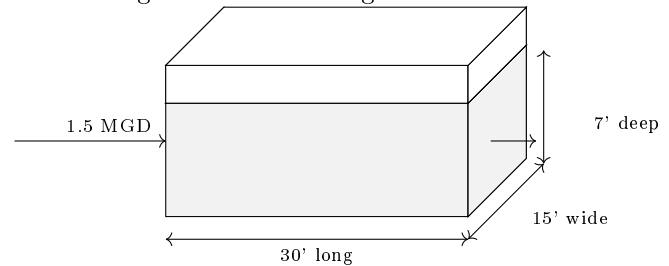


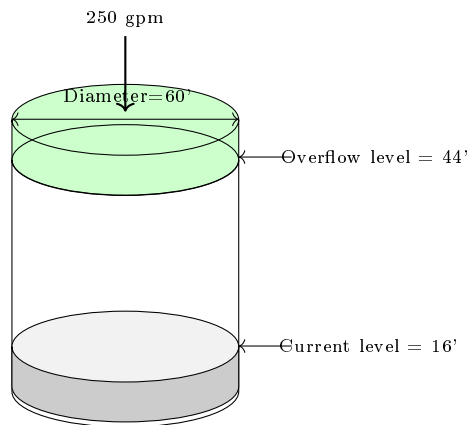
1. How long will it take to fill a 50 gallon hypochlorite tank if the flow is 5gpm ?
2. Find the detention time in a 45,000 gallon reservoir if the flow rate is 85gpm.
3. If the fuel consumption to the boiler is 35 gallons per day. How many days will the 500 gallon tank last.
4. The sedimentation basin on a water plant contains 5,775 gallons. What is the detention time if the flow is 175gpm.
1. A flocculation basin is 7 ft deep, 15 ft wide, and 30 ft long. If the flow through the basin is 1.35



MGD, what is the detention time in minutes?

$$DT = \frac{(30 * 15 * 7)ft^3 * 7.48 \frac{gal}{ft^3}}{1,350,000 \frac{gal}{day} * \frac{day}{1440min}} = 25min$$

2. A tank has a diameter of 60 feet with an overflow depth at 44 feet. The current water level is 16 feet. Water is flowing into the tank at a rate of 250 gallons per minute. At this rate, how many days will it take to fill the tank to the overflow?



$$\text{Fill time} = \frac{\text{Volume}}{\text{Flow}} = \frac{0.785 * 60^2 * (44 - 16)ft^3 * \frac{7.48gallons}{ft^3}}{250 \frac{gallons}{min} * \frac{1440 min}{day}} = 1.6 days$$

3. Solution:

4. Solution:

5

$$DT = \frac{50\text{gal}}{5\text{gal/min}} = 10 \text{ min}$$

5. Solution:

$$DT = \frac{45,000\text{gal}}{85\text{gal/min}} = 529 \text{ min} \quad \text{or} \quad \frac{529 \text{ min}}{60 \text{ min/hr}} = 8.8\text{hrs}$$

6. Solution:

$$DT = \frac{500 \text{ gal}}{35\text{gal/ day}} = 14.3 \text{ days}$$

7. Solution:

$$DT = \frac{5,775\text{gal}}{175\text{gal/min}} = 33 \text{ min}$$

8. At a 2.5 MGD wastewater treatment plant the primary clarifier has a detention time of 2 hours.

How many gallons does this clarifier hold?

- a. 104,000 gallons
- *b. 208,000 gallons
- c. 250,000 gallons
- d. 500,000 gallons
- e. 5,000,000 gallons

Solution:

$$\text{Clarifier detention time (hr)} = \frac{\text{Clarifier volume(gal)}}{\text{Influent flow (gal/hr)}}$$

$$\Rightarrow \text{Clarifier volume(gal)} = \text{Clarifier detention time (hr)} * \text{Influent flow (gal/hr)}$$

$$\Rightarrow \text{Clarifier volume(gal)} = (2 \text{ hrs}) * \left(2.5 * 10^6 \frac{\text{gal}}{\text{day}} * \frac{\text{day}}{24 \text{ hrs}}\right) = \boxed{208,333 \text{ gals}}$$

9. Calculate the detention time for a sedimentation tank that is 48 feet wide, 210 feet long and 9 feet deep with a flow of 5 MGD.

- *a. 3.25 hours.
- b. 3.63 hours.
- c. 5.65 hours.
- d. 5.82 hours.

