I think I use all of the things I learned on the class and more. The problem I had encounter the most is probably the unit conversion. I would have converted everything to make my answer much more desirable. The best one I did are problem A and E. Problem B, C, and D are not exactly the same as the answer sheet, but the process is correct. I think the problem is my unit. But, the last problem (g), this one is wrong wrong wrong. I thought the phenomenon was not dealing with cavitation but with water hammer. I think this is where I made a mistake. I was surprised at the equation.

I could not find the rubric for the test so I could not write it as shown on the first test, but I believe I should get a B or a C. I could not image myself of getting an A. I made unit mistakes and the very last question is wrong. The strength I demonstrated in the test is I got the flow and procedure in a write way. My unit especially the P is terrible. The problem had most trouble on solving is the last problem. I did not remember doing that in class, so I look at the book to find how to solve it. I thought it was in the last chapter of chapter 11. My assumption is wrong.
I think I would have enough time to do it and revise my answers if I did not have a personal problem while doing the test. I didn't want to discuss that in here. The problem main source is time. From what I learn in government job is, we could always ask to extent on the due that as long we submit the correct data in the end. But school is different. But I think problems A and E are correct. Except problem g, I think I also did not do bad for the other problem. My unit was wrong, but I believe I showed that I did the procedure correctly.
I do want to change something such as fixing my unit and probably using only one type. I do not know how to fix the last problem (g).

New concepts have you learned is using the %diff=RHS-LHS/LHS. Plus, I think I learned a lot on using excel such as f4 such. I think engineers use those concepts when dealing with troubleshooting. I work in a place where we make prototyping, first article, and doing production level, and I think we use troubleshooting extensively. Too many complications were happening in different stages as well. I honestly do not know where I will use all of this anywhere. I mean I use excel in BOMs and probably schedules but never did to show percentage or error difference to anybody. I mostly do not need to show equation because everything was provided to use from a data table or within a spec of something. Plus, most of what I deal with are cabinets, cables, and fab drawing. I do not believe I have learned something I will use for my professional career. Maybe, I learned to be patient.
Areas I feel I was most successful or improved the most is probably doing the procedures correctly and knowing how to do the Bernoulli's. I do not know if you notice but I solve Bernoulli's at the beginning and use it as my baseline where I get my units. I still believe I did the best choice. I think I did not do well with time. I tried to be organized everything. I also tried to put all the info I needed in the test. I do not know why but I was on panic mode the whole time. I was dealing of something as well. But, regardless of that I still did not think I did that bad. I still think I did my best on the test and I do wish I had more time. I know what I did most on and that was time and my unit conversion. I was too focus on doing something else that I forgot to submit the test2 where you going to comment on the Saturday. I kind of mixed up the days. But, despite that, I still did well in my opinion. I actually think I did better without help this time better than the one I did on test1. I think I got most of the correct direction of thinking how to

solve it because of when the teacher said something about it being two system. That time I do not understand that comment but then I saw chapter 11. I think I did answer test 2 without help and I think my procedure is closing than when I did solo on test 1. On test 1, I needed help on having the correct mindset. I think I got the correct mindset on test2. My direction is correct, and my procedure and process were also correct. I kind of messed up on picking certain variables and incorrect unit. With all this being said, ll in all I still believe I did well.

PURPOSE:

(A) To find the depth of the water (y)
We have to use the Table from chapter 14.3

(B) To find the forces from F_y & F_x of the whole system.

(C) To find the largest hickory wood log the open channel can carry (Buoyancy and stability of the hickory wood).

