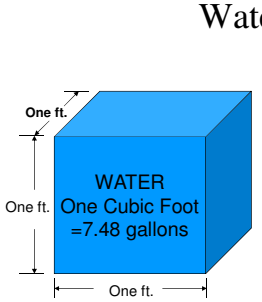
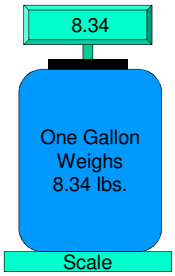
Basic Math

Pre-certification Training

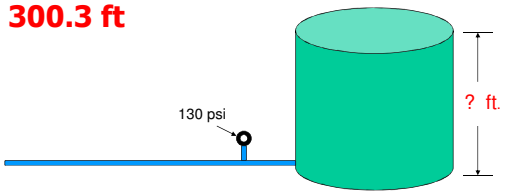
Water Facts





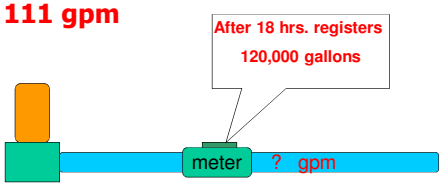
How many feet of head would create a pressure of 130 psi?

- **Formula: psi x 2.31 = feet of head**
- **130 psi x 2.31 ft/psi =**
- **300.3 ft**



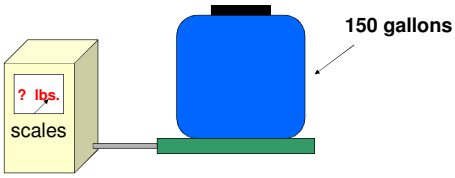
Pump runs 18 hours and pumps 120,000 gallons what is gpm pumping rate?

- **18 hours x 60 min = 1080 minutes**
- **120,000 gallons = 1080 min**
- **111 gpm**



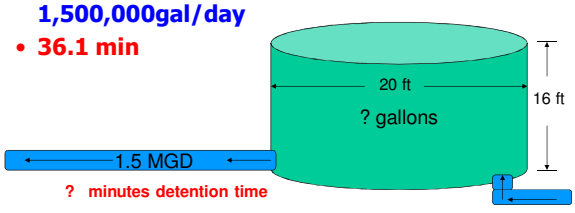
How much would 150 gallons of water weigh?

- **Formula: gal. X 8.34 = lbs. of water**
- **150 gal x 8.34 lbs./gal =**
- **1,251 lbs.**



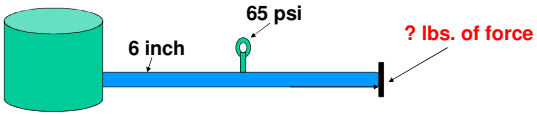
What is detention time in minutes of 20 ft diameter tank 16 ft deep with flow of 1.5 MGD?

- **20 ft x 20 ft x 0.785 = 314 ft²**
- **314 ft² x 16 ft = 5,024 ft³**
- **5,024 ft³ x 7.48 gal/ft³ = 37,579.5 gal**
- **37,580 gal = .025 days x 1440 min= 1,500,000gal/day**
- **36.1 min**



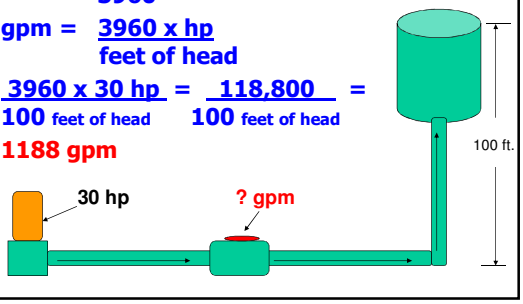
How much force on 6" blind flange with 65 psi?

- 6" x 6" x 0.785 = 28.26 in^2
- 28.26 in^2 x 65 psi =
- 1,836.9 pounds



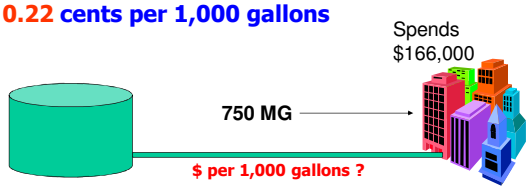
What would be the maximum pumping rate of a 30 hp pump with 100 ft of head?

