Print

BASIC MATH
PRACTICE PROBLEMS

1. How many feet of head would create a pressure of 90 psi?

1 psi = 2.31 ft

$$90 \text{ psi} \times \frac{2.31 \text{ ft}}{1 \text{ psi}} = \boxed{207.9 \text{ feet}}$$

2. A pump runs 24 hours and pumps 120,000 gallons. What is the pumping rate in gallons per minute?

$$24 \text{ hours} \times \frac{60 \text{ min}}{1 \text{ hr}} = 1{,}440 \text{ min}$$

$$\frac{120{,}000 \text{ gal}}{1{,}440 \text{ min}} = \boxed{83.33 \text{ gpm}}$$

3. How much does 500 gallons of water weigh?

1 gal = 8.34 lbs.

$$500 \text{ gal} \times \frac{8.34 \text{ lbs}}{\text{gal}} = \boxed{4{,}170 \text{ lbs.}}$$

4. Garrison Dam releases water at a rate of 40,000 cubic feet per second. How many gallons in a day are released from the dam?

$1 \text{ ft}^3 = 7.48 \text{ gal}$ also convert time from seconds to days

$$\frac{40{,}000 \text{ ft}^3}{\text{sec}} \times \frac{7.48 \text{ gal}}{1 \text{ ft}^3} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{24 \text{ hrs}}{1 \text{ day}} = \boxed{25{,}851{,}000{,}000 \frac{\text{gal}}{\text{day}}}$$

5. What is the detention time (in minutes) for a tank with a diameter of 30 feet and a depth of 20 feet with a flow of 2 MGD?

first find volume of tank

$V = \pi R^2 \times \text{depth} = 3.14(15')^2 \times 20' = 14{,}130 \text{ ft}^3$

$$14{,}130 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 105{,}692.4 \text{ gal}$$

$$105{,}692.4 \text{ gal} \times \frac{1 \text{ day}}{2{,}000{,}000 \text{ gal}} \times \frac{24 \text{ hrs}}{1 \text{ day}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \boxed{76.1 \text{ min}}$$

6. A city spends $80,000 in a year and sells 400 million gallons of water. What is the cost per 1,000 gallons?

$$\frac{400{,}000{,}000\ gal}{1{,}000\ gal} = 400{,}000\ units\ of\ 1{,}000\ gal$$

$$\frac{\$80{,}000}{400{,}000\ units\ (of\ 1{,}000\ gal)} = \boxed{\$.20\ or\ 20\ cents/1{,}000\ gal}$$

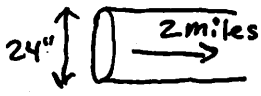
7. How many gallons of water can a tank with a radius of 30 feet and a depth of 20 feet hold?

Note radius is given, not diameter

$$V = \pi R^2 \times depth = 3.14\,(30')^2 \times 20' = 56{,}520\ ft^3$$

$$56{,}520\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = \boxed{422{,}769.6\ gal}$$

8. How many gallons of water are in a 24 inch pipe that is 2 miles long?



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

$$= 3.14\,(1')^2 \times 10{,}560\ ft = 33{,}158.4\ ft^3$$

$$33{,}158.4\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = \boxed{248{,}024.83\ gal}$$

9. A tank holds 100,000 gallons. How long will it take to empty the tank if it is releasing 200 gpm?

$$100{,}000\ gal \times \frac{1\ min}{200\ gal} = 500\ min$$

$$500\ min \times \frac{1\ hr}{60\ min} = 8.33\ hrs$$

$$\boxed{500\ min\ \text{or}\ 8.33\ hrs}$$

10. A rectangular tank measures 10 feet x 18 feet x 20 feet. How many gallons can the tank hold?

$$V = L \times W \times H = 10' \times 18' \times 20' = 3{,}600\ ft^3$$

$$3{,}600\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = \boxed{26{,}928\ gal}$$

11. How many 25 foot long sections of ductile iron pipe will be needed for 250 feet of line?

$$\frac{250\ ft}{25\ ft/section} = \boxed{10\ sections}$$

12. How many hours would it take to fill a 50 foot diameter tank with a height of 30 feet at a filling rate of 1,000 gpm?

$V = \pi R^2 \times height = 3.14(25')^2 \times 30' = 58,875\ ft^3$

$58,875\ ft^3 \times \frac{7.48\ gal}{ft^3} = 440,385\ gal$

$440,385\ gal \times \frac{1\ min}{1,000\ gal} = 440.4\ min \times \frac{1\ hr}{60\ min} = \boxed{7.34\ hrs}$

13. How many pounds of 65% HTH would be needed to dose 5,000,000 gallons at 50 mg/L?

$lbs\ HTH = 5\ MG \times \frac{50\ parts}{million} \times 8.34\ lbs/gal$

$= \frac{2,085\ lbs}{.65} = \boxed{3,207.7\ lbs\ HTH}$

14. How many pounds of 65% HTH would be needed to dose a length of 2,000 feet of 6 inch pipe to 50 mg/L?

6" ↕ □ ⟶ 2,000 ft

$V = \pi R^2 \times length = 3.14(.25')^2 \times 2,000'$

$= 392.5\ ft^3 \times \frac{7.48\ gal}{ft^3} = 2,935.9\ gal$

$lbs.HTH = .0029359\ MG \times \frac{50\ parts}{million} \times \frac{8.34\ lbs}{gal} = \frac{1.22\ lbs}{.65} = \boxed{1.88\ lbs.HTH}$

15. A water treatment plant is producing 10 MGD and the chlorine residual leaving the plant is 3 mg/L. If chlorine costs 20 cents per pound, what is the plant spending on chlorine per day?

