
State Water Resources Control Board

**GRADE II OPERATOR CERTIFICATION EXAMINATION
INFORMATION AND SAMPLE QUESTIONS**

The Grade II examination contains questions regarding the following subjects: basic safety practices, hazards encountered during wastewater treatment plant operations, sampling and simple analysis of wastewater constituents, operation and maintenance procedures in preliminary and primary treatment unit processes, anaerobic sludge digestion and disinfection. It also includes specific questions on the operation and maintenance of wastewater stabilization ponds and state regulations regarding the classification of wastewater treatment plants and operator certification. In addition, the Grade II examination includes questions on secondary unit processes (e.g. trickling filters, activated sludge), sludge handling, evaluation of wastewater unit processes as well as overall plant performance and basic supervision responsibilities.

The Grade II examination also contains mathematical questions. Examinees may be asked to calculate a variety of problems including hydraulic or organic loading rate, SVI index, removal efficiency (% removal), activated sludge F/M ratio, activated sludge MCRT, pumping rate, sludge pumping rate, detention time, chlorine residual/demand, flow velocity, volume or surface area, overflow rate and nitrification. The examinee should be familiar with typical calculations related to the subject matter listed in paragraph 1.

Examinees are given 2 ½ hours to complete the examination. The question format is as follows:

50 True/False Questions	@	1 point each
30 Multiple Choice Questions	@	2 points each
10 Math Problems	@	<u>4 points each</u>
TOTAL POINTS		150

The following are examples of the types of questions that you would find on the Grade II certification examination (see attached key for answers).

True/False Questions

1. The F in the F to M ratio refers to the pounds of mixed liquor volatile suspended solids under aeration in an activated sludge plant.
2. Digester gas containing 60% methane by volume will likely explode when exposed to a spark or flame.
3. The units ppm and % are considered roughly equivalent for wastewater treatment calculations.
4. The velocity of wastewater flowing through a long channel type of grit chamber may be controlled by a proportional weir.
5. High amounts of hydrogen sulfide gas in a moist atmosphere can result in corrosion of concrete structures.
6. The trickling filter recirculation ratio is calculated as follows:

$$\frac{Q}{Q_r} \text{ where } Q_r \text{ is the recirculated flow.}$$

Multiple Choice Questions

7. The measure of the effectiveness of chlorine in disinfection is:
 - a. The chlorine demand.
 - b. The chlorine dosage.
 - c. The chlorine residual.
 - d. The amount of chloramine formed.
 - e. The final effluent coliform concentration.
8. Carry over of grit from the grit chamber may indicate the need to:
 - a. Clean the chamber more frequently.
 - b. Decrease the operational depth of the channel.
 - c. Increase the flow to the primary clarifier.
 - d. Change the cycle of sludge removal.
 - e. Increase the air input to an aerated grit chamber.

9. The expected range of BOD removal in a well operated primary clarifier is:
- 10 to 20%
 - 20 to 40%
 - 40 to 60%
 - 60 to 80%
10. Which one of the following process units is usually classified as a sludge thickening device as opposed to a dewatering device:
- DAF unit.
 - Sludge drying bed.
 - Vacuum filter press.
 - Belt press.
 - All of the above are thickeners, not dewatering devices.
11. A trickling filter wastewater treatment plant receives a flow 1.95 MGD. Calculate the organic loading to this plant if it has a 135 ft diameter trickling filter with a 5 foot media depth and has a primary effluent BOD concentration of 110 mg/L.
- 0.5 lbs BOD/1000 ft³/day.
 - 2.7 lbs BOD/1000 ft³/day.
 - 25 lbs BOD/1000 ft³/day.
 - 39 lbs BOD/1000 ft³/day.
 - 44 lbs BOD/1000 ft³/day.
12. At a wastewater treatment plant which receives a flow rate of 650,000 gallons per day, a total of 50 cubic feet of grit was removed for the month. Calculate the rate of grit removal assuming 30 days in a month.
- 1.1 cu.ft./MG.
 - 1.3 cu.ft./MG.
 - 1.7 cu.ft./MG.
 - 2.0 cu.ft./MG.
 - 2.6 cu.ft./MG.
13. At an activated sludge wastewater treatment plant receiving 3.25 MGD, the final effluent suspended solids concentration averages 21.2 mg/L. What would the calculated MCRT value be when the aeration basin carries 2050 mg/L MLSS and wastes 0.0550 MGD. The waste activated sludge has a concentration of 7980 mg/L. The aeration tank has a volume of 1.00 MG and the secondary clarifier has an operational volume of 0.250 MG.
- 2.5 days
 - 5.0 days
 - 7.5 days
 - 15 days
 - 42 days

