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$$SG = \frac{\rho}{\rho_{H_2O} @ 4\,^\circ C}$$

$$1.15 = \frac{\rho}{1000 \frac{kg}{m^3}}$$

$$\rho = (1.15)\left(1000 \frac{kg}{m^3}\right) = \underline{\underline{1150 \frac{kg}{m^3}}}$$

$$\gamma = \rho g = \left(1150 \frac{kg}{m^3}\right)\left(9.81 \frac{m}{s^2}\right) = \underline{\underline{11.3 \frac{kN}{m^3}}}$$

Question 2: When poured into a graduated cylinder, a liquid is found to weight 8N when occupying a volume of 600 ml. Determine its specific weight, density and specific gravity.

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$$\gamma = \frac{\text{weight}}{\text{volume}} = \frac{8\,N}{(0.600\,\ell)\left(10^{-3}\,\frac{m^3}{\ell}\right)} = \underline{13.3\,\frac{kN}{m^3}}$$

$$\rho = \frac{\gamma}{g} = \frac{13.3 \times 10^{3}\,\frac{N}{m^3}}{9.81\,\frac{m}{s^2}} = \underline{1.36 \times 10^{3}\,\frac{kg}{m^3}} =$$

$$SG = \frac{\rho}{\rho_{H_2O}\,@\,4^\circ C} = \frac{1.36 \times 10^{3}\,\frac{kg}{m^3}}{10^{3}\,\frac{kg}{m^3}} = \underline{\underline{1.36}}$$

Question 3: For flowing water, what is the magnitude of the velocity gradient needed to produce a shear stress of 1.0 N/m^2 (take the viscosity of water as 1.12×10^{-3} $N.s/m^2$). If the flowing liquid were blood, what would be the value of the velocity gradient? Discuss.

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$$\tau = \mu \frac{du}{dy} \quad \text{where } \mu = 1.12\times10^{-3}\ \frac{N\cdot s}{m^2} \text{ and } \tau = 1.0\ \frac{N}{m^2}$$

Thus,

$$\frac{du}{dy} = \frac{\tau}{\mu} = \frac{1.0\ \frac{N}{m^2}}{1.12\times10^{-3}\ \frac{N\cdot s}{m^2}} = \underline{\underline{893\ \frac{1}{s}}}$$

Blood viscosity is higher than water viscosity which means blood is more viscous than water, hence in the equation (the shear stress is constant-still 1 N/m2) since the viscosity would be higher the value of the velocity gradient would be lower. (you can take the viscosity of blood as 3.18×10^{-3} $N.s/m^2$)

Question 5: (a) The water strider bug shown in the figure below is supported on the surface of a pond by surface tension acting along the interface between the water and the bug's legs. Determine the minimum length of this interface needed to support the bug. Assume the bug weighs 10^{-4} N and the surface tension force acts vertically upwards. (b) Repeat part (a) if the surface tension were to support a person weighing 750 N. (take the surface tension of water as 7.34 x 10-2 N/m).

Question 5: (a) The water strider bug shown in the figure below is supported on the surface of a pond by surface tension acting along the interface between the water and the bug's legs. Determine the minimum length of this interface needed to support the bug. Assume the bug weighs 10^{-4} N and the surface tension force acts vertically upwards. (b) Repeat part (a) if the surface tension were to support a person weighing 750 N. (take the surface tension of water as 7.34 x 10-2 N/m).

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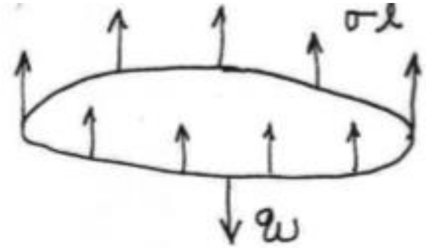
For equilibrium,

$$\mathcal{W} = \sigma \ell$$



$\mathcal{W}$ ~ weight

σ ~ surface tension

ℓ ~ length of interface

(a) $$\ell = \frac{\mathcal{W}}{\sigma} = \frac{10^{-4}\ N}{7.34 \times 10^{-2}\ \frac{N}{m}}$$

$$= 1.36 \times 10^{-3}\ m$$

$$= (1.36 \times 10^{-3}\ m)\left(10^{3}\ \frac{mm}{m}\right) = \underline{\underline{1.36\ mm}}$$

(b) $$\ell = \frac{750\ N}{7.34 \times 10^{-2}\ \frac{N}{m}} = \underline{\underline{1.02 \times 10^{4}\ m}} \quad (6.34\ mi\ !!)$$