



Certification Boulevard

Roy Pelletier



Test Your Knowledge of Wastewater Disposal

dechlorinate effluent following disinfection with chlorine?

- A. H₂SO₄
- B. Sodium Hypochlorite
- C. SO₂
- D. FeCl₃

7. Given the following data, what is the equivalent percent total solids?
 - There is 10 ml of sample
 - Tare weight of filter paper is 1.8873 grams.
 - Final weight of filter paper after drying is 2.2255 grams.
 - A. 2.2 percent
 - B. 1.3 percent
 - C. 3.4 percent
 - D. 4.3 percent
8. What is the final effluent TSS value if the plant influent TSS is 225 mg/L and the TSS percent removal is 98.9 percent?
 - A. 7.6 mg/L
 - B. 2.5 mg/L
 - C. 6.7 mg/L
 - D. 1.1 mg/L
9. Which formula is used to calculate the circumference of a circular tank?
 - A. πr^2
 - B. πd^2
 - C. $0.785 d^2$
 - D. πd
10. What is the volume of reclaimed water in 38 inches of a storage tank with a diameter of 100 feet?
 - A. 58,718 gallons
 - B. 185,960 gallons
 - C. 20,588 gallons
 - D. 238,545 gallons

ANSWERS ON PAGE 46

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 mail to:

Roy Pelletier
Wastewater Project Consultant
City of Orlando
Public Works Department
Environmental Services Wastewater Division
5100 L.B. McLeod Road, Orlando, FL 32811

1. Which chemical typically is not used to adjust effluent pH (between 6.0 to 8.5) before being discharged to a surface water outfall?
 - A. Lime
 - B. Alum
 - C. Sodium hydroxide
 - D. Caustic soda
2. What typically happens to the chlorine demand of reclaimed water when the nitrate concentration is elevated?
 - A. The chlorine demand doubles for each pound of nitrate oxidized.
 - B. The chlorine demand is cut in half for each pound of nitrate oxidized.
 - C. The chlorine demand is unaffected by nitrate concentrations
 - D. The chlorine demand is multiplied by more than 5 for each pound of nitrate oxidized.
3. What is the detention time of a reclaimed water storage tank if the tank volume is 2.5 MG and the flow entering the tank is 9.75 MGD?
 - A. 6.15 hours
 - B. 164 hours
 - C. 1.23 hours
 - D. 3.90 hours
4. What typically happens to the ORP value of reclaimed water when the ammonia concentration drops from 4 mg/L to 0.5 mg/L?
 - A. The ORP value increases.
 - B. The ORP value decreases.
 - C. The ORP value is fairly unaffected by the ammonia level.
 - D. Ammonia at any level will cause a typical ORP probe to fail.
5. Given the following data, what is the pressure equivalent expressed in bar delivered by this effluent pump?
 - Pump discharges 1,500 gpm
 - Total dynamic head (TDH) of 155 feet
 - A. 4.56 bar
 - B. 67.11 bar
 - C. 14.7 bar
 - D. 2.88 bar
6. Which chemical is more commonly used to

FEBRUARY CORRECTIONS...

After our February edition of "Certification Boulevard" was published in the *Journal*, Hubert Barnes, P.E., from Hollywood noticed that although Question 1 asked for the velocity in cubic feet per second (cfs) of a 1.5-mgd stream of water, the correct term should be "flow rate" instead of "velocity," since flow rate is expressed in volume over time using units such as cfs, while velocity is the vector rate of change of distance over time using units such as mph, fps, km/hr, etc. The correct answer remains the same.

Hubert also pointed out that since Question 2 asks for the approximate hydraulic horsepower delivered by a particular pump, the answer is actually the hydraulic horsepower of the pump. The correct answer and calculation shown in the Answer Key actually represented the electrical horsepower to the pump's motor.

Here are Question 2 and the calculation for the answer, with the correct answer for hydraulic horsepower indicated in red.

