Name: _____

Period: _____

Day 14—Classification of Matter

Objective 4

Physical vs. Chemical Change

Afterward, is it still the same substance?

Yes — Physical Change

Examples of physical changes: change of temperature (due to external heat), ripping; cutting.

No — Chemical Change

Evidence of chemical change: Bubbles; Turns cloudy; Temperature change when mixed; color change; change of smell.

If it can be separated thru physical means we call it a: **Mixtures**

Heterogeneous Mixtures

Different throughout. Two samples might be different. Ex: Chicken soup; Chex mix; Rocky Road ice cream.

Homogenous Mixtures

Same throughout. Any two samples are the same. Ex: Milk; Salt water; Vanilla ice cream

Chemicals

If it cannot be separated physically we call it a:

Elements

Only one type of atom. Cannot be broken down further. Gold (Au); Oxygen (O_2); Anything on the Periodic Table is an Element.

Compounds

When two or more elements are chemically combined. Can be chemically separated into elements. Salt (NaCl); Carbon Dioxide (CO_2); Water (H_2O)

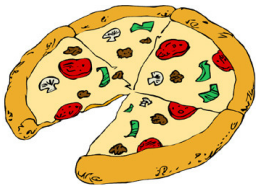
1. Chemical or physical change?

   A. ____ Burning paper.
   B. ____ Melting ice.
   C. ____ Baking soda mixed into vinegar produces bubbles.
   D. ____ Cutting up a piece of paper.
   E. ____ Heating up metal with a flame.
   F. ____ You mix two liquids together and they get colder.
   G. ____ Dissolving sugar into water.
   H. ____ You mix two liquids together and they change color.
   I. ____ Chewing food.
   J. ____ When acids in your stomach break down your food into nutrients your body can absorb.
   K. ____ When enzymes in your saliva pre-digest and soften your food in your mouth before you swallow.
   L. ____ The complete act of digestion (*all of the above*).

2. Salt is put into water. The water is stirred until the salt disappears.
   A. Is this a physical or chemical change?
   B. Could you filter the salt out?
   C. How can you get the salt out of salt water?

3. Element (E), Compound (C), Heterogeneous Mixture (He), or Homogeneous Mixture (Ho)?

   A. ____ Water
   B. ____ A bunch of gold atoms
   C. ____ Sugar water
   D. ____ Lithium and Oxygen combined chemically.
   E. ____ Can be separated physically.
   F. ____ A chocolate chip cookie.
   G. ____ Has only one kind of atom.
   H. ____ Can be separated by sorting.
   I. ____ Needs a chemical to break it up.
   J. ____ Found on the periodic table.
   K. ____ A can of mixed nuts.
   L. ____ An alloy of two metals (can be melted apart).



4. A. What kind of matter is a pizza?
   B. Why?

Name: _____

Period: _____

Day 14—Classification of Matter

Physical vs. Chemical Change

Afterward, is it still the same substance?

Yes — Physical Change

Examples of physical changes: change of temperature (due to external heat), ripping; cutting.

No — Chemical Change

Evidence of chemical change: Bubbles; Turns cloudy; Temperature change when mixed; color change; change of smell.

If it can be separated thru physical means we call it a: **Mixtures**

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Different throughout. Two samples might be different. Ex: Chicken soup; Chex mix; Rocky Road ice cream.

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Same throughout. Any two samples are the same. Ex: Milk; Salt water; Vanilla ice cream

Chemicals

If it cannot be separated physically we call it a:

Elements

Only one type of atom. Cannot be broken down further. Gold (Au); Oxygen (O_2); Anything on the Periodic Table is an Element.

Compounds

When two or more elements are chemically combined. Can be chemically separated into elements. Salt (NaCl); Carbon Dioxide (CO_2); Water (H_2O)

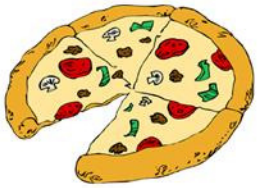
1. Chemical or physical change?

   A. _C_ Burning paper. *(ash, not paper anymore)*
   B. _P_ Melting ice. *(Still water)*
   C. _C_ Baking soda mixed into vinegar produces bubbles. *(liquid and solid make a gas)*
   D. _P_ Cutting up a piece of paper. *(still paper)*
   E. _P_ Heating up metal with a flame. *(heat comes from external source)*
   F. _C_ You mix two liquids together and they get colder. *("cold" is internal)*
   G. _P_ Dissolving sugar into water. *(Still tastes like sugar)*
   H. _C_ You mix two liquids together and they change color.
   I. _P_ Chewing food. *(Just smaller pieces of food)*
   J. _C_ When acids in your stomach break down your food into nutrients your body can absorb.
   K. _C_ When enzymes in your saliva pre-digest and soften your food in your mouth before you swallow.
   L. _Both_ The complete act of digestion (*all of the above*).

2. Salt is put into water. The water is stirred until the salt disappears.
   A. Is this a physical or chemical change? *Dissolving is ALWAYS a physical change (always [always])*
   B. Could you filter the salt out? *No—it is mixed at the molecular level.*
   C. How can you get the salt out of salt water? *Boil the water off. Salt will be left.*

3. Element (E), Compound (C), Heterogeneous Mixture (He), or Homogeneous Mixture (Ho)?

   A. _C_ Water
   B. _E_ A bunch of gold atoms
   C. _Ho_ Sugar water
   D. _C_ Lithium and Oxygen combined chemically.
   E. _He,Ho_ Can be separated physically.
   F. _He_ A chocolate chip cookie.
   G. _E_ Has only one kind of atom.
   H. _He Ho_ Can be separated by sorting.
   I. _C_ Needs a chemical to break it up.
   J. _E_ Found on the periodic table.
   K. _He_ A can of mixed nuts.
   L. _Ho_ An alloy of two metals (can be melted apart).



4. A. What kind of matter is a pizza? Heterogenous Mixture
   B. Why? *Not the same everywhere—two slices can be slightly different (or even two different bites can be different)*

Name: _____

Period: _____

Day 15— Density, Viscosity, Buoyancy

Objective 4

Density

Density is how compact an object is.

If two objects have the same size, the heavier one is denser.
Density is a physical property of a substance. (If you divide an object, both sides will have the same density.)
The density of water is 1 g/mL.

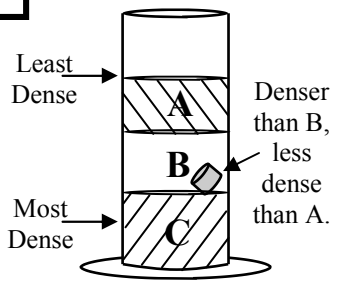
Density

in g/mL or g/cm³ → $D = \frac{m}{v}$ ← Volume *in cm³ or mL*

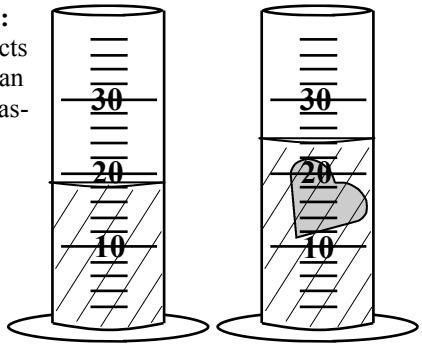
(m: Mass in grams (g))

Density = Mass ÷ Volume

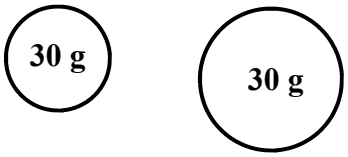
Floating—Less dense things (and liquids) float on more dense liquids. The diagram shows a density column.



