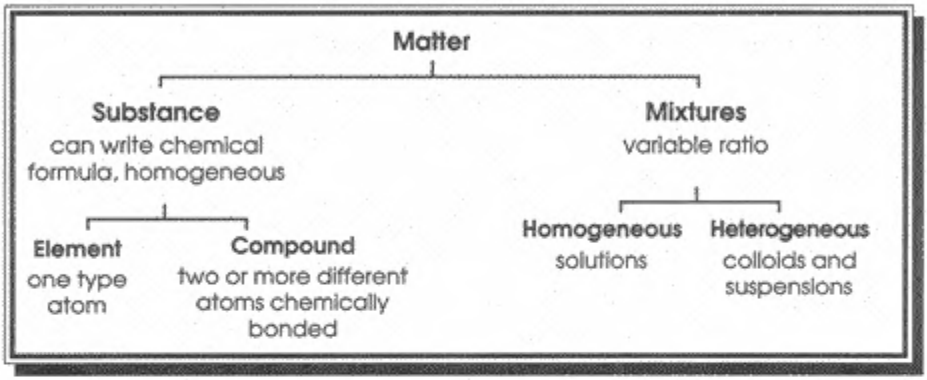
MATTER—SUBSTANCES VS. MIXTURES

Name _____

All matter can be classified as either a substance (element or compound) or a mixture (heterogeneous or homogeneous).



Classify each of the following as to whether it is a substance or a mixture. If it is a substance, write Element or Compound in the substance column. If it is a mixture, write Heterogeneous or Homogeneous in the mixture column.

Type of Matter	Substance	Mixture
1. chlorine		
2. water		
3. soil		
4. sugar water		
5. oxygen		
6. carbon dioxide		
7. rocky road ice cream		
8. alcohol		
9. pure air		
10. iron		

PHYSICAL VS. CHEMICAL CHANGES

Name _____

In a physical change, the original substance still exists, it has only changed in form. In a chemical change, a new substance is produced. Energy changes always accompany chemical changes.

Classify the following as being a physical or chemical change.

1. Sodium hydroxide dissolves in water. _____
2. Hydrochloric acid reacts with potassium hydroxide to produce a salt, water and heat. _____
3. A pellet of sodium is sliced in two. _____
4. Water is heated and changed to steam. _____
5. Potassium chlorate decomposes to potassium chloride and oxygen gas. _____
6. Iron rusts. _____
7. When placed in H_20, a sodium pellet catches on fire as hydrogen gas is liberated and sodium hydroxide forms. _____
8. Evaporation _____
9. Ice melting _____
10. Milk sours. _____
11. Sugar dissolves in water. _____
12. Wood rotting _____
13. Pancakes cooking on a griddle _____
14. Grass growing in a lawn _____
15. A tire is inflated with air. _____
16. Food is digested in the stomach. _____
17. Water is absorbed by a paper towel. _____

PHYSICAL VS. CHEMICAL PROPERTIES

Name _____

A physical property is observed with the senses and can be determined without destroying the object. For example, color, shape, mass, length, density, specific heat and odor are all examples of physical properties.

A chemical property indicates how a substance reacts with something else. When a chemical property is observed, the original substance is changed into a different substance. For example, the ability of iron to rust is a chemical property. The iron has reacted with oxygen and the original iron metal is gone. It is now iron oxide, a new substance. All chemical changes include physical changes.

Classify the following properties as either chemical or physical by putting a check in the appropriate column.

	Physical Property	Chemical Property
1. red color		
2. density		
3. flammability		
4. solubility		
5. reacts with acid to form hydrogen		
6. supports combustion		
7. bitter taste		
8. melting point		
9. reacts with water to form a gas		
10. reacts with a base to form water		
11. hardness		
12. boiling point		
13. can neutralize a base		
14. luster		
15. odor		

CHEMICAL vs. PHYSICAL CHANGE

Name _____

In a physical change, the original substance still exists, it has only changed in form. Energy changes usually do not accompany physical changes, except in phase changes and when substances dissolve.

In a chemical change, a new substance is produced. Energy changes always accompany chemical changes. Physical changes usually accompany chemical changes.

Classify the following as being either a chemical or a physical change.

