Print

CONVERSION PROBLEMS

1. 20 ft^3 = 149.6 gallons $20\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = 149.6\ gal$

2. 100 gallons = 13.37 ft^3 $100\ gal \times \frac{1\ ft^3}{7.48\ gal} = 13.37\ ft^3$

3. 70 lbs = 8.39 gallons $70\ lbs \times \frac{1\ gal}{8.34\ lbs.} = 8.39\ gal$

4. 200 gallons = 1,668 lbs. $200\ gal \times \frac{8.34\ lbs.}{1\ gal} = 1,668\ lbs.$

5. 158,400 inches = 2.5 miles $158,400\ in \times \frac{1\ ft}{12\ in} \times \frac{1\ mile}{5,280\ ft} = 2.5\ miles$

6. 1,500 ft^3 = 93,575 lbs. $1,500\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} \times \frac{8.34\ lbs}{1\ gal} = 93,575\ lbs.$

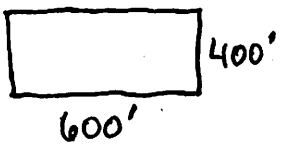
7. 25 ft^3 = .93 yd^3 $25\ ft^3 \times \frac{1\ yd^3}{27\ ft^3} = .93\ yd^3$

8. 3.5 acres = 152,460 ft^2 $3.5\ acres \times \frac{43,560\ ft^2}{1\ acre} = 152,460\ ft^2$

9. 261,360 ft^2 = 6 acres $261,360\ ft^2 \times \frac{1\ acre}{43,560\ ft^2} = 6\ acres$

10. 130 ft^3 = 8,109.82 lbs of water $130\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} \times \frac{8.34\ lbs.}{1\ gal} = 8,109.8\ lbs.$

1. A stabilization pound area is to be enclosed by a barbwire fence. Due to regulations, the fence must consist of three separate strands. The area that is to be enclosed measures 400 feet wide by 600 feet long. What length of wire will the city have to purchase to enclose the pond with three strands?

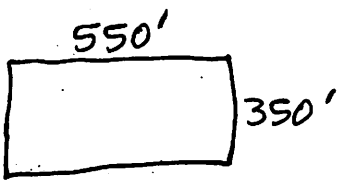


$2(600') + 2(400') = 2{,}000\ ft$

$\times 3$ strands

$\boxed{6{,}000\ ft}$

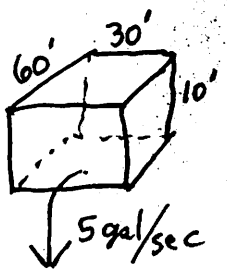
2. Calculate the total acreage of a stabilization pond that measures 350 feet long by 550 feet wide.



$550' \times 350' = 192{,}500\ ft^2 \times \frac{1\ acre}{43{,}560\ ft^2}$

$= \boxed{4.42\ acres}$

3. A rectangular shaped container is 60 feet long, 30 feet wide, and 10 feet deep.
   A. How many gallons of water can this container hold?
   B. How much would the water weigh?
   C. How many minutes would it take to empty the full tank at a pumping rate of 5 gallons/second?



A. $60' \times 30' \times 10' = 18{,}000\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = \boxed{134{,}640\ gal}$

B. $134{,}640\ gal \times \frac{8.34\ lbs}{1\ gal} = \boxed{1{,}122{,}897.6\ lbs}$

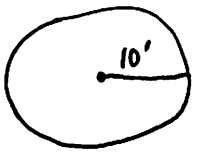
C. $134{,}640\ gal \times \frac{1\ sec}{5\ gal} = 26{,}928\ sec \times \frac{1\ min}{60\ sec} = \boxed{448.8\ min}$

4. A clearwell is 15 feet long by 13 feet 4 inches wide and measures 9 feet 6 inches deep.
   A. How many gallons of water can the clearwell hold?
   B. How many tons would the contained water weigh?

A. $15' \times 13.33' \times 9.5' = 1{,}899.5\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = \boxed{14{,}208\ gal}$

B. $14{,}208\ gal \times \frac{8.34\ lbs}{1\ gal} = 118{,}495\ lbs \div 2000\ \frac{lbs}{ton} = \boxed{59.25\ tons}$

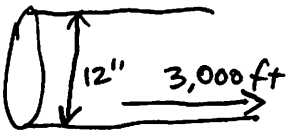
5. A tank has a 10 foot radius. What is it's circumference and area?



