Unit 1: Introduction to Chemistry

Name: __________________

Internet web site: www.unit5.org/christjs/

Safety

#1 Rule:
Others: No horseplay.
        No unauthorized experiments.
        Handle chemicals/glassware with respect.

- Safety Features of the Lab

- Material Safety Data Sheet (MSDS)
  --
  -- lists Dos and Don'ts; emergency procedures

- Chemical Exposure
  acute exposure vs. chronic exposure

  e.g., e.g.,

LD_{50}: lethal dosage for 50% of creatures that the chemical is tested on

Example:
Science

- **The Functions of Science**
  
  pure science vs. applied science

  e.g., aluminum e.g.,

  strong

  lightweight

  good conductor

  risk-benefit analysis:

- **How does scientific knowledge advance?**
  
  1.  
  2.  
  3.  
  4.

- **The Scientific Method**
  
  **Key:**
  
  1. Identify an unknown.
  2. Make a hypothesis:

  --

  3. Repeatedly experiment to test hypothesis.

  procedure: order of events in experiment

  variable:

  Experiment must be controlled:

  observation vs. inference

Types of Data

qualitative data vs. quantitative data

-- descriptions -- measurements

e.g.,
e.g.,

**conclusion**: must be based on data
- **Law vs. Theory**

  **law:**
  - does not change
  - never violated
  - e.g.,

  **theory:**
  - based on current evidence
  - e.g.,

  **Phlogiston Theory of Burning**
  1. Flammable things contain phlogiston.
  2. During burning, phlogiston is released into air.
  3. Burning stops when...

- **Chemistry**

  - **The Beginning**
    
    early practical chemistry

  - **The Greeks**
    
    Greeks believed in four elements.
Alchemy (~500 – 1300 A.D.)  
the quest for the Philosopher’s Stone

Alchemical symbols for substances…

transmutation:

In ordinary chemistry…

Contributions of alchemists:

chemistry:

Areas of Chemistry

organic: the study of carbon-containing compounds
inorganic: studies everything except carbon (e.g., metals)
biochemistry: the chemistry of living things
physical: measuring physical properties of substances

Careers in Chemistry

research  
production  
development  
chemical sales  
software engineering  
teaching

The skills you will develop by an earnest study of chemistry will help you in any career field.
- **The Scope of Chemistry**
  - petroleum products
  - synthetic fibers
  - bulk chemical manufacturing
  - pharmaceuticals
  All fields of endeavor are affected by chemistry.

- **Government Regulation of Chemicals** …to protect the…
  - environment
  - consumer
  - worker

### Manipulating Numerical Data

- **Graphs**

  - Bar graph:

  - Pie graph:

  - Line graph:

** In chemistry…

Elements of a “good” line graph:

1. 
2. 
3. 
4.
**Scientific Notation**

-- used for very large or very small numbers, and/or
to indicate precision

Form:

Examples:

\[800 = 8 \times 10 \times 10 = 8 \times 10^2\]
\[2531 = 2.531 \times 10 \times 10 \times 10 = 2.531 \times 10^3\]
\[0.0014 = 1.4 \div 10 \div 10 \div 10 = 1.4 \times 10^{-3}\]

Put in standard form.

\[1.87 \times 10^{-5} = \quad 7.88 \times 10^1 = \]
\[3.7 \times 10^8 = \quad 2.164 \times 10^{-2} = \]

Change to scientific notation.

\[12,340 = \quad 0.008 = \]
\[0.369 = \quad 10,000,000 = \]

**Essential Math of Chemistry**

Units must be carried into answer, unless they cancel.

\[\frac{5.2 \text{ kg} (2.9 \text{ m})}{18 \text{ s} (1.3 \text{ s})} = \quad \frac{4.8 \text{ g} (23 \text{ s})}{18 \text{ s} (37 \text{ s})} = \]

Solve for \(x\).

\[x + y = z\]

\[F = k \times x\]

\[\frac{B \times A}{x} = \frac{T \times R}{H}\]

**SI Prefixes**

kilo- (k) centi- (c)
milli- (m) deci- (d)

Also, \[1 \text{ mL} = 1 \text{ cm}^3\] and \[1 \text{ L} = 1 \text{ dm}^3\]
Conversion Factors and Unit Cancellation

1. How many cm are in 1.32 meters? equality (equivalence statement):
conversion factors:

2. How many m is 8.72 cm?

3. How many kilometers is 15,000 decimeters?

4. How many seconds are in 4.38 days?

Simple Math with Conversion Factors

Find area of rectangle.

Convert to m².

Convert to mm².

For the rectangular solid: L = 14.2 cm W = 8.6 cm H = 21.5 cm
Find volume.

Convert to mm³.

mm and cm differ by a factor of: 
mm² “ cm² “ “ “ “ “ “ 
mm³ “ cm³ “ “ “ “ “ “
Using the Exponent Key

The EE or EXP or E key means “times 10 to the…”

How to type $6.02 \times 10^{23}$:  

```
6 . 0 2 E 2 3
```

do not…

```
6 . 0 2 X 1 0 E 2 3
```
or…

```
6 . 0 2 y x 2 3
```
and do not…

```
6 . 0 2 X 1 0 y x 2 3
```

Also, know when to hit your (–) sign.

```
1 . 2 E 5 \div 2 . 8 E 1 9 =
```

$7.5 \times 10^{-6} \div (-8.7 \times 10^{-14}) =

$5.76 \times 10^{-16} \div 9.86 \times 10^{-4} =

$4.35 \times 10^{6} (1.23 \times 10^{-3}) =

$8.8 \times 10^{11} \times 3.3 \times 10^{11} =

Basic Concepts in Chemistry

chemical:

chemical reaction: a rearrangement of atoms such that

“what you end with” differs from “what you start with”

methane + oxygen $\rightarrow$ carbon dioxide + water

sodium + water $\rightarrow$ hydrogen + sodium hydroxide

Law of Conservation of Mass:

synthesis: putting small molecules together, usually in

many steps, to make something more complex