1. Sodium chloride dissolves in water. _____
2. Hydrochloric acid reacts with sodium hydroxide to produce a salt, water and heat. _____
3. A pellet of sodium is sliced in half. _____
4. Water is heated and changed to steam. _____
5. Food is digested. _____
6. Starch molecules are formed from smaller glucose molecules. _____
7. Ice melts. _____
8. Plant leaves lose water through evaporation. _____
9. A red blood cell placed in distilled water will swell and burst. _____
10. The energy in food molecules is transferred into molecules of ATP. _____
11. The roots of a plant absorb water. _____
12. Iron rusts. _____
13. Oxygen is incorporated into hemoglobin to bring it to the cells. _____
14. A person gets cooler by perspiring. _____
15. Proteins are made from amino acids. _____
16. A match burns. _____
17. A toothpick is broken in half. _____

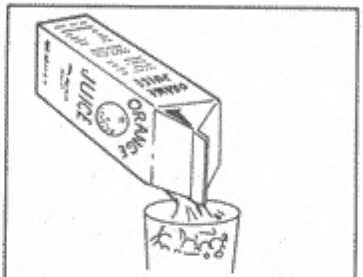
ELEMENTS, COMPOUNDS AND MIXTURES

Name _____

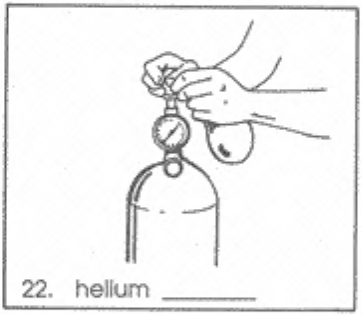
An element consists of only one kind of atom. A compound consists of two or more different elements chemically combined in a fixed ratio. The components of a mixture can be in any proportion and are not chemically bound.

Classify each of the following as an element, compound or mixture by writing E, C or M in the space provided.

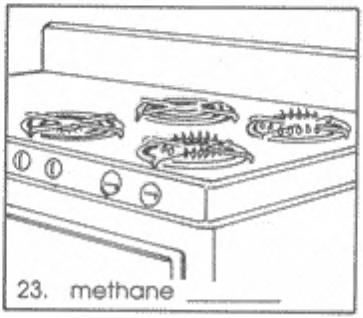
1. sodium _____
2. water _____
3. soil _____
4. coffee _____
5. oxygen _____
6. alcohol _____
7. carbon dioxide _____
8. cake batter _____
9. air _____
10. soap _____
11. iron _____
12. salt water _____
13. ice cream _____
14. nitrogen _____
15. eggs _____
16. blood _____
17. table salt _____
18. nail polish _____
19. milk _____
20. cola _____



21. orange juice _____



22. helium _____



23. methane _____

BOYLE'S LAW

Name _____

Boyle's Law states that the volume of a gas varies inversely with its pressure if temperature is held constant. (If one goes up, the other goes down.) We use the formula:

$$P_1 \times V_1 = P_2 \times V_2$$

Solve the following problems (assuming constant temperature).

1. A sample of oxygen gas occupies a volume of 250. mL at 740. torr pressure. What volume will it occupy at 800. torr pressure?

_____

2. A sample of carbon dioxide occupies a volume of 3.50 liters at 125 kPa pressure. What pressure would the gas exert if the volume was decreased to 2.00 liters?

_____

3. A 2.0 liter container of nitrogen had a pressure of 3.2 atm. What volume would be necessary to decrease the pressure to 1.0 atm?

_____

4. Ammonia gas occupies a volume of 450. mL at a pressure of 720. mm Hg. What volume will it occupy at standard pressure?

_____

5. A 175 mL sample of neon had its pressure changed from 75 kPa to 150 kPa. What is its new volume?

_____

6. A sample of hydrogen at 1.5 atm had its pressure decreased to 0.50 atm producing a new volume of 750 mL. What was its original volume?

_____

7. Chlorine gas occupies a volume of 1.2 liters at 720 torr pressure. What volume will it occupy at 1 atm pressure?

_____

8. Fluorine gas exerts a pressure of 900. torr. When the pressure is changed to 1.50 atm its volume is 250. mL. What was the original volume?

_____

CHARLES' LAW

Name _____

Charles' Law states that the volume of a gas varies directly with the Kelvin temperature, assuming that pressure is constant. We use the following formulas:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{or} \quad V_1 \times T_2 = V_2 \times T_1$$

$$K = °C + 273$$

Solve the following problems assuming a constant pressure.

1. A sample of nitrogen occupies a volume of 250 mL at 25° C. What volume will it occupy at 95° C?

_____

2. Oxygen gas is at a temperature of 40° C when it occupies a volume of 2.3 liters. To what temperature should it be raised to occupy a volume of 6.5 liters?

