

DW Module 25:
Hypochlorite
Answer Key



Exercise for Unit 1 – Background and Properties

1. List and explain two uses of hypochlorite.

Answers may include disinfection, oxidation, and control of taste and odor.

2. Two gallons of a 12% solution of liquid sodium hypochlorite are equivalent to how many pounds of chlorine gas?

- a. 1 pound
- b. 2 pounds This is the correct answer since:

2 gal water x 8.33 pounds/gal water x 0.12 = 2.0 pounds equivalent Cl₂ gas.

- c. 3 pounds
- d. 4 pounds

3. Assume that calcium hypochlorite has 65% available chlorine. How many pounds of calcium hypochlorite is needed to provide the equivalent of 2.6 pounds of chlorine gas?

- a. 1 pound
- b. 2 pounds
- c. 3 pounds
- d. 4 pounds This is the correct answer since:

pounds (calcium hypochlorite) x 0.65 = 2.6 pounds (Cl₂ equivalent)

pounds (calcium hypochlorite) = 2.6 pounds/0.65 = 4.0 pounds

4. Dry calcium hypochlorite will lose 3 to 5 percent available chlorine per year.

5. All hypochlorite solutions will release oxygen gas as the solution decomposes.

a. True X

b. False _____



Exercise for Unit 2 – Storage, Handling and Safety

1. Sodium hypochlorite should not be stored longer than 45 days since its strength decomposes in storage.
 2. Calcium hypochlorite should be stored in its original containers until it is used.
 3. Hypochlorites decompose and release chlorine into the air.
 4. Forced air ventilation should be turned on whenever workers enter the hypochlorite storage or work area. a. True X b. _____
 5. MSDS is an abbreviation for Material Safety Data Sheet.
 6. Typical information in a MSDS includes:
 - a. The product name and its synonyms.
 - b. Fire and explosion hazard data.
 - c. Toxicity data.
 - d. First aid procedures.
 - e. All of the above. **This is the correct answer.**
 7. Hypochlorite spills should be washed with large amounts of water to dilute it.
 8. Hypochlorite will react spontaneously with organic material and should be kept separate from all organic compounds such as: fats, sugar, oils, turpentine, and other oxidizable materials.
 - a. True X
 - b. False _____
 9. First aid procedures for skin contact with hypochlorite include showering with large quantities of water and calling for medical assistance.
 10. Hypochlorite should be stored so that it does not get direct exposure to answers could include water, heat, direct sunlight, and organic matter.
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Exercise

1. Explain what breakpoint chlorination is.

Ans: Breakpoint chlorination is the addition of a sufficient amount of chlorine to satisfy all the chlorine demand in the water.

2. A water treatment plant operating at 750,000 gallons per day adds 33.6 gallons of 12.5% sodium hypochlorite each day for disinfection. After a 30 minute contact period, the chlorine residual is measured at 1.35 mg/l. Compute the chlorine demand of this water.

Ans: **Step 1:** Calculate the equivalent chlorine feed rate (ECF) in lb/day.

$$\begin{aligned} \text{ECF (lb/day)} &= (33.6 \text{ gal/day}) (1.04 \text{ lb/gal}) \\ &= 35 \text{ lb Cl/day} \end{aligned}$$

Step 2: Calculate equivalent chlorine dosage (ECD) in mg/l.

$$\begin{aligned} \text{ECD (mg/l)} &= \frac{\text{ECF (lb/day)}}{\text{Flow (mgd)} \times 8.34 \text{ (lb/gal)}} \\ &= \frac{35 \text{ lb Cl/day}}{0.75 \text{ (mgd)} \times 8.34 \text{ (lb/gal)}} \\ &= \frac{35 \text{ lb Cl/day}}{6.26 \text{ million lb water/day}} \\ &= 5.59 \text{ lb Cl/million lb water} \\ &= 5.59 \text{ mg/l} \end{aligned}$$

Step 3: Calculate the Chlorine Demand in mg/l

$$\begin{aligned} \text{Chlorine Demand (mg/l)} &= \text{Chlorine Dose (mg/l)} - \text{Chlorine Residual (mg/l)} \\ \text{Chlorine Demand (mg/l)} &= 5.59 \text{ (mg/l)} - 1.35 \text{ (mg/l)} \\ &= 4.24 \text{ mg/l} \end{aligned}$$



Exercise for Unit 3 – Chemical Feed

1. The breakpoint chlorination curve can be used to determine how much chlorine is required for disinfection.

2. The disinfection process for surface water supplies must achieve 99.9 percent (3 log) inactivation of Giardia cysts and 99.99 percent (4 log) inactivation of enteric viruses.
3. Chlorine dose = chlorine demand (mg/l) + chlorine residual (mg/l).
4. A day tank stores daily amounts of chemical required for delivery by feeders.
5. In the event of an abnormal operation, be sure to inform your supervisor about the problem.
6. Calcium hypochlorite solutions are typically prepared with a 1 to 3 % strength.