

Rebecca Sopher Chapter 2

due 9.12.17

- 2.17 Give four examples of the types of fluids that are non-Newtonian
 blood plasma & adhesives (pseudoplastic)
 starch in water (dilatant)
 toothpaste & paint (Bingham fluids)

2.18, 2.29, 2.35 give the value of the viscosity for:

Water at $40^\circ\text{C} = 6.5 \times 10^{-4} \text{ N}\cdot\text{s}/\text{m}^2$ (approx.)

Hydrogen at $40^\circ\text{F} = 1.9 \times 10^{-7}$ (approx.)

SAE 30 oil at $210^\circ\text{F} = 2.2 \times 10^{-4}$ (approx.)

- 2.34 A plane surface is coated with an oil layer of uniform thickness. A cubical block weighing 60N is slid across the surface w/ a velocity of 15cm/s . The fluid has a dynamic viscosity of $0.8 \text{ N}\cdot\text{s}/\text{m}^2$ & a density of $800 \text{ kg}/\text{m}^3$. Calculate the kinematic viscosity of the oil.

$$\nu = \frac{\eta}{\rho} = \frac{\frac{\text{kg}}{\text{m}\cdot\text{s}} \cdot \frac{\text{m}^2}{\text{kg}}}{\frac{\text{kg}}{\text{m}^3}}$$

$$\tau = \frac{\text{force}}{\text{area}} = \frac{\text{N}}{\text{m}^2}$$

$$\tau = \eta (\Delta v / \Delta y)$$

dynamic viscosity

0.8

$$\frac{60 \text{ kg}\cdot\text{m}}{\text{s}^2} \div 9.81 \text{ m/s}^2 = 6.12 \text{ kg}$$

$$\nu = \frac{0.8}{800} = 0.001 \text{ m}^2/\text{s}$$

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3.6 T

3.7 F atmospheric pressure varies with weather & altitude

3.8 -55.8 Pa (abs) F There are no negative absolute pressures.

3.9 -4.65 psig T

3.10 -150 kPa (gauge) F pressures do not go this low - minimum is -101 kPa (gauge)

3.11 $\Delta p = \gamma h$

$h = 4000 \text{ ft}$
 $\rho_{\text{air}} = 0.0023762$

@ 4000 ft above sea level, Temp $\approx 40^\circ \text{C}$

$$\Delta p = 270.48 \text{ psi}$$

Pressure $\approx 12.5 \text{ psi}$

3.13 ϕ Pa (gauge)

$\frac{\text{lb}}{\text{ft}^3}$

Density $\approx 2.1 \times 10^{-5} \text{ slugs/ft}^3$

$$\gamma = \frac{\rho}{\rho_{\text{water}}}$$

$$\gamma = \frac{\text{density} \times 32.2}{\text{ft/s}^2}$$

$$\frac{\text{lb} \cdot \text{s}^2}{\text{ft}^3}$$