14. At a 5.32 MGD wastewater treatment plant the final effluent is determined to have a suspended solids concentration of 23.5 mg/L. How many pounds of suspended solids are being discharged daily?
- a. 1043 lbs/day
 - b. 935 lbs/day
 - c. 125 lbs/day
 - d. 37 lbs/day
 - e. 15 lbs/day
15. It is found that at a wastewater treatment pond system 35 days are required to bring the pond system to its operations depth of 3.5 feet. Assuming that the pond system was empty when the filling of the pond was initiated and that a constant incoming flow rate fills the pond, what would be the hydraulic loading on this pond system?
- a. 0.47 inches/day
 - b. 1.2 inches/day
 - c. 2.1 inches/day
 - d. 3.5 inches/day
 - e. 10.0 inches/day

ANSWER KEY

GRADE II

- | | | |
|----------|----------|-------|
| 1. False | 6. False | 11. C |
| 2. False | 7. E | 12. E |
| 3. False | 8. B | 13. B |
| 4. True | 9. B | 14. A |
| 5. True | 10. A | 15. B |

THINGS TO KEEP IN MIND

1. A one-page "Formulas and Equivalents" sheet is included in the front of each examination (see attachment).
2. All multiple choice questions have only one right answer.
3. On the math problems **SHOW ALL YOUR WORK**. You may receive partial credit.
4. **REMEMBER:** In order to pass, you must achieve an overall score of at least 70%. Also be aware that you are required, in addition, to score at least 50% on the math section of the examination to pass.

STATE WATER RESOURCES CONTROL BOARD OPERATOR CERTIFICATION EXAMINATION

EQUIVALENTS

1 acre = 43,560 square feet

1 cubic foot of water = 7.48 gallons

1 gallon = 8.34 pounds

1 day = 1,440 minutes = 86,400 seconds

1 million gallons/day = 694 gallons/minute = 1.547 cubic feet/second = 3.069 acre-feet/day

1% = 10,000 mg/L

$\pi = 3.14$

1 in. mercury = 1.133 feet of water

1 psi = 2.31 feet of water

1 HP = 0.746 Kw = 550 ft-lb/sec = 33,000 ft-lb/min

FORMULAS

Area of a rectangle = Length x Width

Area of a circle = $\frac{\pi}{4} \times \text{Diameter}^2 = 0.785 \times \text{Diameter}^2$

Volume of rectangular tank or circular tank with uniform depth = Area x Depth

Volume of cone = $\frac{1}{3} \times \text{Base Area} \times \text{Depth}$

Circumference = $\pi \times \text{Diameter}$

Velocity = $\frac{\text{Flow}}{\text{Area}}$

Detention time = $\frac{\text{Volume}}{\text{Flow}}$

Pounds/day = 8.34 x Flow, mgd x Concentration, mg/L

F/M = $\frac{\text{Pounds of BOD applied per day}}{\text{Pounds of MLVSS under aeration}}$

MCRT = $\frac{\text{Pounds of MLSS in secondary system (aeration tank + clarifier)}}{\text{Pounds of MLSS leaving secondary system per day (effluent + WAS)}}$

Water HP = $\frac{\text{Flow, gpm} \times \text{Total Head, ft}}{3960 \frac{\text{gpm} \cdot \text{ft}}{\text{HP}}}$

Brake HP = Power to electric motor x Motor efficiency