HW1.2 AUSTIN GOODMAN

3.6) THE VALUE FOR ABSOLUTE PRESSURE WILL ALWAYS BE GREATER THAN THAT FOR GAGE PRESS. (T/F)

$\boxed{\text{ANS: TRUE}}$; GIVEN THE FORMULA $P_{ABS} = P_{GAGE} + P_{ATM}$, P_{ABS} WILL ALWAYS BE GREATER.

3.7) AS LONG AS YOU STAY ON THE SURFACE OF THE EARTH, $P_{ATM} = 14.7$ psia. (T/F)

$\boxed{\text{ANS: FALSE}}$; ATMOSPHERIC PRESSURE CAN CHANGE SIGNIFICANTLY FROM SEA LEVEL TO SOMEWHERE WITH A HIGHER ALTITUDE, e.g. MOUNTAINS

3.8) THE PRESS. IN A TANK IS -55.8 Pa (abs) (T/F)

$\boxed{\text{ANS: FALSE}}$; THE LOWEST POSSIBLE ABSOLUTE PRESSURE IS 0 WHICH WOULD BE A PERFECT VACUUM. GIVEN THIS, ABSOLUTE PRESSURE WILL ALWAYS BE POSITIVE.

3.9) SAME AS ABOVE.

3.10) THE PRESSURE IN A CERTAIN TANK IS -150 kPa (gage) (T/F)

$\boxed{\text{ANS: TRUE}}$; GIVEN THAT IT IS GAGE PRESSURE, IT IS POSSIBLE THAT IT IS A VACUUM.

3.11) IF YOU WERE TO RIDE IN AN OPEN-COCKPIT AIRPLANE TO 4000 ft ABOVE SEA LEVEL, WHAT WOULD THE ATMOSPHERIC PRESSURE BE IF IT CONFORMS TO THE STANDARD ATMOSPHERE?

GIVEN: ALTITUDE OF 4000 ft

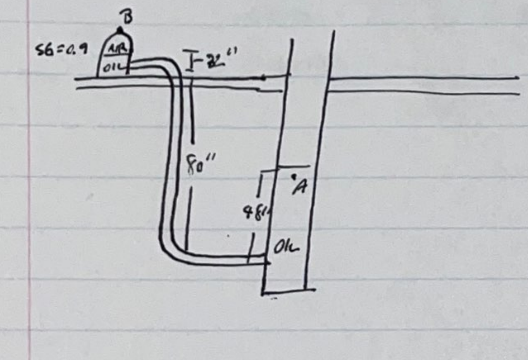
SOLUTION: USING FIGURE E.1 IN BACK OF TEXT, $\boxed{P_{ATM} = \sim 12.7 \text{ psia} @ 4000 \text{ ft}}$

3.13) EXPRESSED IN GAGE PRESSURE, WHAT IS THE PRESSURE AT THE SURFACE OF A GLASS OF MILK?

SOLUTION: ATMOSPHERIC PRESSURE AT SURFACE $= 14.7$ psia $\rightarrow$ 0 psig $= P_{GAGE}$

HW 1.2

3.41)



KNOWN: $P_A = 180\,psig$, $\gamma = \rho \cdot g$, FIND P_B

SOLUTION: 1. $\rho_w = 1.94 \frac{slugs}{ft^3} \cdot \left(\frac{1ft}{12in} \cdot \frac{1ft}{12in} \cdot \frac{1ft}{12in}\right) = 0.001123 \frac{slugs}{in^3}$

2. $\rho_{oil} = \rho_w \cdot SG_{oil} \rightarrow 0.001123 \frac{slugs}{in^3}(0.9) = 0.001011 \frac{slugs}{in^3}$

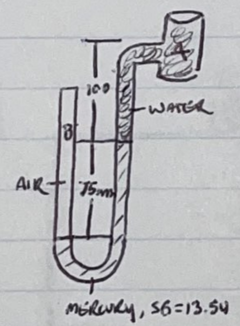
3. $\gamma_{oil} = \rho_{oil} \cdot g \rightarrow 0.001011 \frac{slugs}{in^3}\left(32.2 \frac{ft}{s^2} \cdot \frac{12 in}{1ft}\right) = 0.39065$