_____

3. Hydrogen gas was cooled from 150° C to 50° C. Its new volume is 75 mL. What was its original volume?

_____

4. Chlorine gas occupies a volume of 25 mL at 300 K. What volume will it occupy at 600 K?

_____

5. A sample of neon gas at 50° C and a volume of 2.5 liters is cooled to 25° C. What is the new volume?

_____

6. Fluorine gas at 300 K occupies a volume of 500 mL. To what temperature should it be lowered to bring the volume to 300 mL?

_____

7. Helium occupies a volume of 3.8 liters at -45° C. What volume will it occupy at 45° C?

_____

8. A sample of argon gas is cooled and its volume went from 380 mL to 250 mL. If its final temperature was -55° C, what was its original temperature?

_____

PARTS OF AN ATOM

Name _____

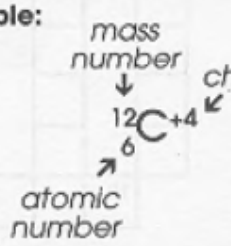
An atom is made up of protons and neutrons which are in the nucleus, and electrons which are in the electron cloud surrounding the atom.

The atomic number equals the number of protons. The electrons in a neutral atom equal the number of protons. The mass number equals the sum of the protons and neutrons.

The charge indicates the number of electrons that have been lost or gained. A positive charge indicates the number of electrons (which are negatively charged) lost. A negative charge indicates the number of electrons gained.

This structure can be written as part of a chemical symbol.

Example:



This carbon ion would have 6 protons, 6 neutrons and 2 electrons.

Complete the following chart.

Element/ Ion	Atomic Number	Mass Number	Charge	Protons	Neutrons	Electrons
$^{24}_{12}Mg$						
$^{39}_{19}K$						
$^{23}_{11}Na^{+1}$						
$^{19}_{9}F^{-1}$						
$^{27}_{13}Al^{+3}$						
$^{1}_{1}H$						
$^{24}Mg^{2+}$						
Ag						
S^{-2}						
$^{2}_{1}H$						
$^{35}Cl^{-}$						
Be^{2+}						

ELEMENTS AND THEIR SYMBOLS

Name _____

Write the symbols for the following elements.

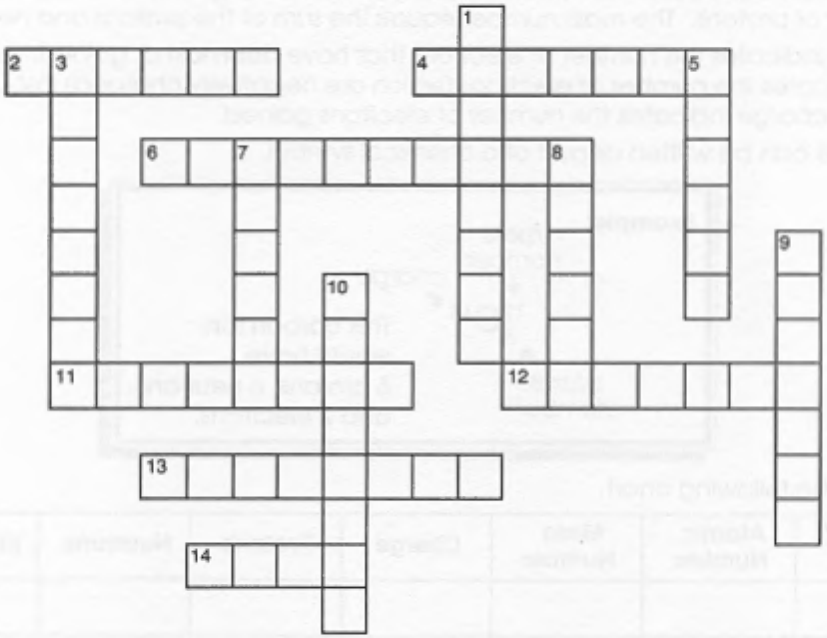
1. oxygen _____
2. hydrogen _____
3. chlorine _____
4. sodium _____
5. fluorine _____
6. carbon _____
7. helium _____
8. nitrogen _____
9. copper _____
10. sulfur _____
11. magnesium _____
12. manganese _____
13. neon _____
14. bromine _____
15. phosphorus _____
16. silver _____
17. lead _____
18. iron _____
19. calcium _____
20. potassium _____

Write the name of the element that corresponds to each of the following symbols.

