

# Operator Quiz Test No. 121 – Math Math Math

The following questions are designed for trainees as they prepare to take the ABC wastewater operator test. It is also designed for existing operators to test their knowledge. Each issue of *Clear Waters* will have more questions from a different section of wastewater treatment. Good luck!

- Which of the following is the correct equation for the area of a circle?
  - $(\text{Base}) \times (\text{Height}) / 2$
  - $(\pi) \times (\text{Radius}^2)$
  - $(\text{Length}) \times (\text{Width})$
  - $(\pi) \times (\text{Diameter})$
- What is the approximate detention time in hours of a clarifier with a total volume of 0.5 million gallons and an influent flow rate of 12.5 MGD?
  - 1.0 hour
  - 25 hours
  - 2.5 hours
  - 0.5 hour
- Calculate the surface overflow rate of a tank that is 15 ft deep x 30 ft long x 10 ft wide with an influent flow rate of 0.15 MGD.
  - 200 gpd/ft<sup>2</sup>
  - 300 gpd/ft<sup>2</sup>
  - 400 gpd/ft<sup>2</sup>
  - 500 gpd/ft<sup>2</sup>
- If a rectangular tank is 150 ft x 25 ft x 15 ft, what is the volume in cubic feet?
  - 375 ft<sup>3</sup>
  - 3750 ft<sup>3</sup>
  - 56,250 ft<sup>3</sup>
  - 420,750 ft<sup>3</sup>
- If a rectangular tank is 90 ft x 30 ft x 12 ft, what is its approximate volume in gallons?
  - 270,000 gal
  - 242,000 gal
  - 32,000 gal
  - 320,000 gal
- 1 MGD = \_\_\_\_\_ gpm?
  - 1,000,000
  - 41,666
  - 1440
  - 694
- Plant influent BOD averages 130 mg/L. The daily average influent flow is 100 MGD. What is the average daily BOD loading for this plant?
  - 108,420 lbs
  - 13,000 lbs
  - 97,240 lbs
  - 130,000 lbs
- Calculate the mean cell residence time using the following data:  
Aeration system flow: 5 MGD  
WAS: 400 lbs/day  
Aeration tank size: 90 ft x 30 ft x 12 ft  
FE TSS: 3.0 mg/l  
Aeration tank MLSS: 2,000 mg/l  
Clarifier volume: 150,000 gal  
Clarifier total solids: 400 lbs
  - 15.5 days
  - 12.2 days
  - 8.4 days
  - 6.3 days
- Calculate the Food to Microorganism ratio with a BOD<sub>5</sub> of 20,000 lbs/day and MLVSS of 100,000 lbs.
  - 0.1
  - 0.2
  - 0.3
  - 0.4
- Calculate the Sludge Volume Index from the following data.  
Assume a 1,000 mL sample is used.  
30 min settling test result: 150 mL  
MLSS: 2500 mg/L
  - 60
  - 120
  - 180
  - 240

**Answers and math explained on next page.**

For those who have questions concerning operator certification requirements and scheduling, please contact Tanya May Jennings at 315-422-7811 ext. 4, [tmj@nywea.org](mailto:tmj@nywea.org), or visit [www.nywea.org/OpCert](http://www.nywea.org/OpCert).

### Operator Quiz Test No. 121 “Math Math Math” Answers Explained

1. (a) Is the area of a right triangle; (b) is the correct equation; (c) is the area of a rectangle; (d) is the circumference of a circle.

2. Detention time = Volume / Flow = 500,000 gal / 12,500,000 gal/day = 0.04 days;  
0.04 days \* 24 hr/day = 0.96 hr, or approximately 1.0 hour

3. SOR = Total flow, gpd / Area ft<sup>2</sup> = 150,000 gpd / 300 ft<sup>2</sup> = 500 gpd/ft<sup>2</sup>

4. Volume = L \* W \* H = 150 ft \* 25 ft \* 15 ft = 56,250 ft<sup>3</sup>

5. V = L \* W \* H = 32,400 ft<sup>3</sup>; 1 ft<sup>3</sup> = 7.48 gal; (32,400 ft<sup>3</sup>) \* (7.48 gal/ft<sup>3</sup>) = 242,352 gal

6. 1,000,000 gal/day \* 1 day/24 hr \* 1hr/60 min = 1,000,000 gal/1440 min = 694.4 gal/min

7. Mass = (Volume, MG) \* (Concentration, mg/L) \* (8.34 lbs/gal) = (100 MG) \* (130 mg/L) \* (8.34 lbs/gal) = 108,420 lbs

8. MCRT = (Aeration tank TSS, lbs + Clarifier TSS, lbs) / (TSS wasted, lbs/day + FE TSS, lbs/day)

- Aeration TSS = (90ft \* 30ft \* 12ft) \* (7.48 gal/ft<sup>3</sup>) = 242,352 gal; (0.242352 MG) \* (2,000 mg/l) \* (8.34) = 4042 lbs
- FE TSS, lbs/day = (5.0 MGD) \* (3.0 mg/l) \* (8.34 lb/gal) = 125.1 lbs/day
- MCRT = (4042 lbs + 400 lbs) / (400 lbs/day + 125 lbs/day) = 4442 lbs / 525 lbs/day = 8.46 days

9. F:M = (BOD<sub>5</sub>, lbs) / (MLVSS, lbs) = (20,000 lbs) \* (100,000 lbs) = 0.2

10. SVI = (settled sludge volume, mL/L \* 1000) / suspended solids, mg/L = (150 mL/L \* 1000) / 2,500 mg/L = 150,000/2,500 = 60