

Cameron Sutton

HW 1.1

1.107.) Purpose: Find the density of Alcohol in slugs/ft³ and g/cm³

107, 18, 35

Sources: Mott, R., Untener, J.A. "Applied Fluid Mechanics," 7th Edition

Design Consideration: Constant properties, incompressible fluid

Data: SG = 0.79, $\rho_w @ 4^\circ\text{C} = 1000 \text{ kg/m}^3$ or 1.94 slugs/ft^3

Procedure: I will use specific gravity formula to calculate the density and then convert units.

Calculation:

$$SG = \frac{\rho_f}{\rho_w @ 4^\circ\text{C}}$$

$$0.79 = \frac{\rho_f}{1000 \text{ kg/m}^3}$$

$$790 \text{ kg/m}^3 = \rho_f$$

$$.79 \text{ g/cm}^3 = \rho_f$$

$$SG = \frac{\rho_f}{\rho_w @ 4^\circ\text{C}}$$

$$0.79 = \frac{\rho_f}{1.94 \text{ slugs/ft}^3}$$

$$1.5326 \text{ slugs/ft}^3 = \rho_f$$

Summary: Using the provided data and the constant values of the density of water at 4°C , I was able to find the density of Alcohol.

Materials: Alcohol

Analysis: In this problem we were given the specific gravity of alcohol. Since the properties of fluids vary with temperature when the temperature is increased the specific gravity also increases and vice versa.

2.18.) Purpose: Find the value of the viscosity of Water at 40°C .

Drawing: N/A

Source: Mohl, R., Untener, J.A., "Applied Fluid Mechanics", 7th Edition,
Pearson Education, Inc. (2015)

Design Considerations: Constant properties, incompressible fluid

Data: Water at 40°C

Procedure: I will use the Appendix in the textbook to locate the dynamic viscosity of water at the specified temperature.

Calculations: $\eta = 6.5 \times 10^{-4} \text{ N}\cdot\text{s}/\text{m}^2$

Summary: By using the provided data in the textbook, it was found that the dynamic viscosity of water at 40°C is $6.5 \times 10^{-4} \text{ N}\cdot\text{s}/\text{m}^2$

Materials: Water

Analysis: The dynamic viscosity is the fluid's ability to resist flow and is directly proportional to the magnitude of the shear stress. Dynamic viscosity is a function of temperature, the lower the temperature, the higher the dynamic viscosity.

2:35.) Purpose: Find the value of the viscosity of SAE 30 oil @ 210°F

Drawing: N/A

Source: Mott, R., Untener, J.A., "Applied Fluid Mechanics," 7th Edition, Pearson Education, Inc (2015)

Design Consideration: Constant properties, incompressible fluid

Data: SAE 30 oil @ 210°F

Procedure: I will use the Appendix in the textbook to locate the dynamic viscosity of SAE 30 oil at the specified temperature.

Calculations: $\eta = 2.2 \times 10^{-4} \text{ lb-s/ft}^2$

Summary: Using Appendix D in the textbook, I was able to find that the dynamic viscosity of SAE 30 oil at 210°F is $2.2 \times 10^{-4} \text{ lbs/ft}^2$.

Materials: SAE 30 oil

Analysis: The dynamic viscosity of oil is dependent on temperature. Standard grades of oil are denoted as 10W, 15W, 20W, etc which means that the higher the grade, the higher the viscosity.