Name _____ Period _____ Date _____

"Need to know" Review Sheet Scientific Measurements (Appendix A) Part <u>One</u>

Qualitative measurement is expressed in descriptive, nonnumerical form (the water is warm).
Quantitative measurement is expressed in definite form usually with numbers and unit (54°C).

Qualitative or quantitative?

A. The flame is hot. _____ C. A candle's height decreases 4.2 cm/h. _____

B.A candle has a mass of 90 g. _____ D. Wax is soft. _____

In **<u>scientific notation</u>,** a number is written as the product of two numbers:
a coefficient (≥ 1and <10) and 10 raised to a power: 3.5×10^3

If the exponent is **positive**, the number is **bigger than 1** example: $3.5 \times 10^3 = 3500$
(Move decimal point to the **right** to write scientific notation as regular number)

If the exponent is **negative**, the number is **between 0 and 1** example: $2.5 \times 10^{-2} = 0.025$
(Move decimal point to the **left** to write scientific notation as regular number)

Write in scientific notation: 3600 m = _____ 0.00075 cm = _____

379 000 m = _____ 9 99 Kg = _____ 314 ml = _____

Solve scientific notation: 8.5×10^4 = _____ 6.21×10^{-2} = _____

To <u>multiply</u> numbers written in scientific notation, <u>multiply</u> the coefficients and <u>add</u> the exponents.

$$(3.0 \times 10^4) \times (2.0 \times 10^2) = (3.0 \times 2.0) \times 10^{4+2} = 6.0 \times 10^6$$

To <u>divide</u> numbers written in scientific notation, <u>divide</u> the coefficients and <u>subtract</u> the exponents.

$$\frac{(3.0 \times 10^4)}{(2.0 \times 10^2)} = \frac{3.0}{2.0} \times 10^{4-2} = 1.5 \times 10^2$$

You try:

a) $(5.5 \times 10^5) \times (2.0 \times 10^3)$ = _____

b) $\frac{(8.8 \times 10^9)}{(2.0 \times 10^3)}$ = _____

International System of Units (SI)

The standards of measurements used in science are those of the **metric system**. All units are based on 10 or multiples of 10, which makes it simple to use.

The **International System of Units (SI)** is a revised version of the metric system. There are seven SI base units, from which all other units are derived.

Table 1. The Seven SI Base Units

Quantity	SI unit	Symbol
Length	meter	m
Mass	kilogram	kg
Temperature	Kelvin	K
Time	second	s
Amount of substance	mole	mol
Luminous intensity	candela	cd
Electric current	ampere	A

Derived units are for quantities such as
area (m2), volume (m3), density, energy (Joule), pressure (Pascal) etc.

Sometimes **non-SI units** are preferred for practical reasons: **(metric but not SI)**
Examples are liter for volume,
Degree Celsius for temperature,
Calorie for energy, and
Atmosphere or millimeter of mercury for pressure.

Table 2. Commonly Used Prefixes in the Metric System

Prefix	Symbol	Meaning	Factor	Scientific. not.
giga	**G**	1 billion times larger	1 000 000 000	10^{9}
mega	**M**	1 million times larger	1 000 000	10^{6}
kilo	**k**	1000 times larger	1 000	10^{3}
deci	**d**	10 times smaller	1/10	10^{-1}
centi	**c**	100 times smaller	1/100	10^{-2}
milli	**m**	1000 times smaller	1/1000	10^{-3}
micro	**μ**	1 million times smaller	1/1 000 000	10^{-6}
nano	**n**	1000 million times smaller	1/1 000 000 000	10^{-9}
pico	**p**	1 trillion times smaller	1/1 000 000 000 000	10^{-12}

(Watch out for negative exponents for some prefixes in scientific notation)

You will get table 2 on the test.

Practice problems: p. 787 # 1 + 2

"Need to know" Review Sheet Chapter 2 Scientific Measurements Part Two

Table 3. Metric Units of Length

unit	Symbol	Relationship
kilometer	**km**	1 km = 10^3m
meter	**m**	base unit
decimeter	**dm**	10^1 dm = 10 dm = 1 m
centimeter	**cm**	10^2 cm = 100 cm = 1 m
millimeter	**mm**	10^3 mm = 1000 mm = 1 m
micrometer	**μm**	10^6 mm = 1m
nanometer	**nm**	10^9 nm = 1 m

Examples:

5 m = ? mm _____

5 km = ? m _____

50 dm = ? m _____ _____ mm in 1 meter

Length

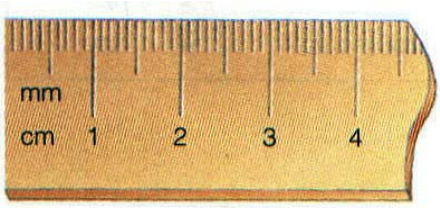


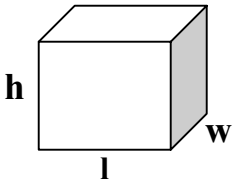
Figure 2.9 A meter stick is divided into 100 divisions. Each division is a centimeter. Each centimeter is divided into 10 millimeters. How many millimeters are there in a meter?

Volume

The space occupied by any sample of matter is called its volume.

for a cube: length x height x width

- ⇨ **m x m x m = m^3 = cubic meter (SI unit for volume);**
- ⇨ about the size of a dishwasher



More convenient is **liter (L),** metric but not SI unit

1 L = 10cm x 10cm x 10cm = 1000 cm^3 (one liter = one cubic decimeter = dm^3)

1 mL = 1 cm x 1 cm x 1 cm = 1 cm^3 (one milliliter = one cubic centimeter)

1 liter (1 L) = _____ mL = _____ cm^3 = _____dm^3

Mass

is a measure of the quantity of matter, constant, regardless of its location.

Weight

is a force of gravity exerted on a given mass,
which varies depending on its location

1 g is 1 cm^3 of liquid water at 4 °C (or 1 kg of water at 4 °C = _____ L)

Imagine yourself on the moon: How would your weight change?
How would your mass change?

Table 4. Metric Units of Mass

Unit	Symbol	Relationship	Example
kilogram	**kg**	base unit	2.2 lbs
gram	**g**	1 g = 10^{-3} kg (or 1000 g = 1 kg)	dollar bill
milligram	**mg**	10^{3} mg = 1 g	ten grains of salt
microgram	**μg**	10^{6} μg = 1g	particle of baking powder

Density is the ratio of the mass of an object to its volume.

$$\textbf{Density} = \frac{\textbf{mass}}{\textbf{volume}} \qquad \textbf{Specific Gravity} = \frac{\textbf{density of substance } \cancel{(g/cm^3)}}{\textbf{density of water } \cancel{(g/cm^3)}}$$

Gases have a much lower density than liquids and solids.
units for density: **g/cm^3** for liquids and solids and **g/L** for gases

Density depends only on the composition of a substance, <u>not</u> on the size of the sample.
Usually the density decreases with increase in temperature and a substance has a higher density in the solid state than as a liquid (exception is ice and cold water).

A copper penny has a mass of 3.1g and a volume of 0.35 cm^3. What is the density of copper?

57.9 g of gold occupy a volume of 3.00 cm^3. Calculate the density.

Table for activity (measuring a sheet of paper)

Unit	length	width
m		
dm		
cm		
mm		

measure as exact as possible