- $\frac{100 \text{ ft of head}}{3960} \times \frac{? \text{ gpm}}{} = 30 \text{ hp}$
- gpm = $\frac{3960 \times \text{hp}}{\text{feet of head}}$
- $\frac{3960 \times 30 \text{ hp}}{100 \text{ feet of head}} = \frac{118{,}800}{100 \text{ feet of head}} =$
- 1188 gpm



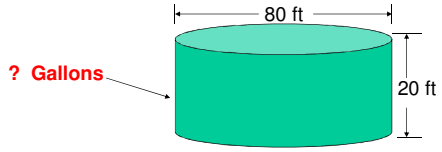
City spends $166,000. per year and sells 750 MG, what is cost per 1,000 gallons?

- 750 MG x 1,000,000 = 750,000,000 gallons
- $\frac{750{,}000{,}000}{1{,}000} = 750{,}000$ gallons
- $\frac{\$166{,}000}{750{,}000} =$
- 0.22 cents per 1,000 gallons



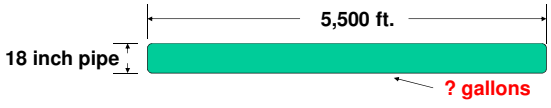
How many gallons in an 80 ft diameter tank filled 20 ft?

- 80 ft x 80 ft x 0.785 = 5,024 ft^2
- 5,024 ft^2 x 20 ft = 100,480 ft^3
- 100,480 ft^3 x 7.48 gal/ft^3 =
- 751,590 gallons



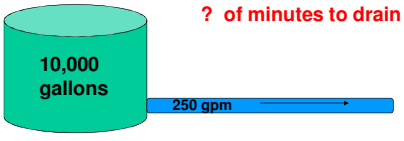
How many gallons of water in an 18 inch pipe that is 5,500 ft long?

- $\frac{18 \text{ in}}{12 \text{ in}} = 1.5 \text{ ft} \times 1.5 \text{ ft} \times 0.785 = 1.766 \text{ ft}^2$
- 1.766 ft^2 x 5,500 ft = 9,714 ft^3
- 9,714 ft^3 x 7.48 gal/ft^3 =
- 72,663 gallons



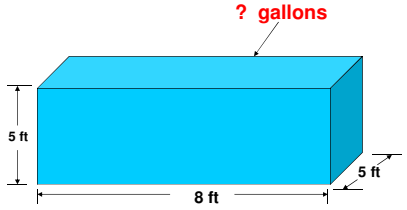
How long will a 10,000 gallon tank flow at 250 gpm?

- $\frac{10{,}000 \text{ gal}}{250 \text{ gal/min}} =$
- 40 min



How many gallons in a rectangular tank 5 ft x 8 ft x 5 ft?

- 5 ft x 8 ft x 5 ft = 200 ft^3
- 200 ft^3 x 7.48 gal/ft^3 =
- 1,496 gallons

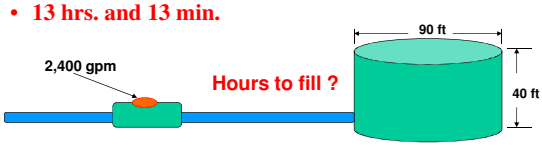


How many 18 ft long sections of ductile iron pipe will be needed for 150 ft of line?

- 150 ft / 18 ft/piece = 8.33 pieces
- 9 pieces

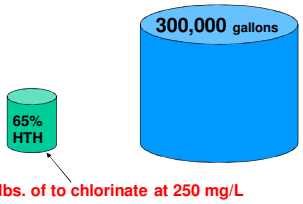
How many hours would it take to fill a 90 ft dia. tank 40 feet high pumping 2,400 gpm?

- 90 ft x 90 ft x 0.785 = 6,358.5 ft^2
- 6,358.5 ft^2 x 40 ft = 254,340 ft3
- 254,340 ft^3 x 7.48 gal/ft^3 = 1,902,460 gal.
- 1,902,460 gal. / 2,400 gal/min = 792.7 min. 792.7 min. / 60 min./hr. =
- 13.21 hrs. 0.21min x 60 min = 12.6 min.
- 13 hrs. and 13 min.



