Measurement and Science Study Guide

The purpose of this unit is to explain the basic units of measurement in the metric system. Students will learn the basic units of measurement and the tools used to measure in the metric system as well as the S.I. units of measurement.

Values

Metric System	Volume	Density
Length	Mass	Temperature
	Weight	

Length

Angstrom	Millimeter	Kilometer
Micrometers	Centimeter	Light Year
Nanometer	Meter	

Volume

Rectangular Solid	Liter	Milliliter
Irregular Solid	Meniscus	
Cubic Centimeter	Formula	

Mass and Weight

Mass	Newton	Kilogram
Weight	Milligram	
Gravity	Gram	

Density

Density	Formula for Density	Density of Water

Temperature

Energy	Kelvin	Particle Movement
Celsius	Kinetic Energy	Absolute Zero

Measurement Tools

Micrometer	Triple Beam Balance	Beaker
Metric Ruler	Scales	Thermometer
Meter Stick	Graduated Cylinder	

Chapter 2-1: The Metric System

I. Metrics

A. The scientific system of measurement is called the METRIC SYSTEM
B. It is also called the International System of Units, or "SI".
C. Metric System is a decimal system based on the number 10 and multiples of 10.
D. Scientists us metric units to measure LENGTH, VOLUME, MASS, WEIGHT, DENSITY, AND TEMPERATURE.

II. Length

A. Length is the distance between 2 points and is measured with a metric ruler or meterstick.
B. The basic unit of length is the METER (m).
C. A METER equals about 39.4 inches (a little more than a yard).
D. To measure the length of objects smaller than a meter, the following units are used:
   1. deci = one-tenth or 0.1 of a meter
   2. centi = one-hundredth or 0.01 of a meter
   3. milli = one-thousandth or 0.001 of a meter
      Example: 1 meter = 10 decimeters
      1 meter = 100 centimeters
      1 meter = 1000 millimeters
E. The diameter of the pupil of your eye = about 1 millimeter.
F. For microscopic measurements the following are used:
   micrometers = millionths of a meter
   nanometers = billionths of a meter
G. When measuring atoms, the unit is called an angstrom.
H. To measure the length of objects larger than a meter, the following units are used:
   1. deka = 10 meters
   2. hecto = 100 meters
   3. kilo = 1000 meters
      Example: 10 meters = 1 deka
      100 meters = 1 hecto
      1000 meters = 1 kilo
I. When measuring long distance such as in space, scientists use a unit of distance called the Light-Year.

Chapter 2: The Metric System

III VOLUME is the amount of space an object (liquid or solid) occupies.

A. LIQUID VOLUME

1. 1 liter = 1 quart (approximately)
2. 1 liter = 1000 milliliters
3. Graduated Cylinder is used to measure liquid volume
   a. each division equals 1 milliliter
   b. the surface of the liquid often appears curved
   c. the curve is called a MENISCUS
   d. read the bottom of the meniscus at eye level

B. REGULAR SHAPED SOLID

1. also called a RECTANGULAR solid
2. determine volume by multiplying the length, width and height.
3. Formula is $V = L \times W \times H$
4. volume of a solid is measured in cubic centimeters (cm^3) or (cc)
5. a metric ruler is used to find the volume of a rectangular solid

C. IRREGULAR SHAPED SOLIDS

1. a GRADUATED CYLINDER is used to determine the volume of an irregular shaped
2. fill the cylinder with a certain amount of water and record the volume of water.
3. carefully, place the solid in the water and record the volume of the solid and water.
4. subtract the volume of the water from the combined volume of the solid and water
5. the result is the volume of the irregular shaped solid.
6. the unit of measure is the cubic centimeter (cm^3) or (cc)

IV. Mass

1. Is the measure of matter in an object.
2. Example: There is more Mass in a car than in a bicycle.
3. Tool: Triple Beam Balance (grams)
4. Units of Measure: Kilograms (kg) for large objects
   Grams (g) for smaller objects
5. Example: A standard brick has a mass of 1 kg.
6. 1 kg equals about 2.2lbs.
7. The Mass of an object is constant – it does not change.

