Chapter 12—Achievement Test

1. An aeration tank is 90 ft long, 30 ft wide, and operates at an average depth of 16 ft. What is the capacity of the tank, in gallons?

ANS_____

2. The BOD content of the wastewater entering an aeration tank is 217 mg/*L*. If the flow to the aeration tank is 1,668,000 gpd, what is the lbs/day BOD loading?

ANS_____

3. The flow to a 210,000-gallon oxidation ditch is 389,000 gpd. The BOD concentration of the wastewater is 218 mg/*L*. If the mixed liquor suspended solids concentration is 3250 mg/*L*, with a volatile solids content of 67%, what is the F/M ratio? (Round to the nearest hundredth.)

ANS_____

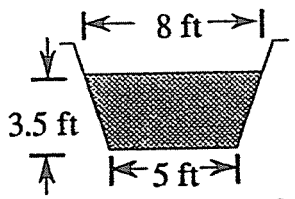
4. A clarifier has a diameter of 80 ft and an average depth of 10 ft. What is the capacity of the clarifier, in gallons?

ANS_____

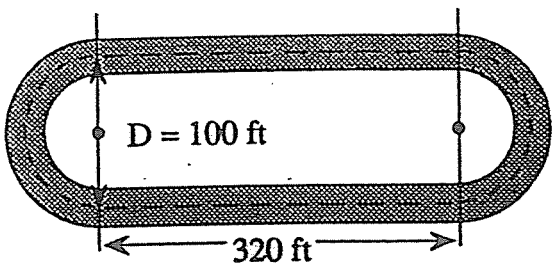
5. An activated sludge aeration tank receives a primary effluent flow of 2.13 MGD with a BOD concentration of 175 mg/*L*. The mixed liquor volatile suspended solids concentration is 2880 mg/*L* and the aeration tank volume is 420,000 gallons. What is the current F/M ratio? (Round to the nearest hundredth.)

ANS_____

6. Calculate the cu ft capacity of the oxidation ditch shown below. The cross section of the ditch is trapezoidal.



Cross Section of Ditch



Top View of Ditch

ANS_____

7. The daily flow to an aeration tank is 3,840,000 gpd. If the COD concentration of the influent wastewater is 155 mg/*L*, how many pounds of COD are applied to the aeration tank daily?

ANS_____

8. An aeration tank contains 525,000 gallons of wastewater with a MLSS concentration of 2610 mg/*L*. If the primary effluent flow is 1.7 MGD with a suspended solids concentration of 185 mg/*L*, what is the sludge age? (Round to the nearest tenth.)

ANS_____

Chapter 12—Achievement Test—Cont'd

9. The desired F/M ratio at a particular activated sludge plant is 0.4 lbs BOD/lb MLVSS. If the 2.78-MGD primary effluent flow has a BOD concentration of 143 mg/*L*, how many lbs of MLVSS should be maintained in the aeration tank? (Round to the nearest tenth.)

ANS_____

10. An oxidation ditch receives a flow of 0.28 MGD. If the volume of the oxidation ditch is 390,000 gallons, what is the detention time in hours?

ANS_____

11. The desired F/M ratio at a particular activated sludge plant is 0.7 lbs COD/lb MLVSS. If the 2,390,000-gpd primary effluent flow has a COD concentration of 158 mg/*L*, how many lbs of MLVSS should be maintained in the aeration tank?

ANS_____

12. An aeration tank is 100 ft long, 45 ft wide, and operates at a depth of 13 ft. The MLSS concentration in the aeration tank is 2830 mg/*L*. If the influent flow to the tank is 1.1 MGD and contains a suspended solids concentration of 160 mg/*L*, what is the sludge age? (Round to the nearest tenth.)

ANS_____

13. If the volume of the oxidation ditch is 600,000 gallons, and an oxidation ditch receives a flow of 0.34 MGD, what is the detention time in hours? (Round to the nearest tenth.)

ANS_____

14. An oxidation ditch has a volume of 250,000 gallons. The 0.3-MGD flow to the oxidation ditch has a suspended solids concentration of 195 mg/*L*. If the MLSS concentration is 3910 mg/*L*, what is the sludge age in the oxidation ditch? (Round to the nearest tenth.)

ANS_____

15. If the mixed liquor suspended solids concentration is 2660 mg/*L*, and the aeration tank has a volume of 425,000 gallons, how many pounds of suspended solids are in the aeration tank?

ANS_____

16. The desired F/M ratio at a conventional activated sludge plant is 0.3 lbs BOD/lb MLVSS. If the 2.81-MGD primary effluent flow has a BOD of 144 mg/*L*, how many lbs of MLVSS should be maintained in the aeration tank?

