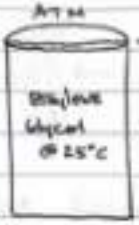
CH.4 2, 10, 17, 28, 42, 54 ✓

HO 1.3 CH.3 41, 62, 83, 90, 94 ✓

JORDAN DAVIS

41)



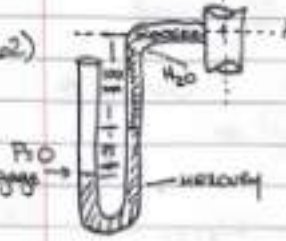
EQ.: $\Delta P = \gamma h$

TABLE B.1: $\gamma_{GAS} = 10.79\ kN/m^3$

ANS: $\Delta P_{GAS} = 10.79\ kN/m^3 (12\ m)$

$= \boxed{129.48\ kPa}$

62)



PURPOSE: PRESSURE @ POINT A

GIVEN: MERCURY $S_g = 13.54$

TABLE A.1: $\gamma_{WATER} = 9.81\ kN/m^3$

EQ.: $\Delta P = \gamma h$

ANS: $-(13.54 \cdot 9.81\ kN/m^3 \cdot .075m) -$

$(1 \cdot 9.81\ kN/m^3 \cdot .1\ m) = \boxed{-10.94\ kPa}$

* PRESSURE DOES NOT CHANGE HORIZONTALLY *

83) 14.2 psia IN INCHES OF Hg?

$$\Rightarrow 14.2\ psia \left(\frac{2.036\ in\,Hg}{1\ lb/in^2}\right) = \boxed{28.91\ in\,Hg}$$

90) VACUUM PRESSURE OF -12.6 psig IN in Hg?

$$\Rightarrow \frac{-12.6\ lb}{in^2}\left(\frac{2.036\ in\,Hg}{1\ lb/in^2}\right) = \boxed{-25.65\ in\,Hg}$$

94)

PURPOSE: FIND h NEEDED FOR 160 kPa GAUGE

GIVEN: P = 160 KPA, ASSUME 25°C

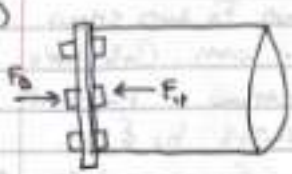
TABLE A.1: $9.78\ kN/m^3 = \gamma_{WATER}$

ANS: $h = \Delta P / \gamma$

$$\Rightarrow \frac{160\ kN/m^2}{9.78\ kN/m^3} = \boxed{16.36\ m}$$

Jordan Davis

2)



Purpose: Find F_B?

Given: Tank Dia = 30"

Internal Press. = 23.6 psig

Eqs: P = Force/Area

$Area_{dia} = \pi d^2/4$, $\sum F_x = 0$, Assume → (+) ← (-)

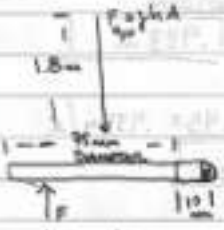
Ans: $Area_{dia} = \pi(30")^2/4 = 706.86 in^2$

$Force = \frac{23.6 lb}{1 in^2}\left(706.86 in^2\right) = 16681.9 lbs$

$\sum F_{xx} = 0$, $F_B - F_{tp} = 0 \Rightarrow F_B = F_{tp}$

$\Rightarrow$ **$F_{Doors} = 16681.9$ lbs**

10)



Purpose: Find F?

Given: 1.8m column of H_2O, Assume 25°C

Valve Dia. = 75mm

Eqs: $F_{H_2O} = \gamma h A_{valve}$ Assume Applied @ 47.5mm From Hinge

$Area_{valve} = \pi d^2/4$

$\sum M = 0$

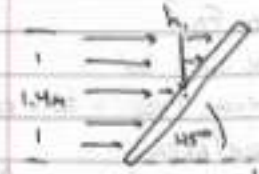
Ans: $F_{H_2O} = \frac{9.78 kN/m^3 (1.8m)(\pi)(.075m)^2}{9}$

$F_{H_2O} = 77.77 N$ $\Rightarrow$ Moment About Hinge, CW (+), CCW (-)

$\Rightarrow \sum M_{Hinge}: F(.065m) - 77.77N(.0475m) = 0$

$\Rightarrow F = \frac{77.77N(.0475)}{.065m} = \boxed{56.83 N}$

17)



PURPOSE: FIND F_R AND SHOW ON DIAGRAM. CALCULATE LOCATION OF PRESSURE CENTER, h_p & L_p.

EQS: $h_1 = 1.4m/2 = .7m$ GIVEN: Oil $sg = .86$

AREA $= (1.4m/\sin 45°)(4)$

$F = \gamma A h_1$, $\gamma = \rho g$

ANS: $F_R = .86(1000 kg/m^3)(9.81 m/s^2)(1.4m/\sin 45)(4)(.7m)$

$\Rightarrow \boxed{F_R = 46.77 kN}$

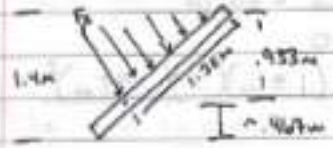
$h_p \rightarrow$ 1/3 of DISTANCE FROM BOTTOM