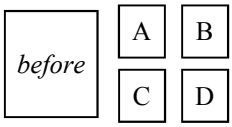
Displacement Method: Irregularly shaped objects (not easily measured) can be put it in water to measure its volume.



1. Which is denser: a golf ball or a ping pong ball?
2. A. Is a penny heavy or light? B. Will a penny sink or float in water?
   C. Why?
3. A. What is the volume of the heart-shaped object in the graduated cylinder?
   B. If the object is 8 gram, calculate its density.
4. A. Which of the 30 gram objects below is more dense?
   B. Why?

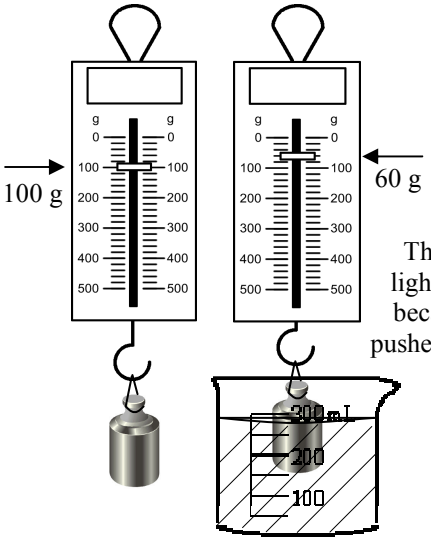


5. A block with a density of 1.60 g/cm³ is cut into four pieces. What is the density of piece B?



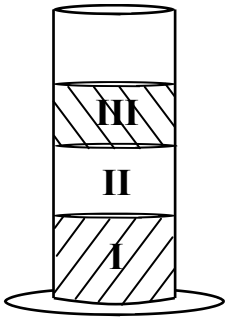
Buoyancy

Buoyancy is the upward force of a liquid on what floats on it.



This mass seems lighter in the liquid because the liquid pushes up on the mass.

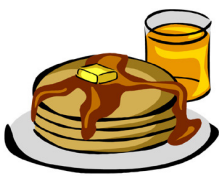
6. Use the density column at the right to answer the following questions. Draw where ice will float in the column.
   A. Which liquid is the most dense?
   B. Which liquid is the least dense?
   C. Which liquid is which? A, B, or C?
      D = 1.35 g/mL = Liquid ___
      D = 0.86 g/mL = Liquid ___
      D = 1.00 g/mL = Liquid ___
   D. Label the liquid you know.
   E. Draw where would ice float.



7. What is the buoyant force on the mass in the diagram at the left?
8. Why is it easier lift a person when you are in a pool?

Viscosity

Viscosity is how slowly a liquid flows. Syrup has high viscosity. Water has low viscosity. Denser liquids tend to have greater viscosity. A liquid's viscosity decreases as it is heated (hot liquids flow easier).



9. Which is more viscous: water or honey?
10. Which would give more buoyant force: syrup or water?
11. How can a liquid be made less viscous?

Day 15— Density, Viscosity, Buoyancy

Density

Density is how compact an object is.

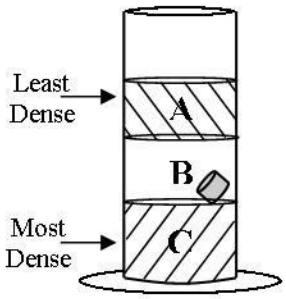
If two objects have the same size, the heavier one is denser.
Density is a physical property of a substance. (If you divide an object, both sides will have the same density.)
The density of water is 1 g/mL.

Density

in g/mL or g/cm³ → $D = \frac{m}{v}$ ← Mass in grams (g); Volume *in cm³ or mL*

Density = Mass ÷ Volume

Floating—Less dense thing (and liquids) float on more dense liquids. The diagram shows a density column.



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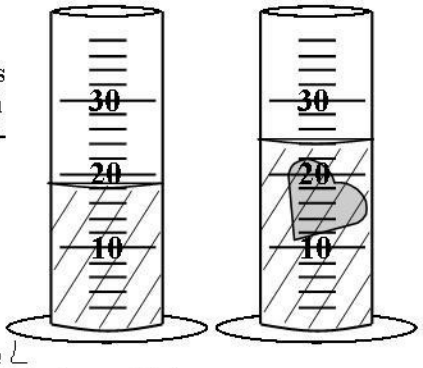
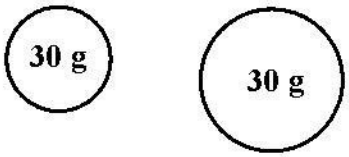
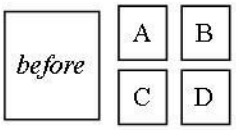


1. Which is denser: a golf ball or a ping pong ball?
2. A. Is a penny heavy or light? B. Will a penny sink or float in water?
   C. Why? more dense
3. A. What is the volume of the heart-shaped object in the graduated cylinder? 6 mL
   B. If the object is 8 gram, calculate its density. $D = m/v = 8/6 = 1.33$ g/mL -2w
4. A. Which of the 30 gram objects below is more dense? small one.
   B. Why? same m, less vol.

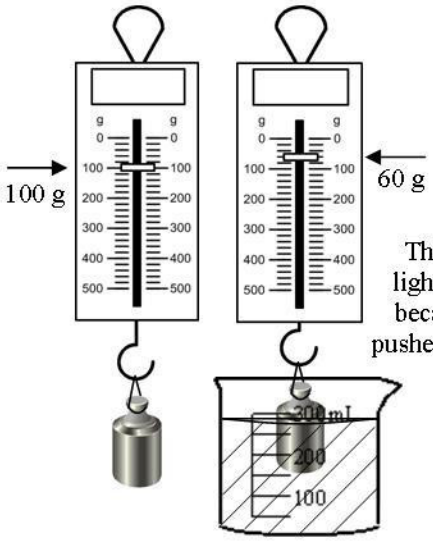


5. A block with a density of 1.60 g/cm³ is cut into four pieces. What is the density of piece B?
   1.60 g/cm³ – same density throughout



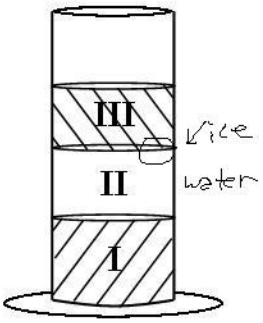
Buoyancy

Buoyancy is the upward force of a liquid on what floats on it.



This mass seems lighter in the liquid because the liquid pushes up on the mass.

6. Use the density column at the right to answer the following questions. Draw where ice will float in the column.
   A. Which liquid is the most dense? I
   B. Which liquid is the least dense? III
   C. Which liquid is which? A, B, or C?
      D = 1.35 g/mL = Liquid I
      D = 0.86 g/mL = Liquid III
      D = 1.00 g/mL = Liquid II
   D. Label the liquid you know. ✓
   E. Draw where would ice float.
      on top of water (II)



7. What is the buoyant force on the mass in the diagram at the left? 40 g (xg)
8. Why is it easier lift a person when you are in a pool?
   water gives buoyant force

Viscosity

Viscosity is how slowly a liquid flows. Syrup has high viscosity. Water has low viscosity. Denser liquids tend to have greater viscosity. A liquid's viscosity decreases as it is heated (hot liquids flow easier).

