**OCT WATER QUALITY ACADEMY**
**A US Government Funded Education Contractor**
**An ANSI/IACET Accredited School Nationwide**
Class Description Submittal to OESAC

Title: **Water Treatment Math, Grades 1-2**
**A two-day class.**

☐ **New Class**, or ☒ **Class Renewal**
CEU Award requested: **1.4 CEUs**

**OVERVIEW:**

Water Treatment math Grades I – II is a two (2) – day lower grades mathematics class for operators which stresses mathematics problems and exercises separated into supporting process units and maintenance. The Grade 1 - 2, W – 04 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 Treatment 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 a host of representative Grade 1 - 2 process control and logic mathematics problems which may be encountered on Grade 1 - 2 State treatment operator examinations.

**CLASS DESCRIPTION:**
This 2 – day mathematics class identifies the **key problem-solving skills** needed by all water treatment 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 W – 04 workbook for water treatment 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.
9. Hydraulics.
10. Pumps.
11. Velocity.
12. Sludge.
13. Maintenance.
14. Water Softening & Chemical formulas

## DETAILED SUPPORTING DESCRIPTION:

1. **The Step-By-Step Method.**

The following is the Step-By-Step Method taught at OCT 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.**

Instructions in the use of a standard TI-30Xa 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.**

EXAMPLE.
**A Grade 2, Step-by-Step Math Problem solution.**

A hydropneumatic tank serving a small pressure zone has a usable 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.

Ans. B.

**Solution:**

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

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

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

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

$$" = \frac{6{,}000 \text{ gals}}{(3{,}000 \text{ GPH})}$$

" = 2.0 Hours

**OBJECTIVES:**

- Students will learn to solve math problems and calculations that they will encounter in day-to-day operations.
- Students will gain a basic fundamental knowledge of all topics listed in the outline above.
- Students will have the opportunity to interact with an experienced instructor to clarify information on problems where they lack knowledge and understanding.
- Students will be prepared for state operations examinations to increase licensure in their state of residence.

## TIME PRESENTATION OUTLINE:

### Day 1:

| Start Time | End Time | Instructional Time | Allotted Break Time | Chapter/Discussion/Quiz |
|---|---|---|---|---|
| 8:00am | 8:50am | 50 minutes | 8:50am–9:00am | Introduction, The Step-By-Step Method & Using Your Scientific Calculator |
| 9:00am | 9:50am | 50 minutes | 9:50am–10:00am | Summary of Key Formulas |
| 10:00am | 10:50am | 50 minutes | 10:50am-11:00am | Conversions & Diagramming |
| 11:00am | 12:00pm | 60 minutes | 12:00pm-12:30pm | Volumes |
| 12:30pm | 1:20pm | 50 minutes | 1:20pm-1:30pm | Volumes Continued |
| 1:30pm | 2:20pm | 50 minutes | 2:20pm-2:30pm | Chemical Dosage Calculations |
| 2:30pm | 3:20pm | 50 minutes | 3:20pm-3:30pm | Chlorine Demand |
| 3:30pm | 4:30pm | 60 minutes | | Solutions and Solution Percentages |
| | | 420 minutes | | |

6 sessions of 50 minutes of instruction and 2 sessions of 60 minutes of instruction equals 420 minutes. 420 minutes equates to 7 hours of instruction divided by 10 which is 0.7 CEUs.

**Day 2:**

| Start Time | End Time | Instructional Time | Allotted Break Time | Chapter/Discussion/Quiz |
|---|---|---|---|---|
| 8:00am | 8:50am | 50 minutes | 8:50am–9:00am | Filtration |
| 9:00am | 9:50am | 50 minutes | 9:50am–10:00am | Hydraulics |
| 10:00am | 10:50am | 50 minutes | 10:50am-11:00am | Pumping |
| 11:00am | 12:00pm | 60 minutes | 12:00pm-12:30pm | Velocity |
| 12:30pm | 1:20pm | 50 minutes | 1:20pm-1:30pm | Sludge |
| 1:30pm | 2:20pm | 50 minutes | 2:20pm-2:30pm | Maintenance problems. |
| 2:30pm | 3:20pm | 50 minutes | 3:20pm-3:30pm | Water Softening & Chemical Formulas |
| 3:30pm | 4:30pm | 60 minutes | | Chemical Formulas continued |
| | | 420 minutes | | |

6 sessions of 50 minutes of instruction and 2 sessions of 60 minutes of instruction equals 420 minutes. 420 minutes equates to 7 hours of instruction divided by 10 which is 0.7 CEUs.

END