Circumference = $\pi \times$ diameter = $3.14 \times 20' =$ **62.8 feet**

Area = $\pi R^2 = 3.14 \times (10')^2 =$ **314 ft^2**

6. How many gallons of water would it take to completely fill a total of 3,000 feet of 12 inch water main?



Volume = $\pi R^2 \times$ length

$= 3.14 (.5')^2 \times 3,000'$

$= 2,355\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} =$ **17,615.4 gal**

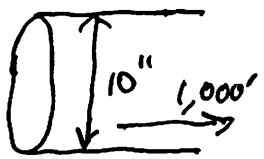
7. If three stabilization ponds cover 5 acres, 7 acres, and 10.5 acres, how many square feet is this? If all three ponds are 8 feet deep and completely full, how many gallons of water will they hold?

Total acres = $22.5\ acres \times \frac{43,560\ ft^2}{1\ acre} =$ **980,100 ft^2**

$980,100\ ft^2 \times 8\ ft = 7,840,000\ ft^3 \times \frac{7.48\ gal}{1\ ft^3}$

= **58,649,184 gal**

8. A sewer line is 10 inches in diameter and 1,000 feet long. How many gallons does it hold?



Volume = $\pi R^2 \times$ length

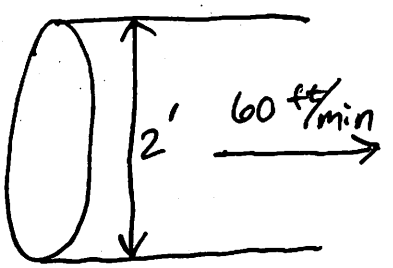
$= 3.14 (.417')^2 \times 1,000'$

$= 546\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} =$ **4,084 gal**

9. A trench is to be excavated that is 7 feet wide, 30 feet long, and 36 inches deep. What is the volume in cubic yards of the trench?

$7' \times 30' \times 3' = 630\ ft^3 \times \frac{1\ yd^3}{27\ ft^3} =$ **23.33 yd^3**

10. A pipe has a diameter of 2 feet and is full of water. If the velocity through the pipe is 60 feet per minute, what is the flow rate through the pipe in cubic feet per second?



Q (Flow rate) $= \text{Velocity} \times \text{Area}$

$= 60 \frac{ft}{min} \times 3.14\ ft^2$

$= 188.4 \frac{ft^3}{min} \times \frac{1\ min}{60\ sec}$

$= \boxed{3.14 \frac{ft^3}{sec}}$

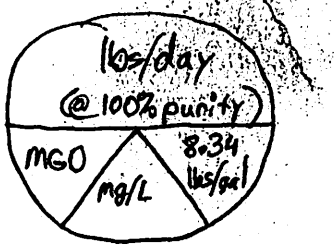
$\text{Area} = \pi R^2$

$= 3.14 (1)^2$

$= 3.14\ ft^2$

11. A water storage tank holds 500,000 gallons of water. How much chlorine (HTH) in pounds must be added to chlorinate the water to 50 mg/L? (Assume HTH is 65% chlorine).

Chemical fed (lbs.) = flow or water treated (million gallons) × dosage (mg/L) × weight of water (8.34 lbs/gal)



$= .5$ million gal $\times$ 50 mg/L ($\frac{\text{parts}}{\text{million}}$) $\times$ 8.34 lbs/gal

$= 208.5$ lbs (@ 100% chlorine)

$= 208.5 \div .65 = \boxed{320.8 \text{ lbs}}$

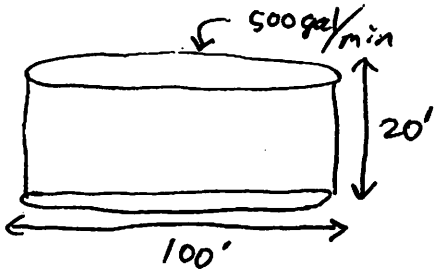
12. A water plant is treating 2,000,000 gallons per day. A test for free chlorine residual at the plant indicates a level of 0.2 mg/L. Based on experience, the operator knows they must bring the free chlorine level up to 1.7 mg/L at the plant in order to maintain a level of 1.0 mg/L free residual in the distribution system. If the rotameter on the chlorinator is set at 35, what must the new setting be?