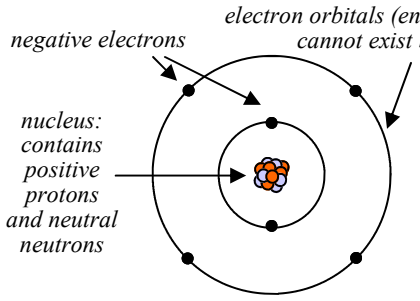
9. Which is more viscous: water or honey?
10. Which would give more buoyant force: syrup or water? more dense = more viscous = more buoyant force
11. How can a liquid be made less viscous?
    heat it.

Name: _____

Period: _____

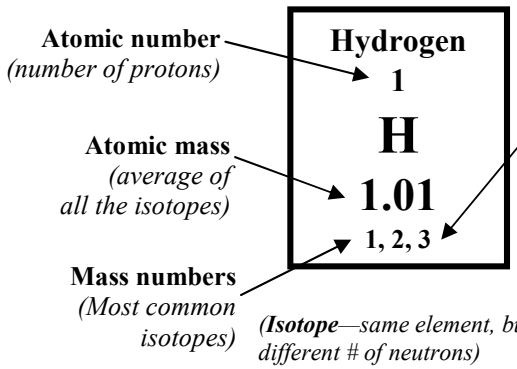
Day 16— Atomic Structure and Periodic Table

Objective 4



Valence Electrons: *outer electrons only; involved in chemical bonding. This atom has 4 valence electrons. Elements with the same # of valence electrons react in a similar way (similar reactivity).*

Reading a periodic table tile



***(Isotope**—same element, but different # of neutrons)*

Finding the # of Neutrons

Mass # = protons + neutrons

Neutrons = mass # – protons

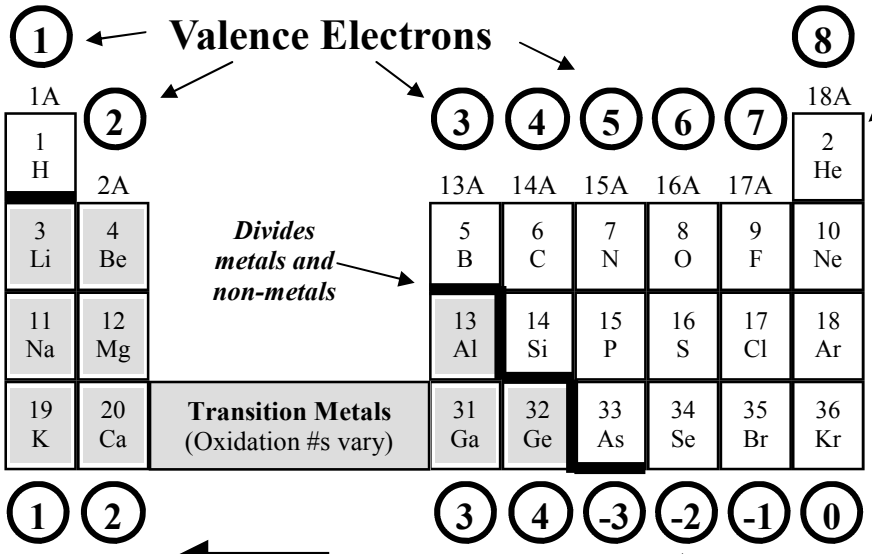
For Hydrogen 3:
3 (mass #) – 1 (atomic #)
= 2 (neutrons)

Hydrogen 3 has 1 proton and 2 neutrons.

*Vertical columns are called **groups** and have similar properties. 1A and 17A are the most reactive.*

Oxidation #'s tell you how many e's are gained or lost atoms combine.

Oxidation Numbers



Divides metals and non-metals

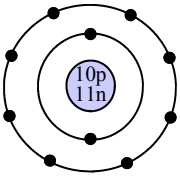
Helium only has 2 valence electrons

The elements in group 18A (the Noble Gases) have an oxidation # of 0. This means they don't gain or lose electrons, so they don't react or form compounds. They are ***INERT***.

Metals (Positive Ions) Positive because they ***LOSE*** electrons.

Non-metals (Negative Ions) Negative because they ***GAIN*** electrons.

1. Protons, Electrons, or Neutrons?
   - A. ___ Neutral charge.
   - B. ___ Not in the nucleus
   - C. ___ Positive
   - D. ___ In the nucleus.
   - E. ___ Repels a proton.
   - F. ___ Lose this and the atom becomes positive.
2. How many protons does magnesium (Mg) have?
3. Then how many neutrons does magnesium 25 have?
4. How many valence electrons does Chlorine (Cl) have?
5. What is the oxidation number for Sulfur (S)?
6. Metal or non-metal:
   - A. ___ Carbon (C)
   - B. ___ Calcium (Ca)
   - C. ___ Hydrogen (H)
7. Which is more reactive: Beryllium (Be) or Lithium (Li)?
8. Why do metals tend to be positive?
9. Give an example of a noble gas.
10. What is the oxidation number of a noble gas (and why?)
11. What does "inert" mean?
12. What is the atomic number for Bromine (Br)?
13. How many valence electrons does helium have?
14. What are the vertical columns called?
15. What is an isotope?
16. How many valence electrons does the atom have below?



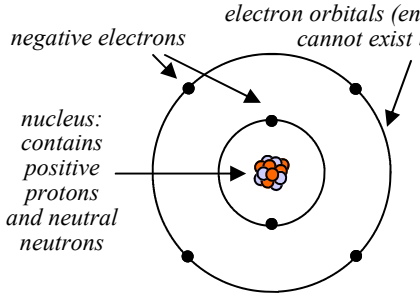
17. What is its mass number?
18. What element is it?

Name: _____

Period: _____

Day 16— Atomic Structure and Periodic Table

Objective 4



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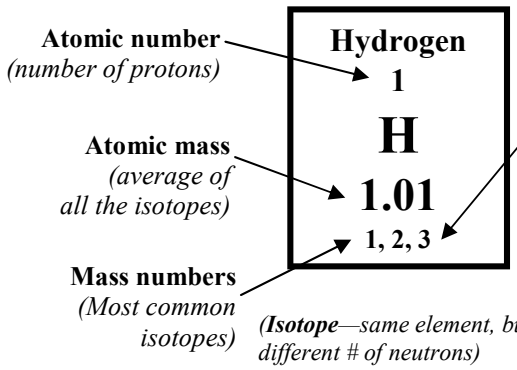
Reading a periodic table tile



***(Isotope**—same element, but different # of neutrons)*

Finding the # of Neutrons

Mass # = protons + neutrons

Neutrons = mass # – protons

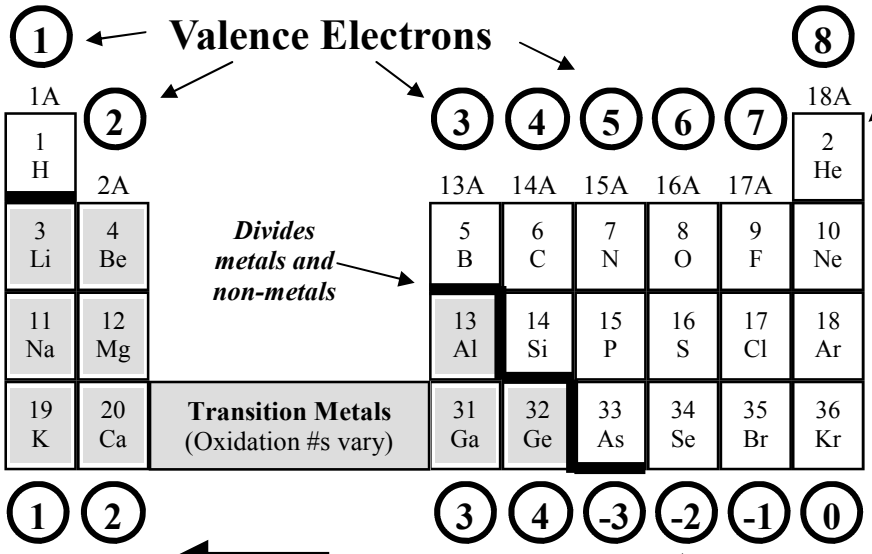
For Hydrogen 3:
3 (mass #) – 1 (atomic #)
= 2 (neutrons)

Hydrogen 3 has 1 proton and 2 neutrons.