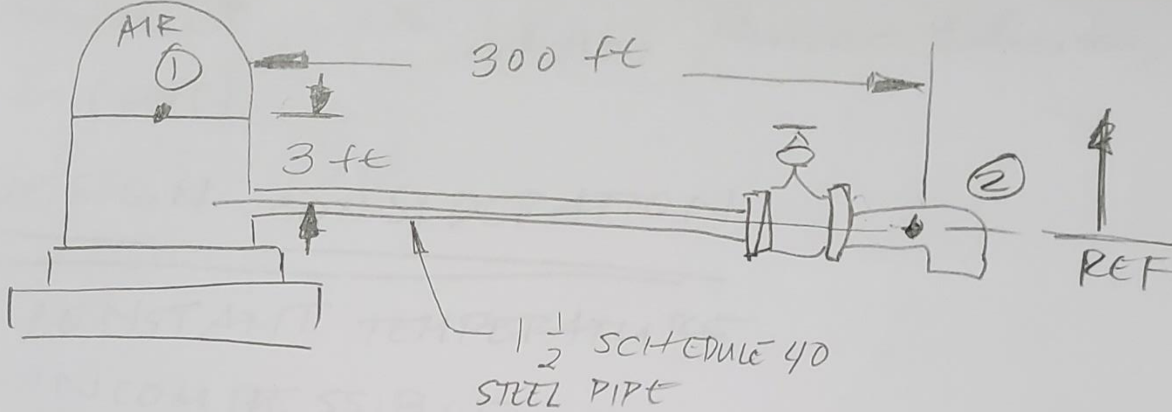
(D) TO FIND THE PRESSURE DROP

(E) TO FIND THE PRESSURE INCREMENT AFTER THE SUDDEN CLOSING

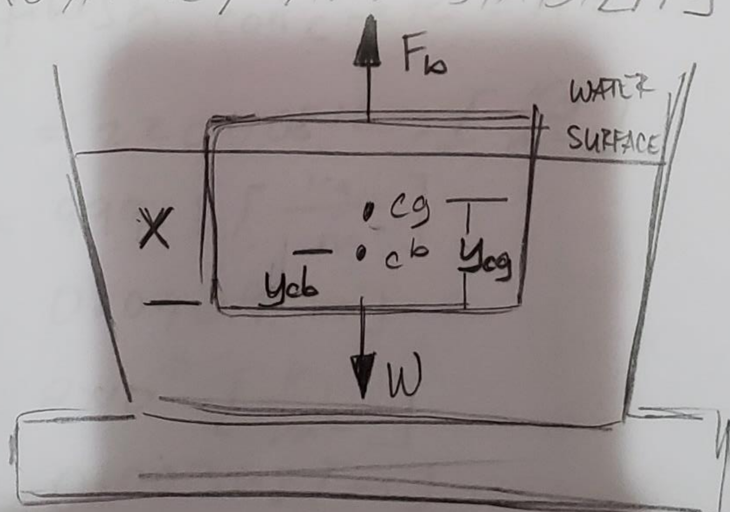
(F) TO FIND THE LARGEST DRAG FORCE IT WOULD EXPERIENCE IF IT GOT STUCK AT THE BOTTOM

(G) TO FIND THE FORCE ACTING UPON THE BLIND FLANGE

DRAWING AND DIAGRAM.



- BUOYANCY AND STABILITY



SOURCES

• Mott, R, Untener, I. A., "Applied Fluid Mechanics," 7th edition Pearson Education, In (2015)

DESIGN CONSIDERATION

CONSTANT TEMPERATURE
INCOMPRESSIBLE
CONSTANT PROPERTES GIVEN

VARIABLES

TABLE 14.1 Values for Manning's n
unfinish concrete = n = 0.017

$E_o = 220110816 3 \left[\frac{kg}{m^2}\right]$

$\rho = 999.1 \left[\frac{kg}{m^3}\right]$

$D = 0.0409 [m]$

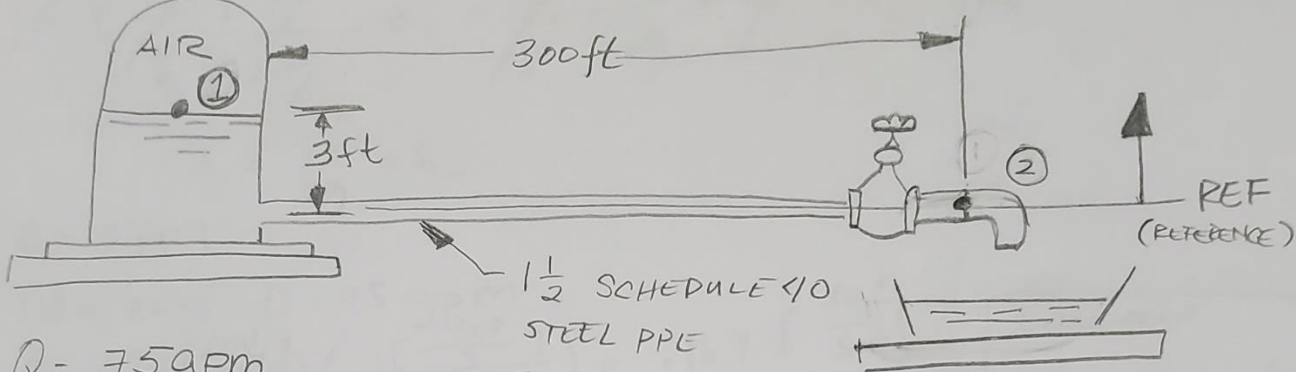
$E = 2\times10^{10} \left[\frac{kg}{m^2}\right]$

$\delta = 0.00368 [m]$

$V_1 = 3.6 \left[\frac{m}{s}\right]$

DRAWING & DIAGRAMS

WATER @ 60°F



$Q = 75 gpm$

$E = 200 GPa$

$\rho_{Hickory} = 830 \frac{kg}{m^3}$

(A) TABLE 14.3

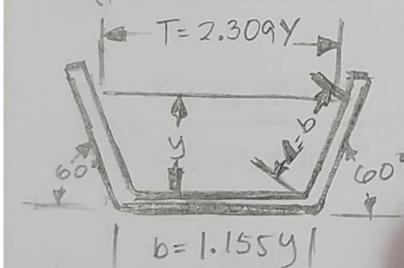
SECTION	AREA	WETTED PERIMETER WP	HYDRAULIC RADIUS R
TRAPEZOID (HALF OF A HEXAGON) 	$1.73y^2$	$3.46y$	$\frac{y}{2}$

TABLE A.2 U.S. CUSTOMARY SYSTEM UNITS (14.7 psia)

TEMP (°F)	Specific weight (lb/ft³)	Density ρ (slugs/ft³)	Dynamic Viscosity η (lb-s/ft²)	Kinematic Viscosity ν (ft²/s)
60	62.4	1.94	2.35×10^{-5}	1.21×10^{-5}

TABLE F.1 Schedule 40

Nominal Pipe Size		Outside Diameter		Wall Thickness		INSIDE DIAMETER			FLOW AREA	
NPS (IN)	DN (mm)	(in)	(mm)	(in)	(mm)	(in)	(ft)	(mm)	(ft²)	(m²)
1 1/2	40	1.900	48.3	0.145	3.68	1.610	0.1342	40.9	0.01414	1.314×10^{-3}

(H) 5

KNOWN

$Q = V \times A$

$$h_A + \frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + h_L + h_R$$

$$z_1 = \frac{V_2^2}{2g} + h_L$$

$z_1 = 3$ [ft]

FLOW RATE = Q = 75 gpm

$$Q = \left(\frac{75 [\frac{Gal}{min}]}{1}\right)\left(\frac{1 [\frac{ft^3}{s}]}{449 [\frac{Gal}{min}]}\right) = .167 [\frac{ft^3}{s}]$$

