3.6 – 3.10

GIVEN:

A STATEMENT IS MADE FOR EACH QUESTION

REQUIRED:

STATE WHETHER EACH STATEMENT IS TRUE OR FALSE.

SOLUTION:

3.6: THE VALUE FOR ABS. PRESSURE WILL ALWAYS BE GREATER THAN GAGE PRESSURE.

T $P_{ABS} = P_{atm} + P_{gage}$, P_{atm} IS NEVER NEGATIVE

3.7: AS LONG AS YOU STAY ON THE SURFACE OF EARTH, $P_{atm} = 14.7$ psia

F P_{atm} CHANGES W/ ELEVATION, IT IS ONLY 14.7 psia AT SEA LEVEL

3.8 AND 3.9: THE PRESSURE IN A CERTAIN TANK IS −55.8 Pa (abs)

F P_{abs} IS BASED ON AN ABSOLUTE Ø REFERENCE POINT, AND THEREFORE CAN NOT BE NEGATIVE

- UNSURE WHY 3.8 AND 3.9 ARE IDENTICAL, IS THERE A TYPO IN THE BOOK?

3.10: THE PRESSURE IN A CERTAIN TANK IS −150 kPa (gage)

T −150 kPa MEANS P_{atm} WOULD NEED TO BE GREATER THAN 150 kPa. ON EARTH, $P_{atm} = 101$ kPa. ON A PLANET W/ GREATER THAN $P_{atm} = 150$ kPa, OR IF THE GAUGE IS USED IN AN ENVIRNMENT WHERE $P_{atm} \geq 150$ kPa THIS READING IS POSSIBLE.

3-11

GIVEN:

AN OPEN-COCKPIT AIR CRAFT TRAVELS TO $h = 4000$ ft

REQUIRED:

FIND P_{atm} IF IT CONFORMS TO STANDARD ATMOSPHERE CONDITIONS.

SOLUTION:

$\Delta P = \gamma_{air} \cdot \Delta h$ WHERE $\Delta P = P_{atm\ SEA} - P_{atm\ 4k'}$

$\gamma_{air} = 0.0764\ ^{lb}/_{ft^3}$ (@ ROOM TEMPERATURE)

3-11 cont

$$P_{atm\ SEA} - P_{atm\ 4k'} = \gamma_{air} \cdot \Delta h$$

$$\therefore$$

$$P_{atm\ 4k'} = P_{atm\ sea} - \gamma_{air} \cdot \Delta h$$

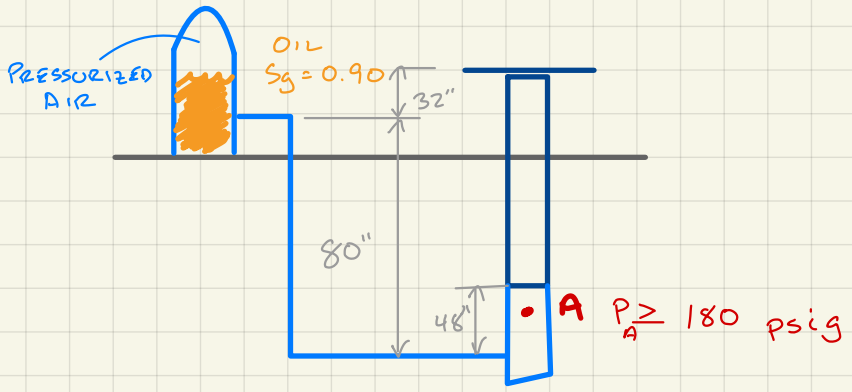
$$= (14.7\ psia) - (0.0764\ lb/ft^3)(4000\ ft)\left(\frac{1\ lb}{12\ in^2}\right)$$

$$= \boxed{12.6\ psia}$$

3-41

GIVEN:

A HYDRAULIC LIFT MUST MAINTAIN A GIVEN OIL PRESSURE BY CREATING A PRESSURIZED ZONE WITHIN THE OIL RESEVOIR.



REQUIRED:

CALCULATE P_{AIR} TO MAINTAIN $P_A \geq 180$ psig

SOLUTION:

$$\Delta P = \gamma_{OIL} \cdot \Delta h \quad \text{WHERE} \quad \Delta P = P_A - P_{AIR}$$

$$Sg_{OIL} = \frac{\gamma_{OIL}}{\gamma_{H_2O}} \quad \therefore \quad \gamma_{OIL} = (0.90)(62.4\ lb/ft^3) = \boxed{56.2\ lb/ft^3}$$

$$\Delta h = (-48") + (80") + (32") = \boxed{64"}$$

$$P_{AIR} = P_A - \gamma_{OIL} \cdot \Delta h = (180\ psig) - (56.2\ lb/ft^3)\left(\frac{1\ lb}{12"^3}\right) \cdot (64")$$

$$= \boxed{177.9\ psig}$$

3-85

GIVEN:

A BAROMETER READS ATMOSPHERIC PRESSURE AS 30.65 in MERCURY

REQUIRED:

FIND P_{atm} IN psia

SOLUTION:

$\Delta P = \gamma_{Hg} \cdot \Delta h$ WHERE $\Delta P = P_{atm} - 0$ • BULB IN BAROMETER $P_{ABS} = 0$

$\gamma_{Hg} = 844.9\ lb/ft^3$

$P_{atm} = (844.9\ lb/ft^3)\left(\frac{1ft}{12"^3}\right) \cdot (30.65")$

$= \boxed{15.0\ psia}$