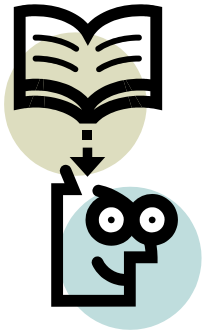
Density

Specific Gravity

Specific Volume



Reference text: Pharmaceutical Calculation by Stoklosa; Latest edition.

No	Lecture title
1.	Some fundamentals of measurements and calculations.
2.	Interpretation of prescription or medication orders.
3.	The metric system.
4.	Calculation of doses.
5.	Reducing and enlarging formulas
6.	Density, specific gravity and specific volume.
7.	Isotonic and Buffer Solutions

Lecturer:

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Density, Specific Gravity and Specific Volume

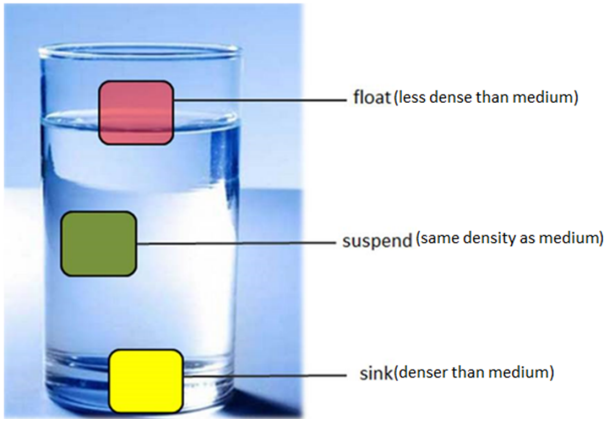
Common topics

- Define *density, specific gravity, and specific volume and determine each through appropriate* calculations.
- Calculate specific gravity from data derived from the use of a pycnometer.
- Apply specific gravity correctly in converting weight to volume and volume to weight.

Density (d):

It is mass per unit volume of a substance and is usually expressed as grams per cubic centimeter (g/cm^3).

The density of water is 1 g/cm^3.



$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Example: if 10 mL of sulfuric acid weighs 18 g, its density is:

$$\text{Density} = \frac{18\ (g)}{10\ (mL)} = 1.8 \text{ grams per milliliter}$$

Specific gravity (Sp. gr.)

It is a ratio, expressed decimally, of the weight of a substance to the weight of an equal volume of a substance chosen as a standard, both substances at the same temperature.

Water is used as the standard for the specific gravities of liquids and solids.

$$\text{Sp. gr.} = \frac{\text{Weight of substance}}{\text{Weight of equal volume of water}}$$

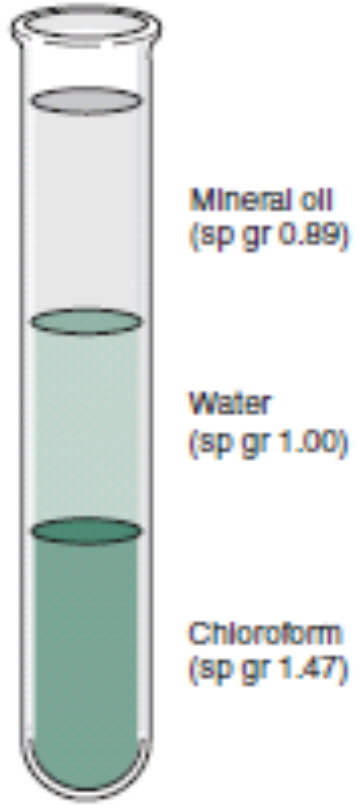
Example: if 10 mL of sulfuric acid weighs 18 g, and 10 mL of water, under similar conditions, weighs 10 g, the specific gravity of the acid is:

$$\text{Sp. gr.} = \frac{18\ (g)}{10\ (g)} = 1.8$$

Density, Specific Gravity and Specific Volume

- Substances that have a specific gravity less than 1 are lighter than water.

- Substances that have a specific gravity greater than 1 are heavier than water.



Density, Specific Gravity and Specific Volume

- It is important to remember that specific gravity is a factor that expresses how much heavier or lighter a substance is than water, the standard with a specific gravity of 1.0.

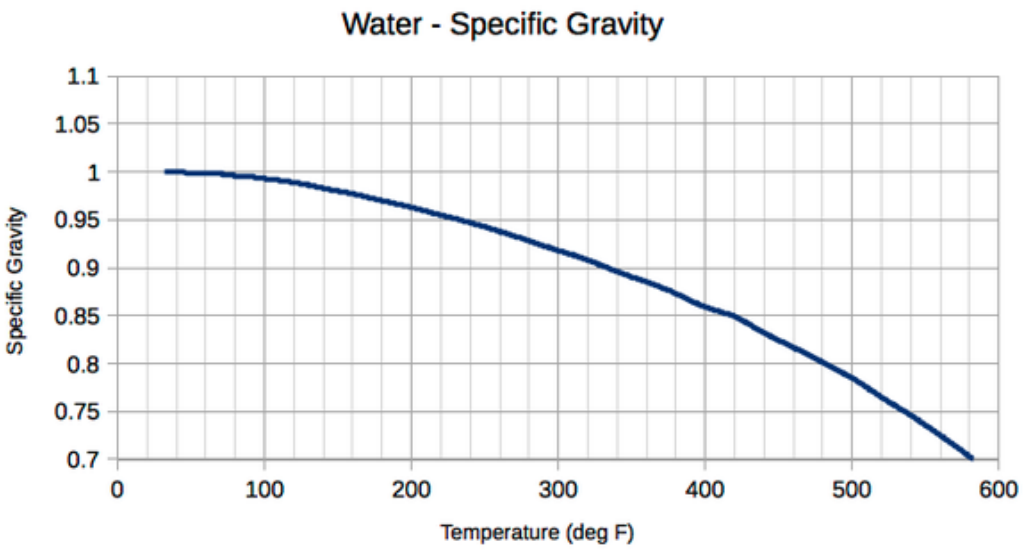
For example, a liquid with a specific gravity of 1.25 is 1.25 times as heavy as water, and a liquid with a specific gravity of 0.85 is 0.85 times as heavy as water.

