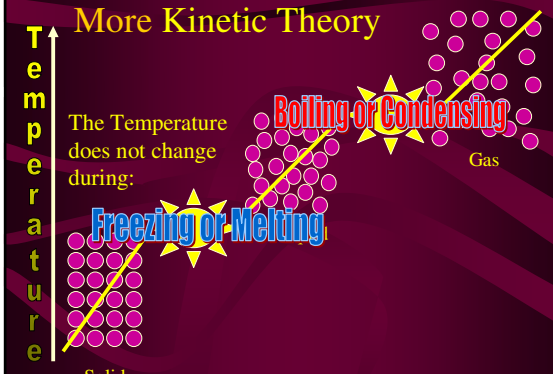
More Kinetic Theory



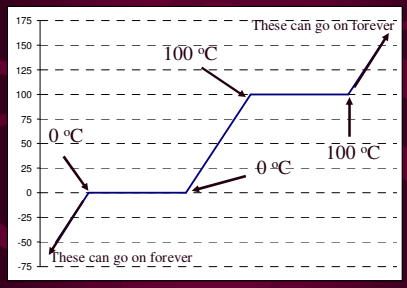
Cheaters

- _____ – Changing directly from solid to gas.

More Kinetic Theory



Energy required to change phase for water.



Energy required to change phase for water.