ANS_____

17. The aeration tank of a conventional activated sludge plant has a mixed liquor volatile suspended solids concentration of 2470 mg/*L*. If the aeration tank is 100 ft long, 45 ft wide, and has wastewater to a depth of 17 ft, how many pounds of MLVSS are in the aeration tank?

ANS_____

Chapter 12—Achievement Test—Cont'd

18. The MLSS concentration in an aeration tank is 2740 mg/*L*. The aeration tank contains 705,000 gallons of wastewater. If the primary effluent flow is 1.78 MGD with a suspended solids concentration of 180 mg/*L*, what is the sludge age? (Round to the nearest tenth.)

ANS_____

19. Determine the solids retention time (SRT) given the following data: (Use the "core sampler" method of calculating system solids.)

Aer. Tank Vol.—1,380,000 gal	MLSS—2650 mg/*L*
Fin. Clar.—117,000 gal	WAS—5960 mg/*L*
P.E. Flow—2.9 MGD	S.E. SS—20 mg/*L*
WAS—75,000 gpd	CCSS—1900 mg/*L*

ANS_____

20. The settleability test after 30 minutes indicates a sludge settling volume of 228 m*L*/*L*. Calculate the RAS flow as a ratio to the secondary influent flow. (Round to the nearest hundredth.)

ANS_____

21. The desired F/M ratio at an activated sludge plant is 0.5 lbs BOD/lb MLVSS. It was calculated that 3630 lbs/day BOD enter the aeration tank. If the volatile solids content of the MLSS is 71%, how many lbs MLSS are desired in the aeration tank?

ANS_____

22. Calculate the solids retention time (SRT) given the following data: (Use the "combined volume" method of calculating system solids.)

Aer. Tank Vol.—360,000 gal	MLSS—2890 mg/*L*
Fin. Clar.—125,000 gal	WAS—6050 mg/*L*
P.E. Flow—1.42 MGD	S.E.SS — 22 mg/*L*
WAS—28,000 gpd	

ANS_____

23 The desired sludge age for a plant is 4.8 days. The aeration tank volume is 770,000 gal. If 3670 lbs/day suspended solids enter the aeration tank and the MLSS concentration is 2730 mg/*L*, how many lbs/day MLSS (suspended solids) should be wasted?

ANS_____

24. It has been determined that 4100 lbs/day of dry solids must be removed from the secondary system. If the RAS SS concentration is 6340 mg/*L*, what must be the WAS pumping rate, in MGD? (Round to the nearest thousandth.)

ANS_____

25. Given the following data, calculate the lbs/day WAS SS to be wasted. (Use the "combined volume" method of calculating system solids.)

Desired SRT—10 days	RAS SS—5910 mg/*L*
Clarifier + Aerator Vol.—1.45 MG	S.E. SS—18 mg/*L*
MLSS—2870 mg/*L*	P.E. Flow—5.68 MGD

ANS_____

CHAPTER 12 ACHIEVEMENT TEST

1. (90 ft)(30 ft)(16 ft)(7.48 gal/cu ft) = 323,136 gal

2. (217 mg/*L*)(1.668 MGD)(8.34 lbs/gal) = 3019 lbs/day

3. $$\frac{(218 \text{ mg/}L)(0.389 \text{ MGD})(8.34 \text{ lbs/gal})}{(3250 \text{ mg/}L)(0.21 \text{ MG})(8.34 \text{ lbs/gal})\left(\frac{67}{100}\right)} = 0.19$$

4. (0.785)(80 ft)(80 ft)(10 ft)(7.48 gal/cu ft) = 375,795 gal

5. $$\frac{(175 \text{ mg/}L)(2.13 \text{ MGD})(8.34 \text{ lbs/gal})}{(2880 \text{ mg/}L)(0.42 \text{ MG})(8.34 \text{ lbs/gal})} = 0.31$$

6. (6.5 ft)(3.5 ft)[(640 ft + (3.14)(100 ft)]

   = (6.5 ft)(3.5 ft)(954 ft)

   = 21,704 cu ft

7. (155 mg/*L*)(3.84 MGD)(8.34 lbs/gal) = 4964 lbs/day

8. $$\frac{(2610 \text{ mg/}L)(0.525 \text{ MG})(8.34 \text{ lbs/gal})}{(185 \text{ mg/}L)(1.7 \text{ MG})(8.34 \text{ lbs/gal})} = 4.4 \text{ days}$$