*Vertical columns are called **groups** and have similar properties. 1A and 17A are the most reactive.*

Oxidation #'s tell you how many e's are gained or lost atoms combine.

Oxidation Numbers



Divides metals and non-metals

Helium only has 2 valence electrons

The elements in group 18A (the Noble Gases) have an oxidation # of 0. This means they don't gain or lose electrons, so they don't react or form compounds. They are ***INERT***.

Metals (Positive Ions) Positive because they ***LOSE*** electrons.

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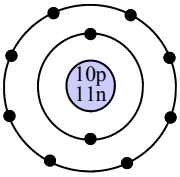
1. Protons, Electrons, or Neutrons?
   - A. _n_ Neutral charge.
   - B. _e_ Not in the nucleus
   - C. _p_ Positive
   - D. _p,n_ In the nucleus.
   - E. _p_ Repels a proton.
   - F. _e_ Lose this and the atom becomes positive.
2. How many protons does magnesium (Mg) have? *12 (atomic #)*
3. Then how many neutrons does magnesium 25 have? *25-12 = 13*
4. How many valence electrons does Chlorine (Cl) have? *7*
5. What is the oxidation number for Sulfur (S)? *-2*
6. Metal or non-metal:
   - A. _n_ Carbon (C)
   - B. _m_ Calcium (Ca)
   - C. _n_ Hydrogen (H)
7. Which is more reactive: Beryllium (Be) or Lithium (Li)? *(in group 1A)*
8. Why do metals tend to be positive? *Lose electrons to non metals*
9. Give an example of a noble gas. *He, Ne, Ar, or Kr*
10. What is the oxidation number of a noble gas (and why?) *0, it doesn't gain or lose electrons*
11. What does "inert" mean? *will not combine with other elements*
12. What is the atomic number for Bromine (Br)? *35*
13. How many valence electrons does helium have? *2*
14. What are the vertical columns called? *groups*
15. What is an isotope? *Elements with same # of protons, but different # of neutrons*
16. How many valence electrons does the atom have below? *8*
17. What is its mass number? *21*
18. What element is it? *Neon*



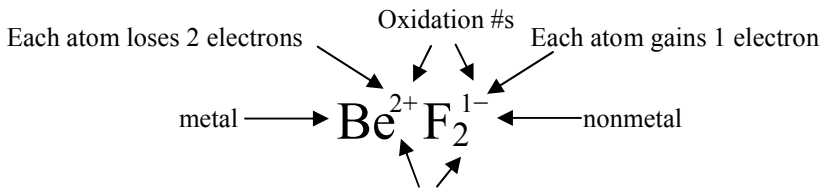
Name: _____

Period: _____

Day 17— Balanced Ionic Compounds

Objective 4

Ionic compounds are formed between metals (which lose electrons) and nonmetals (which gain electrons). Ionic compounds always form in a certain ratio. The number of electrons that are lost by the metal must equal the number of electrons gained by the nonmetal. The number of electrons lost or gained comes from the oxidation numbers.



Electron Arrows — An easy visual aid.

The Symbols

→ Losing 1 electron

≻ Gaining 1 electron

⇉ An ionic bond

Magnesium loses 2 electrons

Mg^{2+} →→

Chlorine gains 1 electron

≻ Cl^{1-}

Magnesium will combine with 2 Chlorines

Mg^{2+} ⇉ Cl^{1-}

Mg^{2+} →≻ Cl^{1-}

Magnesium Chloride: **$MgCl_2$ (a 1:2 ratio)**

Magnesium Sulfide: **MgS**

Mg^{2+} →→ *Loses 2*

≻ S^{2-} *Gains 2*

Mg^{2+} ⇉ S^{2-} **MgS**

1. For each of the following elements tell me how many electrons they gain or lose. The first one is done for you. (*Big Hint: think Oxidation Numbers*)

A. *G 1* Chlorine
B. _____ Oxygen
C. _____ Sodium
D. _____ Argon
E. _____ Nitrogen
F. _____ Calcium

2. Using electron arrows make balanced ionic compounds for the following:

A. Lithium and Oxygen

Formula: _____

B. Calcium and Fluorine.

Formula: _____

3. Write the balanced ionic formula for Calcium and Nitrogen:

Polyatomic ions are combinations of atoms that are not completely balanced. They still have a charge. When balancing ionic formulas, treat the polyatomic ion like any other single atom. The oxidation numbers for the polyatomic ions are found on the charge at the right.

Li^{1+} →≻ SO_4^{2-}

Li^{1+} →≻

4. Using electron arrows make balanced ionic compounds for the following:

A. Magnesium and Nitrate

Formula: _____

B. Sodium and Carbonate.

Formula: _____

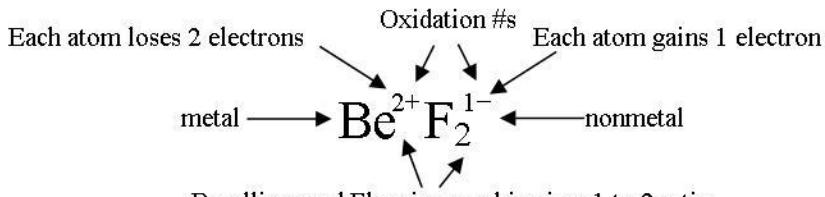
Polyatomic Ions		
Oxidation #	**Name**	**Formula**
1+	ammonium	NH_4^+
1-	acetate	$C_2H_3O_2^-$
2-	carbonate	CO_3^{2-}
2-	chromate	CrO_4^{2-}
1-	hydrogen carbonate	HCO_3^{1-}
1+	hydronium	H_3O^+
1-	hydroxide	OH^{1-}
1-	nitrate	NO_3^{1-}
2-	peroxide	O_2^{2-}
3-	phosphate	PO_4^{3-}
2-	sulfate	SO_4^{2-}
2-	sulfite	SO_3^{2-}

Name: _____

Period: _____

Day 17— Balanced Ionic Compounds

Ionic compounds are formed between metals (which lose electrons) and nonmetals (which gain electrons). Ionic compounds always form in a certain ratio. The number of electrons that are lost by the metal must equal the number of electrons gained by the nonmetal. The number of electrons lost or gained comes from the oxidation numbers.



Electron Arrows — An easy visual aid.

