

EXPERIMENT NO. 2

MEASUREMENT OF DENSITIES AND SPECIFIC GRAVITIES

I. INTRODUCTION

EXPERIMENT A: Determining Specific Gravity Using a Hydrometer

EXPERIMENT B: Determining Specific Gravity Using a U-Tube Manometer

A manometer is a tube usually bent in a form of a U, containing a known specific gravity, the surface of which moves proportionally to changes on pressure. It is used to measure pressure.

The three types of manometer are open type, differential type, and piezometer. The open type manometer has an atmospheric surface in one leg and is capable of measuring gage pressures. A differential type manometer is without an atmospheric surface and capable of measuring only differences of pressure. A piezometer is the simplest form of open manometer. It is a tube tapped into a wall of a container or conduit for the purpose of measuring pressure. The fluid in the container or conduit rises in this tube to form a free surface.

II. OBJECTIVES

EXPERIMENT A: To determine densities and specific gravities using a hydrometer

EXPERIMENT B: To be able to get the specific gravity of the kerosene using the manometer

III. SKETCH OF APPARATUS

Hydrometer – an instrument that is used to determine specific gravity.

Hydrometer Jar - a transparent glass tube that is filled with liquid being measured.

Manometer – an instrument for measuring the pressure acting on a column of fluid, especially with a U-shaped tube of liquid in which a difference in the pressure acting in the two arms of the tube causes the liquid to reach different heights in the two arms.

IV. LABORATORY PROCEDURE

EXPERIMENT A:

METHOD:

- (a) Fill one hydrometer jar with sufficient water to float the hydrometer and check that the scale marking corresponding to depth of immersion reads 1.00
- (b) Fill three hydrometer jars with the liquids to be tested with sufficient of the liquids to float the hydrometer and note for each liquid the scale reading.

NOTE: It is suggested that the liquids should be those to be used in Experiment 2 for determining the viscosity of liquids: an engine oil, glycerol, and castor oil.

EXPERIMENT B:

1. Set up the manometer.
2. Place water to the tube.
3. Place kerosene after you placed the water.
4. Record the reading of the pressure head.
5. Repeat steps 3 and 4 for the succeeding trial.
6. Solve for the specific gravity.

V. RESULTS

EXPERIMENT A:

Liquid	Density, ρ	
	gm/ml	kg/m ³
Water	1.000	1000
Kerosene	0.780	780
Diesel	0.835	735
Cooking Oil	0.910	910

EXPERIMENT B:

GROUP NO.	TRIAL NO.	γ_{H_2O} (kN/m ³)	h_w (m)	h_K (m)	S_w	S_K
Kerosene	1	9.81	0.230	0.290	1	0.793
	2	9.81	0.262	0.333	1	0.787
	3	9.81	0.144	0.176	1	0.818
Diesel	1	9.81	0.0115	0.0137	1	0.831
	2	9.81	0.181	0.216	1	0.838
	3	9.81	0.110	0.127	1	0.866
Cooking Oil	1	9.81	0.256	0.282	1	0.908
	2	9.81	0.298	0.327	1	0.911
	3	9.81	0.268	0.237	1	0.934

VI. SAMPLE COMPUTATION

EXPERIMENT A:

Given:

$$\rho_{H_2O} = 1.00 \frac{gm}{ml}$$

Solution:

Water:

$$\rho_{H_2O} = 1.00 \frac{gm}{ml} \cdot \left(\frac{1 ml}{1 cc} \right) \cdot \left(\frac{100 cm}{1 m} \right)^3 \cdot \left(\frac{1 kg}{1000 gm} \right) = 1000 \frac{kg}{m^3}$$

EXPERIMENT B:

Given:

$$h_w = 0.023 m$$

$$h_k = 0.029 m$$

Trial 1:

$$S_K = \frac{h_w}{h_k}$$

$$= \frac{0.023}{0.029}$$

$$S_K = 0.793$$

VII. CONCLUSION

Density is the degree of compactness of a substance. It is the degree of consistency measured by the quantity of mass per unit volume. Furthermore, specific gravity is the ratio of the density of a substance to the density of a standard, usually water for a liquid or solid, and air for a gas. In this experiment, we need to determine the densities and specific gravities of a liquid using a hydrometer and an open-type manometer.

On the first part of the experiment, we used the hydrometer. Different fluids were placed in the hydrometer jar to clearly read the data. We let the hydrometer float into the fluid until it stops moving. Then we record the data. We concluded that as the density of a particular liquid increases its specific gravity will increase as well due to its directly proportional relationship. After collecting all the data, we conclude that water is the densest among the fluids and the kerosene is the least dense of all the fluids.

For the second part, we used the U-tube manometer. This device can determine the specific gravity of a fluid with the use of pressure heads. The line wherein the interface of the two liquids occur will be the reference line. The height being recorded from the reference line will be used to calculate the specific gravity of the fluid. In calculating the specific gravity of the fluid, we need to divide the height of the water to the height of the fluid. For the specific gravity of the water, its value will always be constant 1.00. With the recorded data, we concluded that as the height of the fluid increases, the value of its specific gravity will decrease. Therefore, their relationship is inversely proportional.

VIII. APPLICATION TO ENGINEERING

Density and Specific Gravity are essential to engineers. Engineers when it comes to ships should make a transportation that will float through the water. By knowing the density and specific gravity of the ship, they will know if this will cruise through the ocean. For civil engineers, knowing the specific gravity of a fluid is important when it comes to configuring a mixer because it will affect the horsepower and torque that is necessary to suitably mix the fluid. If a fluid has a higher specific gravity, more torque should be needed to create a desired result. If we did not include the specific gravity of the fluid, erroneous result will occur which may also lead to motor damage or failure of the engine of the mixer.

IX. REFERENCE

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