Chapter 3

problem 6 The value for the absolute pressure will always be greater than that for the gage pressure.

True.

problem 7 As long as you stay on the surface of the Earth, the atmospheric pressure will be 14.7 psia.

False. Atmospheric pressure varies with location and climate, varying from about 13.8-15.3 psia on Earth's surface.

problem 8 The pressure in a certain tank is -55.8 Pa(abs).

False. Absolute pressure is referenced to a perfect vacuum and can not be negative

problem 9 is actually a duplicate of problem 8 in my book.

problem 10 The pressure in a certain tank is -150 kPa(gage).

True (or, well, plausible)

problem 11 If you were to ride in an open-cockpit airplane to an elevation of 4000 ft above sea level, what would the atmospheric pressure be if it conforms to the standard atmosphere?

$$\Delta p = \gamma \cdot h$$ going vertical, so negative

$$= -0.0764 \frac{lb}{ft^3} \cdot 4000 ft \times \frac{1 psi}{144 \frac{lb}{ft^2}}$$

$$= -2.12 psi$$

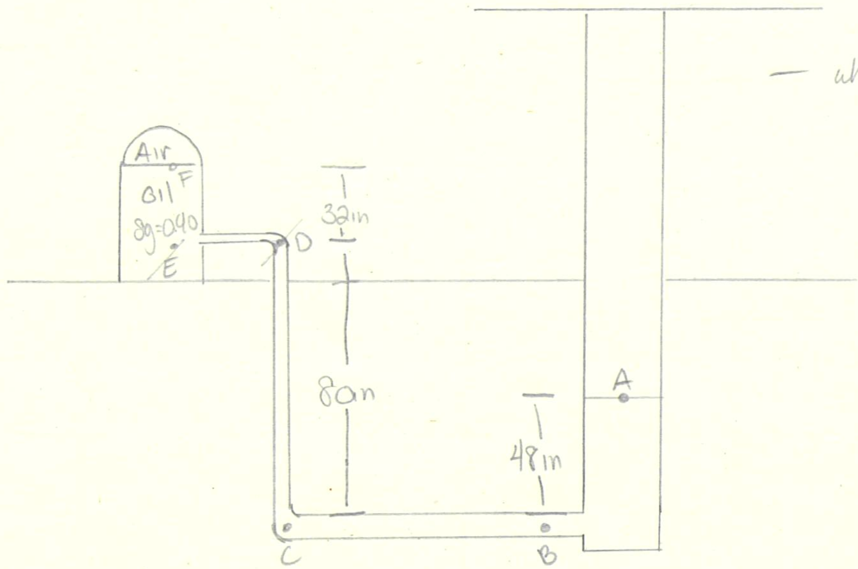
$$14.696 psi - 2.12 psi = \boxed{12.576 psia}$$

problem 13 Expressed as gage pressure, what is the pressure at the surface of a glass of milk?

Ø psig. Exposed to the atmosphere

problem 41 Figure 3.19 shows a diagram of the hydraulic system for a vehicle lift. An air compressor maintains pressure above the oil in the reservoir. What must the air pressure be if the pressure at point A must be at least 180 psig?

Figure 3.19



— what is a lift cylinder?

added own reference points B-F

$P_A = 180$ psig $P_{air} = ?$ $sg_{oil} = 0.90$ $sg = \frac{\gamma_{oil}}{\gamma_{water\,24°C}}$

$\Delta p = \gamma \cdot h$

$P_B = P_C$ ∘ cango straight $C \to F$
$P_D = P_E$
$P_F = P_{air}$

$\gamma_{water\,24°C} \times sg = \gamma_{oil}$
$62.4 \frac{lb}{ft^3} \times 0.90 = 56.16 \frac{lb}{ft^3} = \gamma_{oil}$

@ point B

going down, so positive

$\Delta p = \gamma \cdot h$
$= \left(56.16 \frac{lb}{ft^3} \times 4ft\right) \times \frac{1psi}{144 \frac{lb}{ft^2}}$

$= +1.56$ psi

$180 + 1.56$ psi $= 181.56$ psig   this is also equal to point C.

