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Test Your Knowledge of Distribution and Collections

1. What is the main cause of water seepage into a sanitary sewer?
 - A. Poor construction of the collection line, especially at the pipe joints.
 - B. Sewer line is too deep.
 - C. Sewer line diameter is too small.
 - D. Improper cycling of lift stations.
2. Which of the following lines are not used in transporting wastewater from its source in a home to the treatment plant?
 - A. House sewers
 - B. Lateral sewers
 - C. Trunk sewers
 - D. Storm sewers
3. Given the following data, what is the detention time in this 24-in. diameter force-main?
 - 14,700 ft long
 - 3,000 gal-per-min (gpm) pump capacity
 - Pumping cycle is 6 min ON and 5 min OFF
 - A. 2 hours, 4 min
 - B. 3 hours, 31 min
 - C. 4 hours, 5 min
 - D. 250 min
4. Which may be the most appropriate chemical to use in a wet scrubber treating high levels of ammonia?
 - A. Sodium hydroxide
 - B. Sulfuric acid
 - C. Unchlorinated water
 - D. Polymer
5. Given the following data, what is the volume of this wet well?
 - wet well diameter is 16 ft
 - bottom elevation of wet well is 82.5 ft
 - top elevation of wet well is 103.4 ft
 - A. 177,563 gal
 - B. 31,416 gal
 - C. 332,043 gal
 - D. 24,391 gal
6. Which gases may be found in sewer collection systems?
 - A. Explosive gases
 - B. Hydrogen sulfide
 - C. Methane
 - D. All of the above.
7. Given the following data, how many cu yds (yd³) of backfill are needed to fill a trench?
 - 9.25 ft wide
 - 28 yd long
 - 6.5 ft deep
 - A. 62 yd³
 - B. 257 yd³
 - C. 959 yd³
 - D. 187 yd³
8. Which gases do not usually cause problems in sewer collection systems?
 - A. Explosive gases
 - B. Hydrogen sulfide
 - C. Methane
 - D. Carbon dioxide
9. Given the following data, what is the volume of this wet well?
 - flow entering is 255 gpm
 - frequency and duration of flow is 5 min every 15 min
 - detention time is 1.75 hours
 - A. 169,280 gal
 - B. 8,925 gal
 - C. 4,464 gal
 - D. 0.0744 mil gal (MG)
10. What is the minimum velocity in a sanitary sewer pipeline necessary to prevent settling of solids and debris?
 - A. 1 ft per second (fps)
 - B. 0.5 fps
 - C. 2 fps
 - D. 2 ft per min (fpm)

Answers on page 62

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 email to roy.pelletier@cityoforlando.net, or by mail to:

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Certification Boulevard Answer Key

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1. **A) Poor construction of the collection line, especially at the pipe joints.**

Poor sealing of the pipe joints typically cause water seeping into a sewer pipe. It can, however, also be caused by holes in the pipe from H₂S corroding the crown of the pipe.

2. **D) Storm sewers**

Storm sewers are designed to only convey street runoff and other rain catch basin flows to a destination, like a lake or treatment facility. Sanitary or domestic waste streams are not conveyed through storm drains.

3. **B) 3 hours 31 min**

Formula for Detention Time in Min
 $= \text{pipe volume in cu ft} \div (\text{flow pumped in mgd} \times 92.84 \text{ cfm per mgd})$

Pipe Volume

$= \pi r^2 \times \text{length, ft}$
 $= 3.14 \times 1 \text{ ft} \times 1 \text{ ft} \times 14,700 \text{ ft}$
 $= 46,158 \text{ ft}^3$

Flow Pumped

$= 6 \text{ min ON} + 5 \text{ min OFF}$
 $= 11 \text{ min per cycle}$
 $= 1,440 \text{ min per day} \div 11 \text{ min per cycle}$
 $= 130.9 \text{ cycles per day}$
 $= 6 \text{ min ON per cycle} \times 130.9 \text{ cycles per day}$

$= 785.4 \text{ min pumped per day}$
 $= 3,000 \text{ gpm} \times 785.4 \text{ min per day}$
 $= 2,356,200 \text{ gpd} \div 1,000,000$
 $= 2.3562 \text{ mgd}$

$46,158 \text{ ft}^3 \div (2.3562 \text{ mgd} \times 92.84 \text{ cfm per mgd})$

Detention Time

$= 211 \text{ min} \dots \text{divided by } 60 \text{ min per hour}$
 $= 3.516 \text{ hours (or, 3 hours 31 min)}$

4. **B) Sulfuric acid**

Sodium hydroxide is typically used when a wet scrubber is treating odorous air high in hydrogen sulfide. However, it typically requires a low pH when scrubbing air high in ammonia.

5. **B) 31,416 gal**

Gal Capacity
 $= 0.785 \times \text{diameter}^2 \times \text{depth, ft} \times 7.48 \text{ gal per ft}^3$
 Or
 $\pi r^2 \times \text{depth, ft} \times 7.48 \text{ gal per ft}^3$

Liquid depth in wet well

$= 103.4 \text{ ft} - 82.5 \text{ ft} = 20.9 \text{ ft}$
 $= 0.785 \times 16 \text{ ft} \times 16 \text{ ft} \times 20.9 \text{ ft} \times 7.48 \text{ gal per ft}^3$
 $= 31,416.5 \text{ gal}$

6. **D) All of the above.**

All of these gases can typically be found in sewer collection systems. Explosive gases are measured by the Lower Explosive Limit (LEL) reading. Hydrogen sulfide gas is heavier than air and will settle to the

bottom of a space. Methane gas is lighter than air and will rise to the top of a space.

7. **D) 187 yd³**

Cu Yd
 $= 9.25 \text{ ft wide} \times (28 \text{ yd long} \times 3 \text{ ft per yard}) \times 6.5 \text{ ft deep}$
 $\text{divided by } 27 \text{ ft}^3 \text{ per yd}^3$
 $= 187.06 \text{ yd}^3$

8. **D) Carbon dioxide**

Carbon dioxide (CO₂) is the least harmful gas listed in this question. However, high CO₂ concentrations in a space, accompanied with low oxygen concentrations, can be very harmful to people.

9. **B) 8,925 gal**

Volume, MG
 $= Q, \text{ mgd} \div 24 \text{ hours per day} \times D.T., \text{ hours}$
 $Q = 20 \text{ min per hour} \times 24 \text{ hours per day}$
 $= 480 \text{ min per day} \times 255 \text{ gpm}$
 $= 122,400 \text{ gpd}$
 $0.1224 \text{ mgd} \div 24 \text{ hours per day} \times 1.75 \text{ hours}$
 $= 0.008925 \text{ MG} \times 1,000,000$
 $= 8,925 \text{ gals}$

10. **C) 2 fps**

Sanitary sewer pipelines are typically designed and constructed to maintain a minimum velocity of 2 fps (feet per second) to prevent settling of solids and debris.