2. Given the following data, calculate the approximate hydraulic horsepower delivered by this pump:
 - Flow is 675 gpm
 - TDH is 95 feet
 - A. 13.5 HP
 - B. **16.2 HP**
 - C. 25 HP
 - D. 7.5 HP

Hydraulic Horsepower

$$= \text{pounds of liquid per minute} \times \text{head (in feet)} \div 33,000$$

$$= (\text{gpm} \times \text{TDH, feet} \times 8.34 \text{ lbs/gal}) \div 33,000 \text{ foot lbs/second}$$

$$= (675 \text{ gpm} \times 95 \text{ TDH} \times 8.34 \text{ lbs/gal}) \div 33,000$$

$$= 16.21 \text{ HP (Note: TDH = Total Dynamic Head)}$$

Thank you, Hubert, for your comments and for setting me straight ... you can teach an old operator new tricks!—Roy

Looking for Answers? Check the Archives

Are you new to the water and wastewater field? Want to boost your knowledge about topics you'll face each day as a water/wastewater professional?

All past editions of *Certification Boulevard* back through the year 2000 are available on the Florida Water Environment Association's Web site at www.fwea.org. Click the "Site Map" button on the home page, then scroll down to the Certification Boulevard Archives, located below the Operations Research Committee.

Certification Boulevard Answer Key

From page 9

1. **A. Alum**

Water that is disinfected with chlorine and then dechlorinated with sulfur dioxide may require a chemical to stabilize the pH within the required 6.0 to 8.5 range. A commonly used chemical for this application is sodium hydroxide ... caustic soda. Alum is acidic and would never be used for this application.

2. **C. The chlorine demand is unaffected by nitrate concentrations**

Nitrate (NO_3) values have little to no affect on demand for chlorine in the disinfection process. However, Nitrites (NO_2) will consume about 5 times their weight in chlorine before a residual is detected.

3. **A. 6.15 hours**

Detention Time, hours

= Tank Volume, mg x 24 hrs/day ÷ Flow into Tank, MGD
 = 2.5 MG x 24 hr per day ÷ 9.75 MGD
 = 6.15 hours

4. **A. The ORP value increases.**

ORP and ammonia are inversely proportional to each other. When the ammonia level drops, the ORP value increases. Conversely, when the ammonia level increases, the ORP value decreases.

5. **A. 4.56 bar**

1.0 bar = 14.7 psi
 155 feet TDH x 0.433 psi per foot of head
 = 67.115 psi ÷ 14.7 psi/bar
 = 4.56 bar

OR

= 155 feet TDH ÷ 2.31 feet of head per psi
 = 67.099 psi ÷ 14.7 psi/bar
 = 4.56 bar

6. **C. SO_2**

SO_2 (Sulfur dioxide) is the only chemical on this list that will effectively dechlorinate chlorinated effluent. Others chemicals used for dechlorination are sodium thiosulfate and sodium bisulfite.

7. **C. 3.4%**

TSS, ppm

= weight of suspended solids in grams x (1,000,000 ÷ ml of sample)

Weight of TSS

= Final Wt. - Paper Tare Wt.
 = 2.2255 gm - 1.8873 gm
 = 0.3382 gm

TSS, ppm

= 0.3382 gm x 1,000,000 ÷ 10 ml sample
 = 33,820 mg/L (ppm)

TS, %

= TSS, mg/L ÷ 10,000 mg/L per 1%
 = 33,820 mg/L ÷ 10,000 mg/L per 1%
 = 3.38%

8. **B. 2.5 mg/L**

= 225 mg/L x 0.989
 = 222.525 mg/L
 = 225 mg/L - 222.525 mg/L
 = Effluent TSS of 2.475 mg/L

OR

= 100% - 98.9%
 = 1.1%
 = 225 mg/L x 0.011
 = Effluent TSS of 2.475 mg/L

9. **D. π**

Circumference is calculated as pi times the diameter, or πd . Basically, you can take the diameter of any circle and wrap it around the circumference (the outer wall of the circle) 3.14 times. If you have a calculator with a pi button, it typically displays 3.14159265359 ...

10. **B. 185,960 gallons**

Volume per foot

= $\pi r^2 \times 1 \text{ foot} \times 7.48 \text{ gals/ft}^3$
 = 3.14 x 50 ft x 50 ft x 1 ft x 7.48 gals/ft³
 = 58,718 gallons per foot

= 38 inches ÷ 12 inches per foot
 = 3.167 feet
 = 58,718 gals per foot x 3.167 feet
 = 185,959.9 gallons in 38 inches in a 100-foot diameter tank