Tyler Crouse 9-3-24

Questions 17, 18, 27, 35, 61

(17) Non-Newtonian Fluids:

- Peanut Butter
- Tooth paste
- Grease
- Printing Ink

(18) Dynamic Viscosity of water at 40°C:

$$\tau_{w@40°C} = 6.5 \times 10^{-4}\ Pa\text{-}s$$

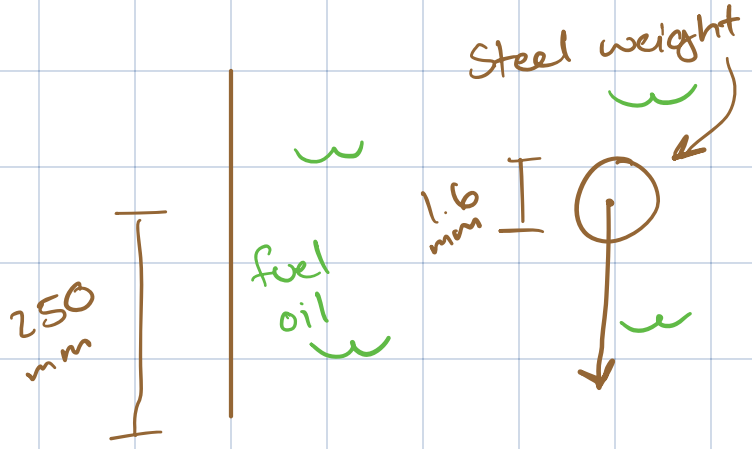
(27) Dynamic Viscosity of Hydrogen at 40°F:

$$\tau_{H@40°F} = 1.9 \times 10^{-7}\ lb\text{-}s/ft^2$$

(35) Dynamic Viscosity of SAE30 oil at 210°F:

$$\tau_{SAE30@210°F} = 2.1 \times 10^{-4}\ lb\text{-}s/ft^2$$

(61) Falling-Ball Viscometer



$Sg_{fo} = 0.94$

$\rho_b = 7.7\ kg/m^3$

$s = 250mm = 0.250m$

$t = 10.4s$

$D_b = 0.0016\ m$

$$\eta = \frac{(\gamma_b - \gamma_f) D^2}{18 v}$$

$$Sg = \frac{\gamma_s}{\gamma_{w@4^\circ C}} = \frac{\rho_s}{\rho_{w@4^\circ C}} \qquad \gamma = \frac{W}{\forall} \qquad \rho = \frac{m}{\forall}$$

$$\forall_b = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (0.0008m)^3 = 2.14 \times 10^{-9}\ m^3$$

$$V = \frac{s}{t} = \frac{(0.250m)}{(10.4s)} = 0.0240\ m/s$$

$$m_b = \rho_b \forall_b = (7.7 kg/m^3)(2.14 \times 10^{-9}\ m^3) = 1.65 \times 10^{-7} kg$$

$$\gamma_b = \frac{(1.65 \times 10^{-7} kg)(9.81 m/s^2)}{2.14 \times 10^{-9} m^3} = 756.4\ N/m^3$$

$$\gamma_s = Sg_s (\gamma_{w@4^\circ C}) = 0.94 (9.807\ kN/m^3) = 9.22\ kN/m^3$$

$$\eta = \frac{(.7564\ kN/m^3 - 9.22\ kN/m^3)(0.0016m)^2}{18(0.0240\ m/s)}$$

$$\boxed{\eta = 0.784\ kNs/m^2}$$