I. <u>What is Density</u>?

- A. A substance's density is a _____.
- B. Density is defined as the ______ of a matter in a certain amount or ______.
 - 1. The quantity of the material (matter) is its
 - 2. The amount of space occupied by the material is its _____.
- C. Phases of Matter
 - 1. _____
 - a. Retains a fixed volume and
 - b. ______ particles locked into place
 - c. Most materials are _____ in their solid phase.
 - 2.
 - a. Takes the _____ of its container
 - b. Compressible and capable of _____
 - c. _____ and _____ are fluids
 - (1) Liquids
 - (a) Assume the shape of the part of the container which they occupy
 - (b) Particles can move/slide past one another
 - (2) Gases
 - (a) Assume the shape and volume of the container which they occupy.
 - (b) Particles can move past one another
 - (c) Easily compressible
 - (d) Will expand to the volume of the container it occupies

II. Finding Density

A. Density is the ratio of a substance's ______ to its ______.

- 1. <u>Measure the Mass</u>
 - a. Use a ____

is commonly used.

2. <u>Measure the Volume</u>

- a. Liquids
 - (1) Use a volumetric container that is appropriate to the fluid (e.g., graduated cylinder or beaker)
 - (2) Volume units
 - (a) The SI unit for volume is the _____
 - (b) This is usually used for _____.
 - (c) The ______ is commonly used for density measurements.

- Solids b.
 - (1) Objects with ______ geometric shapes can be measured and then the values can be substituted into the appropriate equation for volume.
 - (2) ______ can be used for irregularly shaped objects.
 (3) Units: Usually expressed as ______ instead of liters or milliters.

B. Substitute Values into the Density Equation

1. It can be expressed using the equation:

Density = $\frac{\text{mass}}{\text{volume}}$

- 2. Density Units
 - a. Denisty is labeled using a _____ unit.
 b. For _____ use g/cm³

 - c. For use g/mL.
- C. Comparing Densities by Flotation in Water



III. **Factors Affecting Density**

- Temperature A.
 - 1. As the temperature of most substances increases
 - a. Atoms move faster and spread apart.
 - b. Expansion ______ the volume which ______ the density
 because the mass

 c. This is an

 relationship.

Β. Pressure

- 1. Solids
 - a. At great depths below Earth's surface there is extremely high pressure from the overlying rocks.
 - Minerals are compressed b.
 - (1) Volume _____.
 - (2) Density ______.
 (3) This is a ______ relationship.
- 2. Fluids (Particularly gases such as the atmosphere)

a. As pressure gases expand.

b. This results in an _____ in volume.

- c. Density_____.
- d. This is a _____ relationship.

C. <u>Shape and Size</u>

- 1. If the temperature of a materials remains constant, the size and shape will **not** affect it's density.
- 2. The mass and volume change ______.

D. <u>Phase of Matter</u>

- 1. For most substances particles are most closely packed in the _____ phase.
- 2. Most materials are ______ in their solid phase.
- 3. Water is densest as a _____
 - a. As liquid water cools, it contracts and becomes denser until its temperature reaches 4° Celsius (3.98° C).
 - b. As water cools from 3.98° C to 0° C it _____, becoming _____ dense.
 - c. This has profound implications.
 - (1) Ice floats resulting in
 - (a) Icebergs_____ in the ocean
 - (b) Lakes freezing from the top down.
 - (2) Expanding water in pipes and cracks in rocks will cause them to break apart.
 - d. The reason for this unusual property is the nature of the water molecule.
 - (1) Two hydrogen atoms are tightly bonded to the oxygen atom.
 - (2) The molecule's shape is asymmetrical and polarized.
 - (a) One side is positively charged
 - (b) The other side has a slight excess of negative charge.
 - (3) When water is in the liquid state
 - (a) Molecules are moving around.
 - (b) Because of polarity some molecules are slightly attracted to one another
 - (c) The are closer together than in most liquids.
 - (4) When water freezes
 - (a) Bonding hydrogen atoms are shared between adjacent water molecules.
 - (b) An orderly, hexagonal pattern results.
 - (c) The open honeycomb-like crystal structure contrasts with the more closely packed molecules in liquid water.



