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1. When particles are **CLOSER TOGETHER**, DENSITY is GREATER.
2. Particles in SOLIDS have FEWER SPACES between them.
The ATTRACTIVE FORCES between the particles in a **SOLID** PREVENT the particles FROM COMING APART.
For a LIQUID, an object moves through a FLUID pushing the particles apart because ATTRACTIVE FORCES between particles are WEAKER.
3. A CHANGE IN DENSITY of a substance ONLY OCCURS if a STATE CHANGE OCCURS.
Water change its density will DECREASE if water is WARMED i.e. state changes from a LIQUID to WATER VAPOUR.
4. When every LIQUID has a GREATER DENSITY than a SOLID, the SOLID will FLOAT on it.
The force of gravity upon one unit VOLUME of that liquid will be greater than the force of GRAVITY on the SOLID.
GRAVITY will pull the MORE MASSIVE PARTICLES of the LIQUID to a LOWER LEVEL than the LESS MASSIVE PARTICLES of the SOLID.
THIS PROCESS forces the SOLID to FLOAT on the LIQUID.

NOTE: If substances have the SAME VOLUME, they can have DIFFERENT MASSES.

If VOLUME is the SAME and MASSES are DIFFERENT, then DENSITY MUST BE DIFFERENT.

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1. GOLD is red, hot in the LIQUID STATE. At that temperature, PARTICLES are MOVING QUICKLY, ARE FAR APART, and are LESS ATTRACTED TO EACH OTHER than in the SOLID STATE.
NOTE: A number of gold particles in LIQUID STATE occupies a LARGER VOLUME than the SAME number of gold particles in the SOLID STATE.
LIQUID GOLD is SLIGHTLY LESS DENSE than SOLID GOLD. (Most substances are like this.)
2. Water particles are far apart and AIR particles are VERY FAR APART so the particles move more easily out of the way of a moving dolphin.
3. NOTE: Your table should be NEAT, well organized, and LABELLED. Items DENSER than water will SINK.
4. Warm air expands, become less dense and rise.
Cool air contracts, become more dense and descend(drop).
- 5.
6. "EMPTY SPACE" has NO MATTER AT ALL. It is a COMPLETE VACUUM.
"AIR" is mostly empty space but it does have air particles flying around in it.
7. The particles in water are CLOSER TOGETHER and MORE STRONGLY ATTRACTED TO EACH OTHER. It is HARDER to move through particles in a LIQUID like water.

PAGE 312 Using TABLE on page 312

$$1. \quad D = D = \frac{m}{V}$$
$$D = \frac{(8.1 \text{ g})}{(3.0 \text{ cm}^3)}$$
$$= 2.7 \text{ g/cm}^3$$

The density of the metal is 2.7 g/cm³ SO it is ALUMINUM.

$$2. \quad D = \frac{m}{V}$$
$$D = \frac{(3.15 \text{ g})}{(2.5 \text{ mL})}$$
$$= 1.26 \text{ g/mL}$$

The density of the metal is 1.26 g/mL SO it NOT water since WATER has a density of 1.0 g/mL.

$$3. \quad D = \frac{m}{V}$$
$$D = \frac{(2.0 \text{ g})}{(1000 \text{ mL})}$$
$$= 0.0020 \text{ g/mL}$$

The density of the gas is 0.0020 g/mL SO the gas is probably CARBON DIOXIDE.

PAGE 313 Using table on 312

$$1. \quad V = \frac{m}{D}$$
$$= \frac{(9.66 \text{ g})}{(19.32 \text{ g/cm}^3)}$$
$$= 0.50 \text{ cm}^3$$

The VOLUME is 0.50 cm³.

$$2. \quad V = \frac{m}{D}$$
$$= \frac{(15 \text{ g})}{(0.0002 \text{ g/mL})}$$
$$= 75 \text{ 000 mL}^3$$

SO HELIUM would occupy 75 L.

$$3. \quad V = \frac{m}{D}$$
$$= \frac{(250 \text{ g})}{(1.03 \text{ g/mL})}$$
$$= 243 \text{ mL}$$

The VOLUME of SEA WATER is 243 mL.

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1. $m = V \times D$
= (20 000 mL) x (0.0014 g/mL)
= 28 g
It's mass is 28 g.
2. $m = V \times D$
= (6.5 cm³) x (8.92 g/cm³)
= 57.98 g
COPPER has a mass of 58 g.
3. $m = V \times D$
= (7.0 mL) x (0.90 g/mL)
= 6.3 g
MACHINE OIL has a MASS of 6.3 g.

