Chemistry: ***Introduction to Chemistry***

Name: _____ Hr: ___

Pure Science vs. Applied Science

pure science ("science") =

In science, we often try to establish a cause-effect relationship

What drives pure scientists?

applied science ("technology") =

EXAMPLE: science:

technology:

What are some pros / cons of our present-day technology?

Science has a **moral component**.

The Science of Chemistry

chemistry =

alchemy = the quest for the Philosopher's Stone, a liquid that would change cheap metals into gold; practiced during the Middle Ages (~500 to ~1300 A.D.)

Chemistry is concerned with **chemicals** =

All matter IS chemicals.

Usually the term "chemicals" brings to mind dangerous or toxic substances.

Chemistry studies the properties of chemicals.

Because chemicals are all around us, chemistry is all around us.

Everyone needs some background in chemistry.

Areas of Chemistry

Organic – study of carbon-containing compounds

Inorganic – study of all substances that DON'T contain carbon

Analytical – measuring quantities very carefully with highly-sensitive instruments

Physical – calculating values

Biochemistry – the chemical reactions inside living creatures

A Career in the Field of Chemistry – What do chemists do?

research chemists discover new products and materials

for every pharmaceutical drug that makes it to market, 10,000 other compounds don't

chemists who work in development design large-scale production equipment and facilities for the manufacture of products and materials

production chemists and technicians monitor production processes to ensure that manufactured products meet quality standards

other jobs for chemists: chemical sales, software engineering, patent law, teaching, banking and finance

The Scope of Chemistry

The **chemical industry** has a large effect on our lives.

bulk chemical manufacturing:

synthetic fibers:

petroleum products:

pharmaceuticals:

All fields of endeavor are affected by chemistry

agriculture, environmental jobs, law, industry, insurance, food service, office products

Government Regulation of Chemicals

The government regulates chemicals to reduce the risk to the…

consumer:

worker:

environment:

Safety in the Science Classroom

The Science Safety Contract must be followed. Violations are intolerable. Common sense should dictate what behaviors are appropriate. You are responsible for each item on the Safety Contract, especially…

wear goggles

no horseplay

handle chemicals, glassware, and equipment will care and respect

stay out of all chemical storage areas

ask your teacher how to properly dispose of chemicals

In case of accident or emergency, remain calm and notify your teacher immediately.

Equipment you should be familiar with:

Material Safety Data Sheet (MSDS)

Federal law requires that every chemical have a Material Safety Data Sheet (MSDS).

The MSDS contains important information about the chemical:

Using Units in Chemistry

Unlike in math, in chemistry we never use numbers by themselves. This is because chemistry involves actual, physical quantities of matter and energy that can be measured.

measurement =

Examples:

In chemistry, you must use units.

The International System (SI System) of Units

The SI system is the system adopted as the worldwide standard system of measurement. This is the system we will use in chemistry. We will never use English system units such as the pound, tablespoon, or ^{o}Fahrenheit. The **base units** for the SI system that you should know are:

Quantity	***Base Unit***	***Symbol***
length		
mass		
time		
amount of substance		
temperature		

Once you are familiar with it, the SI system is easy to use because it is based on multiples of ____.

SI prefixes are used to make the number part of the measurement more manageable.

Examples:

The SI prefixes you should know are:

For the quantity of length…

Scientific Notation

Scientific notation is often used in chemistry to handle very small numbers and very large numbers. Numbers in scientific notation are expressed in the form:

Examples: Write the following numbers in scientific notation.

3000 m

0.007 L

14500000 kg

0.00000004302 cm

Graphs

Often, a large amount of information is more easily conveyed by using a graph. There are 3 main types of graphs.

Line Graph:

Bar Graph:

Pie Graph:

How Does Scientific Knowledge Advance?

1. Sometimes, we set out with a specific goal in mind.

2. People make an observation and then get curious.

3. We also learn by experience.

4. Discovery by accident
   Alexander Fleming, 1920's –
   safety glass –
   shoe protectant –

The Scientific Method

The scientific method is an organized, logical procedure used by scientists to advance scientific knowledge.

Basic Steps of the Scientific Method

1. **observe** –
2. propose a **hypothesis** –

   A hypothesis is often in the "If – Then" format

3. test the hypothesis by conducting **controlled experiments**

variable – any factor that could influence the outcome of an event

In a **controlled experiment**, the variables are altered one at a time.

After each variable is changed, scientists note the effect that particular variable is having on the results of the experiment.

Experiments require **data** –

Experiments must be repeated many times before scientists have confidence in their data.

4. draw a **valid conclusion** –

Conclusions must be supported by data in order to be valid.

Theory vs. Law

A hypothesis that withstands repeated testing may become part of a theory.

theory –

based on all evidence available at the time

theories undergo revision, and are occasionally thrown out altogether

Explaining observed facts of nature with theories involves using models

Models help us simplify what we are trying to study

A **law** of nature states what happens

"Nature is THIS way…"; we do not revise laws

EXAMPLE: the phlogiston theory of burning

How is a burning candle explained by the phlogiston theory?

How did Lavoisier disprove the phlogiston theory?

Some Basic Concepts in Chemistry

In chemistry, we will study chemical reactions.

chemical reaction =

Chemical reactions have two main parts, reactants and products.

reactants =

products =

Example reaction: sodium + water → hydrogen + sodium oxide

2 Na (s) + H_2O (l) → H_2 (g) + Na_2O (s)

Let's visualize what's happening at the "particle level"…

What happens to the **particles** during a chemical reaction?

Is there a **change in energy** associated with a chemical reaction?

The Law of Conservation of Mass:

The Law of Conservation of Mass is one of the fundamental cornerstones of chemistry. Remember it.

Chemical Reactions in Industry

Chemical reactions involving large quantities of substances occur every day in industrial processes. The results of these reactions are the many products we take for granted. Most of these products are NOT produced in a single chemical reaction, but are the result of many reactions, one after the other. Consider, for example, aspirin:

At a large-scale production plant, many factors must be considered:

How to Succeed in Learning Chemistry

1. Learn the language. Take time to learn new vocabulary by going over the new terms several times.
2. Use the illustrations in the textbook.
3. Review your notes frequently. What was complete nonsense the first time around may become clear on the 4^{th} or 5^{th} try.
4. Work as many problems as possible for practice.
5. Do NOT cram for exams. For best results, keep up with your work.

A General Procedure for Solving Problems

In this class, we will often combine our knowledge of chemistry concepts with math to solve simulated, real-world problems. Although no single method of solving problems will work in all situations, you should attempt to follow the "recipe" included below.

1. Read the problem carefully and make a list of "knowns" and "unknowns."
2. Look up any other information you may need. Your lecture outline will have most of the formulas and constants you will use, and you will learn to refer often to the Periodic Table as well.
3. Solve the problem on paper, writing down all relevant information and taking care NOT to skip steps.
4. Check your work. Be sure the units are correct, and ask yourself if the answer seems reasonable.
5. Do as many problems as you can. Repetition builds understanding and confidence.

Student Signature _____ **Date** _____

Teacher Sign-off _____ **Points** _____