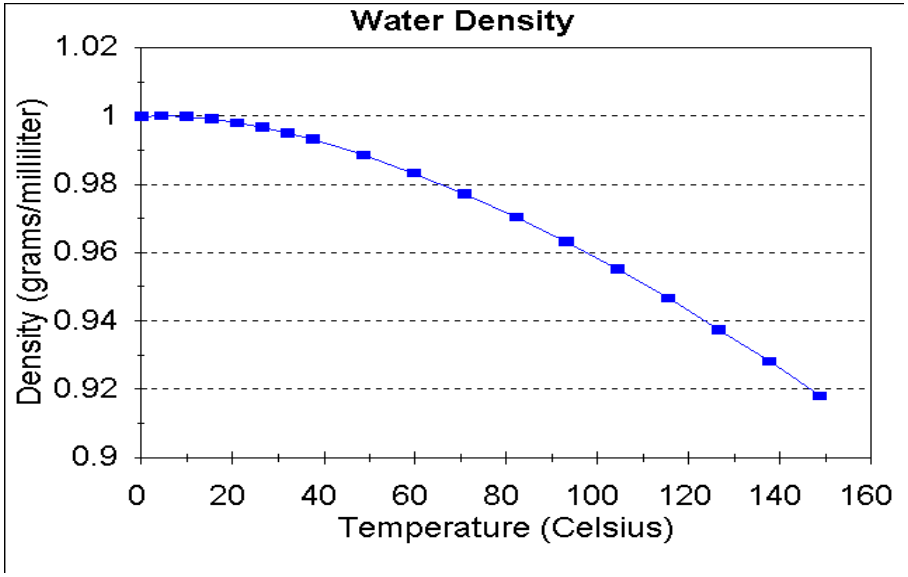
- Thus, if we had 50 mL of a liquid with a specific gravity of 1.2, it would weigh 1.2 times as much as an equivalent volume of water.

An equivalent volume of water, 50 mL, would weigh 50 g, and therefore the liquid would weigh 1.2 times that, or 60 g.

Density, Specific Gravity and Specific Volume

Density and specific gravity are affected by changing temperature





Calculating the Specific Gravity of Liquids

Examples:

If 54.96 mL of an oil weighs 52.78 g, what is the specific gravity of the oil?

- 54.96 mL of water weighs 54.96 g

$$\text{Sp. gr. of oil} = \frac{52.78\ (g)}{54.96\ (g)} = 0.9603$$

Calculating Weight, Knowing the Volume and Specific Gravity

Grams (other liquid) = Grams (of equal volume of water) x Specific gravity (other liquid)

Examples:

What is the weight, in grams, of 3620 mL of alcohol with a specific gravity of 0.820?

3620 mL of water weigh 3620 g

3620 g x 0.820 = 2968 g, answer.

Density, Specific Gravity and Specific Volume

Examples:

What is the weight, in grams, of 2 fl. oz. of a liquid having a specific gravity of 1.118?

In this type of problem, it is best to convert the given volume to its metric equivalent first and then solve the problem in the metric system.

2 x 29.57 mL = 59.14 mL

59.14 mL of water weigh 59.14 g

59.14 g x 1.118 = 66.12 g, answer.

Calculating Volume, Knowing the Weight and Specific Gravity

$$\text{Milliliters} = \frac{\text{Grams}}{\text{Specific gravity}}$$

Examples:

What is the volume, in milliliters, of 492 g of nitric acid with a specific gravity of 1.40?

492 g of water measure 492 mL

$$\frac{492\ (g)}{1.4\ (g)} = 351\ mL$$

Calculating Specific Volume

Specific volume (SP. Vol.)

It is usually defined as an abstract number representing the ratio, expressed decimally, of the volume of a substance to the volume of an equal weight of another substance taken as a standard, both having the same temperature.

Note:

Sp.gr.& sp.vol. are reciprocal, if it multiplied together, the product is 1.

Example:

If 25 gm of glycerin measure 20 ml & 25 gm of water measure 25 mL, under the same conditions Calculate the sp. Vol.?

$$\frac{\text{Volume of 25 g of glycerin}}{\text{Volume of 25 g of water}} = \frac{20\ (\text{mL})}{25(\text{mL})} = 0.8$$

Example:

Calculate the specific volume of a syrup, 91.0 mL of which weighs 107.16 g?

107.16 g of water measures 107.16 mL

$$\text{Sp. vol. of syrup} = \frac{91.0\ (\text{mL.})}{107.16\ (\text{mL.})} = 0.849, \textit{ answer}$$