

**Onsite Domestic Wastewater Treatment, Dispersal and Reuse**  
**Biosystems Engineering 532**  
**Final Exam Fall 2008**  
**Due by 4:00 p.m. Monday December 8, 2008**  
**(either by email or hardcopy)**

Name \_\_\_\_\_

Instructions: This exam is composed of multiple choice, true/false, and short answer questions. Show your calculations where appropriate and discussion answers should be concise but complete.

1. Liquid/solid separation is best characterized as:
  - a) Chemical Treatment
  - b) Physical Treatment
  - c) Biological Treatment
  - d) No Treatment
  
2. BOD<sub>5</sub> is a measure of:
  - a) Biological Oxygen Demand
  - b) Biology Oxygen Demand
  - c) Biochemical Oxygen Demand
  - d) Biomicrobics Oxygen Demand
  
3. COD and BOD<sub>5</sub> are measures of a wastewater's strength. What is the impact that a high BOD<sub>5</sub> or COD wastewater will have on a receiving waterbody?
  - a) Aerobic and facultative microorganisms use dissolved oxygen as an electron acceptor to breakdown dissolved organic compounds into CO<sub>2</sub> and H<sub>2</sub>O – thus consuming dissolved oxygen out of the natural waterbody.
  - b) Anaerobic microorganisms use dissolved oxygen as an electron acceptor to breakdown dissolved organic compounds into CO<sub>2</sub> and H<sub>2</sub>O – thus consuming dissolved oxygen out of the natural waterbody
  - c) The high BOD<sub>5</sub>/COD wastewater is a direct toxin to the aquatic life and a discharge of this wastewater would result in a fish kill.
  
4. The microorganisms that digest domestic wastewater prefer a neutral pH. Thus the pH of the wastewater entering an aerobic treatment device should range between:
  - a) 1 to 4
  - b) 4 to 6
  - c) 6 to 8
  - d) 8 to 14

5. It is recommended that an event timer and a flow meter should be installed on all systems that have pressurized effluent distribution. Why?
  
  
  
  
  
  
  
  
  
  
6. If fecal *coliform* is found in a water sample taken from a waterbody, this is a direct indicator that human-derived sewage has been discharged into the waterbody.
  - a) Yes
  - b) No
  
  
  
  
  
  
  
  
  
  
7. Why should we be concerned about whether the wastewater source is from a residence as compared to a bakery?
  
  
  
  
  
  
  
  
  
  
8. How would a garbage disposal (in-sink grinder) affect an onsite wastewater management system?
  
  
  
  
  
  
  
  
  
  
9. All other things held constant, why will the flow of water out of the pump decrease as the water level changes from the high water level to the low water level?







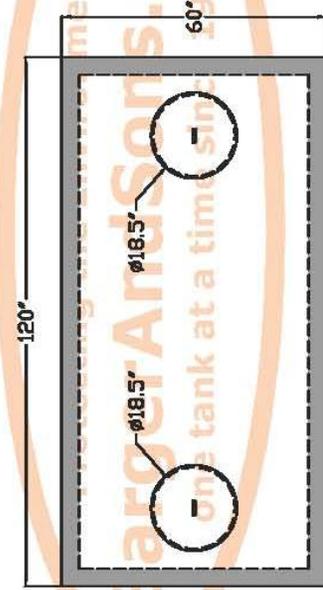




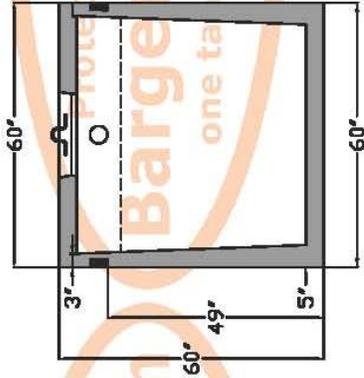
25. Which phrase best describes the function of a suspended-growth aerobic treatment device. (bugs are beneficial microorganisms)
- a) A happy home for happy bugs
  - b) food is brought to the bugs
  - c) the bugs are attached to their food
  - d) the food is mixed with the bugs
26. Residential aerobic treatment devices operate in this mode.
- a) Endogenous respiration
  - b) Fermentation
  - c) Oxidation/Reduction
  - d) Autotrophic
27. The oxidation of organic carbon is exothermic. This natural reaction should produce sufficient heat to maintain the water temperature within a below-ground ATU at 80°F.
- a) True
  - b) False
28. A blower is supply air to an ATU. Odors from the ATU are very strong. The blower seems to be working but on further inspection you determine that the motor is pulling more amps than indicated on the faceplate. What should you look for?
- a) Hydraulic overloading from the wastewater source
  - b) A kink in the air tubing or clog in the air diffuser
  - c) Organic overloading from the wastewater source
  - d) A dirty air filter serving the blower
  - e) Both a and c
  - f) Both b and d
29. A packed-bed media filter uses a blower to aerate septic tank effluent
- a) True
  - b) False
30. Open cell foam, non-woven textile sheets, inert highly porous aggregates, and peat are all examples of:
- a) Attached-growth treatment media
  - b) fixed-film treatment media
  - c) Both a and b
  - d) None of the above
31. The conversion of soluble nitrate into gaseous nitrogen is:
- a) Nitrification
  - b) Denitrification
  - c) Ammonification
  - d) Putrefaction

