**ACTIVATED SLUDGE FINAL EXAM - Only one correct answer, sorry.**

1. Which of the following is true regarding suspended solids in activated sludge?

1. Volatile suspended solids represent the inorganic portion of the solids
2. Total suspended solids analyses require filtering, while total volatile suspended analyses do not
3. There are no organic materials in mixed liquor volatile suspended solids
4. **Particulate matter in aeration tanks is called “mixed liquor suspended solids”**
5. It is formally referred to as “liquid poo”

2. What type of microorganism must have dissolved oxygen to survive?

1. Facultative
2. Symbiotic
3. Anaerobic
4. **Aerobic**
5. One with COPD

3. Temperature can affect solids settling in clarifiers.

1. **True**
2. False

4. If the dissolved oxygen is continually too low in an aeration basis, the mixed liquor will appear to be:

1. Having white foam and be very thin
2. Light brown with no noticeable odor
3. **Black in color with an offensive odor**
4. Green from algae growth
5. Angry red

5. Two ways of calculating wasting rates in activated sludge are:

1. Measuring the RAS and subtracting from influent flow
2. **Constant MLSS and Constant Sludge Age**
3. Constant feet of sludge in both primary and secondary clarifiers
4. Influent TSS minus effluent TSS
5. Visual observation and wild guesses

6. The “typical” percent of municipal waste volatile solids is:

1. Around 30 percent
2. Around 50 percent
3. **Around 70 percent**
4. Around 90 percent

7. What is the reason for black clumps of gaseous sludge rising to the surface of final clarifiers?

1. Bulking sludge from filamentous growth
2. Ashing from too high aeration rates
3. **Rising sludge from denitrification in the sludge layers**
4. Too much grease in the influent

8. If a plant has a high Food to Microorganism (F:M) ratio and the quality of the effluent is deteriorating, the operator may want to:

1. **Waste more**
2. Waste less
3. Do nothing – it’ll work itself out
4. Take vacation

9. What is the optimum nutrient ratio for healthy microbes in activated sludge?

1. 10-10-10 Nitrogen-Carbon-Potash
2. 5-10-100 Nitrogen-Carbon-Phosphorus
3. 17.5-100-10 Carbon-Nitrogen-Phosphorus
4. **100-5-1 Carbon-Nitrogen-Phosphorus**

10. In order to test for volatile solids, a laboratory must have a/an:

1. Atmospheric oven
2. **Muffle furnace**
3. ISE meter
4. Spectrophotometer
5. Coffee pot

11. How can Solids Retention Time (SRT) (MCRT) (Sludge Age) be reduced when trying to control filamentous organisms?

1. Wasting less
2. **Wasting more**
3. Chlorination
4. Increasing the F:M
5. Shut off the influent

12. Why are fine bubble diffusers preferable over course bubble diffusers?

1. Less diffuser fouling
2. Less maintenance
3. **Higher oxygen transfer efficiency**
4. Lower chemical cleaning costs
5. They create a lovely ambiance

13. What is the best indication that a toxic shock load has traveled through an activated sludge plant?

1. Increased pH
2. Decreased pH
3. Increased D.O.
4. Decreased D.O.
5. Puking protozoa
6. **Both C and E**

14. What is the best indication that an organic shock load has traveled through an activated sludge plant?

a. Increased pH

b. Decreased pH

c. Increased D.O.

d**. Decreased D.O.**

15. The optimum detention time for a final clarifier is:

a. Less than 1 hour

**b. One to four hours**

c. Six hours

d. One SRT

16. Nitrification reduces:

1. Mixed liquor suspended solids
2. Wasting rates
3. Respiration rates
4. **Alkalinity**

17. Assuming that the influent does not change, which items are affected by the amount of WAS removed from an activated sludge system?

1. Sludge levels in final clarifier
2. Detention time in the aeration basins
3. F:M ratio
4. **All of the above**

18. In extended aeration, volatile solids reduction is:

a**. Increased**

b. Decreased

c. Stays the same

d. Not occurring

19. Approximately how many pounds does one gallon of water weigh?

1. 7.48
2. 7.90
3. **8.34**
4. 10.0

20. Denitrification requires:

1. Five Sludge ages
2. Dissolved oxygen of greater than 2.0 mg/L
3. **An anoxic zone**
4. An anaerobic zone
5. Ferric addition

21. Phosphorus accumulating organisms (PAOs) require:

1. **An anaerobic, then an aerobic zone**
2. An anoxic, then aerobic zone
3. An anaerobic digester
4. Four square meals a day

22. If you have foam that looks like the insides of a Three Muskateers candy bar, and under a microscope look like they are branched filaments, you have:

1. Old sludge, and dead nematodes
2. ***Norcardia*, and a grease problem**
3. A nice healthy batch of protozoa
4. A reason to get out of town quickly

23. Your 30 minute settling test was 500 mL, and your mixed liquor suspended solids test was 2300 mg/L. What is your SVI?