@ point F

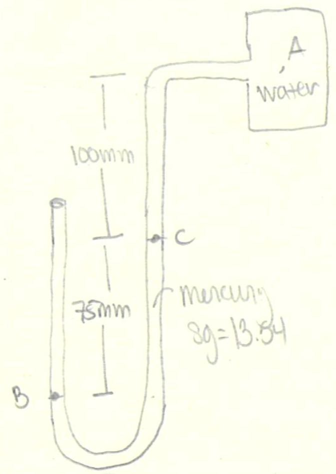
$\Delta p = \gamma \cdot h$ going up, so negative

$= -\left(56.16 \frac{lb}{ft^3} \times \left(112in \times \frac{1ft}{12in}\right)\right) \times \frac{1psi}{144 \frac{lb}{ft^2}}$

$= -3.64$ psi

181.56 psig $- 3.64$ psi $= \boxed{177.92 \text{ psig}}$

problem 62 Water is in the pipe shown in Fig 3.26. Calculate the pressure at point A in kPa(gage)



100mm = 10cm = 0.1m
75mm = 0.075m

'assuming point B, surface of mercury, is open to atmosphere and at Ø psig.

$1Pa = \frac{1N}{m^2}$

$1kPa = \frac{1kN}{m^2}$

$$sg_{mercury} \times \gamma_{water@4°C} = \gamma_{Hg}$$

$$13.54 \times 9.81 \frac{kN}{m^3} = 132.827 \frac{kN}{m^3} = \gamma_{Hg}$$

@point C, from point B

$$\Delta p = -(\gamma_{Hg} \cdot h)$$

$$= -\left(132.827 \frac{kN}{m^3} \times 0.075m \times \frac{1kPa}{1\frac{kN}{m^2}}\right)$$

$$\Delta p = -9.962\ kPa$$

@ point A, from point C

$$\Delta p = -\gamma_{water} \cdot h$$

$$= -\left(9.81 \frac{kN}{m^3} \times 0.1m \times \frac{1kPa}{1\frac{kN}{m^2}}\right)$$

$$= -0.981\ kPa$$

$$0 - 9.962kPa - 0.981kPa = \boxed{p_A = 10.943\ kPa}$$

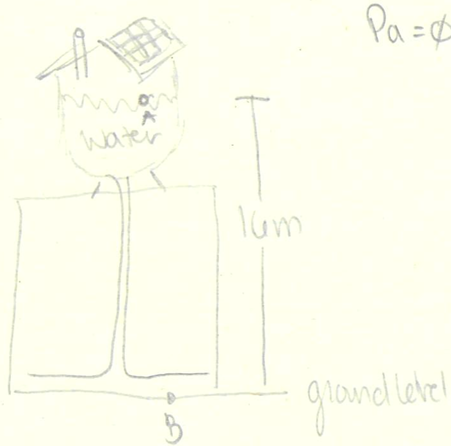
problem 83 A barometer indicates the atmospheric pressure to be 30.65 in of mercury. Calculate the atmospheric pressure in psia.

$$30.65\ \text{inHg} \times \frac{1\ \text{lb/in}^2}{2.036\ \text{inHg}} \times \frac{1\ \text{psi}}{1\ \text{lb/in}^2} = \boxed{15.054\ \text{psia}}$$

problem 90 The pressure in a vacuum chamber is -68.2kPa. Express this in mmHg.

$$-68.2\text{kPa} \times \frac{1000\ \text{Pa}}{1\text{kPa}} \times \frac{1\ \text{mmHg}}{133.3\ \text{Pa}} = \boxed{-511.627\ \text{mmHg}}$$

problem 94 A passive solar water heater is to be installed on the roof of a multi-story building. The heater tank is open to atmospheric pressure and is mounted 16m above ground level. In the static state, what gage pressure (in kPa) must the plumbing be designed to withstand if it is connected all the way down to ground level?



$P_a = \emptyset$

$$\Delta p = \gamma_{water} \cdot h$$

$$= 9.81\frac{\text{kN}}{\text{m}^3} \cdot 16\text{m} \times \frac{1\text{kPa}}{1\frac{\text{kN}}{\text{m}^2}}$$

$$= \boxed{156.96\ \text{kPa}}$$