The Symbols

→ Losing 1 electron

≻ Gaining 1 electron

⇉ An ionic bond

Magnesium loses 2 electrons

Mg^{2+} ⇉

Chlorine gains 1 electron

≻ Cl^{1-}

Magnesium will combine with 2 Chlorines

Mg^{2+} ⇉ ≻ Cl^{1-} ; ⇉ ≻ Cl^{1-}

Magnesium Chloride: **$MgCl_2$ (a 1:2 ratio)**

Magnesium Sulfide: **MgS**

Mg^{2+} → *Loses 2*

≻ S^{2-} *Gains 2*

Mg^{2+} ⇉ S^{2-} **MgS**

1. For each of the following elements tell me how many electrons they gain or lose. The first one is done for you. (*Big Hint: think Oxidation Numbers*)

A. G 1 Chlorine
B. G 2 Oxygen
C. L 1 Sodium
D. 0 Argon
E. G 3 Nitrogen
F. L 2 Calcium

2. Using electron arrows make balanced ionic compounds for the following:

A. Lithium and Oxygen

Li → ≻ O
Li → ≻

Formula: Li_2O

B. Calcium and Fluorine.

Ca ⇉ ≻ F
Ca ⇉ ≻ F

Formula: CaF_2

3. Write the balanced ionic formula for Calcium and Nitrogen:

Ca ⇉ ≻ N
Ca ⇉ ≻ N
Ca ⇉ ≻ N

Ca_3N_2

Polyatomic ions are combinations of atoms that are not completely balanced. They still have a charge. When balancing ionic formulas, treat the polyatomic ion like any other single atom. The oxidation numbers for the polyatomic ions are found on the charge at the right.

Li^{1+} ⇉ ≻ SO_4^{2-}
Li^{1+} ⇉ ≻

Polyatomic Ions		
Oxidation #	**Name**	**Formula**
1+	ammonium	NH_4^+
1-	acetate	$C_2H_3O_2^-$
2-	carbonate	CO_3^{2-}
2-	chromate	CrO_4^{2-}
1-	hydrogen carbonate	HCO_3^{1-}
1+	hydronium	H_3O^+
1-	hydroxide	OH^{1-}
1-	nitrate	NO_3^{1-}
2-	peroxide	O_2^{2-}
3-	phosphate	PO_4^{3-}
2-	sulfate	SO_4^{2-}
2-	sulfite	SO_3^{2-}

4. Using electron arrows make balanced ionic compounds for the following:

A. Magnesium and Nitrate

Mg ⇉ ≻ NO_3
≻ NO_3

Formula: $Mg(NO_3)_2$

B. Sodium and Carbonate.

Na ⇉ ≻ CO_3
Na ⇉ ≻

Formula: $Na_2(CO_3)$

Name: _____

Period: _____

Day 18— The Law of Conservation of Mass

Objective 4

How to read chemical reactions:

The 2 is a coefficient. It means there are two Li_3N molecules. → $2Li_3N = Li_3N + Li_3N = Li_6N_2$ ← *So, $2Li_3N$ really means Li_6N_2. We will call this reaction notation.*

The 3 is a subscript ("sub" means under). It means there are three Lithium atoms in each molecule.

BEFORE	AFTER
Reactants	**Products**

$2H_2 + O_2 \xrightarrow{\text{form}} 2H_2O$

$2K_3N + 3CaCrO_4 \rightarrow Ca_3N_2 + 3K_2CrO_4$

1. *Circle* the second reactant. *Underline* the first product.
2. How many potassium atoms on the reactant side?
3. How many oxygen atoms on the product side?

4. Write the following in reaction notation:

   $3Be_2Br$: _____ $2AlCl_3$: _____ $4Fe_2O_3$: _____

5. What coefficient produces the given reaction notation:

   ___$O_2 = O_4$ ___$Li_3N = Li_{12}N_4$ ___$CO_2 = C_3O_6$

During chemical reactions atoms are recombined into different chemicals, but no atoms are gained or lost. Sometimes liquids and solids can react and form invisible gases, but even when you can see the products—they are still there.

Open System

Products can escape.

Before: 54 grams **Mass *seems* to be lost.** *After: 51 grams*

3 grams escaped the open reaction.

The Law of Conservation of Mass states: in any closed reaction the total amount of mass stays the same.

$MgCl_2 + Li_2O \rightarrow MgO + 2LiCl$

35 g 11 g 26 g ? g

Since mass must be conserved, 20 g of LiCl must have been produced in this reaction.

35 + 11 = 26 + ?

46 = 26 + ?

46 – 26 = ?

? = 20

6. A. Is this an open or closed reaction?
   B. Will the mass of his products be greater than, less than, or equal to his reactants?
   C. Why?

$4K + O_2 \rightarrow 2K_2O$

25g + 5 g ? g

7. How much potassium oxide is produced in this reaction?

When balancing chemical reactions remember that subscripts cannot be changed and that coefficients multiply.

$H_2 + O_2 \rightarrow H_2O$ NOT BALANCED (more O's on left)

$H_2 + O_2 \rightarrow \underline{2}H_2O$

H_4O_2 ← Write reaction notation under as you change coefficients.

$2H_2 + O_2 \rightarrow 2H_2O$ BALANCED

H_4 H_4O_2

balanced *balanced*

Treat polyatomic ions (like the CrO_4 below) as a single element unless the ion is broken up on one side.

Unbalanced: $K_3N + Ca(CrO_4) \rightarrow Ca_3N_2 + K_2(CrO_4)$

Balanced: $2K_3N + 3Ca(CrO_4) \rightarrow Ca_3N_2 + 3K_2(CrO_4)$

K_6N_2 $Ca_3(CrO_4)_3$ Ca_3N_2 $K_6(CrO_4)_3$

8. Balance the following reactions:

___ Fe + ___ O_2 → ___ Fe_2O_3

___ NH_3 → ___ N_2 + ___ H_2

___ NH_3 + ___ O_2 → ___ NO + ___ H_2O

___ Mg + ___ $Ag(NO_3)$ → ___ $Mg(NO_3)_2$ + ___ Ag

Name: _____

Period: _____

Day 18— The Law of Conservation of Mass

Objective 4

How to read chemical reactions:

The 2 is a coefficient. It means there are two Li_3N molecules. → $2Li_3N = Li_3N + Li_3N = Li_6N_2$ ← *So, $2Li_3N$ really means Li_6N_2. We will call this reaction notation.*

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BEFORE	AFTER
Reactants	**Products**

$2H_2 + O_2 \xrightarrow{\text{form}} 2H_2O$

$2K_3N + 3CaCrO_4 \rightarrow Ca_3N_2 + 3K_2CrO_4$

1. *Circle* the second reactant. *Underline* the first product.
2. How many potassium atoms on the reactant side? 6 total 2(3) = 6
3. How many oxygen atoms on the product side? 3(4) = 12

4. Write the following in reaction notation:
   $3Be_2Br$: Be_6Br_3 $2AlCl_3$: Al_2Cl_6 $4Fe_2O_3$: Fe_8O_{12}
5. What coefficient produces the given reaction notation:
   2 $O_2 = O_4$ 4 $Li_3N = Li_{12}N_4$ 3 $CO_2 = C_3O_6$

During chemical reactions atoms are recombined into different chemicals, but no atoms are gained or lost. Sometimes liquids and solids can react and form invisible gases, but even when you can see the products—they are still there.

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35 g 11 g 26 g ? g

Since mass must be conserved, 20 g of LiCl must have been produced in this reaction.