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1. To find DENSITY, you need to measure both VOLUME and MASS of the substance.
2. $D = \frac{m}{V}$

MEASURE an OBJECT with an IRREGULAR SHAPE

3. To measure the VOLUME with an IRREGULAR SHAPE,
put a volume of water into a **graduated cylinder** and measure the VOLUME ACCURATELY.
Place small objects into the water, causing the water level to rise in the cylinder.
Read the new volume level.
THE **DIFFERENCE** between the **FIRST VOLUME** from the **SECOND VOLUME LEVEL** must be the
volume of the irregular shape. **DISPLACEMENT**
4. If the mass of a **PURE SUBSTANCE INCREASES**, there must be MORE OF IT, THUS, the
VOLUME must also INCREASE.

PAGE 321.

1. GOLD is most dense. It is a SOLID at room temperature.
2. HYDROGEN is LEAST DENSE. It is a GAS at room temperature.
3. SOLIDS tend to be MOST DENSE.
4. GOLD is DENSER than MERCURY.

PAGE 321 ANALYZE ANSWERS

1. ANY substance with DENSITY LESS THAN 1.0 g/cm^3 , will FLOAT on WATER.
2. ANY substance with DENSITY GREATER THAN 1.0 g/cm^3 , will SINK in WATER.

PAGE 322

1. $D = \frac{m}{V}$
 $D = \frac{(1780 \text{ g})}{200 \text{ cm}^3}$
 $= 8.9 \text{ g/cm}^3$

The density of the metal is 8.9 g/cm^3 SO it is NICKEL.

2. $D = \frac{m}{V}$
 $D = \frac{(972 \text{ g})}{360 \text{ cm}^3}$
 $= 2.7 \text{ g/cm}^3$

The density of the metal is 2.7 g/cm^3 ; it is ALUMINUM.

3. $D = \frac{m}{V}$
 $D = \frac{(132.79 \text{ g})}{9.8 \text{ mL}}$
 $= 13.6 \text{ g/mL}$

The density of the gas is 13.6 g/mL SO the gas is probably MERCURY.

4. $D = \frac{m}{V}$
 $D = \frac{(1404 \text{ g})}{650 \text{ cm}^3}$
 $= 2.2 \text{ g/cm}^3$

The density is 2.6 g/cm^3 ; it is SALT

5. $D = \frac{m}{V}$
 $D = \frac{(1422 \text{ g})}{1800 \text{ cm}^3}$
 $= 0.79 \text{ g/cm}^3$

The density of the gas is 0.79 g/cm^3 SO it is ETHYL ALCOHOL.

PAGE 323

1. Density of a 2 cm³ with mass 3.18 g:

$$D = \frac{m}{V}$$

$$D = \frac{(3.18 \text{ g})}{(2 \text{ cm}^3)} \\ = 1.59 \text{ g/cm}^3$$

Handwritten: $D = \frac{m}{V}$
 $PD = \underline{11.349}$

2. LEAD has a GREATER DENSITY.
3.

SUBSTANCE	MASS (g)	VOLUME (cm ³)	DENSITY (g/cm ³) MASS to VOLUME RATIO
ALUMINUM	5.40	2.00	2.70
SALT	6.48	3.0	2.16
COPPER	44.6	5.0	8.92
OAK	0.33	0.47	0.70
SALT	8.64	4.0	2.16

4. The DENSITY of WATER: 1.00 g/mL
Regular soft drinks must have a greater density MORE than 1 and DIET POP must have a DENSITY of LESS than 1.
5. Density of a PURE SUBSTANCE is ALWAYS THE SAME (at the SAME TEMPERATURE and pressure).
MASS of a PURE SUBSTANCE is DIRECTLY PROPORTIONAL to ITS VOLUME.
Adding one more mL of liquid always adds precisely the SAME MASS.
6. The volume of a LIQUID is measured using a GRADUATED CYLINDER.
The volume of any solid can be measured by submerging it into a liquid and measuring the displaced liquid.
If the solid has a regular shape $V = lwh$
GASES fill the container so VOLUME of a GAS is the VOLUME of the container.
7. The mass-to –volume ratio of a substance is the DENSITY of the substance.
8. DISPLACEMENT of WATER can be used to measure the volume of any solid, liquid or gas, as long as the substance is NOT SOLUBLE in the water. The displaced water would have the same volume as the item displacing it.

9. COPPER is SOLID. Particles are very close together and strongly attracted to each other. The MERCURY atoms will NOT be able to FLOW between the copper particles. The mercury will eventually diffuse into the copper; silver copper/mercury amalgam is created which takes a very long time to happen.