Solution:

$$\text{Clarifier detention time (hr)} = \frac{\text{Clarifier volume (cu.ft or gal)}}{\text{Influent flow (cu.ft or gal)/hr}}$$

$$\text{Clarifier detention time (hr)} = \frac{(48 * 210 * 9) \text{ft}^3}{\frac{5 \cancel{\text{MG}}}{\cancel{\text{day}}} * \frac{10^6 \text{gal}}{\cancel{\text{MG}}} * \frac{\cancel{\text{ft}^3}}{7.48 \text{gal}} * \frac{\cancel{\text{day}}}{24 \text{hrs}}} = \boxed{3.25 \text{hrs}}$$

10. The detention time in a chlorine contact chamber is 42 minutes. If the chamber holds 3200 gallons, what is the flow rate in gpm?
11. A clearwell has a detention time of 2 hours. What is the flow rate in gpm if the clearwell holds 8000 gallons?
12. A tank holds 500 gallons. A pump is used to fill the tank at a rate of 25gpm. How long will it take to fill the tank?
13. A finished water storage tank is 35 feet in diameter and 65 feet high. With no water entering the tank, the water level dropped 14 feet in 5 hours. Find the average rate of flow for water leaving the tank in gallons per minute.

$$\text{Time} = \frac{\text{Volume}}{\text{Flow}}$$

$$\text{Volume} = 0.785 \text{ d}^2 \text{ h} = (0.785)(35\text{ft})^2(14\text{ft}) = 13462.75\text{cf}$$

$$5 \text{ HRS} = \frac{100,70/\text{gal}}{\text{Flow}}$$

$$(5 \times \text{flow}) = 100,701\text{gal}$$

$$\text{Flow} = 20,140\text{gal}$$

$$20,140 \text{ gal} \left| \frac{1\text{hr}}{\text{hr}} \right| \left| \frac{\text{hr}}{60 \text{ min}} \right| = 336\text{gpm}$$

14. If two pumps transfer 120 gpm each, how long will it take to fill a tank 50 feet long, 20 feet wide, and 8 feet deep? Express your answer in hours and minutes.

$$V = l \cdot w \cdot h(50\text{ft})(20\text{ft})(8\text{ft}) = 8,000\text{cf}$$

$$8,000\text{cf} \left| \frac{7.48\text{gal}}{\text{lcf}} \right| = 59840\text{gal}$$

$$\text{Time} = \frac{\text{Volume}}{\text{Flow}} = \frac{59,840\text{gal}}{240\text{gpm}} = 249 \text{ minutes} \quad \text{TIME is also 4 hours 9 minutes}$$

15. What is the average detention time in a basin given the following: diameter is 65 feet, depth is 12 feet, influent flow is 700gpm.
16. A settling basin that is 60 feet long, 15 feet wide, and 12 feet deep is used to treat a flow of 2.4mgd. What is the detention time?
17. What is the detention time in days for a reservoir if the influent flow rate is 0.785mgd, the reservoir covers 17 acres, and has an average depth of 22 feet?

$$Time = \frac{Volume}{Q}$$

$$\pi \text{ TIN} = \frac{121.9 \text{ mg}}{0.785 \text{ mgD}}$$

$$T_{\text{IdE}} = 155$$

18. A rectangular basin measures 100 feet long by 50 feet wide by 12 feet deep. A pump drawing water out of the tank is able to empty the tank in 1.24 days. What is the pump rate in gpm?

$$\frac{\text{Volume pumped (gal)}}{\text{min}} = \frac{(100 * 50 * 12) \cancel{\text{ft}^3} * \frac{\text{gal}}{\cancel{\text{ft}^3}}}{1.24 \cancel{\text{ days}} * \frac{1440 \text{ min}}{\cancel{\text{ day}}}} = \boxed{251 \frac{\text{gal}}{\text{min}}}$$

19. Determine the flow capacity of a pump in gpm if the pump lowers the water in a six-foot square wet well by 8 inches in 5 minutes.

$$\frac{\text{Volume pumped (gal)}}{\text{min}} = \frac{\left(8 \text{ in} * \frac{\text{ft}}{12 \text{ in}} * (6 \text{ ft})^2\right) \text{ft}^3 * \frac{\text{gal}}{\text{ft}^3}}{5 \text{ min}} = \boxed{36 \frac{\text{gal}}{\text{min}}}$$

20. Determine the detention time in hours for the following water treatment system:

- Distribution pipe from water plant to storage tank is 549 ft in length and 14 in. in diameter
- Storage tank averages 2,310,000 gal of water at any given time
- Flow through system is 6.72 mgd

- a. 7.2 hr
- b. 7.4 hr
- c. 8.0 hr
- d. 8.3 hr