OCT ACADEMY
Class Description submittal to OESAC

Title: **Water Distribution Math, Grades I – II.**

☐ **New Class**, or ☐ **Class Renewal**

CEU Award requested: 1.4 **CEUs**

OVERVIEW:

The 2 – day Grade I – II Water Distribution Operator mathematics problems are exercises in supporting process units operations. The Grade I – II workbook offers the following direction support information; Step-by-Step methods of solving problems in Algebraic format, the Use of a Scientific Calculator, a Summary of working Water Distribution Formulas set up by process unit with typical math problems per chapter followed by a letter code answer page, and multiple Pages of problem solutions that can be re-worked numerous times to meet self-paced, self-learning goals.

They consist of representative Grade I - II process control and logic mathematics problems which may be encountered on Grade I - II State water distribution operator examinations.

CLASS DESCRIPTION:
This 2 – day mathematics class identifies the **key problem-solving skills** needed by all operators. State and Association examinations heavily stress the need to know and use formulas and conversions throughout the course of each examination. OCT teaches standard Algebraic math and not dimensional analysis.

The mathematics exercises found within the accompanying WD – 05 workbook for water distribution operators has been arranged according to process unit. Word problems are presented together with multiple choice answers. Solutions are provided in the Step-By-Step format with a summary of working formulas, unit process problems with written solutions, and chapter quizzes with solutions. A summary of the chapter topics appears below.

OUTLINE:
1. The Step-By-Step Method
2. Using Your Scientific Calculator
3. Summary of the Key Formulas
4. Conversions
5. Volumes
6. Dosage, demand and residual
7. Pounds formula problems
8. Solutions & Solution Percentages
10. Hydraulics
11. Pumps
12. Velocity

DETAILED SUPPORTING DESCRIPTION:

1. The Step-By-Step Method

The following is the Step-By-Step Method taught at OCT, Inc. workshops.

Step 1. Write Down The Formula That Applies.
Step 2. Rewrite the Formula With the Known's Given in the Problem.
Step 3. Complete all Conversions.
Step 4. Reduce Terms.
Step 5. Solve For The Answer (using correct units).

2. Use of a scientific calculator.

Instruction in the use of a standard scientific calculator is given.

3. Summary of the Key Formulas

Examples:

1.	**Lbs/Day**	**=**	**(Vol, MGD) x (Conc., mg/l) x (8.34 lbs/gal)**
2.	**Dosage, mg/L**	**=**	**(Feed, lbs/day)** / **(Vol, MGD) X (8.34 lbs/gal)**
3.	**Rectangular Tank Volume, cu. ft.**	**=**	**(Length, ft) x (Width, ft) x (Height, ft)**
	i) Vol, Gals	**=**	**Multiply the above by the factor 7.48 gals/cu.ft.**
4.	**Right Cylinder Volume, cu. ft.**	**=**	**(0.785) x (D^2,ft) x (Height or Depth,ft)**
	i) Vol, Gals	**=**	**Multiply the above by the factor 7.48 gals/cu.ft.**

4. Conversions

A conversion is a number that is used to multiply or divide into another number in order to change the units of the number. In most instances conversion numbers cannot be derived. They must be known.

Conversion Factors:
1 acre = 43,560 square feet
1 acre foot = 326,000 gallons
1 cubic foot = 7.48 gallons
1 cubic foot = 62.4 pounds
1 cubic foot per second = 0.646 MGD

1 foot = 0.305 meters
1 foot of water = 0.433 psi
1 gallon = 3.79 liters
1 gallon = 8.34 pounds
1 grain per gallon = 17.1 mg/L
1 horsepower = 0.746 kW or 746 watts or 33,000 ft. lbs./min.
1 mile = 5,280 feet
1 million gallons per day = 694 gallons per minute
1 million gallons per day = 1.55 cubic feet per second (cfs)
1 pound = 0.454 kilograms
1 pound per square inch = 2.31 feet of water
1 ton = 2,000 pounds
1% = 10,000 mg/L
Π or pi = 3.14159

5. Volumes

Problem:

A hydropneumatic tank serving a small pressure zone has a useable capacity of 6,000 gallons. The output of the service pumps to the tank is 300 GPM, but a construction project is using a constant 200 GPM over and above the normal 150 GPM average flow in the zone. At this usage rate, how long will it take, in hours, or minutes, to deplete the pressure tank's capacity ?

a) 1.0 hour.

b) 2.0 hours.

c) 3.0 hours.

d) 8.0 hours.

Solution:

$$\text{Time, Hrs.} = \frac{\text{Volume, gallons}}{(\text{GPM Out} - \text{GPM In}) \times 60 \text{ min/hr}}$$

$$\text{"} = \frac{6{,}000 \text{ gals}}{(200 + 150 \text{ GPM}) - 300 \text{ GPM}) \times 60 \text{ min/hr.}}$$

$$\text{"} = \frac{6{,}000 \text{ gals}}{(350 \text{ GPM} - 300 \text{ GPM}) \times 60 \text{ min/hr}}$$

$$\text{"} = \frac{6{,}000 \text{ gals}}{(50 \text{ GPM} \times 60 \text{ min/hr.})}$$

" = 6,000 gals
(3,000 GPH)

" = 2.0 Hours

END