Chapter Review Page 330-331

1. Density is the RATIO of MASS to UNIT VOLUME.
2. The MORE CLOSELY the particles of a pure substance are packed, the MORE DENSE the substance.
The MORE MASSIVE each particles, the MORE DENSE it will be.
3. The particles are packed much more closely in a LIQUID WATER than they are in WATER VAPOUR. (At room temperature water in liquid form is 2000 times denser.)
4. A lump of solid can push aside the particles in the liquid or gas, so the solid lump can move through the liquid.
5. An example where a LIQUID state is DENSER than a solid:

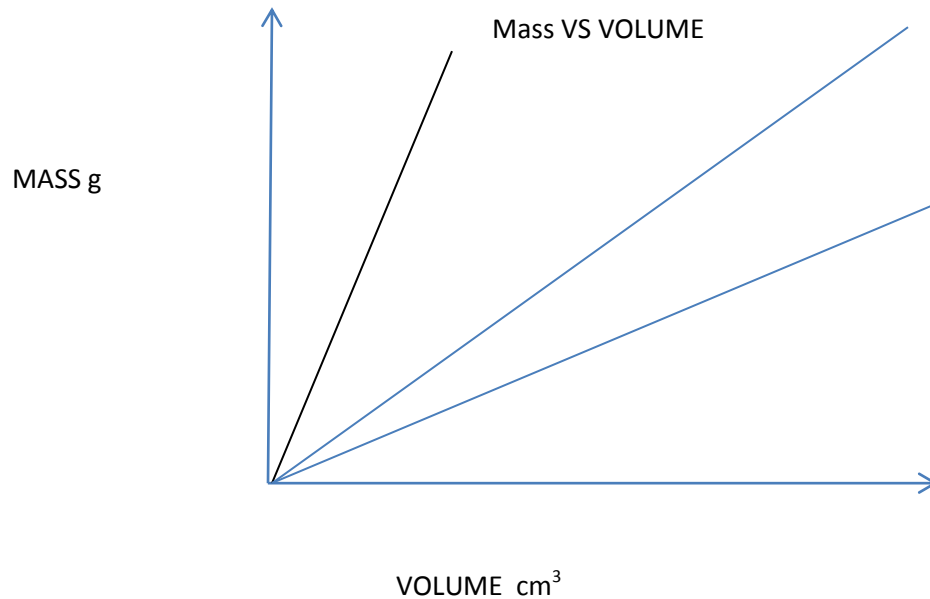
Liquid water is denser than solid wax
6. The volume of an irregular shaped object can be measured ONLY by DISPLACEMENT OF WATER because you can never take all the measurements you would need to calculate the volume with a formula.
7. MASS is the TOTAL QUANTITY OF MATTER in an object.

DENSITY is the AMOUNT OF MASS in a GIVEN VOLUME of a substance.
8. For density of a substance to remain constant, TEMPERATURE and PRESSURE must REMAIN THE SAME.
9. A draft near a window:

As warm air near a window cools down , particles move less getting closer together. They get MORE DENSE causing a draft of cold air near the window.

10. A) material 1 has the largest mass 50 cm³ has a mas of 570 g.
 B) Material 3 takes up the MOST SPACE. 100g occupies 40 cm³.
 C) Material 1 D= 11 g/cm³
 Material 2 D= 8.0 g/cm³
 Material 3 D= 2.6 g/cm³

11.



- B) mass to volume ratio for each measurement is 1.0000 g/cm³.
 C) Mystery substance from Table 8.1 on page 312 is WATER.
 D) The line for the HIGHER DENSITY will lie ABOVE and TO THE LEFT of WATER. LOWER DENSITY line will lie BELOW and to the RIGHT of water.

12. Four methods all use a GRADUALTED CYLINDER as a measuring instrument.

WATER:

Pour into graduated cylinder to measure VOLUME.

ICE:

HALF FILL graduated cylinder .Add ice cubes to water and measure the
 DIFFERENCE in VOLUME of WATER (the displacement)

FILL water bottles to brim with water. Pour into graduated cylinder to measure its volume.

Put water vapour Into a contain of known volume, like the water bottle above.

13. DENSITY of GOLD is GREATER than the DENSITY of FEATHERS. GOLD particles must be more densely packed than the feathers. 1 kg gold will occupy LESS space than 1 kg of feathers.

14. Density and viscosity are NOT directly related. They VARY INDEPENDENTLY of each other.

Ex. Density of oil is LESS than density of WATER

OILS viscosity is GREATER than viscosity of water.

Density of molasses is more than density of water.

Viscosity of molasses is GREATER than the viscosity of water

Density depends on MASS and SIZE of each particle.

VISCOSITY depends on "STICKINESS" of the particles and their ability to interfere or tangle with the motion of other particles.