

Atomic Structure

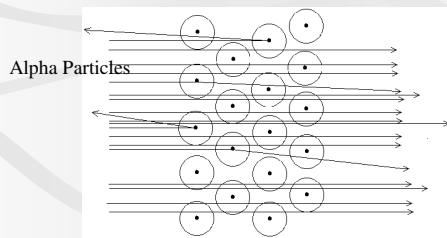
Atomic Structure

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

	Charge	Relative Mass	Location
Protons	+1	1	Nucleus
Neutrons	0	1	Nucleus
Electrons	-0.0005	0.0005	Electrons

History of the atom

- The Rutherford Experiment.



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

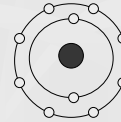
It's all about electrons

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



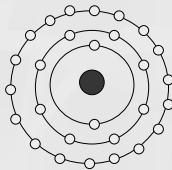
It's all about electrons

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



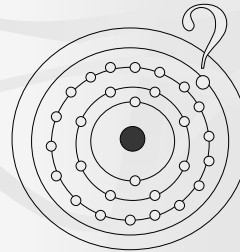
It's all about electrons

- 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.....

Periodic Table of the Elements																	
1	2															18	19
H	He															Ar	Kr
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
Fr	Ra	Ac	Unq	Unp	Unh	Uns	Uno	Une	Uub	Uut	Uuq	Uur	Uus	Uuo	Uuq	Uur	Uus
105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	123	124	125	126
Rf	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	147	148	149	150

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

Periodic Table of the Elements

Legend:

- hydrogen
- alkali metals
- alkali earth metals
- transition metals
- poor metals
- nonmetals
- noble gases
- rare earth metals

The table shows elements from Hydrogen (1) to Oganesson (118). An arrow points to the first column (Group 1), which includes Lithium (3), Sodium (11), Potassium (19), Rubidium (37), Cesium (55), and Francium (87).

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

Periodic Table of the Elements

Legend:

- hydrogen
- alkali metals
- alkali earth metals
- transition metals
- poor metals
- nonmetals
- noble gases
- rare earth metals

The table shows elements from Hydrogen (1) to Oganesson (118). An arrow points to the 17th column (Group 17), which includes Fluorine (9), Chlorine (17), Bromine (35), Iodine (53), and Astatine (85).

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)

Periodic Table of the Elements

Legend:

- hydrogen
- alkali metals
- alkali earth metals
- transition metals
- poor metals
- nonmetals
- noble gases
- rare earth metals

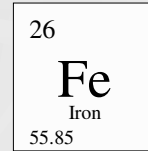
The table shows elements from Hydrogen (1) to Oganesson (118). An arrow points to the 18th column (Group 18), which includes Helium (2), Neon (10), Argon (18), Krypton (36), Xenon (54), and Radon (86).

The Periodic Table

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

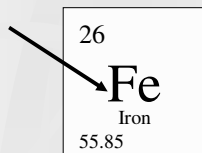
The Periodic Table

- Start by drawing this.....



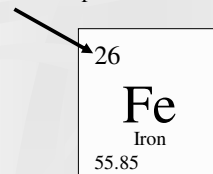
The Periodic Table

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



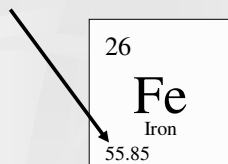
The Periodic Table

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



The Periodic Table

- Mass Number
 - The total number of protons and neutrons



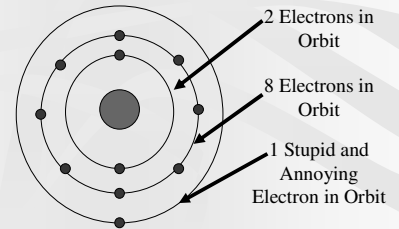
Ionic Bonding

Ionic Bonding

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

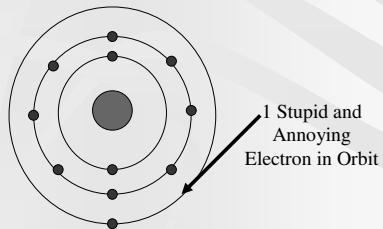
Ionic Bonding

- Sodium



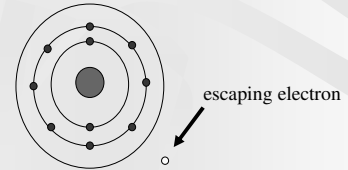
Ionic Bonding

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



Ionic Bonding

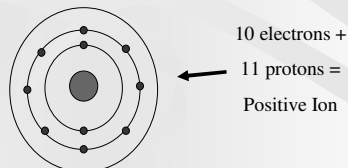
Sodium (Na) really wants to shed the electron so that it has a full outer orbit. When Na does shed the electron, Na has one more proton than electrons so it has a net positive charge...