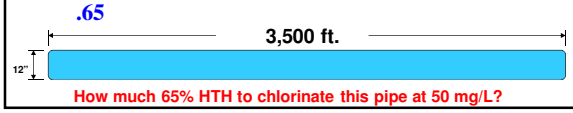
How many pounds of 65% HTH would be needed to dose 300,000 gal. at 250 mg/L?

- 300,000 gal. / 1,000,000 = 0.3 MG
- 0.3 x 250 mg/L x 8.34 =625.5 lbs.
- 625.5 lbs. / 65% =
- 962 lbs.



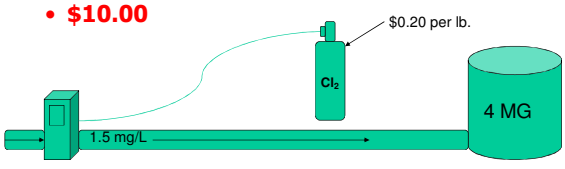
How many pounds of 65% HTH would be needed to dose 3,500 ft of 12 inch pipe to 50 mg/L?

- 12" / 12" = One Foot
- 1 ft x 1 ft x 0.785 = 0.785 ft^2
- 0.785 ft^2 x 3,500 ft = 2,747.5 ft^3
- 2,747.5 ft^3 x 7.48 gal/ft^3 = 20,550 gal
- 20,550 gal. / 1,000,000 = 0.021 MG x 50 mg/L x 8.34=
- 8.757 lbs. / .65 = 13.5 lbs.



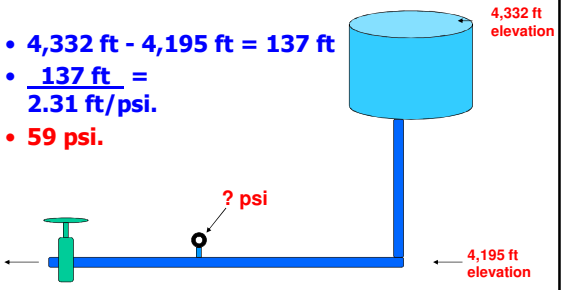
What would be the cost per day to chlorinate 4 MG at 1.5 mg/L if chlorine cost 20 cents per pound?

- 4 MGD x 1.5 mg/L x 8.34 = 50.04 lbs
- 50.04 lbs. x $0.20 per lbs. =
- $10.00



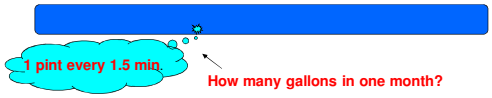
What would the psi at an outlet at elevation of 4,195 ft if the water level in the tank above is 4,332 ft?

- 4,332 ft - 4,195 ft = 137 ft
- 137 ft = 2.31 ft/psi.
- 59 psi.



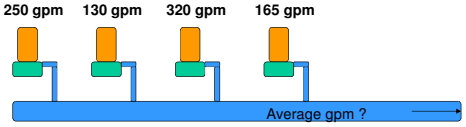
A leak of 1 pint every 1.5 min. would leak how many gallons in 30 days?

- 1 pint / 1.5 minutes = .667 pints/minute
- .667 pints/min x 1440 min/day = 960.48 pints/day
- 30 days x 960.48 pints/day = 28814.4 pints
- 28814.4 pints = 8 pints/gallon
- 3,602 gallons



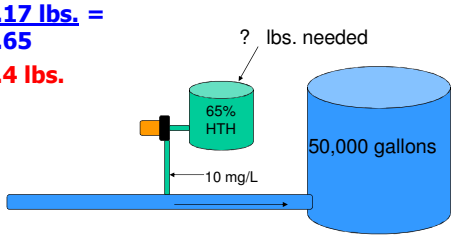
What would be the gpm average of the following 4 wells that flow at a rate of 250 gpm, 130 gpm, 320 gpm and 165 gpm?

