Certification Boulevard

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Test Your Knowledge of Wastewater Treatment Topics

1. Given the following data, what is the solids loading rate on this secondary clarifier?
   - The plant influent flow is 5.5 mgd.
   - The RAS rate is 50 percent of Q.
   - There is one 100-foot diameter secondary clarifier.
   - The aeration MLSS is 2,200 mg/L.

   A. 19.3 lbs/day/ft^2 B. 8.6 lbs/day/ft^2
   C. 18.9 lbs/day/ft^2 D. 15.5 lbs/day/ft^2

2. Which is a lowest life form in the activated sludge process—a free-swimming ciliate, a stalked ciliate, or a rotifer?
   A. Free-swimming ciliate
   B. Stalked ciliate
   C. Rotifer
   D. They are all the same.

3. What is the best definition of a shock load?
   A. An unexpected bump.
   B. A high oxygen demand entering the aeration tank.
   C. A high concentration of solids entering the aeration tank.
   D. A heavy truck load entering the plant.

4. Which condition may produce the worst denitrification efficiency in an aeration tank?
   A. Low air supply
   B. High aeration D.O.
   C. Low aeration D.O.
   D. Low WAS rate

5. Which activated sludge growth phase is considered to have the highest F/M ratio, the lowest SRT, the highest sludge yield, and the best oxygen utilization efficiency?
   A. High rate aeration
   B. Extended aeration
   C. Conventional aeration
   D. Declining growth

6. Which group of bacteria is responsible for conversion of inorganic ammonia in wastewater?
   A. Carbon eaters B. Methanogens
   C. Autotrophic D. Heterotrophic

7. Which two age parameters are most similar to each other?
   A. GSA and F/M ratio
   B. SRT and MCRT
   C. SRT and GSA
   D. GSA and MCRT

8. Which group of bacteria is most responsible for removal of phosphorus in the BNR activated sludge process?
   A. SVI B. GSA
   C. Autotrophic D. PAO

9. How much alkalinity is required to convert 1.0 pound of ammonia-nitrogen during the nitrification process?
   A. 7.2 lbs B. 8.34 lbs
   C. 7.48 lbs D. 4.6 lbs

10. What will organic material do in a muffle furnace?
    A. It will burn.
    B. It will not burn.
    C. It will change to inorganic material.
    D. It will convert to dissolved solids.

ANSWERS ON PAGE 52

Looking for Answers?

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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, or by mail to:

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CERTIFICATION BOULEVARD – ANSWER KEY –

From page 30

1. **A. 19.3 lbs/day/ft²**

Formula: (Total lbs/day Entering the Secondary Clarifier) ÷ (Total Clarifier Surface Area)

= (151,371 lbs/day) ÷ (7,850 ft2)

= 19.28 lbs/day/ft2

Total lbs/day Entering the Secondary Clarifier

= (5.5 mgd + 2.75 mgd) x 2,200 mg/L x 8.34 lbs/gal

= 151,371 lbs/day

Clarifier Surface Area

$= \pi r^2$

= 3.14 x (50 ft x 50 ft) = 7,850 ft²

2. **A. Free-swimming ciliate**

Beginning with the lowest life form, the microorganism indicators are amoebas, small flagellates, large flagellates, free-swimming ciliates, stalk ciliates, rotifers, nematodes (worms) and water bears. So, of the three indicators listed in the question, the free-swimming ciliate is the lowest life form in the activated sludge process.

3. **B. A high oxygen demand entering the aeration tank.**

The term "loading" refers to the demand for oxygen placed on the activated sludge process from the flow being treated. A shock load is a high demand for oxygen (from $CBOD_5$, COD, or nitrogen) placed on the activated sludge process in a short period of time.

4. **B. High aeration D.O.**

Because denitrification is an anoxic reaction, high dissolved oxygen levels in the aeration tank will typically result in the worst (slowest) denitrification efficiency.

5. **A. High rate aeration**

In regard to the growth curve of microorganisms, the far left side of the curve has high food availability, rapid bug growth, high yield of new cells, low solids inventory, and excellent oxygen utilization transfer efficiency. This translates to high F/M ratio, low SRT, high sludge yield, and reduced pounds of oxygen per pound of $CBOD_5$ destroyed. This high rate aeration is also called "log growth."

6. **C. Autotrophic**

There are two main groups of autotrophic bacteria that are responsible for the conversion of inorganic ammonia to nitrate. The first group, nitrosomonas, known as ammonia-oxidizing bacteria, converts ammonia to nitrite. The second group, nitrobacter, known as nitrite- oxidizing bacteria, converts nitrite to nitrate. The process of nitrification does not necessarily remove nitrogen from the wastewater; it only converts it to a more stable form.

7. **B. SRT and MCRT**

The SRT and MCRT have similar concepts: pounds of solids in the activated sludge system divided by the pounds per day of solids LEAVING the process. Typically, SRT is based on total solids, and MCRT is based on volatile solids. Gould Sludge Age (GSA), however, is the pounds of solids in the activated sludge process divided by the pounds per day of solids ENTERING the aeration system.

8. **D. PAO**

PAO, or phosphorus accumulating organisms, are responsible for the uptake and removal of phosphorus from the wastewater in a BNR activated sludge process.

9. **A. 7.2 lbs**

Nitrification consumes alkalinity at the rate of about 7.2 lbs of alkalinity for each lb of ammonia oxidized. Because this action causes the mixed liquor pH to drop, biological denitrification is desirable, which replenishes the alkalinity at a rate of about 3.6 lbs of alkalinity for each lb of nitrate that is consumed as a source of oxygen. The action of denitrification helps to stabilize the MLSS pH in a range acceptable to the nitrifying bacteria.

10. **A. It will burn.**

Organic material, and other volatile matter, will typically burn in a muffle furnace at temperatures of about 550°C; however, just because something burns in a muffle furnace does not necessarily mean that it is biological in nature. For example, a PVC pipe shaved into a sample will burn in a muffle furnace. The PVC, however, is neither biology, nor food for the biology.