2 million $\frac{gal}{day}$ $\times$ 1.5 mg/L (ppm) $\times$ 8.34 $\frac{lbs}{gal}$ $= 25.02 \frac{lbs}{day}$

$+ 35$

$\boxed{60.02 \frac{lbs}{day} \text{ or } 60}$

13. Water is flowing into a sedimentation basin at a rate of 500 gpm. Find the detention time for the basin if it is in the shape of a cylinder with a diameter of 100 feet and 20 feet deep.



$V = \pi R^2 \times h = 3.14 (50')^2 \times 20'$

$= 157{,}000\ ft^3 \times \frac{7.48\ gal}{1\ ft^3}$

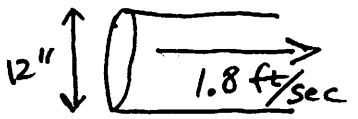
$= 1{,}174{,}360\ gal \times \frac{1\ min}{500\ gal}$

$= \underline{2{,}348.72\ minutes} \times \frac{1\ hr}{60\ min}$

or

$\underline{39.1\ hours}$

14. A 12 inch sewer line is completely full and the velocity of the wastewater through it is 1.8 feet per second. What is the flow through the line in gpm?



$Q = V \times A$

$= 1.8\ \frac{ft}{sec} \times .785\ ft^2$

$= 1.413\ ft^3/sec$

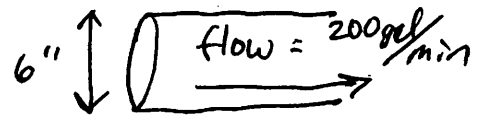
$A = \pi R^2$

$= 3.14 (.5')^2$

$= .785\ ft^2$

$1.413\ \frac{ft^3}{sec} \times \frac{7.48\ gal}{1\ ft^3} \times \frac{60\ sec}{1\ min} = \underline{634.2\ gal/min}$

15. A 6 inch water main has a discharge of 200 gallons per minute. Determine the velocity of the water in the main.



$Q = V \times A$ so $V = \frac{Q}{A}$

$V = \frac{200\ gal/min}{.19625\ ft^2}$ (must convert gal to ft^3)

$A = \pi R^2$

$= 3.14 (.25')^2$

$= .19625\ ft^2$

$200\ \frac{gal}{min} \times \frac{1\ ft^3}{7.48\ gal} = 26.7\ \frac{ft^3}{min}$

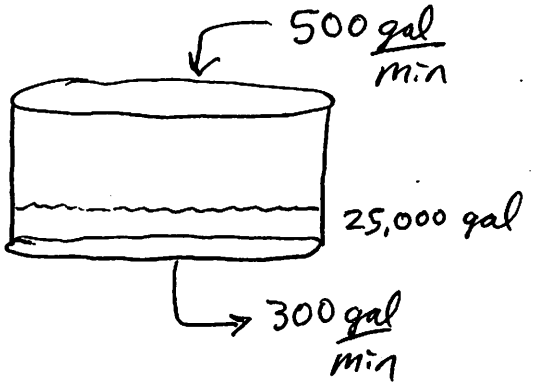
$\frac{26.7\ \frac{ft^3}{min}}{.19625\ ft^2} = \underline{136\ \frac{ft}{min}}$

16. A stabilization pond is being loaded at the rate of 150 pound of BOD_5 per day. A small industry contributes 35 pounds of BOD_5 per day to the total loading. If the average per capita of BOD_5 is 0.17 pounds per day, what is the approximate population of the city?

150 lbs − 35 lbs = 115 lbs. BOD_5 from population

$$115 \frac{lbs}{day} \times \frac{1 \text{ person}}{.17 \frac{lbs}{day}} = \underline{676 \text{ people}}$$

17. The reservoir for a water treatment plant has a capacity of 250,000 gallons. If the reservoir is only 10% full and the capacity of the plant is 500 gpm while the usage from the customers is a constant 300 gpm, how long will it take to fill the reservoir?



Net inflow = 200 gal/min

Need 225,000 gal to fill reservoir

$$225{,}000 \text{ gal} \times \frac{1 \text{ min}}{200 \text{ gal}}$$

$$= \underline{1{,}125 \text{ minutes}} \times \frac{1 \text{ hour}}{60 \text{ min}}$$

or

$$\underline{18.75 \text{ hours}}$$

18. The wastewater entering a stabilization pond has a BOD_5 of 250 mg/L. The discharge from the pond in the fall has a BOD_5 of 25 mg/L. What is the efficiency of the pond?

$$\frac{250 \frac{mg}{L} - 25 \frac{mg}{L}}{250 \frac{mg}{L}} = .9 = \underline{90\%}$$