FLOW AREA

1.5[IN] = 0.01414 ft^2

$$V = \frac{Q}{A} = \frac{.167 [\frac{ft^3}{s}]}{0.01414 [ft^2]} = 11.81 [\frac{ft}{s}]$$

* FRICTION

$$N_R = \frac{VD}{\nu} = \frac{(11.81 [\frac{ft}{s}])(0.1342 [ft])}{1.21 \times 10^{-5} [\frac{ft^2}{s}]} = 131,018.5$$

TABLE 8.2 PIPE ROUGHNESS

STEEL ε:

1.5×10^{-4} [ft]

$$\frac{D}{\varepsilon} = \frac{(0.1342 [ft])}{(1.5 \times 10^{-4} [ft])} = 894$$

$$f = \frac{0.25}{\left[\log\left(\frac{1}{3.7(\frac{D}{\varepsilon})} + \frac{5.74}{N_R^{0.9}}\right)\right]^2} = \frac{0.25}{\left[\log\left(\frac{1}{3.7(894)} + \frac{5.74}{131,018^{0.9}}\right)\right]^2} = \frac{0.25}{\left[\log(4.4 \times 10^{-4})\right]^2} = \frac{0.25}{11.7} = .02$$

* PIPE DIAMETER

$$\phi = \sqrt{\frac{4Q}{\pi V}} = \sqrt{\frac{4(.167 [\frac{ft^3}{s}])}{\pi(11.81 [\frac{ft}{s}])}} = \sqrt{\frac{.668 [\frac{ft^3}{s}]}{37.1 [\frac{ft}{s}]}} = \sqrt{0.018 [ft]} = .13 [ft]$$

* ENERGY LOSSES

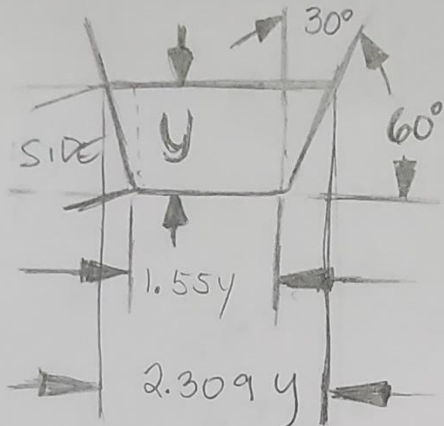
* ENTRANCE LOSS $= h_{L1} = k\left(\frac{V^2}{2g}\right) = (0.5)\left(\frac{11.81 [ft]^2}{2.32.2 [\frac{ft}{s}]}\right) = 1.003 [\frac{ft}{s}]$

* Globe valve $= h_{L5} = k\left(\frac{V^2}{2g}\right) = 340(0.028)(2.166 \frac{ft}{s}) = 20.62 [\frac{ft}{s}]$

* PIPE $= h_{L3} = f\left(\frac{L}{D}\right)\frac{V^2}{2g} = (0.02)\left(\frac{300 [ft]}{.13 [ft]}\right)(2.166 [\frac{ft}{s}]) = 97 [ft]$

$$\Sigma h_L = h_{L1} + h_{L2} + h_{L3} = 1.003 [ft] + 20.62 [ft] + 97 [ft] = 118.6 [ft]$$

(A)



$A = WD + XD$

$WP = W + 2L$

$AREA_{REC} = y(1.55y) = 1.55y^2$

$AREA_{TRI} = \cancel{2}\left(\frac{hb}{\cancel{2}}\right) = hb$

$= (\tan 30°(y))(y) = y^2 \tan 30$

$AREA_{TOTAL} = 1.55y^2(y^2 \tan 30)$

$AREA_{TOTAL} = 1.55y^4 \tan 30$

$SIDE = \frac{y}{\cos 30°}$

$WP = y + 2\left(\frac{y}{\cos 30°}\right) = y + \left(\frac{2y}{\cos 30°}\right)$

$\frac{3.46\cancel{y}}{\cancel{y}} = \frac{y + \left(\frac{2y}{\cos 30°}\right)}{y}$

$3.46 = 1 + \frac{\left(\frac{2\cancel{y}}{\cos 30°}\right)}{\cancel{y}} \frac{\left(\frac{1}{\cancel{y}}\right)}{\left(\frac{1}{\cancel{y}}\right)}$

(NOT SURE WHAT I WAS TRYING TO DO. <u>ATTEMPT #1</u>)

ATTEMTY #2

slope = 0.1 percent

TABLE 14.1 values for Manning's n
unfinish concrete = $n = 0.017$

$$R = \frac{A}{WP}$$

$$\frac{y}{2} = \frac{1.73y^2}{3.46y}$$

$$\frac{y}{2}(3.46y) = 1.73y^2$$

$$1.73y^2 = 1.73y^2$$

$$Q = \left(\frac{1.00}{n}\right) AR^{2/3} S^{\frac{1}{2}} = \left(\frac{1.00}{0.017}\right)(1.73y^2)\left(\frac{y}{2}\right)^{\frac{2}{3}}(0.1)^{\frac{1}{2}}$$

$$.167 \left[\frac{ft^3}{s}\right] = (58.8)(.0865\, y^{2+\frac{2}{3}+\frac{1}{2}})$$

$$\frac{.167}{5.0862} = \frac{5.0862\, y^{\frac{19}{6}}}{5.0862}$$

$$y^{\frac{19}{6}} = .0328$$

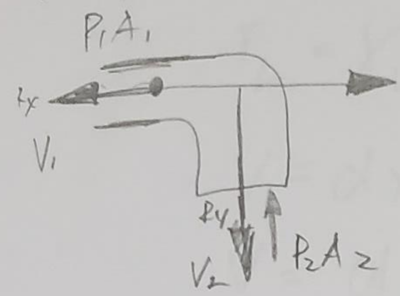
$$(\sqrt[6]{y})^{19} = .0328$$

$$y = (\sqrt[19]{.0328})^6 = .0328^{\frac{6}{19}} = .34$$

$y = .134$ ft

$y = 0.13183$ ft

(B.)



