Certification Boulevard

Test Your Knowledge of Disinfection

In recognition of the 65th anniversary of the *Journal*, here is the first
Certification Boulevard column that was published in the magazine in July 2000.

QUESTION WAY
ANSWER ST

Roy Pelletier

1. What is the approximate expansion ratio of one volume of chlorine liquid when it evaporates to a gas?

   A. 750
   B. 8.34
   C. 7.48
   D. 460

2. Calculate the chlorine demand, given the following data:
   • Total daily lbs used is 1,400 lbs/day
   • The plant flow is 13.5 mgd
   • The effluent chlorine residual is 2.5 mg/L

   A. 6,305 lbs/day
   B. 1,118 lbs/day
   C. 1,681 lbs/day
   D. 281 lbs/day

3. What chemical is used to identify a chlorine leak?

   A. Sulfur dioxide
   B. Sodium hydroxide
   C. Ammonia
   D. Sulfuric acid

4. What is the term most associated with free chlorine residual?

   A. Breakpoint
   B. Chloramine
   C. Fecal
   D. Alkalinity

5. Calculate the required volume of a chlorine contact chamber, given the following data:
   • Plant average daily flow is 5.7 mgd
   • Plant peak flow is 9.9 mgd
   • Required detention time at average daily flow (ADF) is 30 min
   • Required detention time at peak flow is 15 min

   A. 13,721 cubic ft
   B. 102,636 gal
   C. 12,367 cubic ft
   D. 118,750 gal

6. What does this formula best represent?

$$\frac{Tank\ Volume,\ ft^3}{Flow,\ mgd \times 92.84\ cfm/mgd}$$

   A. Chlorine residual
   B. Contact chamber detention time
   C. Fecal coliform
   D. Tank volume in gal

7. Sulfur dioxide and sodium bisulfite can be used as dechlorination chemicals.
   A. True   B. False

8. Never trap liquid chlorine between two closed valves.
   A. True   B. False

9. Leaking chlorine gas will tend to collect near the ceiling of a closed room.
   A. True   B. False

10. Match the following emergency repair kits to their respective containers:

    Kit A   Tank cars and trucks

    Kit B   150-lb cylinders

    Kit C   Ton containers

Answers on page 66

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/waste-water professional?

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Certification Boulevard Answer Key

1. **D) 460**
   The weight of one volume of liquid chlorine equals the weight of 456.5 volumes of chlorine gas. Under atmospheric temperature and pressure, liquid chlorine evaporates quickly, with one lb of liquid forming about 5.4 cubic ft of chlorine gas.

2. **B) 1,118 lbs/day**
   Supply - Demand = Residual
   • Supply is given at 1,400 lbs/day
   • Residual = 13.5 mgd x 2.5 mg/L x 8.34 lbs/gal = 281.47 lbs/day
   • 1,400 lbs/day - 281.47 lbs/day = 1,118.5 lbs/day

3. **C) Ammonia**
   To check for chlorine leaks, use ammonium hydroxide, which gives off chemical amplification. This results in a white color, which has greater visibility.

4. **A) Breakpoint**
   When sufficient chlorine dosages are applied to waters containing ammonia and ammonia compounds, reactions will occur resulting in the destruction of the ammonia and the formation of free chlorine residual, which is known as breakpoint chlorination.

5. **D) 118,750 gal**
   • DT @ ADF = 5.7 mgd x 92.84 cfm/mgd x 30 min = 15,875 cu.ft. x 7.48 gal/cu.ft. = 118,750 gal

   • DT @ Peak = 9.9 mgd x 92.84 cfm/mgd x 15 min = 13,787 cu.ft. x 7.48 gal/cu.ft. = 103,125 gal

   • ADF using 103,125 gal would only be 26 min DT

   • Answer is 118,750 gal volume to meet both flow/time requirements
   Notes: 1) DT = detention time; 2) ADF = average daily flow

6. **B) Contact chamber detention time**
   1,000,000 gal ÷ 7.48 gal per cu ft ÷ 1,440 min per day = 92.84 cfm per mgd

7. **True**
   Dechlorination is the process of removing residual chlorine from disinfected wastewater prior to discharge into the environment. Sulfur dioxide is most commonly used for dechlorination.

8. **True**
   Liquid chlorine trapped in piping between two closed valves, or in the body cavity of a closed valve, can cause destructive pressures, unless the design includes features to prevent it.

9. **False**
   Chlorine gas is 2.5 times heavier than air and will tend to collect near the floor of a space.

10. Match the following emergency repair kits to their respective containers:

    Kit A — Tank cars and trucks

    Kit B — 150-lb cylinders

    Kit C — Ton containers