35 + 11 = 26 + ?
46 = 26 + ?
46 − 26 = ?
? = 20

6. A. Is this an open or closed reaction?
   B. Will the mass of his products be greater than, less than, or equal to his reactants?
   C. Why? can't escape

$4K + O_2 \rightarrow 2K_2O$

25g + 5 g ? g

30 g

7. How much potassium oxide is produced in this reaction?

When balancing chemical reactions remember that subscripts cannot be changed and that coefficients multiply.

$H_2 + O_2 \rightarrow H_2O$ NOT BALANCED (more O's on left)

$H_2 + O_2 \rightarrow \underline{2}H_2O$ ← H_4O_2 Write reaction notation under as you change coefficients.

$2H_2 + O_2 \rightarrow 2H_2O$ BALANCED

H_4 H_4O_2

balanced *balanced*

Treat polyatomic ions (like the CrO_4 below) as a single element unless the ion is broken up on one side.

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Balanced: $2K_3N + 3Ca(CrO_4) \rightarrow Ca_3N_2 + 3K_2(CrO_4)$

K_6N_2 $Ca_3(CrO_4)_3$ Ca_3N_2 $K_6(CrO_4)_3$

8. Balance the following reactions:

-2w $4\,Fe + 3\,O_2 \rightarrow 2\,Fe_2O_3$ (O: 6; Fe_4O_6)

-2w $2\,NH_3 \rightarrow 1\,N_2 + 3\,H_2$ (N_2H_6; H_6)

-2w $4\,NH_3 + 5\,O_2 \rightarrow 4\,NO + 6\,H_2O$ (O's must be even #; N_4H_{12}; O_{10}; N_4O_4; $H_{12}O_6$; O_{10})

-2w $1\,Mg + 2\,Ag(NO_3) \rightarrow 1\,Mg(NO_3)_2 + 2\,Ag$ (Mg; $Ag_2(NO_3)_2$; $Mg(NO_3)_2$; Ag_2)

Name: _____

Period: _____

Day 19— Solutions

Objective 4

A solution is a mixture (can be physically separated) that is **homogenous** (same throughout) at the molecular level. Most commonly solutions are liquids with compounds dissolved in them, but alloys (mixed metals, like 18 K gold) are also solutions.

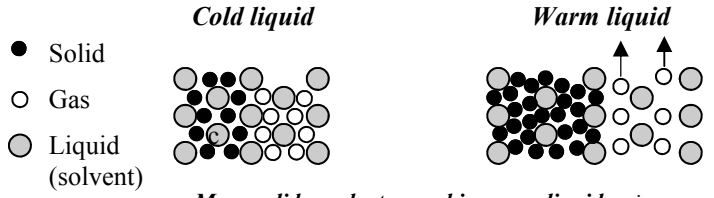
Salt water is a solution. Salt (the **solute**) is dissolved in water (the **solvent**). It can be physically separated, by boiling off the water, leaving salt.

Solution Terms:
Soluble compounds *can* be dissolved.
Insoluble compounds *cannot* be dissolved.
Saturated: cannot dissolve more solute (full).
Unsaturated: can dissolve more solute (unfull).
Supersaturated: overfull; some solute will precipitate (fall) out. Made by cooling a saturated solution.
Dilute: to add liquid, reducing the concentration.

Increasing amount dissolved

1. **More Pressure**: can force more gas into a liquid (CO_2 is pressurized into soft drinks. That's why they fizz when opened).
2. **Temperature**: Liquids expand just a bit with temperature. This expansion affects gases and solids differently.

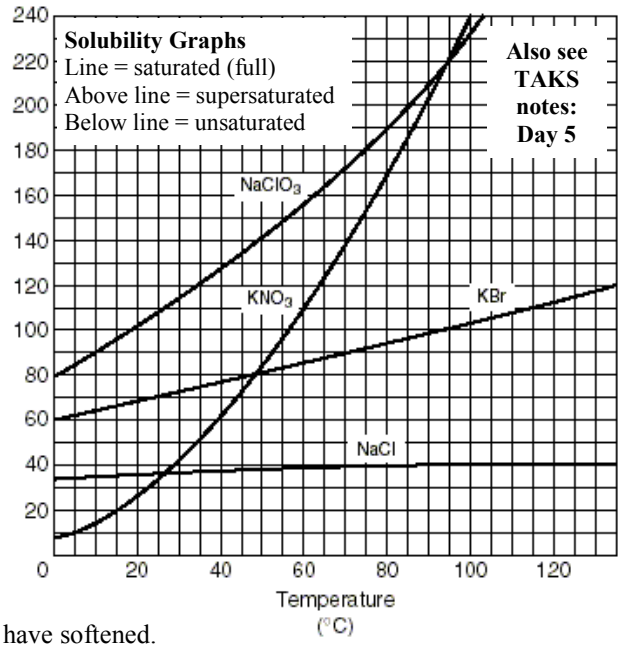
More gas can be trapped in cold liquids. *Gas molecules can escape easier in warm molecules are farther apart.*



More solid can be trapped in warm liquids, *since there is more room for them to settle between them.*

Way to speed up dissolution (how fast it dissolves):

1. **Crushing**: smaller particles = more sides touching.
2. **Stirring**: already dissolved particles spread out faster, diluting the solution near the solute still dissolving.
3. **Increasing Temperature** = faster moving molecules, so they are dissolved faster.



1. Solution (y/n)? Sugar water___; pure gold ___; oil and water___; orange juice___; alloys___.
2. A salt solution is too concentrated. How would you dilute it?
3. Something is mixed in water and seems to dissolve. How can you prove if it was actually dissolved?
4. Which one is the solvent in sugar water: the sugar or the water?
5. A liquid is poured onto a piece of metal. Later on the metal seems to have softened.
   A) Which is the solvent? B) What is happening to the metal?
6. Soluble or insoluble in water: ___oil; ___ salt; ___if it dissolves; ___it falls to the bottom of the liquid and stays there.
7. A solution can dissolve 82 grams of a liquid. Are the following amounts of solute saturated, unsaturated or supersaturated?
   A. ____ 60 g; B. ____ 88 g; C. ____ 82 g.
8. Which will dissolve faster: powdered sugar or sugar cubes; still water or stirred water; hot or cold water?
9. Why do soft drinks fizz when opened?
10. Which holds more dissolved gas: arctic oceans or tropical water?
11. Why are there more fish in cold, northern oceans?
12. Which can hold more dissolved solids: cold or hot liquids?
13. Johnny's Burger Barn keeps their sweet tea cold. Bubba's Grill keeps their sweet tea hot. Which tea is sweeter?
14. What will eventually happen to a supersaturated solution?
15. (*From the graph above*) 100 g of water is at 95°C.
    A. How much potassium bromide (KBr) can be dissolved at this temperature?
    B. Would 140 g of KBr be saturated, unsaturated, or supersaturated in 100g of water at 95°C?
16. At 70° C, how much KNO_3 can be dissolved in 200g of water?

Name: _____

Period: _____

Day 19— Solutions

Objective 4

A solution is a mixture (can be physically separated) that is **homogenous** (same throughout) at the molecular level. Most commonly solutions are liquids with compounds dissolved in them, but alloys (mixed metals, like 18 K gold) are also solutions.

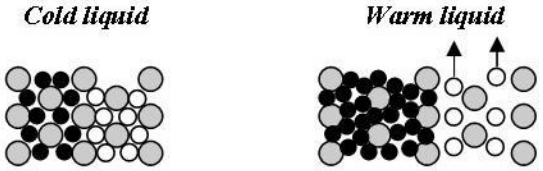
Salt water is a solution. Salt (the **solute**) is dissolved in water (the **solvent**). It can be physically separated, by boiling off the water, leaving salt.