$F_x = \rho Q(V_{2x} - V_{1x}) = R_x - P_1 A_1$

$V_{1x} = -V_1$

$V_{2x} = 0$

$R_x = P_1 A_1 = \rho Q[0 - (-V_1)] = \rho Q V_1 + P_1 A_1$

$V_1 = \frac{Q}{A_1} = 11.81[\frac{ft}{s}] = 3.6[\frac{m}{s}]$

$\rho_1 = 1.94 [\frac{slugs}{ft^3}] = 999.1[\frac{kg}{m^3}] = 9805 \frac{N}{m^3}$

$A_1 = (1.314 \times 10^{-3} [m^2])$

$Q = (.167[\frac{ft^3}{s}])(\frac{0.0283168 m^3}{1 ft^3}) = .004473[\frac{m^3}{s}]$

$P_1 A_1 = (9805[\frac{N}{m^3}])(1.314 \times 10^{-3}[m^2]) = 12.9\ N$

$\rho Q V = (\frac{1000[kg]}{m^3})(.004473[\frac{m^3}{s}])(3.6[\frac{m}{s}]) = 17.028\ N$

$R_x = \rho Q V_1 + P_1 A_1 = (12.9 + 17.028) N = 29.9\ N$

$F_y = \rho Q(V_{2y} - V_{1y}) = R_y + P_2 V_2$

$V_{2y} = -V_{2y}$

$V_{1y} = 0$

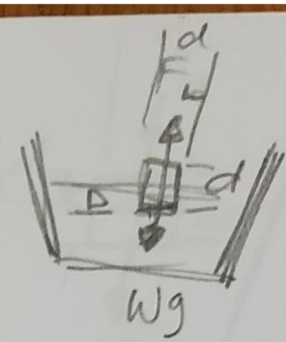
$R_y + P_2 A_2 = -\rho Q V_2$

$R_y = -\rho Q V_2 + -P_2 A_2 = -29.9 N$

$R_x = 29.9 N$

$R_y = -29.9 N$

(c)



$F_b = \gamma_w V_d$

$V = d \times d \times d$

$V = d^3$

$W = \gamma_{hickory} d^3$

$V_d = d^2 (D)$

$F_b = \gamma_w V_d = \gamma_w d^2 D$

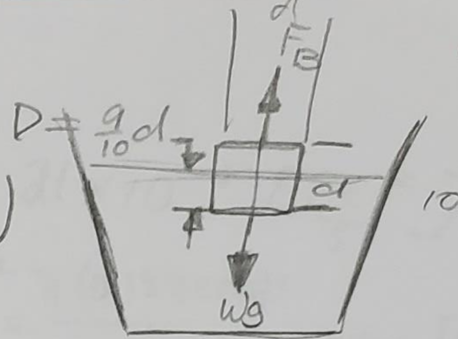
$F_b - W = 0$

$\gamma_w d^2 D - \gamma_{hickory} d^3 = 0$

$D = \dfrac{\gamma_{hickory}}{\gamma_w} d$

(4)

10



$$1.94 \frac{slugs}{ft^3} = \frac{\frac{9}{10}d}{d}\left(1.94 \frac{slugs}{ft^3}\right)$$

$$1 = \frac{9}{10} d$$

$$d = 1.1[ft]$$

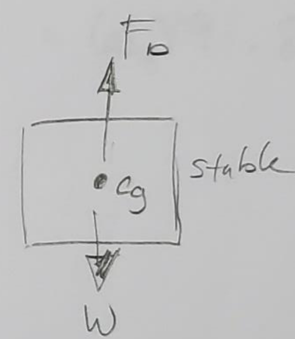
$$\left(830\left[\frac{kg}{m^3}\right]\right)\left(\frac{2.2\ lbs}{1\ kg}\right)\left(\frac{1\ m^3}{35\ ft^3}\right) = 52.2 \frac{lb}{ft^3}$$

$$\gamma_{hickory} = \rho g = \left(52.2\left[\frac{lb}{ft^3}\right]\right)\left(32.2\left[\frac{ft}{s^2}\right]\right)$$

$$= 1679.9\left[\frac{lb}{ft^2 s}\right]$$

$$\gamma_w = 62.4 \frac{lb}{ft^2 s}$$

$$D = 1.1\left(\frac{1679.9}{62.4}\right) = 29.6[ft]$$



$$D = 29.6[ft]$$

-IT IS STABLE. The object is a square. The centroid is in the middle (uniformly flow). The sides are all the same. No moment or moving from one side to the other. $F_b = W$. The shape of the wood is what makes it stable and the weigh is uniformly the same. We can assume the wood does not have an unequal weight or size difference. All sides are the same.