$\Rightarrow h_p = 2/3\,(1.4m) = \boxed{.933 m}$

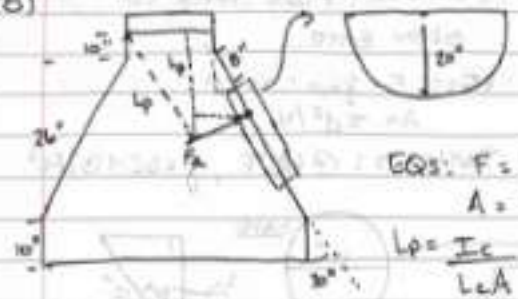
$L_p \rightarrow$

$\Rightarrow \sin 45 = .933m/x$

$\Rightarrow \boxed{L_p = 1.32m}$



28)



PURPOSE: FIND F_R & LOCATION OF PRESSURE FORCE, L_P & h_P. SHOW ON DRAWING

EQS: $F = \gamma \cdot h_c \cdot A$

$A = \pi d^2 / 8$

$L_P = \frac{I_c}{L_c A} + L_c$, $h_P = h_c + \frac{I_c \sin^2\phi}{h_c A}$

GIVEN: Ethylene Glycol sg = 1.10

APP. J: $\bar{y} = .212D = .212(20") = \underline{4.24"}$

$I_c = 6.86 \times 10^{-3}(D^4) = 6.86 \times 10^{-3}(20")^4 = \underline{1097.6 in^4}$

APP. B: Ethylene Glycol $\gamma = 68.47 lb/ft^3$

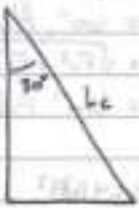
ANS: $h_c = 10" + 8"\cos 30° + 4.24" = \underline{21.17"}$

$\Rightarrow A = \pi(20")^2/8 = \underline{157.08 in^2}$

$\Rightarrow F = 68.47 lb/ft^3 \mid ft^2 \mid 21.17" \mid 157.08 in^2$

$144 in^2/ft^2 \mid 1728 in^3/ft^3$

$\boxed{F_R = 131.76 lb}$



$\Rightarrow \cos 30° = h_c / L_c \Rightarrow L_c = h_c / \cos 30°$

$\Rightarrow L_c = \underline{24.45"}$

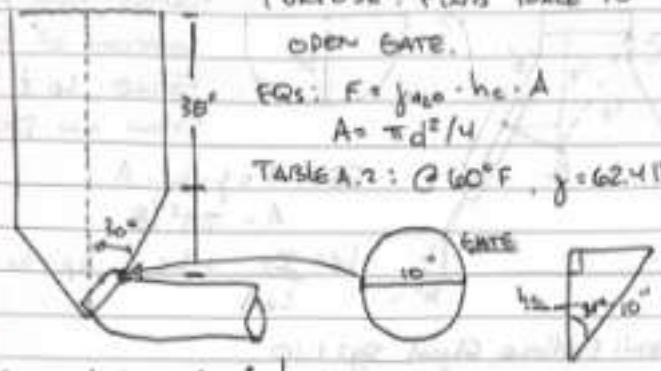
$\Rightarrow L_P = \frac{1097.6 in^4}{24.45" \mid 157.08 in^2} + 24.45"$

$\Rightarrow \boxed{L_P = 24.74"}$

$\Rightarrow h_P = 21.17" + \frac{1097.6 in^4 \mid \sin^2(30°)}{21.17" \mid 157.08 in^2}$

$\Rightarrow \boxed{h_P = 21.35"}$

42)



PURPOSE: FIND FORCE TO OPEN GATE.

EQs: $F = \gamma_{H_2O} \cdot h_c \cdot A$

$A = \pi d^2/4$

TABLE A.2: @ 60°F, $\gamma = 62.4\ lb/ft^3$

ANS: $A_{circ} = \pi(10)^2/4 = 78.54\ in^2$

$h_c = 38" + 10"\cos 30° = 42.33"$

$\Rightarrow F_R = 62.4\ lb \left| \frac{ft^3}{ft^3} \right| \frac{42.33\ in^2}{1728\ in^3} \left| 78.54\ in^2 \right.$

$\Rightarrow \boxed{F_R = 120.05\ lbs}$

54)

PURPOSE: FIND F_V, F_H, F_R & ϕ

GIVEN: LENGTH OF SURFACE 60", Alcohol sg .79

EQs: $F_V = W = \gamma(V)$, $F_R = \sqrt{F_V^2 + F_H^2}$

$F_H = \gamma(h_c)(A)$, $\phi = \tan^{-1} F_V/F_H$

ANS: Alcohol sg = .79 $= \gamma_a / 62.4\ lb/ft^3$

$\Rightarrow \gamma_a = 49.30\ lb/ft^3$

$V = V_{RECT} - V_{circle} = (84")(18")(60") - \left(\frac{(\pi)(10")^2}{8}\right)(60")$

$\Rightarrow V = 88364\ in^3$

$\Rightarrow F_V = 49.30\ lb \left| \frac{ft^3}{ft^3} \right| \frac{88364\ in^3}{1728\ in^3} = \boxed{2521\ lbs}$

$\Rightarrow F_H = 49.30\ lb \left| \frac{ft^3}{ft^3} \right| \frac{160\ in^2}{4} \left| \pi \right| \frac{100\ in^2}{}$

$\Rightarrow \boxed{F_H = 47.07\ lbs}$

Jordan Davis

5H cont) $F_e = \sqrt{(2521 \text{ lbs})^2 + (47.07 \text{ lbs})^2} \Rightarrow \boxed{F_e = 2521.4 \text{ lbs}}$

$\phi = \tan^{-1}\left(2521 \text{ lbs} / 47.07 \text{ lbs}\right) \Rightarrow \boxed{\phi = 88.9^\circ}$