4. $P_A + \gamma_{oil} \cdot 48in - (\gamma_{oil} \cdot 112in) = P_B$

$\rightarrow 180 \frac{lb}{in^2} + 0.39065(48in) - (0.39065 \cdot 112in) = P_B$

$\boxed{P_B = 155\,psig}$

3.62)



KNOWN: $P_B = P_{ATM} = 0\,Pa\,(gage)$

$\gamma_w = 9.81 \frac{kN}{m^3}$

$\gamma_m = SG \cdot \gamma_w$

FIND P_A (kPa)

1. $\gamma_m = SG \cdot \gamma_w \rightarrow 13.54(9.81 \frac{kN}{m^3}) = 132.827 \frac{kN}{m^3}$

2. $P_A = P_B - \gamma_m \cdot (0.075m) - \gamma_w \cdot (0.1m)$

$\rightarrow 0\,kPa\,(gage) - 132.827 \frac{kN}{m^3}(0.075m) - 9.81 \frac{kN}{m^3}(0.1m)$

$\rightarrow P_A = -10.943 \frac{kN}{m^3}$

$\boxed{= 10.943\,kPa\,(gage)}$

3.83) BAROMETER INDICATES 30.65 in OF MERCURY. FIND P_{ATM} IN psia.

GIVEN: $h = 30.65\,in$, KNOWN: $P_{ATM} = \gamma \cdot h$,

SOLUTION: $\gamma_m = 848.7 \frac{lb}{ft^3} \cdot \frac{1ft}{12in} \cdot \frac{1ft}{12in} \cdot \frac{1ft}{12in} = 0.491 \frac{lb}{in^3}$

$P_{ATM} = \gamma_m \cdot h \rightarrow 0.491 \frac{lb}{in^3} \cdot 30.65in = 15.049\,psia$

$\boxed{P_{ATM} = 15.049\,psia}$

3.90) PRESSURE IN A VACUUM CHAMBER IS −68.2 Kpa, EXPRESS IN mmHg.

GIVEN: $P_V = 68.2$ Kpa, FIND mmHg, KNOWN: $1_{ATM} = 760$ mmHg $= P_{ATM}$

SOLUTION:

$$P_{ABS} = P_{ATM} - P_{VACUUM}$$

$$= 760\,\text{mmHg} - P_V \rightarrow P_V = \rho_m \cdot \gamma_w \cdot h$$

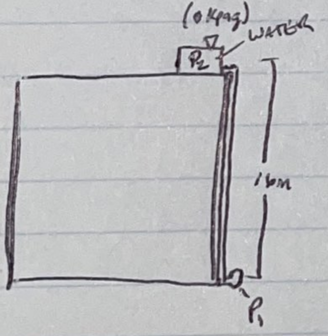
$$\rightarrow h = \frac{P_V}{\rho_m \cdot \gamma_w} = \frac{68.2 \frac{kN}{m^2}(1000)}{\left(13540 \frac{kN}{m^3}\right) \cdot 9.81 \frac{kN}{m^3}}$$

$$= 0.513448 \text{ m Hg}$$

$$\rightarrow P_{ABS} = 760\,\text{mmHg} - 513.448\,\text{mm Hg}$$

$$\boxed{= 246.55\,\text{mmHg}}$$

3.94)



GIVEN: $h = 16$m, $P_2 = 0$ Kpag

KNOWN: $\gamma_w = 9.81 \frac{kN}{m^3}$

SOLUTION: $P_1 = P_2 + \gamma_w \cdot 16\text{m}$

$$= 0\,\text{KPa(gage)} + 9.81 \frac{kN}{m^3}(16\text{m})$$

$$\boxed{P_1 = 156.96 \frac{kN}{m^2} \text{ or KPa(gage)}}$$