(D)

$\beta = \frac{d}{D} = 0.5$

$\nu = 1.21 \times 10^{-5} \left[\frac{ft^2}{s}\right]$

$\gamma_w = \left(62.4 \frac{lb}{ft^3}\right)$

$A_1 = \frac{\pi d^2}{4} = \frac{\pi (0.1342[ft])^2}{4} = .01414\ [ft^2]$

$Q = .167 \left[\frac{ft^3}{s}\right]$

$A_2 = \frac{\pi d^2}{4} = \frac{\pi \left(\frac{0.1342[ft]}{2}\right)^2}{4} = 0.003536$

$V_1 = 11.81 \left[\frac{ft}{s}\right]$

$N_R = \frac{V_1 D}{\nu} = \frac{(11.81 [\frac{ft}{s}])\ d}{1.21 \times 10^{-5} [\frac{ft^2}{s}]} = \frac{(11.81)(0.5D)}{1.21 \times 10^{-5}}$

$N_R = \frac{(11.81)(0.5(0.1342))}{1.21 \times 10^{-5}} = \frac{.792451}{1.21 \times 10^{-5}} = 65,491.8$

$N_R = 65,491.8$

$C = 0.605$

$V_1 = C \sqrt{\frac{2g(P_1 - P_2)/\gamma}{(A_1/A_2)^2 - 1}}$

$\left(\frac{V_1}{C}\right)^2 = \frac{\frac{2g(P_1 - P_2)}{\gamma}}{\left(\frac{A_1}{A_2}\right)^2 - 1}$

$$\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)^2-1\right) = \frac{2g\,(P_1-P_2)}{\gamma}$$

$$\frac{\left(\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)^2-1\right)\right)\gamma}{2g} = \frac{\cancel{2g}\,(P_1-P_2)}{\cancel{2g}}$$

$$\cancel{P_1} - P_2 = \frac{\left(\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)^2-1\right)\right)\gamma}{2g} - P_1$$

$$\cancel{-P_1}$$

$$-1\,(-P_2) = \left(\frac{\left(\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)^2-1\right)\right)\gamma}{2g} - P_1\right) - 1$$

$$P_2 = -\left(\frac{\left(\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)-1\right)\right)\gamma}{2g} - P_1\right) + 1$$

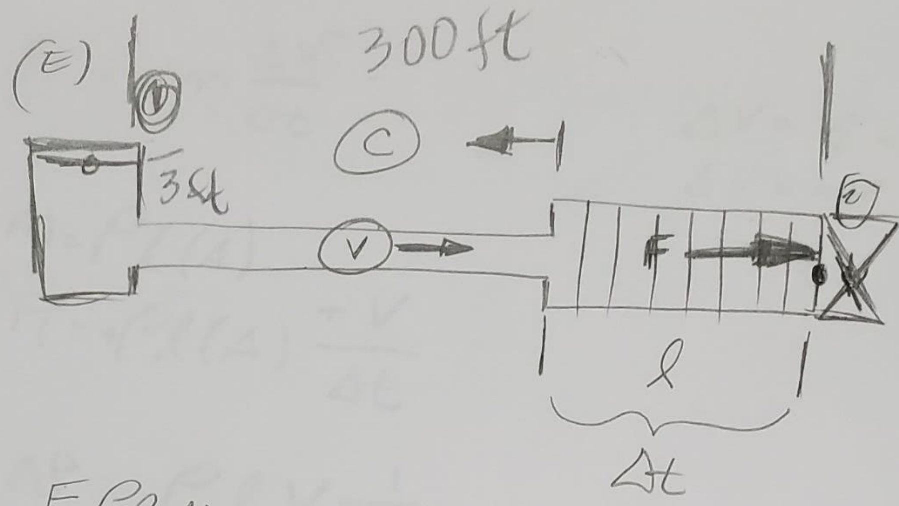
$$P_2 = -\left(\frac{\left(\left(\frac{V_1}{c}\right)^2\left(\left(\frac{A_1}{A_2}\right)-1\right)\right)\gamma}{2g}\right) + P_1 + 1$$

$$P_2 = -\left(\frac{\left(\frac{11.81\,[\frac{ft}{s}]}{0.605}\right)^2\left(\left(\frac{.01414\,[ft^2]}{0.003536\,[ft^2]}-1\right)\right)\left(62.4\,\frac{lb}{ft^3}\right)}{2\left(32.2\,[\frac{ft}{s}]\right)}\right) + 1.94\left[\frac{slugs}{ft^3}\right] + 1$$

$$= -\left(\frac{\left(381\,[\frac{\cancel{ft^2}}{\cancel{s^2}}]\right)(4-1)\left(62.4\,\frac{lb}{\cancel{ft^3}}\right)}{64.4\;\frac{\cancel{ft}}{\cancel{s}}}\right) + 2.94\left[\frac{slugs}{ft^3}\right]$$

$$P_2 = \frac{71323.2}{64.4}\,[lb] + 2.94\left[\frac{slugs}{ft^3}\right]$$

$$P_2 = 1107.5\,[lb] + 2.94\left[\frac{slugs}{ft^3}\right]$$



$$\vec{F} = -m\frac{\Delta V}{\Delta t}$$

$$m = \rho l A$$

$$\Delta V = V_f - V_0$$

$$\Delta V = -V$$

$$F = \rho c \Delta V$$

$$\frac{F}{A} = \rho c V$$

$$\Delta P = \rho c V$$

$$P_{max} = P_{op} + \Delta P$$

$$c = \frac{\sqrt{\frac{E_0}{\rho}}}{\sqrt{1 + \frac{E_0 D}{E\,\delta}}}$$

(google) (cannot find)

$$E_0 = (2.16\,\text{Pa})\left(\frac{1\,\text{kg/m}^2}{9.8\times10^{-9}\,\text{GPa}}\right) = 220408163\left[\frac{\text{kg}}{\text{m}^2}\right]$$

$$\rho = (1.94\left[\frac{\text{slug}}{\text{ft}^3}\right])\left(\frac{515\ \text{kg/m}^3}{1\ \text{slug/ft}^3}\right) = 999.1\left[\frac{\text{kg}}{\text{m}^3}\right]$$

$$D = (40.9\ [\text{mm}])\left(\frac{1\ \text{m}}{1000\ \text{mm}}\right) = 0.0409\ [\text{m}]$$

