

**Exam Math Review  
Collection Grades I & II  
Small Lagoon System  
Answer Key**

*The Division of Water Quality  
makes no claim as to the  
accuracy of any answers  
provided herein.*

**Certification Exam Review**  
Collections Grade I & II  
Small Lagoon Systems

**Math Problems - Conversions**

1. 100 feet of pressure head is how many psi?

$$1 \text{ psi} = 2.31 \text{ ft}$$

$$100 \text{ ft} \times \frac{1 \text{ psi}}{2.31 \text{ ft}} = 43.29 \text{ psi}$$

2. 750 cubic feet of wastewater is how many gallons?

$$1 \text{ ft}^3 = 7.48 \text{ gal}$$

$$750 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 5,610 \text{ gal}$$

3. A 10 KW motor will run what horsepower pump?

$$1 \text{ KW} = 1.34 \text{ hp}$$

$$10 \text{ KW} \times \frac{1.34 \text{ hp}}{1 \text{ KW}} = 13.4 \text{ KW}$$

**Math Problems - Areas**

1. How square feet are there in a 6 inch diameter pipe?, in a 8 inch diameter pipe?

$$6 \text{ in} = 0.5 \text{ ft}$$

$$0.785 \times (0.5 \text{ ft})^2 = 0.196 \text{ ft}^2$$

$$8 \text{ in} = 0.667 \text{ ft}$$

$$0.785 \times (0.667 \text{ ft})^2 = 0.349 \text{ ft}^2$$

2. What is the surface area of a lagoon that is 225 feet by 300 feet. The lagoon operates at a depth of 4 feet.

$$225 \text{ ft} \times 300 \text{ ft} = 67,500 \text{ ft}^2$$

3. After installing a main through a park, a strip that is 1200 feet long and 6 feet wide that must be reseeded with grass. If one bag of grass seed covers 1,000 ft<sup>2</sup>. How many bags of seed do you need to buy?

$$1,200 \text{ ft} \times 6 \text{ ft} = 7,200 \text{ ft}^2$$

$$1 \text{ bag} = 1,000 \text{ ft}^2$$

$$7,200 \text{ ft}^2 \times \frac{1 \text{ bag}}{1,000 \text{ ft}^2} = 7.2 \text{ bags (8 bags)}$$

### Math Problems - Volumes

1. How many gallons will a wet well 50 feet long by 20 feet wide and 8 feet deep hold?

$$50 \text{ ft} \times 20 \text{ ft} \times 8 \text{ ft} = 8,000 \text{ ft}^3$$

$$1 \text{ ft}^3 = 7.48 \text{ gal}$$

$$8,000 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 59,840 \text{ gal}$$

2. How many cubic feet of wastewater will a 4,500 foot section of 8 inch pipe hold?

$$8 \text{ in} = 0.667 \text{ ft}$$

$$0.785 \times (0.667 \text{ ft})^2 \times 4,500 \text{ ft} = 1,570 \text{ ft}^3$$

$$1 \text{ ft}^3 = 7.48 \text{ gal}$$

$$1,570 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 11,743.6 \text{ gal}$$

3. A lagoon system has a surface area of 3.5 acres. The lagoons hold 4,500,000 gallons of wastewater. What is the operating depth of the lagoons?

$$1 \text{ ft}^3 = 7.48 \text{ gal}$$

$$4,500,000 \text{ gal} \times \frac{1 \text{ ft}^3}{7.48 \text{ gal}} = 601,604.3 \text{ ft}^3$$

$$1 \text{ ac} = 43,560 \text{ ft}^2$$

$$3.5 \text{ ac} \times \frac{43,560 \text{ ft}^2}{1 \text{ ac}} = 152,460 \text{ ft}^2$$

$$\frac{601,604.3 \text{ ft}^3}{152,460 \text{ ft}^2} = 3.9 \text{ ft}$$

### Math Problems - Times

1. If two 130 gpm pumps are used how long will it take to de-water a rectangular tank 50 feet long by 20 feet wide and 8 feet deep?

$$50 \text{ ft} \times 20 \text{ ft} \times 8 \text{ ft} = 8,000 \text{ ft}^3$$

$$1 \text{ ft}^3 = 7.48 \text{ gal}$$

$$8,000 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{1 \text{ ft}^3} = 59,840 \text{ gal}$$

$$1 \text{ min} = 2 \times 130 \text{ gal}$$

$$59,840 \text{ gal} \times \frac{1 \text{ min}}{260 \text{ gal}} = 230 \text{ min} \text{ (3 hr, 50 min)}$$

2. If it takes 2 people 10 hours to do a job, how many hours will it take 5 people to do the same job?

$$2 \text{ persons} \times 10 \text{ hr} = 20 \text{ 'man-hr'}$$

$$\frac{20 \text{ 'man-hr'}}{5 \text{ persons}} = 4 \text{ hr}$$

3. An orange takes 1 minutes and 45 seconds to travel from one manhole to another that are 350 feet apart. What is the velocity of the wastewater in the pipe?

$$1 \text{ min, } 45 \text{ sec} = 105 \text{ sec}$$

$$\frac{350 \text{ ft}}{105 \text{ sec}} = 3.33 \frac{\text{ft}}{\text{s}}$$

### Math Problems - Efficiency

1. What is the efficiency of the lift pump motor, if a 10 KW motor is required to run a 10 hp. pump?

$$1 \text{ kW} = 1.34 \text{ hp}$$

$$10 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} = 13.4 \text{ hp} \leftarrow \text{power in}$$

$$\epsilon = \frac{10 \text{ hp}}{13.4 \text{ hp}} \times 100 \% = 74.6 \%$$

2. If a wet well has two 100 gpm pumps in it. How many gallons of wastewater can be pumped a day if one of the pumps is 85% efficient and the other is 75% efficient?

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

$$\text{pump 1} = 100 \text{ gpm} \times 85\% = 85 \text{ gpm}$$

$$\text{pump 2} = 100 \text{ gpm} \times 75\% = 75 \text{ gpm}$$

$$\text{total} = 85 \text{ gpm} + 75 \text{ gpm} = 160 \text{ gpm}$$

$$160 \frac{\text{gal}}{\text{min}} \times \frac{1,440 \text{ min}}{1 \text{ day}} = 230,400 \text{ gpd}$$

### Math Problems - Chlorine Equation

1. What is the chlorine feed rate per day for a flow of 1.5 MGD with a dose rate of 15 mg/L.

$$8.34 \frac{\text{lbs}}{\text{gal}} \times 1.5 \frac{\text{MG}}{\text{Day}} \times 15 \frac{\text{mg}}{\text{L}} = 187.65 \frac{\text{lbs}}{\text{day}}$$

2. How many pounds of TSS are received in the collection system daily, if the system flow is 900,000 gpd and the TSS concentration is 195 mg/L?

$$900,000 \text{ gpd} = 0.9 \text{ MGD}$$

$$8.34 \frac{\text{lbs}}{\text{gal}} \times 0.9 \frac{\text{MG}}{\text{Day}} \times 195 \frac{\text{mg}}{\text{L}} = 1,463.7 \frac{\text{lbs}}{\text{day}}$$