$lbs\ HTH = 10\ MG \times \frac{3\ parts}{million} \times \frac{8.34\ lbs}{gal}$

$= 250.2\ \frac{lbs}{day} \times \frac{\$.20}{lb.} = \boxed{\$50.04/day}$

16. A water tank sits on a hill. The elevation at the bottom of the tank is 2,468 feet. The elevation of the water level in the tank is 2,498 feet. At an outlet point in the town below, the elevation is 2,354 feet. What is the pressure at the bottom of the tank and at the outlet point?

Bottom of tank = 2,498' − 2,468' = 30 ft × $\frac{1 \text{ psi}}{2.31 \text{ ft}}$ = **13 psi**

outlet point = 2,498' − 2,354' = 144 ft × $\frac{1 \text{ psi}}{2.31 \text{ ft}}$ = **62.3 psi**

17. A leak of 1 pint every 1.5 minutes would leak how many gallons in 30 days? (there are 8 pints in a gallon)

30 days × $\frac{24 \text{ hrs}}{1 \text{ day}}$ × $\frac{60 \text{ min}}{1 \text{ hr}}$ = 43,200 min × $\frac{1 \text{ pint}}{1.5 \text{ min}}$ = 28,800 pints

28,800 pints × $\frac{1 \text{ gal}}{8 \text{ pints}}$ = **3,600 gal**

18. Five wells produce a flow of these rates: 150 gpm, 250 gpm, 225 gpm, 200 gpm, and 375 gpm. What is the average flow produced by these wells?

1,200 $\frac{\text{gal}}{\text{min}}$ ÷ 5 = **240 gpm**

19. How many pounds of 65% HTH would be needed to disinfect 25,000 gallons to 150 mg/L?

lbs. HTH = .025 MG × $\frac{150 \text{ parts}}{\text{million}}$ × $\frac{8.34 \text{ lbs}}{\text{gal}}$

= $\frac{31.275 \text{ lbs.}}{.65}$ = **48.1 lbs HTH**

20. A pump drains 8 feet of water out of a tank basin that measures 35 feet x 50 feet in 7 hours. What is the pumping rate in gpm?

V = 35' × 50' × 8' = 14,000 ft³ × $\frac{7.48 \text{ gal}}{\text{ft}^3}$ = 104,720 gal

$\frac{104,720 \text{ gal}}{420 \text{ min}}$ = **249.3 gpm**

21. A reading is taken at a meter and measures 24,375,112 gallons. Thirty days later the meter reads 24,379,636 gallons. What has been the usage during those thirty days and what has the flow been in gpm?

$$\begin{array}{r} 24,379,636 \text{ gal} \\ - \ 24,375,112 \text{ gal} \\ \hline \boxed{4,524 \text{ gal}} \end{array}$$

$$30 \text{ days} \times \frac{24 \text{ hrs}}{1 \text{ day}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 43,200 \text{ min}$$

$$\frac{4,524 \text{ gal}}{43,200 \text{ min}} = \boxed{.105 \frac{\text{gal}}{\text{min}}}$$

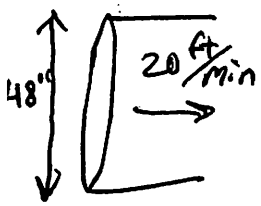
22. How many cubic yards of material will need to be removed to excavate a trench measuring 1.25 mile long, 4 feet wide, and 6 feet deep?

$$1.25 \text{ mile} \times \frac{5280'}{\text{mile}} = 6,600 \text{ ft}$$

$$6,600 \text{ ft} \times 4 \text{ ft} \times 6 \text{ ft} = 158,400 \text{ ft}^3 \times \frac{1 \text{ yd}^3}{27 \text{ ft}^3}$$

$$= \boxed{5,866.7 \text{ yd}^3}$$

23. A pipe has a diameter of 48 inches and is full of water. If the velocity through the pipe is 20 feet per minute, what is the flow rate through the pipe in gallons per minute?