21. Cu _____
22. K _____
23. C _____
24. Au _____
25. Zn _____
26. Pb _____
27. Fe _____
28. Na _____
29. S _____
30. Al _____
31. Ca _____
32. Ag _____
33. P _____
34. O _____
35. I _____
36. Sn _____
37. H _____
38. F _____
39. Ni _____
40. Hg _____

ELEMENTS CROSSWORD

Name _____



ACROSS

2. Element on which life is based
4. Its low melting point is useful in automatic sprinkler systems.
6. Its common allotropes are red and white.
11. It is a good conductor.
12. Halogen found in seawater
13. Most abundant halogen
14. Gas used in lighted signs to produce a red color

DOWN

1. Most abundant element in air
3. Fire resistant material no longer used due to its carcinogenicity
5. Light element used for lifting airships
7. Ozone is an allotrope of this element.
8. This element is responsible for the odor of rotten eggs.
9. Poisonous element that is also used in medicines and rat poison
10. Most reactive nonmetal

PERIODIC TABLE PUZZLE

Name _____

Group Number

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I																	
	F														G	H	
													B				A
C								E				J					

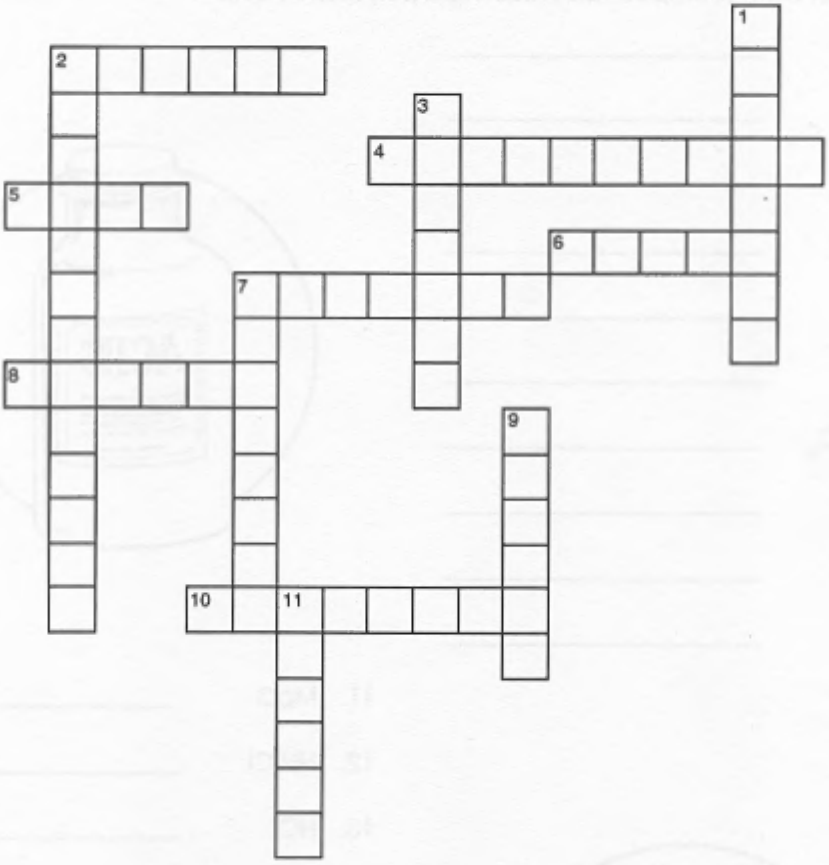
		D												

Place the letter of each of the above elements next to its description below. Each answer may be used only once, so choose the best answer in each case.

1. An alkali metal ____
2. An alkaline earth metal ____
3. An inactive gas ____
4. An active nonmetal ____
5. A semimetal ____
6. An inner transition element ____
7. Its most common oxidation state is -2. ____
8. A metal with more than one oxidation state ____
9. Metal with an oxidation number of +3 ____
10. Has oxidation numbers of +1 and -1 ____

PERIODIC TABLE CROSSWORD

Name _____



Across

2. Group I metals
4. Elements in the middle of the periodic table are the ____ metals.
5. The sum of the protons and neutrons is the _____ number.
6. Inactive gases.
7. The horizontal rows are called _____ .
8. Most of the elements are _____ .
10. Nonmetals tend to form _____ ions.

Down

1. Most active nonmetals
2. Group II metals
3. Atomic number is the number of _____ .
7. Metals tend to form _____ ions.
9. The elements are arranged by atomic _____ .
11. The vertical columns are called families or _____ .