Certification Boulevard

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Test Your Knowledge of Disinfection

1. Why should liquid chlorine never be trapped between two closed valves?
   A. Liquid chlorine may turn to gas, contract, and implode the pipe.
   B. Liquid chlorine may turn to gas, expand, and explode the pipe.
   C. The pressure will drop too rapidly.
   D. Trapping liquid chlorine is not a problem.

2. To which position should you rotate a one-ton container if a leak develops?
   A. With the leak at the bottom.
   B. With the leak at the top.
   C. With the leak on the side.
   D. It does not matter.

3. What chemical is used to identify a chlorine leak?
   A. Ammonia
   B. Sulfur Dioxide
   C. Sodium Hydroxide
   D. Sulfuric Acid

4. ***True or False***: Leaking chlorine liquid will tend to collect near the floor of a closed room.

5. Calculate the required capacity 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 ADF is 30 minutes.
   • Required detention time at peak flow is 15 minutes.
   A. 13,721 cubic feet
   B. 102,636 gallons
   C. 12,367 cubic feet
   D. 118,750 gallons

6. What type of chlorine residual is created when ammonia is present and breakpoint has not been accomplished?
   A. Combined
   B. Free residual
   C. Tri-chloride
   D. Dioxide

7. What is the weight relationship of chlorine liquid as compared to water?
   A. Water and liquid chlorine weigh the same.
   B. Liquid chlorine weighs 2.5 times more than water.
   C. Water weighs 1.5 times more than liquid chlorine.
   D. Liquid chlorine weighs 1.5 times more than water.

8. What are the two types of gaseous poisoning with chlorine called?
   A. Vapor and pellets.
   B. Dry and wet.
   C. Mild and extreme.
   D. Coughing and choking.

9. From where is gas chlorine withdrawn in a one-ton container?
   A. From the bottom valve.
   B. From the top valve.
   C. From top or bottom valves.
   D. Gas cannot be withdrawn from a one-ton container.

10. What pipe material is used to convey chlorine (liquid or gas) under pressure from one-ton containers to downstream equipment components?
    A. Black iron pipe.
    B. PVC pipe.
    C. Ductile clay pipe.
    D. Pre-stressed concrete pipe.

ANSWERS ON PAGE 91

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There is no limit to the number of questions or exercises you may submit. Please include your name, city, and organization or company so we can give you credit.

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Certification Boulevard Answer Key

From page 29

1. **B. Liquid chlorine may turn to gas, expand and explode the pipe.**
The expansion ratio of liquid chlorine to gas is about 460 times. This is why liquid chlorine should never be trapped in a pipeline between two closed valves ... big bang!

2. **B. With the leak at the top.**
Because liquid chlorine will expand about 460 times, it is important to locate the leak "gas side up." With the leak located at the top of the container, the least amount of chlorine will escape.

3. **A. Ammonia**
Ammonia fumes should be used to identify leaks … do not spray liquid ammonia directly on fittings or valves.

4. **True**
Chlorine liquid is about 1.5 times heavier than water, and during a leaking condition, it will typically remain on the floor. As the liquid evaporates to a gas, the gas will also remain low lying because it is about 2.5 times heavier than air.

5. **D. 118,750 gallons**
D.T. @ ADF
= 5.7 mgd x 92.84 cfm/mgd x 30 minutes
= 15,875 cu.ft. x 7.48 gal/cu.ft.
= 118,750 gals
D.T. @ Peak
= 9.9 mgd x 92.84 cfm/mgd x 15 minutes
= 13,786 cu.ft. x 7.48 gal/cu.ft.
= 103,124 gals
- *ADF using 103,124 gals would only be about 26 minutes D.T.*
- *Answer is 118,750 gals capacity to meet both flow/time requirements*

6. **A. Combined**
Combined residual (chloramines) is dominant before the breakpoint.

7. **D. Liquid chlorine weighs 1.5 times more than water.**
Liquid chlorine is an amber-colored liquid with a pungent and irritating odor. It is 1.5 times heavier than water with 6.7 kgs/cm^2 vapor pressure at 20°C and 20 kg/cm^2 vapor pressure at 70°C. The maximum solubility in water is 1.0 percent.

8. **B. Dry and wet.**
There are two types of chlorine gassing, known as dry and wet.
Dry gassing is very irritable and causes choking. If exposed, avoid coughing, leave the area immediately, take short breaths, and do not run from the area, since running causes deeper and more rapid breathing.
Wet gassing comes from fumes of aqueous solutions. This does not seem as irritable and you may be induced into inhaling larger amounts of molecular chlorine, which can cause pulmonary edema (inner-tissue fluid collects and fills the lungs) … drown while sleeping.

9. **B. From the top valve.**
Chlorine ton containers are manufactured with liquid chlorine under pressure. Because of evaporative temperature of chlorine, some of the liquid is always being converted to gas inside of the container. Gas is withdrawn from the top valve and liquid is withdrawn from the bottom valve.

10. **A. Black iron pipe**
The pipe most compatible for conveying chlorine gas or liquid at pressures equal to those in the chlorine ton container is black iron pipe. Liquid chlorine, or gaseous chlorine under pressure, will basically melt PVC pipe; however, PVC pipe is very adequate to convey gaseous chlorine after pressure reduction, and chlorine solution.