Solution Terms:
Soluble compounds *can* be dissolved.
Insoluble compounds *cannot* be dissolved.
Saturated: cannot dissolve more solute (full).
Unsaturated: can dissolve more solute (unfull).
Supersaturated: overfull; some solute will precipitate (fall) out. Made by cooling a saturated solution.
Dilute: to add liquid, reducing the concentration.

Increasing amount dissolved
1. **More Pressure**: can force more gas into a liquid (CO_2 is pressurized into soft drinks. That's why they fizz when opened).
2. **Temperature**: Liquids expand just a bit with temperature. This expansion affects gases and solids differently.

More gas can be trapped in cold liquids. *Gas molecules can escape easier in warm molecules are farther apart.*

● Solid
○ Gas
◯ Liquid (solvent)



More solid can be trapped in warm liquids, *since there is more room for them to settle between them.*

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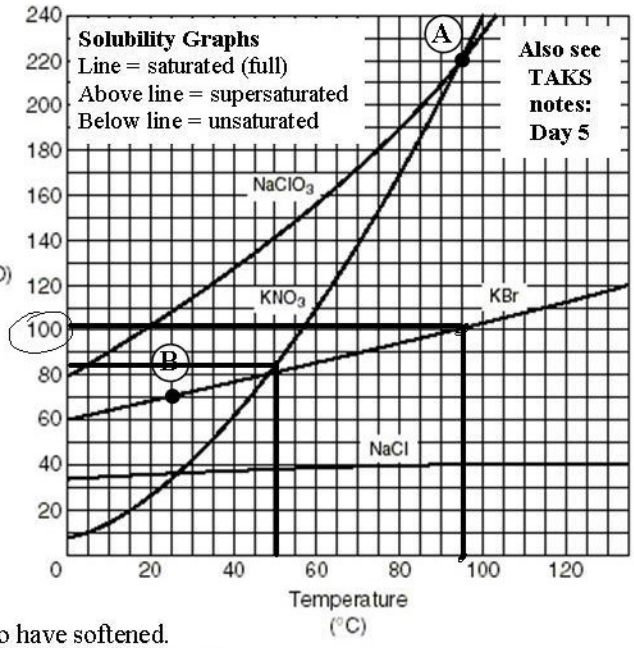


1. Solution (y/n)? Sugar water Y; pure gold N; oil and water N; orange juice N; alloys Y.
2. A salt solution is too concentrated. How would you dilute it? add more water
3. Something is mixed in water and seems to dissolve. How can you prove if it was actually dissolved? boil off the water to get the chemical back.
4. Which one is the solvent in sugar water: the sugar or the water? what does the dissolving
5. A liquid is poured onto a piece of metal. Later on the metal seems to have softened.
   A) Which is the solvent? liquid B) What is happening to the metal? dissolving
6. Soluble or insoluble in water: I oil; S salt; S if it dissolves; I it falls to the bottom of the liquid and stays there.
7. A solution can dissolve 82 grams of a liquid. Are the following amounts of solute saturated, unsaturated or supersaturated?
   A. US 60 g; B. SS 88 g; C. S 82 g.
8. Which will dissolve faster: powdered sugar or sugar cubes; still water or stirred water; hot or cold water?
9. Why do soft drinks fizz when opened? releasing trapped gas.
10. Which holds more dissolved gas: arctic oceans or tropical water? cold liq. hold more gas.
11. Why are there more fish in cold, northern oceans? more O_2 in cold water
12. Which can hold more dissolved solids: cold or hot liquids?
13. Johnny's Burger Barn keeps their sweet tea cold. Bubba's Grill keeps their sweet tea hot. Which tea is sweeter? hot tea holds more solid sugar
14. What will eventually happen to a supersaturated solution? precipitates out—falls to bottom
15. (*From the graph above*) 100 g of water is at 95°C.
    A. How much potassium bromide (KBr) can be dissolved at this temperature? 100 g
    B. Would 140 g of KBr be saturated, unsaturated, or supersaturated in 100g of water at 95°C?
16. At 50° C, how much KNO_3 can be dissolved in 200g of water? *At 70 degrees = 140(2) = 280 g*
    85g for 100g water = 170g

Name: _____

Period: _____

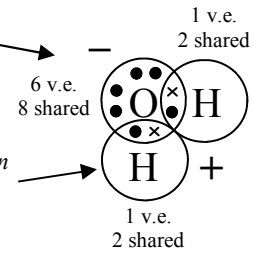
Day 20— The Properties of Water

Objective 4

Water is a polar molecule:
it has a negative and positive side.

Negative side (Oxygen with 2 extra electrons from the Hydrogens).

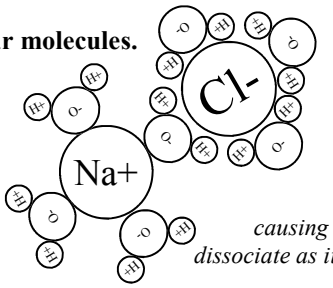
Positive side (Hydrogen without its electron leaves a + proton).



Water dissolves ionic and polar molecules.

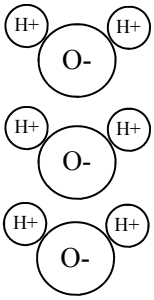
"Likes dissolve likes". Polar compounds dissolve in polar solvents (like water). Non-polar compounds dissolve in non-polar solvents (liquids).

Water is called the "nearly" universal solvent because it dissolves so many things.



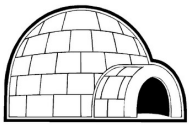
In water, negative Chlorines are attracted to positive Hydrogens and positive Sodiums are attracted to negative Oxygens, causing NaCl (table salt) to dissociate as it dissolves in water.

Compounds that can dissolve in water are called **water soluble**. Compounds that cannot dissolve in water are **insoluble**.



Water "chains" together by <u>cohesion</u> (attraction between other water molecules). This weak attraction between negative oxygens and positive hydrogens is called a **hydrogen bond**. It allows for **water tension** (and why some bugs to walk on water) and **capillary action** (how plants can "suck up" water from their roots to the leaves thru the **xylem**).

Water is the only substance that expands as it freezes. This expansion breaks rocks, causing erosion. This expansion also means **ice is less dense than water, so ice floats on top of water**.



Ice is also an insulator. Lakes freeze from the top down and the insulation of the top layer of ice means the rest of the lake takes longer to freeze, protecting the fish below.

---

1. A. Which side of water is positive? B. Why?
2. A. Do metals become positive or negative?
   B. Would a metal be attracted to water's hydrogens or oxygen?
   C. Would a nonmetal be attracted to water's hydrogens or oxygen?
3. To which side of a water molecule are these attracted?

   ____ Magnesium ___ Calcium ____ Potassium ___ Iron

   ____ Chlorine ___ Sulfur ____ Helium ___ Bromine
4. What is the difference between soluble and insoluble?
5. Soluble or insoluble in water?

   ____ Cooking oil ___ Sugar ___ Ionic Compounds ____ Non-polar molecules

   ____ Polar molecules ___ Salt ___ Dissolves in water ____ Wax
6. What property of water allows it to dissolve so many compounds?
7. What is cohesion?
8. Why are water bugs able to "walk on water"?
9. How do plants get water from their roots up to their leaves?
10. A glass bottle is filled to the top with water and then sealed tightly. What will happen when the bottle is placed in the freezer?
11. A. If solid iron is dropped into liquid iron, will the solid iron float or sink?
    B. If solid water is dropped into liquid water, will the solid water float or sink?
    C. Which of the above is the exception: iron or water?
12. Why do roads break during the winter?
13. Why don't fish freeze under a frozen pond?