9. $$\frac{(143 \text{ mg/}L)(2.78 \text{ MGD})(8.34 \text{ lbs/gal})}{x \text{ lbs MLVSS}} = 0.4$$

   x = 8289 lbs MLVSS

10. $$\frac{390{,}000 \text{ gal}}{11{,}667 \text{ gph}} = 33 \text{ hrs}$$

11. $$\frac{(158 \text{ mg/}L)(2.39 \text{ MGD})(8.34 \text{ lbs/gal})}{x \text{ lbs MLVSS}} = 0.7$$

    x = 4499 lbs MLVSS

12. $$\frac{(2830 \text{ mg/}L)(0.44 \text{ MGD})(8.34 \text{ lbs/gal})}{(160 \text{ mg/}L)(1.1 \text{ MG})(8.34 \text{ lbs/gal})} = 7.1 \text{ days}$$

13. $$\frac{600{,}000 \text{ gal}}{14{,}167 \text{ gph}} = 42.4 \text{ hrs}$$

14. $$\frac{(3910 \text{ mg/}L)(0.25 \text{ MGD})(8.34 \text{ lbs/gal})}{(195 \text{ mg/}L)(0.3 \text{ MGD})(8.34 \text{ lbs/gal})} = 16.7 \text{ days}$$

15. (2660 mg/*L*)(0.425 MG)(8.34 lbs/gal) = 9428 lbs SS

16. $$\frac{(144 \text{ mg/}L)(2.81 \text{ MGD})(8.34 \text{ lbs/gal})}{x \text{ lbs MLVSS}} = 0.3$$

    x = 11,249 lbs MLVSS

17. (2470 mg/*L*)(0.57 MG)(8.34 lbs/gal) = 11,742 lbs MLVSS

18. $$\frac{(2740 \text{ mg/}L)(0.705 \text{ MGD})(8.34 \text{ lbs/gal})}{(180 \text{ mg/}L)(1.78 \text{ MGD})(8.34 \text{ lbs/gal})} = 6.0 \text{ days}$$

19. $$\frac{(2650 \text{ mg/}L)(1.38 \text{ MG})(8.34 \text{ lbs/gal}) + (1900 \text{ mg/}L)(0.117 \text{ MG})(8.34 \text{ lbs/gal})}{(5960 \text{ mg/}L)(0.075 \text{ MGD})(8.34 \text{ lbs/gal}) + (20 \text{ mg/}L)(2.9 \text{ MGD})(8.34 \text{ lbs/gal})}$$

$$= \frac{30{,}499 \text{ lbs MLSS} + 1854 \text{ lbs MLSS}}{3728 \text{ lbs/day SS} + 484 \text{ lbs/day SS}} = 7.7 \text{ days}$$

20. $$\frac{228 \text{ m}L/L}{772 \text{ m}L/L} = 0.30$$

21. $$\frac{3630 \text{ lbs/day}}{(x \text{ lbs MLSS})\frac{(71)}{100}} = 0.5$$

$x = 10{,}225$ lbs MLSS

22. $$\frac{(2890 \text{ mg/}L)(0.485 \text{ MGD})(8.34 \text{ lbs/gal})}{(6050 \text{ mg/}L)(0.028 \text{ MGD})(8.34 \text{ lbs/gal}) + (22 \text{ mg/}L)(1.42 \text{ MGD})(8.34 \text{ lbs/gal})}$$

$$= \frac{11{,}690 \text{ lbs MLSS}}{1413 \text{ lbs/day SS} + 261 \text{ lbs/day}}$$

= 7.0 days

23. First calculate desired lbs MLSS based on desired sludge age:

$$\frac{x \text{ lbs MLSS}}{3670 \text{ lbs/day SS}} = 4.8 \text{ days}$$

$x = 17{,}616$ lbs MLSS

Next, calculate actual lbs MLSS:

(2730 mg/*L*)(0.77 MG)(8.34 lbs/gal) = 17,532 lbs MLSS

Based on these calculations, no MLSS should be wasted.

24. (6340 mg/*L*)(x MGD)(8.34 lbs/gal) = 4100 lbs/day solids

$x = 0.078$ MGD

25. $$\frac{(2870 \text{ mg/}L)(1.45 \text{ MG})(8.34 \text{ lbs/gal})}{(x \text{ lbs/day}) + (18 \text{ mg/}L)(5.68 \text{ MGD})(8.34 \text{ lbs/gal})} = 10 \text{ days}$$

$$\frac{34{,}707 \text{ lbs/day MLSS}}{x \text{ lbs/day} + 853 \text{ lbs/day}} = 10 \text{ days}$$

$$\frac{34{,}707}{10} = x + 853$$

$$3471 = x + 853$$

2618 lbs/day = x