$$E = (200\,\text{GPa})\left(\frac{1\,\text{kg/m}^2}{9.8\times10^{-9}\,\text{GPa}}\right) = 2\times10^{10}\ \left[\frac{\text{kg}}{\text{m}^2}\right]$$

$$\delta = (3.68\ [\text{mm}])\left(\frac{1\ \text{m}}{1000\ \text{mm}}\right) = 0.00368\ [\text{m}]$$

$$V_1 = (11.81\left[\frac{\text{ft}}{\text{s}}\right])\left(\frac{0.3048\,\text{m}}{1\ \text{ft}}\right) = 3.6\left[\frac{\text{m}}{\text{s}}\right]$$

$$F_i = -m\frac{\Delta V}{\Delta t}$$

$$\Delta V = V_f - V_0$$
$$\delta V = -V$$

$$m = \rho l (A)$$

$$F_i = +\rho l (A)\frac{+V}{\Delta t}$$

$$\Delta P = \rho l V_1 \frac{1}{\Delta t}$$

$$\Delta P = \rho C V_1$$

$$C = \frac{\sqrt{\frac{E_0}{\rho}}}{\sqrt{1+\frac{E_0 D}{E\delta}}} = \frac{\sqrt{\frac{220408163\left[\frac{kg}{m^2}\right]}{999.1\left[\frac{kg}{m^3}\right]}}}{\sqrt{1+\frac{220408161\left[\frac{kg}{m^2}\right](0.0409\,m)}{(2\times10^{10}\left[\frac{kg}{m^2}\right])(0.00368\,[m])}}}$$

$$C = \frac{469.7\ m}{\sqrt{1+\frac{9014693.9\left[\frac{kg}{m}\right]}{73600000\left[\frac{kg}{m}\right]}}} = \frac{469.7\ m}{\sqrt{1+.122\frac{kg}{m}}} = \frac{469.7}{\sqrt{1.122}} = \frac{469.7\ m}{1.06\frac{kg}{m}}$$

$$\boxed{C = 443}$$

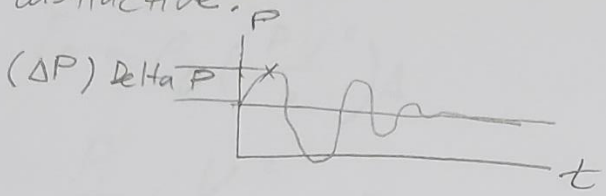
$$\Delta P = \rho C V_1 = \left(999.1\left[\frac{kg}{m^3}\right]\right)(443)\left(3.6\left[\frac{m}{s}\right]\right)$$

$$\boxed{\Delta P = 1593364.68}$$

15

*Why ?.

Cavitation happened when its low pressure and Water hammer happened when its high pressure. Both are distractive.



Pressure wave $= c = \dfrac{\sqrt{E_v/\rho}}{\sqrt{1+\frac{E_v D}{E\delta}}} = 443$

Pressure wave is 443

Delta P (ΔP) = 1593364.7

THUS, Cavitation happend when low pressure occure and Water hammer happend when high pressure happen. The phenomenon shown above is a water hammer. When the valve is close suddenly a high pressure occure. The water that is going toward the valve is stop suddenly creating a pressure wave ⇄ that will go back and forth until the energy is gone. This pressure wave could damage the pipe/valve. This is not cavitation since cavitation is typically assosiated when low pressure occure and which released air with the turbine. Bubble occare which that could damage the pipe over time.

This problem remind me of the video shown to us a week ago about water hummer. I do not think this is cavitation. But, I did notice the air bubbles as the water go back and forth.

(F) (Make any Reasonable assumption)

square cylinder $C_D = 1.60$

$$F_D = C_D\left(\frac{\rho V^2}{2}\right)A$$

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} = \frac{P_s}{\gamma}$$

$$P_s = P_1 + \frac{\gamma V_1^2}{2g} = P_1 + \frac{\rho V_1^2}{2}$$

$l = w = 1.1\ ft$

$V_1 = 11.81 [\frac{ft}{s}]$

$\rho = 1.94 [\frac{slugs}{ft^3}]$

$\gamma_w = 62.4 \frac{lb}{ft^3}$

$\mu = 2.35 \times 10^{-5} [\frac{lb \cdot s}{ft^3}]$

$\nu = 1.21 \times 10^{-5} [\frac{ft^2}{s}]$

$A = l(w) = 2(1.1 ft) = 2.2 [ft^2]$

$$F_D = 1.6\left(\frac{1.94[\frac{slugs}{ft^3}](11.81[\frac{ft}{s}])}{2}\right) = 18.3 \quad [\frac{slugs}{ft^3 \cdot s}]$$

$$F_D = 18.3 \left[\frac{slugs}{ft^3 \cdot s}\right]$$

(6)

(11-8)

$$D = 0.66\left\{\varepsilon^{1.25}\left[\frac{LQ^2}{gh_L}\right]^{4.75} + \nu Q^{9.4}\left(\frac{L}{gh_L}\right)^{5.2}\right]^{0.04}$$