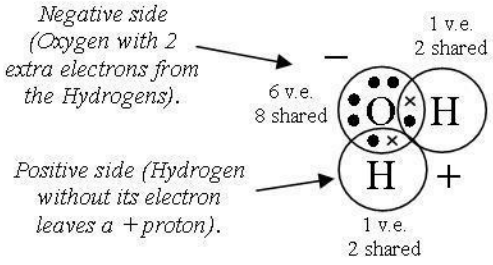
Name: _____

Period: _____

Day 20— The Properties of Water

Objective 4

Water is a polar molecule:
it has a negative and positive side.



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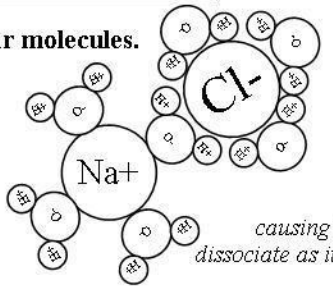

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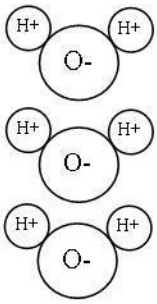

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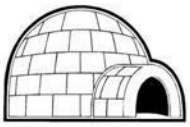

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---

1. A. Which side of water is positive? hydrogens B. Why? lose e's
2. A. Do metals become positive or negative? (think oxid. #s)
   B. Would a metal be attracted to water's hydrogens or oxygen? hydrogen
   C. Would a nonmetal be attracted to water's hydrogens or oxygen? pos.
3. To which side of a Water Molecule are these Attracted?

   H Magnesium metal H Calcium M H Potassium M H Iron M

   O Chlorine NM O Sulfur NM neither Helium Noble gas O Bromine NM
4. What is the difference between soluble and insoluble? soluble can dissolve
5. Soluble or insoluble in water?

   I Cooking oil S Sugar S Ionic Compounds I Non-polar molecules

   S Polar molecules S Salt S Dissolves in water I Wax
6. What property of water allows it to dissolve so many compounds?
   It has a positive and negative side. (polar)
7. What is cohesion? *attraction of different water molecules due to hydrogen bonds.*
8. Why are water bugs able to "walk on water"?
   Hydrogen bonds between water give "water tension".
9. How do plants get water from their roots up to their leaves? *capillary action in xylem - hydrogen bonds.*
10. A glass bottle is filled to the top with water and then sealed tightly. What will happen when the bottle is placed in the freezer? *when water freezes it expand and will break the glass.*
11. A. If solid iron is dropped into liquid iron, will the solid iron float or sink?
    B. If solid water is dropped into liquid water, will the solid water float or sink?
    C. Which of the above is the exception: iron or water? *ALL other solids sink in their liquids.*
12. Why do roads break during the winter? *water gets in cracks, freezes, expands and breaks the road*
13. Why don't fish freeze under a frozen pond?
    Ice floats on top and is an insulator - protecting the fish below.

Name: _____

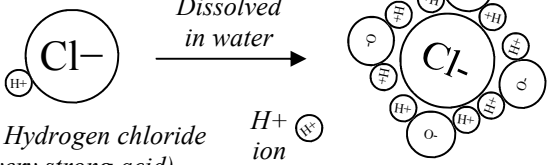
Period: _____

Day 21— Acids and Bases

Objective 4

Acids

Acids compounds make H+ ions when dissolved in water.



HCl: Hydrogen chloride (a very strong acid), found in your stomach.

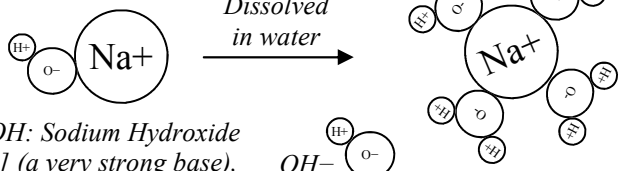
Chlorine surrounded by the + side of water.

The released H+ ion (a proton) is very reactive, very corrosive: it wants to combine to neutralize. Strong acids (like HCl) can etch (eat away) glass and will burn your skin.

Acids tend to taste sour and feel squeaky clean. Most foods are acidic (like lemon juice).

Bases

Bases are compounds that make OH− ions when dissolved in water.



NaOH: Sodium Hydroxide [lye] (a very strong base), used as a drain cleaner.

Sodium surrounded by the − side of water.

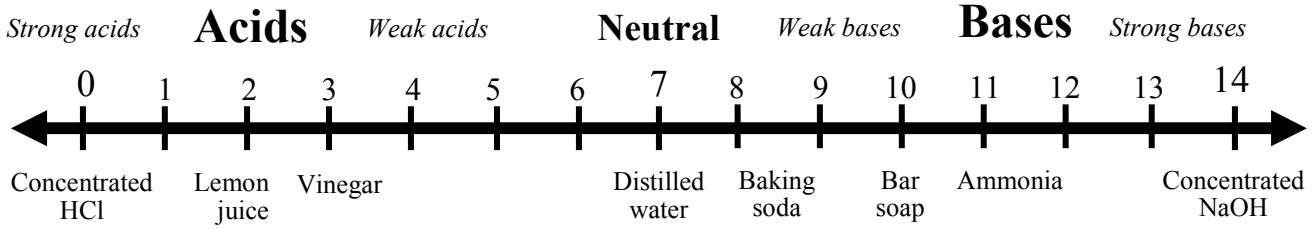
The released OH− ion is also very reactive, very caustic. NaOH can etch Aluminum, can dissolve grease (like in oven cleaners), and can also badly burn your skin.

Bases tend to taste bitter and feel slippery. Many cleaning products are basic (like soap).

pH—The Measure of Acids and Bases

Acids range from pH 0-7, with 0 the most acidic.

Bases range from pH 7-14, with 14 the most basic.



Neutralization—when an acids and bases are combine in equal concentrations they neutralize, forming salt water of pH 7.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

$$Acid + Base \rightarrow Salt + Water$$

Acids and bases are measured with an electronic pH meter or with **litmus paper**. Litmus paper turns different colors depending on the pH of the solution.

1. Acid or Base?

___Makes H+ ions in water	___ pH less than 7	__ Soap	___Tastes bitter
___Makes OH− ions in water.	___ pH more than 7	__ Feels slippery	___Tastes sour
___HCl	___ HCl when not in water.	__ Feels squeaky	___Pure water
___$Mg(OH)_2$	___ pH 13	__ Neutralizes a base.	___pH 7
___$H_2(CO_3)$	___ pH 4	__ More H+ ions.	___An antacid
___NaOH	___ Lemon juice	__ Less H+ ions.	___Very caustic or corrosive.

2. Give two ways chemists use to measure the pH concentration of solutions.

3. When diluting a concentrated acid, do you pour in acid into water or water into acid?

4. Solution A (pH 4); Solution B (pH 2):
   A. Which has more H+ ions?
   B. Which more OH− ions?
   C. Which is more basic?
   D. Which is more acidic?

5. A solution has a pH of 11. You need the solution to have a pH of 8. Do you add an acid or a base?

Name: _____

Period: _____

Objective 4