V. Weight

1. Is the amount of force Earth's gravity exerts on an object.
2. Gravity is a force of attraction
3. Since weight can be considered a force, it is measured in Newtons.
4. The weight of an object can change depending on location.
5. The force of gravity changes with distance, so your weight will change depending on your location.
6. Example: When standing on the top of a mountain, your weight will be LESS than when you are standing at sea level. At the top of the mountain, the pull of gravity is less than it is at sea level.

Mass

Definition: ______________________________

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Unit of Measurement: ______________

Tool used to measure mass: ______________

Examples: ______________________________

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Weight

Definition: ______________________________

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Unit of Measurement: ______________

Tool used to measure weight: ______________

Examples: ______________________________

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Name ______________________________ Date ______________

Measuring Metric Length

Scientists measure length using the decimal system of measure. The meter is the base of this system. All smaller units are divisions of the meter. All larger units are multiples of the meter. Use the words in the word box to identify the unit descriptions in 1–4. Then write the correct metric measurement to use for each description in 5–10. Some words are used more than once.

millimeter	centimeter	meter	kilometer	decimeter

1. ______________ This long unit of measurement can be used to measure great distances. It is equal to 1000 meters.

2. ______________ This very small unit of measurement can be used to measure tiny objects. 1000 of these equals 1 meter.

3. ______________ This measurement is about the width of your pinkie finger. 10 millimeters is equal to this.

4. ______________ This measurement is the standard for metric linear measurement. 1000 millimeters, 100 centimeters, and 10 decimeters each are equal to this.

5. ______________ Measure the distance from your house to the nearest amusement park.

6. ______________ Measure the height of your lab partner.

7. ______________ Measure the height of a 32-story building.

8. ______________ Measure the width of the common house fly.

9. ______________ Measure the width of your classroom.

10. ______________ Measure the diameter of a marble.

METRIC TREASURE HUNT

Find an object in the classroom that will fit into each category given below.

Objects that measure 5 centimeters 1. 2.	Objects that hold about 10 milliliters 1. 2.	Objects that hold about 500 milliliters 1. 2.
Objects that measure 1-5 millimeters 1. 2.	Objects that weigh about 1-5 grams 1. 2.	Objects that weigh about 1 kilogram 1. 2.
Objects that measure about 1 meter 1. 2.	Objects that hold about 1 liters 1. 2.	Objects that hold over 100 liters 1. 2.
Objects that measure 10 meters 1. 2.	Objects that weigh approximately 50 grams 1. 2.	Objects that hold up to 2 liters 1. 2.

Name: ______________________________ Section: ______

Jacob's Experiment

Directions: Read the passage below and complete the questions to show your understanding of Jacob's experiment.

Jacob, a landscaper, wondered if a particular tree would grow better in the sun or in the shade. Without collecting information or doing much research, Jacob claimed that if he could limit the amount of sunlight the tree was exposed to, then the tree would grow taller. To test this idea, Jacob planted 10 trees in a shady area and 10 trees in an area with a significant amount of sunlight. Over the next several months, Jacob watered and fertilized each tree in the exact same way. He also took measurements of the tree's height and averaged them. The data he took is below.

Month	**Average Tree Height in the Sun** (meters)	**Average Tree Height in Shade** (meters)
April	0.2	0.2
May	0.5	0.5
June	0.8	0.6
July	1.1	0.7
August	1.4	0.9
September	1.8	1.0

1. Underline Jacob's hypothesis in the story above.

2. What factor is the independent variable in the experiment? Explain your reasoning.

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3. What factor is the dependent variable in the experiment? Explain your reasoning.

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4. Identify **two** constants in the experiment.

5. Using the grid below, construct a double line graph using the data above. Graph both sets of data on the same graph. Make sure your graph has a title, labeled x & y axis, the appropriate number scale and a key.

6. According to the data as illustrated in the graph above, do you think the data/results support Jacob's hypothesis? Why or why not?