$Q = V \times A$

$A = \pi R^2$

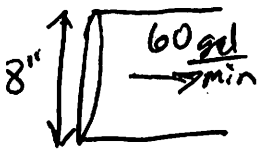
$= 3.14(2')^2$

$= 12.56 \text{ ft}^2$

$$= \frac{20 \text{ ft}}{\text{min}} \times 12.56 \text{ ft}^2$$

$$= 251.2 \frac{\text{ft}^3}{\text{min}} \times \frac{7.48 \text{ gal}}{\text{ft}^3} = \boxed{1,879 \frac{\text{gal}}{\text{min}}}$$

24. An 8 inch pipe carries water through it at a flow rate of 60 gpm. What is the velocity of the water in the pipe?



$Q = V \times A$

$A = \pi R^2$

$= 3.14(.33')^2$

$= .341946 \text{ ft}^2$

Must convert flow rate to $\frac{\text{ft}^3}{\text{min}}$

$$60 \frac{\text{gal}}{\text{min}} \times \frac{\text{ft}^3}{7.48 \text{ gal}} = 8.02 \frac{\text{ft}^3}{\text{min}}$$

$$8.02 \frac{\text{ft}^3}{\text{min}} = \text{Velocity} \times .341946 \text{ ft}^2$$

$V = \boxed{23.5 \text{ ft/min}} \times \frac{1 \text{ min}}{60 \text{ sec}} = \boxed{.39 \text{ ft/sec}}$ (or)

25. A pump runs for 36 hours and delivers 350,000 gallons. What is the flow rate in gpm?

$$36 \text{ hrs} \times \frac{60 \text{ min}}{1 \text{ hr}} = 2,160 \text{ min}$$

$$\frac{350,000 \text{ gal}}{2,160 \text{ min}} = \boxed{162 \frac{\text{gal}}{\text{min}}}$$

26. How many gallons will a 40 foot tall tank with a circumference of 283 feet hold when it is full?

$C = \pi \times d$ $\quad 283' = 3.14 \times d$ $\quad d = 90\ ft$

$V = \pi R^2 \times h = 3.14 (45')^2 \times 40' = 254,340\ ft^3$

$254,340\ ft^3 \times \frac{7.48\ gal}{ft^3} =$ **1,902,463 gal**

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

$\frac{3,000\ gal}{min} \times \frac{60\ min}{1\ hr} \times \frac{24\ hrs}{1\ day} = \frac{4,320,000\ gal/day}{22,000\ people}$

$=$ **196.4 gal/day/person**

28. If a chlorine residual is 1.8 mg/L at the chlorinator and 0.3 mg/L in the distribution system, what is the chlorine demand?

$1.8\ mg/L - .3\ mg/L =$ **1.5 mg/L**

29. What is the drawdown in a well with a static water level of 143 feet and a pumping water level of 169 feet?

$169\ ft$
$-\ 143\ ft$
26 ft

30. What is the velocity of the water (in feet per second) of an 8 inch pipe with a flow of 520 gpm?

$Q = V \times A$ $\quad \frac{520\ gal}{min} = V \times A$ $\quad A = \pi R^2$

$= 3.14 (.33')^2$

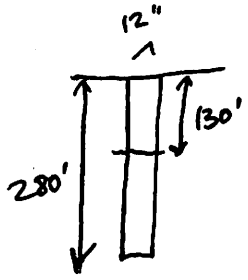
$= .341946\ ft^2$

$\frac{520\ gal}{min} \times \frac{1\ ft^3}{7.48\ gal} = 69.5\ \frac{ft^3}{min}$

$\frac{69.5\ ft^3}{min} = V \times .341946\ ft^2$ $\quad V = 203.2\ \frac{ft}{min} \times \frac{1\ min}{60\ sec}$

$=$ **3.39 ft/sec**

31. How many pounds of 5% hypochlorite will be needed to disinfect a 12 inch diameter well that is 280 feet deep with a static water level of 130 feet to a dosage of 50 mg/L?



$V = \pi R^2 \times h = 3.14(.5')^2 \times 150' = 117.75\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = 881\ gal$

$.000881\ MG \times \frac{50\ parts}{million} \times \frac{8.34\ lbs}{gal}$

$= .367\ lbs. \div .05 = \boxed{7.35\ lbs}$

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

$105\ psi \times \frac{2.31\ ft}{psi} = \boxed{242.55\ ft}$

33. How many cfs of water would 2.5 MGD be?

$\frac{2,500,000\ gal}{day} \times \frac{1\ ft^3}{7.48\ gal} \times \frac{1\ day}{24\ hrs} \times \frac{1\ hr}{60\ min} \times \frac{1\ min}{60\ sec}$

$= \boxed{3.87\ \frac{ft^3}{sec}}$

34. If a 10 mL portion of water developed 3 coliform bacteria colonies, what would be the number of colonies per 100 mL?

$\frac{3\ colonies}{10\ mL} = .3\ \frac{colonies}{mL} \times 100\ mL = \boxed{30\ colonies}$

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

$\frac{300\ gal}{min}$ must be changed to million gal per day

$300\ \frac{gal}{min} \times \frac{60\ min}{1\ hr} \times \frac{24\ hrs}{1\ day} = 432,000\ \frac{gal}{day}$ or $.432\ \frac{MG}{day}$

$12\ lbs = .432\ \frac{MG}{day} \times dosage \times 8.34\ lbs/gal$

$12\ lbs. = 3.6\ million\text{-}lbs \times dosage$

$dosage = \boxed{3.33\ ppm \text{ or } 3.33\ mg/L}$