$Q = .167\left[\frac{ft^3}{s}\right]$

$L = 300[ft]$

$g = 32.2\left[\frac{ft}{s^2}\right]$

$h_L = 118.6\ [ft]$

$\varepsilon\ 1.5\times10^{-10}[ft]$

$\nu = 1.21\times10^{-5}\left[\frac{ft^2}{s}\right]$

$$D = 0.66\left[\left(1.5\times10^{-4}\right)^{1.25}\left[\frac{(300)(.167)}{(32.2)(118.6)}\right]^{4.75} + \left(1.21\times10^{-5}\right)(.167)^{9.4}\left[\frac{300}{(32.2)(118)}\right]^{5.2}\right]^{0.04}$$

$$D = 0.66\left[\left(1.66\times10^{-5}\right)\left(\frac{501}{3818.9}\right)^{4.75} + \left(5.97\times10^{-13}\right)(0.79)^{5.2}\right]^{0.04}$$

$$= 0.66\left[\left(1.66\times10^{-5}\right)\left(6.46\times10^{-5}\right) + \left(1.74\times10^{-13}\right)\right]^{0.04}$$

$$= 0.66\left[1.07\times10^{-9} + \left(1.74\times10^{-13}\right)\right]^{0.04}$$

$$= 0.64\left[1.07\times10^{-9}\right]^{0.04}$$

$$= 0.66(.438)$$

$D = .28908[ft]$

THIS IS FOR CAVITATION
- NO CAVITATION
ON THIS PROBLEM
IT'S A WATER HAMMER

LAST PAGE OF CHAPTER 11.7

t = Basic Wall thickness (in or mm) = 3.68 [mm]
P = Design pressure [psig or Pa (gage)] = 999.1 [Pa]
D = pipe outside diameter (in or mm) = 48.3 [mm]
S = allowable stress in tension (psi or MPa) = ?
E = longitude joint quality factor = 200,000 [MPa]
Y = correction based on material type & temp = 0.40

$$t = \frac{PD}{2(SE + PY)}$$

$$3.68[mm] = \frac{(0.0009991[MPa])(48.3[mm])}{2(S)(200,000[MPa]) + (0.0009991[MPa])(0.40)}$$

$$3.68[mm] = \frac{.04828\ [MPa \cdot mm]}{2(200,000[MPa]S + 3.99\times10^{-4})}$$

$$\frac{.04828}{400,000S}[mm] = 3.68$$

$$\frac{1.207\times10^{-7}}{S} = 3.68\ [mm]$$

$$S = \frac{1.207\times10^{-7}[mm]}{3.68\ [mm]} = 3.28\times10^{-8}\ [mm]$$

The location of the stress are on the sides of the pipe. . It is the weakest part of the pipe. 19

PROCEDURE :

① FIRST, Read the problems, study the FBD, and list all of the materials and variables.

② On the FBD, pick a Reference. Reference should be where we know most about and typically the lowest part of the FBD. Then, pick a point to solve.

③ After determining the given information and reading the problems, it's time to solve the first problem. The first problem is asking for the depth of the water on the water channel.

④ Solve all of the problem from A TO G.

⑤ After solving all of the problem, write the summary, procedure, analysis, and all the requirements needed on the test.

⑥ CREATE an excel spreadsheet.

⑦ submit the test to the teacher

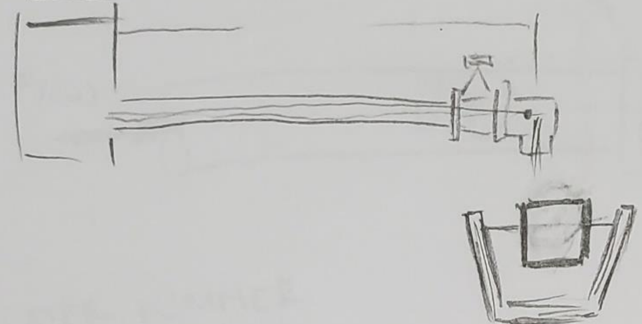
MATERIAL

- TANK
- WATER (FLUID)
- PIPE
- VALVE GLOBE
- ELBOW
- OPEN CHANNEL (TRAPEZOIDAL)
- HICKORY WOOD

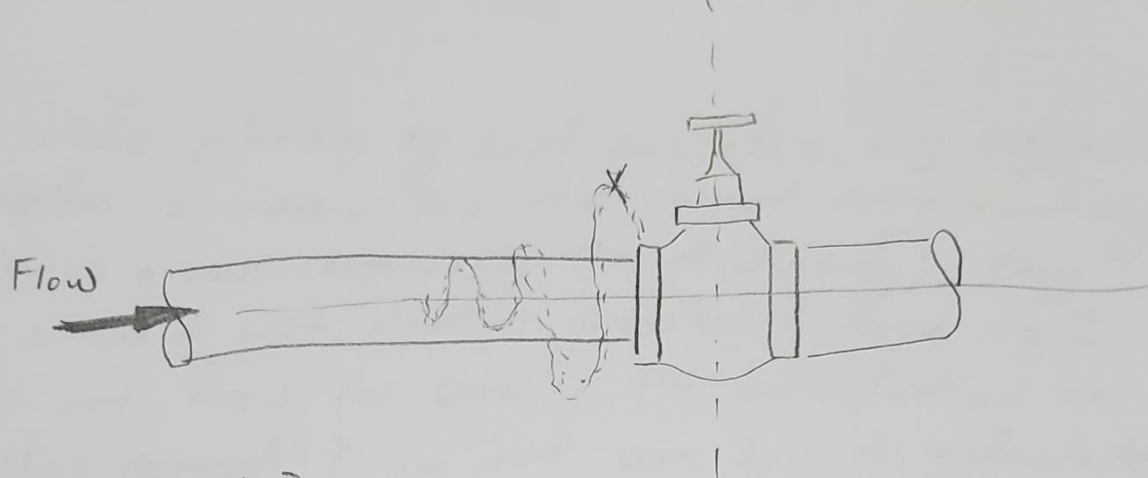
SUMMARY

Gather and understand the phenomenon or the problem. Once everything is set up correctly, solve the first problem. The first problem is to find the depth of the water on the open area. The second is to find all the forces. The third is to find the maximum size of the hickory wood and check the bouyancy and stability. The fourth is to find the pressure drop as you calculate using a diameter of 0.5. Use the graph on the book to get $K_c = 0.605$ from the Raynond number (N_R). The next is to find the cavitation or water hammer (need to include explanation). The next on is asking of the drag force when it got stuck at the bottom of the channel. Lastly, the problem is to solve the diameter of the blind flange.

