



# Certification Boulevard

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## Test Your Knowledge of Miscellaneous Topics

1. What does the unit "parts per million" (ppm) mean?
  - A. one pound per million pounds
  - B. one gallon per million gallons
  - C. 8.34 pounds per million gallons
  - D. one milligram per liter
  - E. All of the above
2. What does hydrogen sulfide (H<sub>2</sub>S) smell like at high concentrations?
  - A. No smell
  - B. Chlorine
  - C. Rotten eggs
  - D. Sulfuric acid
3. Why does scum float on the surface of a clarifier?
  - A. Because its specific gravity is greater than water.
  - B. It is mainly inorganic material.
  - C. Because its specific gravity is less than water.
  - D. Scum does not float ... it sinks to the floor of the clarifier.
4. What two laboratory analyses are necessary to calculate the F/M ratio?
  - A. Aeration MLVSS and influent CBOD<sub>5</sub>
  - B. Aeration MLSS and OUR
  - C. Aeration MLVSS and effluent CBOD<sub>5</sub>
  - D. Aeration MLSS and influent CBOD<sub>5</sub>
5. What adjustment should be made if solids are rising in the secondary clarifier accompanied by large, smelly gas bubbles?
  - A. Increase aeration D.O.
  - B. Decrease the RAS rate.
  - C. Decrease the WAS rate.
  - D. Decrease aeration D.O.
6. Which activated sludge growth phase is considered to have the lowest F/M ratio, the highest SRT, the lowest sludge yield, and the poorest oxygen utilization efficiency?
  - A. High rate aeration
  - B. Extended aeration
  - C. Conventional aeration
  - D. Log growth
7. What happens to the alkalinity in wastewater during the nitrification process?
  - A. It increases.
  - B. It decreases.
  - C. It does not change.
  - D. It stabilizes at 200 mg/l.
8. What is the equivalent in gpm of a pipe that has 1 mgd flowing through it?
  - A. 694 gpm
  - B. 1,440 gpm
  - C. 133,690 gpm
  - D. 7.48 gpm
9. Given the following data, what is the Specific Oxygen Utilization Rate (SOUR) in an aerobic digester?
  - OUR test starting D.O. is 6.9 mg/L.
  - OUR test ending D.O. is 4.2 mg/L.
  - OUR test time is 10 minutes.
  - Digested sludge total solids concentration is 1.7 percent.
  - A. 2.1 mg/hr/gm TS
  - B. 0.95 mg/hr/gm TS
  - C. 1.64 mg/hr/gm TS
  - D. 9.5 mg/hr/gm TS
10. Based on the correct answer in Question No.9, is this SOUR acceptable to meet Class B standards for Vector Attraction Reduction requirements?
  - A. Yes.
  - B. No.
  - C. SOUR does not apply to aerobic digestion.

ANSWERS ON  
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## SEND US YOUR QUESTIONS

Readers are welcome to submit questions or exercises on water or wastewater treatment plant operations for publication in Certification Boulevard. Send your question (with the answer) or your exercise (with the solution) by e-mail to [roy.pelletier@cityoforlando.net](mailto:roy.pelletier@cityoforlando.net), or by mail to:

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# Certification Boulevard Answer Key

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1. **E. All of the above**

One part of anything in relationship to one million parts of the same thing is 1 ppm; like one gallon of water to 1 million gallons of water. For another example, one inch in about 15.78 miles is equal to 1 ppm. Also, in water, one milligram per liter (mg/l) is the same as one part per million (ppm) ... the conversion is long and drawn-out, but it's the same!

2. **A. No smell**

When the concentration of  $H_2S$  is high, it deadens the olfactory senses and you won't smell anything ... maybe ever again! At low concentrations, however,  $H_2S$  will smell like rotten eggs ... that's the smell you may detect in a sprinkler system using water from a canal.

3. **C. Because its specific gravity is less than water.**

Any substance that has a specific gravity less than water (which is 1.0) will float to the surface of a tank. FOG (fats, oil, grease) material will float to the surface because of its low specific gravity.

4. **A. Aeration MLVSS and influent CBOD<sub>5</sub>**

The F/M ratio compares the food value as applied to the volatile bug population. The food value is indicated with the CBOD<sub>5</sub> content in the influent wastewater, and the volatile bug content is identified by testing the aeration system mixed liquor for its volatile fraction ... Mixed Liquor Volatile Suspended Solids.

5. **A. Increase aeration D.O.**

Rising solids with gas could have various causes; however, large, smelly gas bubbles are an indicator of septic conditions (opposed to denitrification conditions). Septic conditions must be resolved with the addition of oxygen to the aeration system. Also, increasing the RAS rate may help to improve the condition.

6. **B. Extended aeration**

An extended aeration process typically has a long hydraulic detention time (about 18 to 24 hours), which allows most of the available CBOD<sub>5</sub> to be consumed or tied up in other reactions. This reduces the F/M ratio and increases the SRT. Because of oxygen getting tied up in endogenous reactions, oxygen utilization efficiency typically gets worse as the sludge gets older.

7. **B. It decreases.**

Alkalinity is consumed in the nitrification process at a rate of about 7.2 lbs of alkalinity (measured as  $CaCO_3$ ) for every pound of ammonia nitrogen converted; therefore, the nitrification process decreases the total alkalinity in the activated sludge mixed liquor.

8. **A. 694 gpm**

$1,000,000 \text{ gals per day} \div 1,440 \text{ mins per day} = 694 \text{ gals per min}$

9. **B. 0.95 mg/hr/gm TS**

**SOUR, mg/hr/gm TS**  
 $= \text{OUR, mg/L/hr} \div \text{TS, gm/L}$   
 $= (6.9 \text{ mg/l} - 4.2 \text{ mg/L}) \div 10 \text{ minutes} \times 60 \text{ mins/hr}$   
 $= 16.2 \text{ mg/L/hr OUR}$   
**gm/L TS**  
 $= \text{mg/L TSS} \div 1,000$   
 $= 1.7\% \text{ TS} \times 10,000$   
 $= 17,000 \text{ mg/L TSS}$   
 $= 16.2 \text{ mg/L/hr} \div (17,000 \div 1,000)$   
 $= 0.95 \text{ mg/hr/gm TS}$

10. **A. Yes.**

The maximum allowable SOUR value for the aerobic digestion process to meet Class B standards for Vector Attraction Reduction is 1.5 mg/hr/gm TS; therefore, 0.95 mg/hr/gm meets the standard.