



Collection System Math - CEU Problems Answer Key

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Chapter 8—Achievement Test

1. A plant has been averaging a screenings removal of 2.4 cu ft/MG. If the average daily flow is 2,900,000 gpd, how many days will it take to fill a screenings pit that has an available capacity of 260 cu ft?

$$\text{Rate} = \left(2.4 \frac{\text{ft}^3}{\text{MG}} \right) \left(\frac{2,900,000 \frac{\text{gal}}{\text{day}}}{1,000,000 \frac{\text{gal}}{\text{MG}}} \right)$$

$$\text{Days} = \frac{260 \text{ ft}^3}{7.0 \frac{\text{ft}^3}{\text{day}}}$$

ANS 37 days

2. During 7 days a total of 200 gallons of screenings were removed from the wastewater screens. What was the average screenings removal in cu ft/day? (Round to the nearest tenth.)

$$\text{Volume} = \frac{200 \text{ gal}}{7.48 \frac{\text{gal}}{\text{ft}^3}}$$

$$\text{Rate} = \frac{26.7 \text{ ft}^3}{7 \text{ days}}$$

ANS 3.8 $\frac{\text{ft}^3}{\text{day}}$

3. A total of 5.2 cu ft of screenings are removed from the wastewater flow during a 24-hour period. If the flow at the treatment plant is 2,840,000 gpd, what is the screenings removal reported as cu ft/MG? (Round to the nearest tenth.)

$$\text{Rate} = \frac{5.2 \frac{\text{ft}^3}{\text{day}}}{\left(\frac{2,840,000 \frac{\text{gal}}{\text{day}}}{1,000,000 \frac{\text{gal}}{\text{MG}}} \right)}$$

ANS 1.8 $\frac{\text{ft}^3}{\text{MG}}$

4. A screenings pit has a capacity of 10 cubic yards available for screenings. If the plant removes an average of 2.3 cu ft of screenings per day, in how many days will the pit be filled?

$$\text{Volume} = (10 \text{ yd}^3) \left(27 \frac{\text{ft}^3}{\text{yd}^3} \right)$$

$$\text{Days} = \frac{270 \text{ ft}^3}{2.3 \frac{\text{ft}^3}{\text{day}}}$$

ANS 117 days

5. A float is placed in a channel. If the float travels 35 ft in 28 seconds, what is the estimated velocity in the channel in ft/sec? (Round to the nearest tenth.)

$$\text{Velocity} = \frac{35 \text{ ft}}{28 \text{ s}}$$

ANS 1.25 $\frac{\text{ft}}{\text{s}}$

6. Using the table shown below, determine the cfs flow rate through a rectangular weir with end contractions if the feet of head indicated at the staff gage is 0.14 and the length of the weir crest is 1 ft.

Head ft	LENGTH OF WEIR CREST IN FEET					
	1		1-1/2		2	
	cfs	MGD	cfs	MGD	cfs	MGD
0.11	.119	.077	.178	.116	.241	.155
0.12	.135	.087	.204	.132	.273	.177
0.13	.152	.098	.230	.149	.308	.199
0.14	.169	.110	.256	.166	.343	.222

ANS 0.169 $\frac{\text{ft}^3}{\text{s}}$

7. What is the MGD flow through a 6-inch Parshall flume if the upstream gage indicates a depth of 0.32 ft? (Assume no submergence condition exists.)

DISCHARGE THROUGH A 6-INCH PARSHALL FLUME							
Head ft	cfs	gps	MGD	Head ft	cfs	gps	MGD
0.31	.3238	2.422	.2092	0.41	.5036	3.767	.3255
0.32	.3404	2.547	.2200	0.42	.5231	3.913	.3381
0.33	.3574	2.673	.2310	0.43	.5429	4.062	.3509
0.34	.3746	2.803	.2421	0.44	.5630	4.212	.3639
0.35	.3922	2.934	.2535	0.45	.5834	4.364	.3770
0.36	.4100	3.068	.2650	0.46	.6040	4.518	.3904
0.37	.4282	3.203	.2767	0.47	.6249	4.675	.4038
0.38	.4466	3.341	.2886	0.48	.6460	4.833	.4175
0.39	.4653	3.481	.3007	0.49	.6674	4.993	.4313
0.40	.4843	3.623	.3130	0.50	.6890	5.155	.4453

ANS 0.2200 MGD

Chapter 8—Achievement Test—Cont'd

8. A grit channel 2.5 ft wide has water flowing to a depth of 14 inches. If the velocity of the water is 0.9 fps, what is the cfs flow in the channel? (Round to the nearest tenth.)

$$\text{Area} = (2.5 \text{ ft}) \left(\frac{14 \text{ inches}}{12 \text{ in/ft}} \right)$$

$$\text{Velocity} = (2.92 \text{ ft}^2) (0.9 \frac{\text{ft}}{\text{s}})$$

$$\text{ANS } \underline{2.6 \frac{\text{ft}^3}{\text{s}}}$$

9. The total daily grit removal for a treatment plant is 210 gallons. If the plant flow is 8.6 MGD, how many cubic feet of grit are removed per MG flow? (Round to the nearest tenth.)

$$\text{Volume} = \left(\frac{210 \text{ gal}}{7.48 \frac{\text{gal}}{\text{ft}^3}} \right)$$

$$\text{Rate} = \left(\frac{28.1 \frac{\text{ft}^3}{\text{day}}}{8.6 \frac{\text{MG}}{\text{day}}} \right)$$

$$\text{ANS } \underline{3.3 \frac{\text{ft}^3}{\text{MG}}}$$

10. A grit channel is 2.5 ft wide with water flowing to a depth of 16 inches. If the flow velocity through the channel is 1.7 ft/sec, what is the gpm flow through the channel?

$$\text{Area} = (2.5 \text{ ft}) \left(\frac{16 \text{ inches}}{12 \text{ in/ft}} \right)$$

$$\text{Velocity} = (3.33 \text{ ft}^2) (1.7 \frac{\text{ft}}{\text{s}})$$

$$\text{Velocity} = (5.67 \frac{\text{ft}^3}{\text{s}}) (7.48 \frac{\text{gal}}{\text{ft}^3}) (60 \frac{\text{s}}{\text{min}})$$

$$\text{ANS } \underline{2,543 \text{ gpm}}$$

11. The average grit removal at a particular treatment plant is 2.2 cu ft/MG. If the monthly average daily flow is 3,540,000 gpd, how many cu yds of grit would be expected to be removed from the wastewater flow during one month? Assume the month has 30 days. (Round to the nearest tenth.)

$$\text{Volume} = \left(2.2 \frac{\text{ft}^3}{\text{MG}} \right) \left(\frac{3,540,000 \frac{\text{gal}}{\text{day}}}{1,000,000 \frac{\text{gal}}{\text{MG}}} \right) \left(30 \frac{\text{days}}{\text{month}} \right)$$

$$\text{Volume} = \left(\frac{233.6 \frac{\text{ft}^3}{\text{month}}}{27 \frac{\text{ft}^3}{\text{yds}}} \right)$$

ANS 8.7 yd³

12. A grit channel 3 ft wide has water flowing to a depth of 11 inches. If the velocity through the channel is 1 fps, what is the cfs flow rate through the channel? (Round to the nearest tenth.)

$$\text{Area} = (3 \text{ ft}) \left(\frac{11 \text{ inches}}{12 \text{ in/ft}} \right)$$

$$\text{Velocity} = (2.75 \text{ ft}^2) \left(1 \frac{\text{ft}}{\text{s}} \right)$$

ANS 2.8 $\frac{\text{ft}^3}{\text{s}}$