1. 111
2. **217**
3. 46
4. 100

24. What information can an operator observe from a 30-minute settling test?

1. If filamentous organisms are hindering settling
2. If denitrification may be occurring in final clarifiers
3. If MLSS or MCRT is too high or low
4. **All of the above**

25. If bacteria are able to survive both with and without dissolved oxygen, they are called:

1. Gram-negative organisms
2. Aerobic organisms
3. Phosphorus-accumulating organisms
4. **Facultative organisms**
5. AC/DC

26. If a WWTP’s influent BOD 248 mg/L and the effluent BOD is 7 mg/L, what is the percent removal? **97%**

27. What is the volume in gallons of a clarifier that is 30 feet in diameter, 20 feet tall, and is filled within 5 feet of the top? **79,269 gallons**

28. What is the detention time of a clarifier given the following data: FORMULA: Volume ÷ Flow **2.53 hours**

Clarifier size: 30 ft. in diameter, 20 feet deep

Plant influent flow: 2.0 MGD

Clarifier receives one half of influent flow.

29. Calculate the geometric mean with the results of four monthly fecal coliform tests of 10, 10, 50, and 50 CFU.

Hint: 1 divided by 4 = .25, then (10X10X50X50=yx.25=) **22.36 CFUs (22 CFUs)**

30. **True** or False? Sidestreams may add phosphorus, BOD, or solids back to the aeration tanks.

31. True or **False**? A second clarifier should be taken off line during high hydraulic loading in order to create settling in the other clarifier.

32. What types of industries can add high BOD and solids loading to an activated sludge plant?

1. Dairy
2. Breweries
3. Food processing
4. Soda bottling
5. **All of the above**

33. What type of activated sludge plant will do the best job of destroying volatile solids?

1. Sequencing batch reactors
2. Conventional plug flow
3. **Extended aeration**
4. Fill and draw

34. What is indicated when you have an overabundance of colony stalked ciliates?

1. Young sludge age
2. **Old sludge age**
3. Toxic overload
4. New plant startup
5. Armegeddon

35. How does a city deal with grease and/or heavy loading from industries into an activated sludge plant?

1. Raise the sewer rates
2. **Have good ordinances and enforce them**
3. Do nothing; you don’t want to anger the industry and drive them out of town
4. Shut off their water
5. Boycott their products

36. Which type of BOD is more immediately available to bacteria?

1. **Soluble**
2. Nitrogenous
3. Insoluble
4. Non-volatile

37**. True** or False? Excess phosphorus in receiving streams causes excess plant growth.

38. An ORP meter is used for:

1. Finding excess voltage
2. **Finding anaerobic and anoxic environments**
3. Finding leaks in pipes
4. Finding problems with your colon

39. How often should you take dissolved oxygen reading in your plant?

1. Weekly
2. Monthly
3. **At least once per day**
4. Annually
5. When your boss tells you to

40. What is the F:M ratio when given the following data**: 0.08 F/M**

Influent flow: 0.275 MGD

Influent BOD: 230 mg/L

Aeration basin volume: 0.432 MG

Aeration basin MLVSS: 1,750 mg/L

FORMULA: Influent BOD, lbs. ÷ MLVSS under aeration, lbs.

41. What is the SRT (sludge age) in days when given the following plant data: **24 days**

Aeration basin volume: 35,000 gallons (0.035 MG)

MLSS concentration: 2,400 mg/L

WAS concentration: 3,500 mg/L

WAS flow: 1,000 gallons (0.001 MG)

FORMULA: MLSS under aeration, lbs. ÷ WAS, lbs./day

42. How much would you waste in gallons if trying to keep the sludge age at 9 days for the following plant: **3600gdp**

Aeration basin volume: 0.090 MG

MLSS concentration: 1,800 mg/L

WAS concentration: 5,000 mg/L

FORMULA : MLSS under aeration, mg/L ÷ desired sludge age, days = lbs per day, THEN TO CONVERT TO GALLONS:

Sludge to waste, lbs., ÷ (WAS concentration, mg/L x 8.34 lbs./gal.) x 1,000,000 = gpd to waste for a 9 day S.A.

43. How much sludge (gallons) would you waste to achieve a desired MLSS level given the following data**: 12,500 gal.**

Aeration basin volume: 250,000 gallons

Current MLSS: 2,200 mg/L

Desired MLSS: 2,000 mg/L

FORMULA: Calculate current lbs. MLSS in aeration, then Calculate desired lbs. MLSS in aeration. Subtract desired from current lbs. THEN:

Sludge to waste, lbs ÷ (WAS concentration, mg/L x 8.34 lbs./gal.) x 1,000,000 = gallons to waste

44. True or **false?** When a plant starts up, it may produce dark, greasy foam.

45. When bacteria break down solids to derive nutrients, they use the process of **adsorption and absorption.**

46. **True** or false? Kay is the most awesome wastewater trainer in the world. (You get 10 extra points for the correct answer.