- 250 gpm + 130 gpm + 320 gpm + 165 gpm =
- 865 gpm
- 865 gpm = 4 wells
- 216.25 gpm



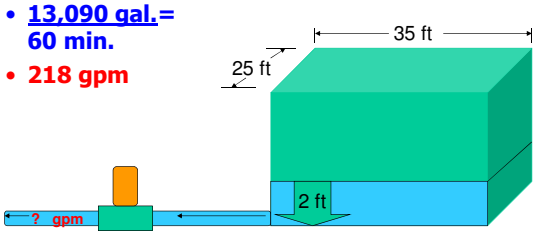
How many lbs. of 65% HTH would be needed to disinfect 50,000 gal. at 10 mg/L?

- 50,000 gal. = 0.05 MG x 10 mg/L x 8.34= 4.17 lbs. / 1,000,000
- 4.17 lbs. = 0.65
- 6.4 lbs.



What is the pumping rate in gpm if the pump drains 2 ft out of a 25 ft x 35 ft basin in 1 hr.?

- 2 ft x 25 ft x 35 ft = 1,750 ft^3
- 1,750 ft^3 x 7.48 gal/ft^3 = 13,090 gal.
- 13,090 gal. = 60 min.
- 218 gpm

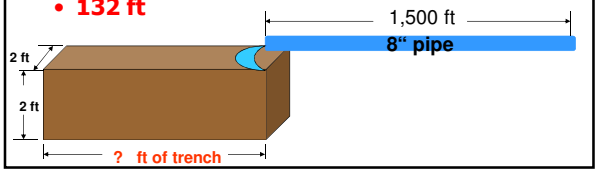


What is the gpm flow of the following meter readings taken three days apart? First reading 59,364,810 gal. Three days later 59,598,590 gal.

- 59,598,590 gal. - 59,364,810 gal = 233,780 gal
- 233,780 gal / 1,440 min/day x 3 days = 233,780 gal. / 4,320 min.
- 54.1 gpm

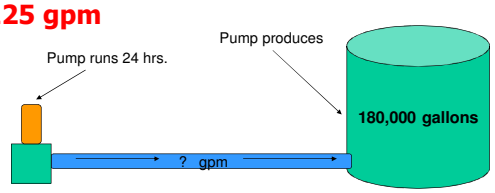
How long of a 2' wide by 2' deep trench will be needed to drain water from 1,500' of 8" water line?

- 8" / 12" = 0.67'
- 0.67 x 0.67' x 0.785 = 0.352 ft² x 1,500′ =528 ft³
- 528 ft³ / 2' x 2' = 528 ft³ / 4 ft² =
- 132 ft



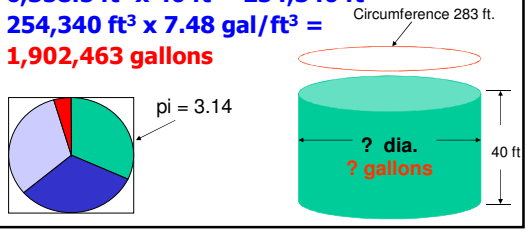
If a pump runs for 24 hours and delivers 180,000 gallons, what is the gpm flow rate?

- 24 hours = 1,440 minutes
- 180,000 gallons = 1,440 minutes
- 125 gpm



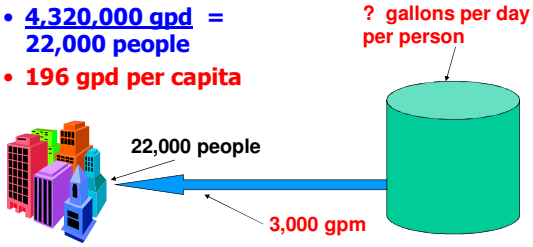
How many gallons will a 40' high tank with a circumference of 283' hold when it is full?

- 283 ft / 3.14 = 90 ft dia.
- 90ft x 90 ft x 0.785 = 6,358.5 ft²
- 6,358.5 ft² x 40 ft = 254,340 ft³
- 254,340 ft³ x 7.48 gal/ft³ =
- 1,902,463 gallons



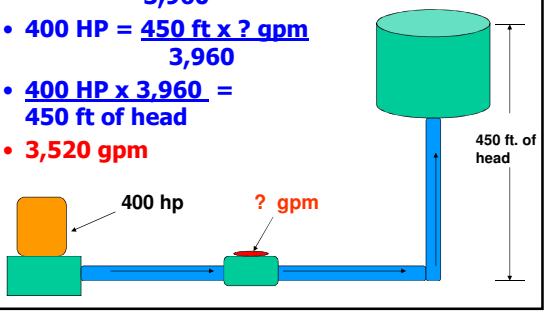
What is the per capita production in gallons per day for a system that produces 3,000 gpm for a population of 22,000?

