MET 330

HOMEWORK 1.2

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CHAPTER 3

3-6) **TRUE** ABSOLUTE PRESSURE = GAGE PRESSURE + ATMOSPHERIC PRESSURE

$$P_{ABS} = P_{GAGE} + P_{ATM}$$ (PAGE 39)

3-7) **FALSE** THE MAGNITUDE OF THE ATMOSPHERIC PRESSURE VARIES WITH LOCATION AND WITH CLIMATIC CONDITIONS. THE RANGE OF NORMAL VARIATION OF ATMOSPHERIC PRESSURE NEAR EARTH'S SURFACE IS APPROXIMATELY FROM 13.8 PSIA TO 15.3 PSIA. (PAGE 39)

3-8) **FALSE** A PERFECT VACUUM IS THE LOWEST POSSIBLE PRESSURE. THEREFORE, AN ABSOLUTE PRESSURE WILL ALWAYS BE POSITIVE (PAGE 39).

3-9) **TRUE** GAGE PRESSURE BELOW ATMOSPHERIC PRESSURE IS NEGATIVE (PAGE 39).

3-10) **FALSE** GAGE PRESSURE ABOVE ATMOSPHERIC PRESSURE IS POSITIVE (PAGE 39).

3-11) GIVEN: ELEVATION = h = 4000 ft,

P_{ATM} = ATMOSPHERIC PRESSURE AT 4000 ft

FROM APPENDIX E (TABLE E.3): P_{ATM} AT 1000 ft = 14.173 psi

P_{ATM} AT 5000 ft = 12.227 psi

INTERPOLATE:

$$P_{ATM} = 14.173 + \left[\left(\frac{4000-1000}{5000-1000}\right)(12.227 - 14.173)\right]$$

$$P_{ATM} = 14.173 + (-1.4595)$$

P_{ATM} AT 4000 ft = 12.71 psia

3-13) **$P_{GAGE} = 0$** SINCE THE DEPTH FROM THE SURFACE OF THE MILK EQUALS ZERO AND THE MILK IS EXPOSED TO THE ATMOSPHERE:

$$P_{GAGE} = P_{ABS} - P_{ATM} = (P_{ATM} + \rho g \times 0) - P_{ATM} = P_{ATM} - P_{ATM} = 0$$

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3-41) GIVEN: PRESSURE AT A $\longrightarrow P_A = 180$ psig

SPECIFIC GRAVITY OF OIL $\longrightarrow sg = 0.90$

SPECIFIC WEIGHT OF WATER $\longrightarrow \gamma_w = 62.4\ lb/ft^3$ (APPX. A, TABLE A-2)

DIFFERENCE IN HEIGHT (POINT A AND COMPRESSOR) $= h = (112\ in - 48\ in)$

$h = 64\ in$

$$P_{AIR} = P_A - (\gamma_{oil})(h) = 180\ psig - \left[(0.9)(62.4\ lb/ft^3)\right]\left[(64\ in)\left(\frac{1\ ft^3}{1728\ in^3}\right)\right]$$

$$P_{AIR} = 180\ psig - (56.16)(0.037)_{psig} = 180\ psig - 2.078\ psig$$

$$P_{AIR} = 177.9\ psig$$

3-62) GIVEN: SPECIFIC WEIGHT OF WATER $= \gamma_w = 9.81\ kN/m^3$ (APPX. A, TABLE A-1)

SPECIFIC GRAVITY OF MERCURY $= 13.54$

$$P_A = -\gamma_m(h_m) - (\gamma_w)(h_w)$$

$$P_A = -13.54(9.81\ kN/m^3)(0.075\ m) - (9.81\ kN/m^3)(0.10\ m)$$

$$P_A = -10.94\ kPa\ (GAGE)$$

3-83) GIVEN: $P_{ATM} = 30.65$ in OF MERCURY

SPECIFIC WEIGHT OF Hg $= \gamma_m = 844.9\ lb/ft^3$ (FROM TEXTBOOK: APPLIED FLUID MECHANICS SEVENTH EDITION APPX. B, TABLE B.2)

$$P_{ATM} = \gamma_m h = (844.9\ lb/ft^3)(30.65\ in)\left(\frac{1\ ft^3}{1728\ in^3}\right)$$

$$P_{ATM} = 14.99\ psia$$

3-90) GIVEN: PRESSURE IN VACUUM CHAMBER $= P = -68.2$ kPa

$$h = \frac{P}{\gamma_m} = \frac{-68.2 \times 10^3\ Pa}{kPa} \times \frac{mm\,Hg}{133.3\ Pa} = -511.63\ mm\,Hg$$

$$h = -511.6\ mm\,Hg$$

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3-94) GIVEN: $h = 16\ m$

GAGE PRESSURE $\longrightarrow$ $\Delta P = \gamma h$

SPECIFIC WEIGHT OF WATER = $\gamma = 9.81\ kN/m^3$ (APPX. A, TABLE A.1)

$\Delta P = \gamma h = (9.81\ kN/m^3)(16\ m) = 156.96\ kPa$

$P_{GAGE} = 157\ kPa$