ANALYSIS/

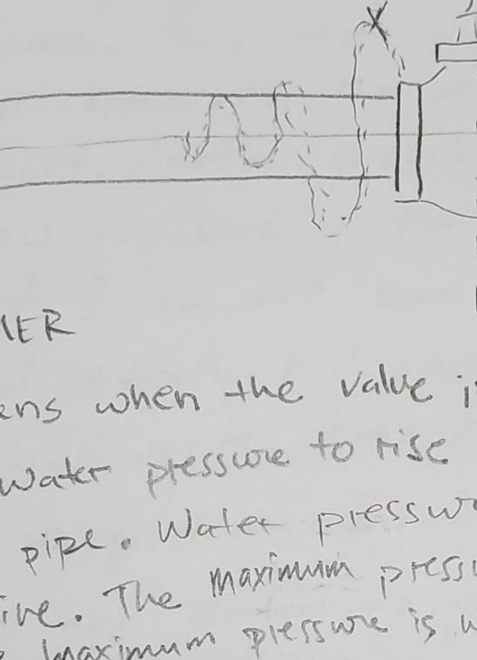


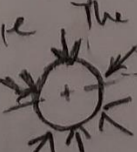
A system (powered by gravity) has a tank, pipe (300 ft), a globe valve, and an elbow is going to a series of test to minimize problem such as water hammer, cavitation, ect. The first problem is to know the water level on the open channel (the specific open channel size is given) but the actual (y) is not given. Due to the matorial used to make the open channel, theres a minimum given percentage of inaccurate build. The second problum is to find the summation of all the force ($\Sigma F_x, \Sigma F_y$) as it exit the pipeline. This is need to know the force of water/pressure of water when the value is suddenly close. Would the water hammer break the pipeline or will it withstand the sudden change of pressure.



WATER HAMMER

- Happens when the value is close suddenly causing the water pressure to rise which could damage the pipe. Water pressure can change the pipeline. The maximum pressure is shown below, if the maximum pressure is within the limit, the pipeline should be safe. But, to make sure everything is safe, another inspection is needed. The weakest part of the pipe is where the pipe & the value are connected





. Finding the Diameter is in chapter 11. The equation is shown below.

$$D = 0.66\left[\varepsilon^{1.25}\left(\frac{LQ}{ghL}\right)^{4.75} + \nu Q^{9.4}\left(\frac{L}{ghL}\right)^{5.2}\right]^{0.04}$$

$t = A\sqrt{\quad}$

I made plenty of unit mistakes. My biggest problem is time. This test is not easy and my unit is a mess especially the ρ (density). Slug is a weird unit. Another problem I have is I do not know for sure if the calculation on part is correct. I am not sure how to calculate y if I could literally put anything on y and test if it will work. Plus, the statement barely floating is vague to me. I use the $\frac{1}{10}$ OR 10% RULE. This test is not similar to what we have done in class, thus it is harder. But, I think my biggest problem is unit and having different direction on solving what is being ask. I think my process is not entirely incorrect. There are minor problems on how I solved the problems. But, the biggest problem is incorrect units. The reason is I tried to use ft instead of meter and slugs. I wish I could have clean up my convention and fix my units. I think I keep converting my units to help with solving. But, I am sure that's where I made most of my mistakes.

25

The second test is harder. I know I made many assumptions that could be wrong and my units were incorrect as well. I think I need more time. I have not done the excel spread sheet. I think I will rush to finish the excel part or not finish it at all (or partially done).

I could not finish all the excel from to b.

Problem A

	RIGHT	LEFT	%diff
1	1.67E-01	0.08499	9649.65%
2	1.67E-01	0.10729	5565.85%
3	1.67E-01	0.13271	2583.48%
4	1.67E-01	0.16139	347.29%
5	1.67E-01	0.19345	-1367.17%
	1.67E-01	0.16700	0.00%

n=	0.017						
slope=	0.1	%					
A=	1.73E-02	2.09E-02	2.49E-02	2.92E-02	3.39E-02	3.01E-02	FT2
R=	1.36E-01	1.45E-01	1.53E-01	1.62E-01	1.70E-01	1.63E-01	
Q=	0.167	ft3/s					
Y=	0.1	0.11	0.12	0.13	0.14	0.131828	FT

Q	V	NR	D/E	f	PIPE DIA	HL1	HL2	HL3	HL
0.167038	11.81314	131018.5	894.6667	0.044007	1.585460364	1.083466	20.62919	18.04411	39.75676

Problem b

B			
P1	A1	RX	RY
9805	0.001314	29.91169	-29.9117

Problem d

D						
d/D	SW	V	A1	A2	NR	C
0.5	62.4	1.21E-05	0.014138	0.003534	65491.81818	0.605

Problem c

d=	1.1	ft				
P=	52.17143					
SH=	1.68E+03					
SW=	6.24E+01					
g=	32.2	ft/s				
D=	29.6	29.4	29.5	29.6	29.7	29.8
	RIGHT	LEFT	%diff			
1	2.96E+01	29.60000	4.72%			
2	2.96E+01	29.90000	-95.66%			
3	2.96E+01	29.50000	38.64%			
4	2.96E+01	29.60000	4.72%			
5	2.96E+01	29.70000	-28.96%			
	2.96E+01	29.80000	-62.42%			