32. A single-zone effluent drip irrigation system has 500 pressure-compensated emitters. Each emitter is rated for 0.62 gallon per hour. You observed the system operate for 10 minutes. How many gallons of effluent should have pumped from the pump tank during the 10 minutes?
33. The system described in problem number 32 does not have a flow meter. The interior of the pump tank is 48 inches wide and 48 inches long. Based on your answer from problem number 32, how inches should the water level have dropped during the 10 minutes?
34. You measured the flow and pressure produced by the pump for the effluent drip irrigation system. Based on the original design information, you determine that the pressure is too low and flow is too high. What do you determine from this information?

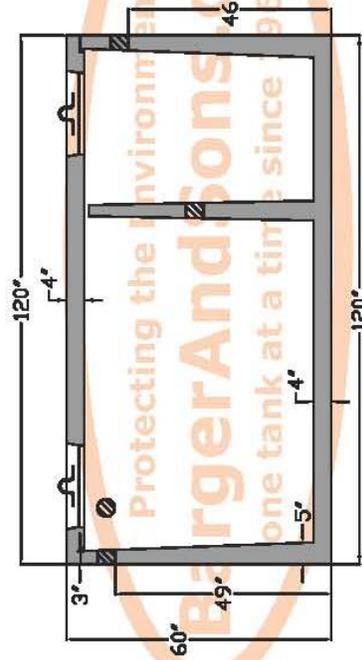
Top View



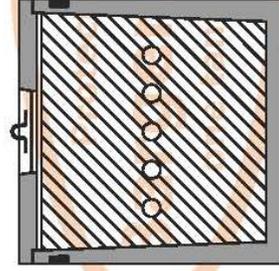
End View



Side View



Baffle View



**Specifications**

**Concrete:** 5,000 psi minimum strength (28 day)

**Reinforcing:** Primary reinforcement will be top, side, and bottom #3 and/or #4 rebar (Grade 60) rebar.

**Risers:** All risers, if required, will be watertight and at least 8" in diameter.

**Sealant:** Sealant used in the seam of the tank will meet or exceed ASTM C990.

**Pipe Penetrations:** Inlet and outlets are fitted with seals that meet or exceed all ASTM C923 specifications.

**Partition Wall:** The partition wall, if present, is poured monolithically.

**Installation:** The tank hole is not to be more than one foot longer and wider than the tank. There shall be a minimum of 6" of  $\frac{3}{4}$ " stone bedding in soil terrain and a 12" stone bedding in rock terrain. Do not install across path of vehicles or heavy equipment. This tank is designed for one hundred fifty pounds per square foot (1.50 lb/ft<sup>2</sup>) uniform loading on the top of the tank with a maximum backfill cover of 36" and a minimum of 6".

**Tank Warranty:** The C. R. Barger & Sons, Inc. septic tank when installed in accordance with manufacturer's instructions is warranted against defective materials and/or workmanship for 1 year from the date of delivery to the project site. Should a defect appear within the warranty period, C. R. Barger & Sons, Inc. will supply a new septic tank in replacement thereof. C. R. Barger & Sons, Inc. liability is limited to the value of the septic tank itself and specifically excludes the cost of installation and/or removal and consequential damages. Failure to comply with C. R. Barger & Sons, Inc. installation procedures and general notes will void warranty.

Manufactured by:  
**C. R. Barger & Sons, Inc.**  
 238 Mays Valley Road  
 Harmon Tn 37748  
 Phone 865.882.5860 Fax 865.882.6394  
 www.bargerandsons.com

General Notes:  
 All vertical measurements are accurate within  $\pm 1$  inch on the tank. The lids can be moved and resized if necessary. Written specifications are available upon request.

Tank Type: **Septic Tank 1000 Gallon Top Seam**  
 Date: **3.262006**  
 Drawn By: **Eric Barger**

Approx. Weight: **11,000 lbs.**  
 Description: **Top Seam**