



Certification Boulevard

Roy Pelletier



Test Your Knowledge of Water Supply and Other Topics

1. What is the velocity in cubic feet per second (cfs) of a 3.75-mgd stream of water?
a. 1.55 cfs b. 7.48 cfs
c. 8.34 cfs d. 5.8 cfs
2. A rectangular flume is two feet by two feet; the water is two feet deep and moving at a velocity of two fps. How many gallons of water will the flume deliver in 4 hours?
a. 3,590 gallons
b. 861,696 gallons
c. 960,158 gallons
d. 247,310 gallons
3. If a gallon of water weighs 8.34 pounds and a cubic foot of water holds 7.48 gallons, how much does a cubic foot of water weigh?
a. 92.8 pounds b. 89.6 pounds
c. 62.4 pounds d. 3.14 pounds
4. What is the flow velocity in a four-inch pipe compared to the flow velocity in an eight-inch pipe, assuming both pipes are carrying a water flow of equal volume per unit time?
a. The same
b. Twice the velocity
c. Three times the velocity
d. Four times the velocity
5. A potable water flow meter reads 175 gpm for eight hours per day and 87 gpm for the remaining 16 hours per day. What is the total daily flow in mgd?
a. 0.647 mgd b. 0.167 mgd
c. 0.943 mgd d. 0.187 mgd
6. What is the flow rate in cubic feet per second (cfs) of a one-mgd stream of water?
a. 1.55 cfs b. 8.34 cfs
c. 7.48 cfs d. 92.84 cfs
7. Which has a lower pH, sodium hydroxide or aluminum sulfate?
a. Aluminum sulfate
b. Sodium hydroxide
c. They are both the same
8. Given the following data, calculate the approximate horsepower delivered by this pump:
• Flow is 675 gpm

- TDH is 95 feet
- Pump efficiency is 88 percent
- Motor efficiency is 95 percent
- a. 15 HP b. 20 HP
- c. 25 HP d. 7.5 HP

9. When pumping water, the Total Dynamic Head is the sum of three main components. List these components.
10. What will the pressure gauge read on the suction of a pump if the pump is located at floor elevation of the tank and the tank has 25 feet of static water level?
a. About 58 psi b. About 9.5 psi
c. About 11 psi d. About 17 psi

ANSWERS ON PAGE 61

Readers are welcome to submit questions or exercises on water or wastewater treatment plant operations for publication in *Certification Boulevard*. Mail your question (with the answer) or your exercise (with the solution) to Roy Pelletier, City of Orlando Public Works Department, 5100 L.B. McLeod Road, Orlando, FL 32811. Or send it by e-mail to roy.pelletier@cityoforlando.net.

Certification Boulevard Answer Key

From page 42

1. **d. 5.8 cfs**
 $1,000,000 \text{ gallons per day} \div 86,400 \text{ seconds per day}$
 $\div 7.48 \text{ gallons per cubic foot} \times 3.75 \text{ mgd}$
 $= 5.8 \text{ cfs}$ Or
 $1.55 \text{ cfs per mgd} \times 3.75 \text{ mgd} = 5.81 \text{ cfs}$
2. **b. 861,696 gals**
 $\text{Length, ft} \times \text{Width, ft} \times \text{Depth, ft} \times 7.48 \text{ gals per cu ft} = \text{gallons}$
 $2.0 \text{ ft} \times 2.0 \text{ ft} \times 2.0 \text{ ft} \times 7.48 \text{ gals per cu ft}$
 $= 59.84 \text{ gallons}$
 $2 \text{ fps} \div 2.0 \text{ ft} = 1.0 \text{ seconds}$
 $1.0 \text{ secs} \times 59.84 \text{ gals} = 59.84 \text{ gals per sec}$
 $59.84 \text{ gals per sec} \times 60 \text{ secs per min}$
 $= 3,590.4 \text{ gpm}$
 $4 \text{ hours} \times 60 \text{ mins per hr} = 240 \text{ mins in 4 hrs}$
 $3,590.4 \text{ gpm} \times 240 \text{ mins} = 861,696 \text{ gals in 4 hrs}$
3. **c. 62.4 lbs**
 $8.34 \text{ lbs per gal} \times 7.48 \text{ gal per ft}^3 = 62.4 \text{ lbs per ft}^3$
4. **d. Four time the velocity**
 $\text{Cross section of a 4-inch pipe} = \pi r^2$
 $3.14 \times (2 \text{ in.} \div 2)^2 = 0.0872 \text{ ft}^2$
 $\text{Cross section of a 12-inch pipe} = \pi r^2$
 $3.14 \times (4 \text{ in.} \div 2)^2 = 0.3488 \text{ ft}^2$
 $= 0.3488 \text{ ft}^2 \div 0.0872 \text{ ft}^2 = 4.0$
5. **b. 0.167 mgd**
 $(175 \text{ gpm} \times 8 \text{ hrs per day} \times 60 \text{ mins per hr}) + (87 \text{ gpm} \times 16 \text{ hrs per day} \times 60 \text{ mins per day})$
 $84,000 \text{ gpd} + 83,5200 \text{ gpd} = 167,520 \text{ gpd} \div 1,000,000$
 $= 0.16752 \text{ mgd}$
6. **a. 1.55 cfs**
 $1,000,000 \text{ gpd} \div 1,440 \text{ mins per day} \div 7.48 \text{ gal per cu.ft.} \div 60 \text{ seconds per minute}$
 $= 1.547 \text{ cfs per mgd}$ Or
 $1,000,000 \text{ gpd} \div 86,400 \text{ secs per day} \div 7.48 \text{ gal per cu.ft.}$
 $= 1.547 \text{ cfs per mgd}$
7. **a. Aluminum sulfate**

Sodium hydroxide (Caustic) is an alkaline with a pH typically greater than 12. Aluminum sulfate (Alum) is an acid with a pH typically below 4.0.
8. **b. 20 HP**

Horsepower

 $= (\text{gpm} \times \text{TDH, feet} \times 8.34 \text{ lbs per gal}) \div 33,000 \text{ foot lbs per second} \div \% \text{ pump eff} \div \% \text{ motor eff}$
 $= (675 \text{ gpm} \times 95 \text{ TDH} \times 8.34 \text{ lbs per gal}) \div 33,000$
 $\div 0.88 \div 0.95$
 $= 19.38 \text{ HP}$
9. **Suction lift, discharge head, and friction losses**

TDH (Total Dynamic Head): A combination of various components—static head, which is a combination of suction lift and discharge head, and friction head (or friction losses), which includes velocity head. All components are expressed in feet. Static head is the actual vertical distance measured from the minimum water level in the basin to the highest point in the discharge piping. Friction head is the additional head created in the discharge system due to resistance to flow within its components.
10. **c. About 11 psi**

Each foot of water generates 0.433 psi

 $25 \text{ feet of water} \times 0.433 \text{ psi} = 10.82 \text{ psi}$