- 3,000 gpm x 1,440 min/day = 4,320,000 gpd
- 4,320,000 gpd / 22,000 people =
- 196 gpd per capita



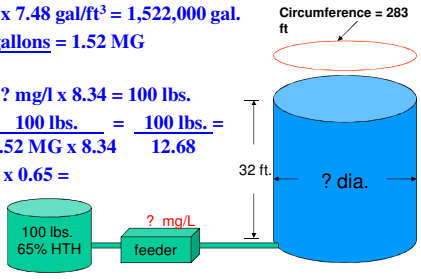
What is the maximum gpm pumping rate of a 400 HP pump with 450 ft of head?

- HP = ft of head x gpm / 3,960
- 400 HP = 450 ft x ? gpm / 3,960
- 400 HP x 3,960 / 450 ft of head =
- 3,520 gpm



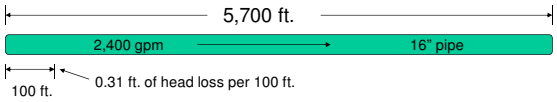
What would be the chlorine dosage if 100 lbs. of 65% HTH was put in a 283 ft circumference tank that had 32 ft of water?

- 283 ft / 3.14 = 90 ft x 90 ft x 0.785 = 6,358.5 ft²
- 6,358.5 ft² x 32 ft = 203,472 ft³
- 203,472 ft³ x 7.48 gal/ft³ = 1,522,000 gal.
- 1,522,000 gallons / 1,000,000 = 1.52 MG
- 1.52 MG x ? mg/l x 8.34 = 100 lbs.
- ? mg/l = 100 lbs. / 1.52 MG x 8.34 = 100 lbs. / 12.68
- 7.89 mg/l x 0.65 =
- 5.13 mg/l



What is the total head loss in feet of 5,700 ft. of 16 in. pipe with a flow of 2,400 gpm if the head loss is calculated at 0.31 psi per 100 ft.?

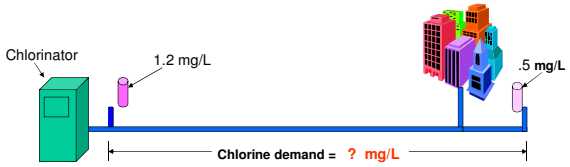
- 5,700 ft. / 100 ft. = 57 x 0.31 psi =
- 17.67 ft x .433 =
- 7.6 psi



? total head loss in feet

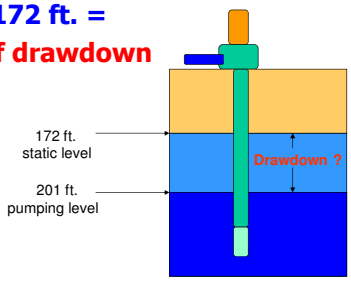
If a chlorine residual is 1.2 at the chlorinator and 0.5 in the distribution system, what is the chlorine demand?

- 1.2 mg/l - 0.5 mg/l =
- 0.7 mg/l chlorine demand



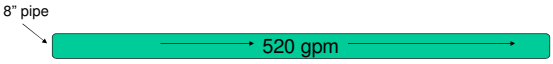
What is the drawdown in a well with a static water level of 172 ft. and a pumping water level of 201 ft.?

- 201 ft. - 172 ft. =
- 29 feet of drawdown



What is the velocity of the water in fps of an 8 inch pipeline with a flow of 520 gpm?

