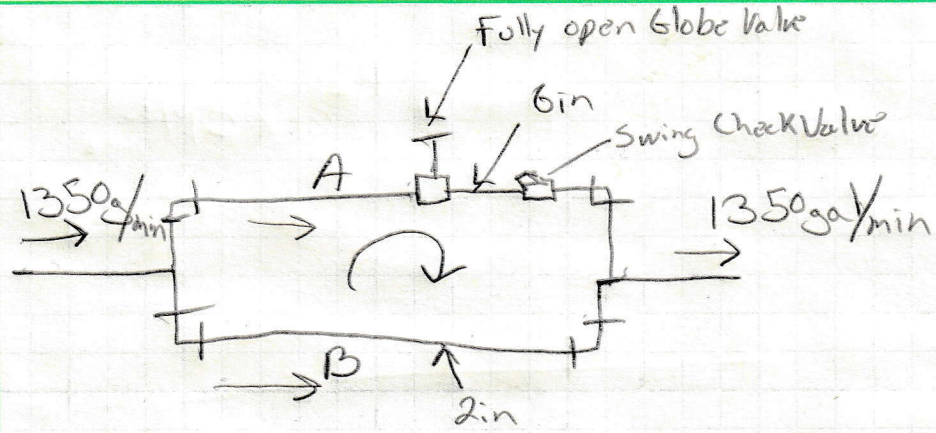
12.7



15.4

$Q = 25\ gal/m = 0.0557\ ft^3/s$

$V = \frac{Q}{A} = .0557\ ft^3/s / .545\ ft^2 = .1022\ ft/s$

$$h = \left(\frac{V_1}{c}\right)^2 \frac{(A_1/A_2)^2 - 1}{2g\left[\left(\gamma_m/\gamma_f\right) - 1\right]}$$

$$= \left(\frac{.1022}{.593}\right)^2 \frac{\left(\frac{.545}{.00545}\right)^2 - 1}{2(32.2\ ft/s^2)\left(\frac{62.4}{51.792}\right) - 1}$$

$h_a = 22.516\ ft$

Ammonia

$\gamma = (.83)(62.4) = 51.792\ lb/ft^3$

Water

$\gamma = 62.4\ lb/ft^3$

$10\ in \cdot \frac{1\ ft}{12\ in} = .833\ ft$

$A_1 = \frac{\pi D^2}{4} = .545\ ft^2$

$A_{2a} = .00545\ ft^2$

$A_{2b} = .267\ ft^2$

$$R_e = \frac{(.1022)(.833\ ft)(.83)(1.94)}{2.5 \times 10^{-6}}$$

$R_e = 54832.205$

$C = .593$

15.4 cont

$$h_b = \left(\frac{.1022 \text{ ft}^4/\text{s}}{.593}\right)^2 \frac{\left(\frac{.545 \text{ ft}^2}{.267 \text{ ft}^2}\right)^2 - 1}{2(32.2 \text{ ft}/\text{s}^2)\left[\left(\frac{62.4}{51.792}\right) - 1\right]}$$

$$h_b = .00713 \text{ ft}$$

Problem 12.7

Trial 1

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1012	2.254746	0.5054	0.00015	500	500	3369.333	11.23925	1152194	0.015636	39.18108	199.1919	176.6868		-15.40%
B	-338	-0.75307	0.1723	0.00015	500	60	1148.667	32.29783	1128786	0.019375	5903.622	-3348.01	8891.65	ΔQ (ft^3/s)	46.11%
												-3148.81	9068.337	-0.34723	

Trial 2

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1167.848	2.601978	0.5054	0.00015	500	500	3369.333	12.9701	1329632	0.015553	38.97298	263.8583	202.8137		-5.48%
B	-182.152	-0.40584	0.1723	0.00015	500	60	1148.667	17.40563	608314.5	0.019649	5987.181	-986.104	4859.624	ΔQ (ft^3/s)	35.15%
												-722.246	5062.437	-0.14267	

Trial 3

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1231.882	2.744645	0.5054	0.00015	500	500	3369.333	13.68125	1402537	0.015525	38.90124	293.0461	213.5402		-1.37%
B	-118.118	-0.26317	0.1723	0.00015	500	60	1148.667	11.28685	394467.4	0.019944	6077.078	-420.883	3198.586	ΔQ (ft^3/s)	14.24%
												-127.837	3412.126	-0.03747	

Trial 4

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1248.698	2.782111	0.5054	0.00015	500	500	3369.333	13.86801	1421682	0.015517	38.88349	300.9637	216.3564		-0.13%
B	-101.302	-0.2257	0.1723	0.00015	500	60	1148.667	9.680019	338309.8	0.020076	6117.227	-311.622	2761.349	ΔQ (ft^3/s)	1.59%
												-10.6581	2977.705	-0.00358	

Trial 5

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1250.304	2.78569	0.5054	0.00015	500	500	3369.333	13.88585	1423511	0.015517	38.88182	301.7256	216.6254		0.00%
B	-99.6958	-0.22212	0.1723	0.00015	500	60	1148.667	9.526508	332944.7	0.02009	6121.692	-302.037	2719.541	ΔQ (ft^3/s)	0.05%
												-0.31115	2936.167	-0.00011	

Trial 6

PIPE	Q (g/min)	Q (ft^3/s)	D (ft)	ε (ft)	L (ft)	Le (ft)	D/ε	V (ft/s)	Re	f	k (s^2/ft^5)	$k*Q^2$	$2*k*Q$		% Error
A	1250.352	2.785796	0.5054	0.00015	500	500	3369.333	13.88638	1423565	0.015517	38.88177	301.7482	216.6334		0.00%
B	-99.6483	-0.22202	0.1723	0.00015	500	60	1148.667	9.521963	332785.9	0.020091	6121.826	-301.755	2718.303	ΔQ (ft^3/s)	0.00%
												-0.00706	2934.937	-2.4E-06	

Q_A=	1250.352 gal/min
Q_B=	99.64828 gal/min