Ionic Bonding

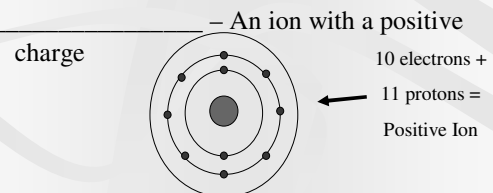
When Na loses its outer electron it becomes an ion.

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.....

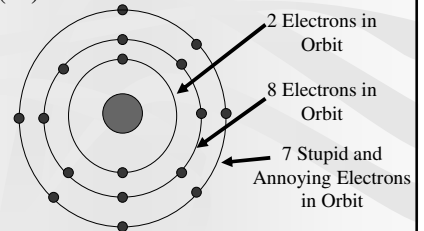


Ionic Bonding

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

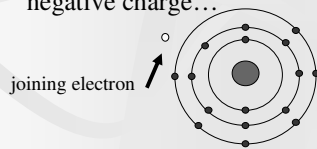
Ionic Bonding

- Chlorine (Cl)



Ionic Bonding

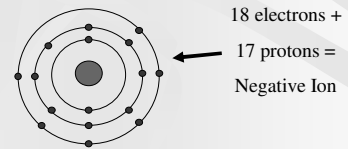
Chlorine (Cl) really wants to gain an electron so that it has a full outer orbit. When Cl does gain an electron, Cl has one fewer protons than electrons so it has a net negative charge...



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

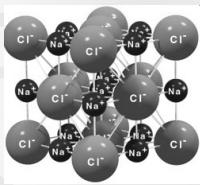
- _____
 - The forces between particles that are caused by their electric charges.
 - Na^+ is a positive ion...cation
 - Cl^- is a negative ion...anion

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
- Hmm...how can this be???

Covalent Bonds

- Both Cl and Br have seven outer electrons...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

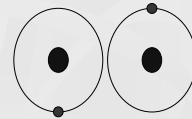
- There is another way.....They can Share.
- Awww ain't that special

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 H₂

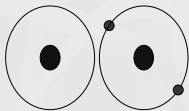
Covalent Bonds

- H₂ does not lose electrons it shares electrons like this.



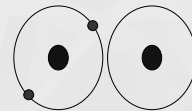
Covalent Bonds

- H₂ does not lose electrons it shares them like this.



Covalent Bonds

- H₂ does not lose electrons it shares them like this.



Matter

- _____
 - Atoms are always in motion.
 - The amount of motion dictates matter's 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 container and is easily compressed.
 - Particles are free to move around each other.

The Kinetic Theorymore proof

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

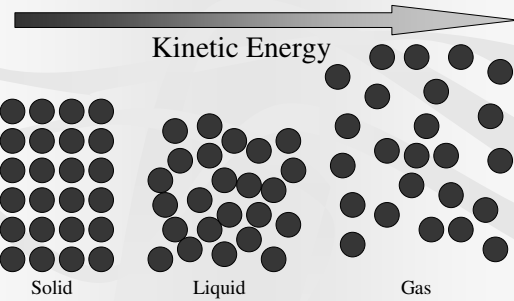
More Kinetic Theory

- _____ -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.

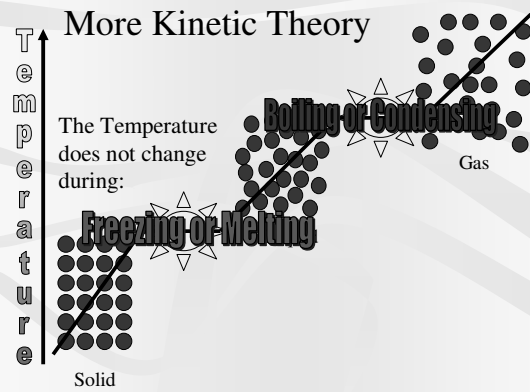
More Kinetic Theory



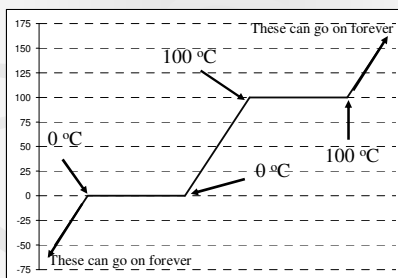
Cheaters

- _____ – Changing directly from solid to gas.

More Kinetic Theory



Energy required to change phase for water.



Energy required to change phase for water.