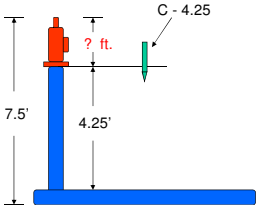
- Q = A x V Q = 520 gpm A = 8 inch pipe
- 520 gpm / 448.8 gpm/cfs = 1.16 cfs
- 8 in / 12 in = 0.67 x 0.67 x 0.785 = 0.352 ft^2
- 1.16 ft^3/sec / 0.352 ft^2 =
- 3.3 fps velocity



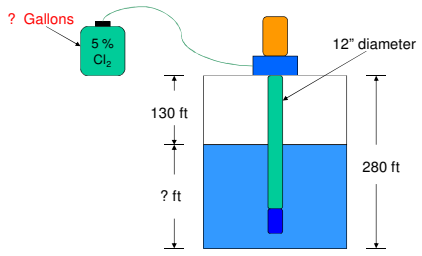
Velocity = ? feet per second

If the cut stake for a fire hydrant is marked AC-4.25@ and the hydrant is 7 ft. 6 in. tall, how high will the top be above the finished grade?

- 6" / 12 in/ft = 0.5 ft
- 7.5 ft. - 4.25 ft. =
- 3.25 ft.



How many gal. of 5% sodium hypochlorite will be needed to disinfect a 12 in. diameter well that is 280 ft. deep with a static water level of 130 ft. to a dosage of 50 mg/l?



NEXT SLIDE

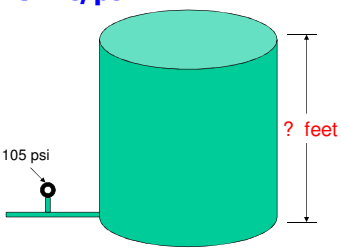
CONTINUED

How many gal. of 5% sodium hypochlorite will be needed to disinfect a 12 in. well that is 280 ft. deep with a static water level of 130 ft. to a dosage of 50 mg/l?

- 280 ft. - 130 ft. = 150 ft.
- $\frac{12"}{12"}$ = 1 ft. x 1 ft. x 0.785 = 0.785 ft^2
- 0.785 ft^2 x 150 ft. = 117.75 ft^3
- 117.75 ft^3 x 7.48 gal/ft^3= 881 gal.
- $\frac{881 \text{ gal.}}{1{,}000{,}000 \text{ gal/MGD}}$ = 0.001 x 50 mg/l x 8.34= 0.417 lbs.
- $\frac{0.417 \text{ lbs.}}{0.05}$ =
- 8.34 lbs. or 1 gallon

What depth of water would create a force of 105 psi.?

- 105 psi. x 2.31 ft/psi =
- 242.5 feet

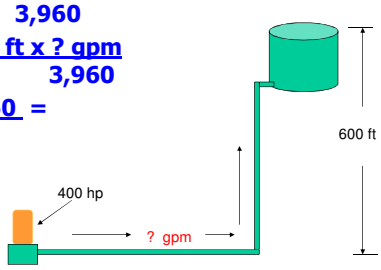


How many cfs of water would 2.5 MGD be?

- 2.5 MGD x 1.55 cfs/MGD =
- 3.875 cfs

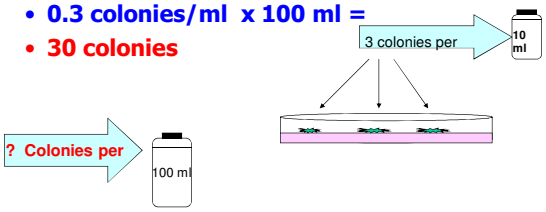
What is the pumping rate of a 400 HP pump with 600 feet of head?

- HP = $\frac{\text{ft of head x gpm}}{3{,}960}$
- 400 HP = $\frac{600 \text{ ft x ? gpm}}{3{,}960}$
- $\frac{400 \text{ HP x } 3{,}960}{600 \text{ ft of head}}$ =
- 2,640 gpm



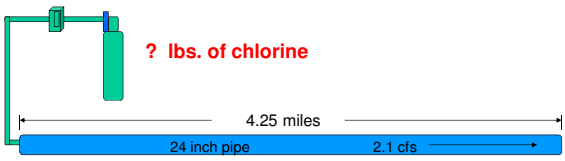
If a 10 ml portion of water developed 3 coliform bacteria colonies what would be the number of colonies per 100 ml?

- $\frac{3 \text{ colonies}}{10 \text{ ml}}$ = 0.3 colonies/ml
- 0.3 colonies/ml x 100 ml =
- 30 colonies



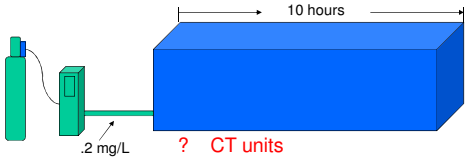
How many pounds of gas chlorine would be needed to dose 1.5 mg/l to a 4.25 mile section of 24 in. pipeline flowing at 2.1 cfs?

- $\frac{2.1 \text{ cfs}}{1.55 \text{ cfs/MGD}}$ = 1.35 MGD
- 1.35 MGD x 1.5 mg/l x 8.34 =
- 16.9 lbs.



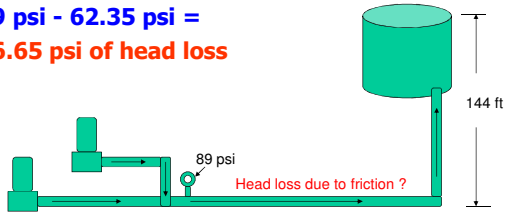
What is the contact time for a 10 hour period of a basin being dosed at 0.2 mg/L?

- **CT = Chlorine concentration x Time in min.**
- **10 hr. x 60 min. = 600 min.**
- **0.2 mg/L x 600 min. =**
- **120 CT units**

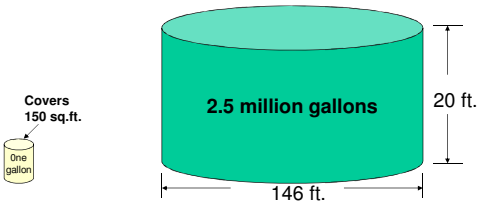


Two pumps are running with an output of 2500 gpm. The pressure gauges read 89 psi on the discharge pipe and the distance between the gauges and the water level in the tank is 144 ft. What is the head loss due to friction?

- **GPM has nothing to do with figuring the answer.**
- **Convert 144 ft to psi 144 x .433 = 62.35 psi**
- **89 psi - 62.35 psi =**
- **26.65 psi of head loss**



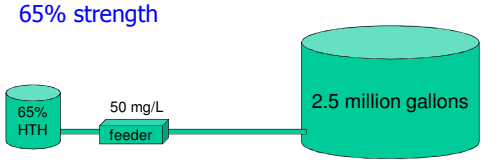
This year your maintenance crew has been given a work order to paint the 2.5 million gallon reservoir. You need to figure how much paint it will require to paint the reservoir inside and out. The reservoir is 146' in diameter and 20' high. A gallon of paint will cover 150 square feet.



- **Formula: Paint required= total area in square feet divided by coverage, sq. ft. per gallon.**
- **Top & bottom: 146' x 146' x .785 x 3 sides =**
- **Top & bottom: 50,199 ft^2**
- **Sides= pi (π) or 3.14 x 146 dia. x 20' x 2 sides**
- **Sides = 18,338 ft^2**
- **50,199 ft^2 + 18,338 ft^2 = 68,537 ft^2**
- **$\frac{68,537\ ft^2}{150\ gal./\ ft^2}$ =**
- **457 gallons of paint**

Disinfecting the Reservoir

- After painting the reservoir you need to disinfect it per AWWA standards.
- Rules say to use AWWA standard C652-92
- One method states you must maintain 50 mg/L residual for 6 hours
- You are using HTH calcium hypochlorite at 65% strength



- Formula: lbs. per day= MGD x 8.34 x ppm
- Known 50 mg/L and 2.5 MGD
- 2.5 MGD x 8.34 lbs./gal x 50 mg/L =
- 1043 lbs.
- 1043 lbs./.65% =
- 1605 lbs. of HTH

A chlorinator is set to feed 12 lbs. per day to a flow of 300 GPM. What is the dose in mg/L?

- **Dose mg/L = $\frac{\text{lbs. per day}}{(\text{MGD})(8.34)}$**
- **300 gpm x 60 min. x 24 hr = 432,000 GPD**
- **$\frac{432{,}000\ \text{GPD}}{1{,}000{,}000\ \text{MGD}}$ = .432 MGD**
- **$\frac{12\ \text{lbs.per day}}{(.432)(8.34)}$ = $\frac{12\ \text{lbs.}}{3.6}$ =**
- **3.3 mg/L**