Name _____

CE 326 Principles of Environmental Engineering
Third Exam - Spring 1999

Defendable True/False. If the statement is true as stated, mark it OK. If it is false, correct it by changing the underlined word or words in the sentence so that it will be true. 3 points each.

1. The mixture of activated sludge and wastewater in the aeration tank of an activated sludge wastewater treatment plant is called mixed liquor.

2. A short SRT increases the observed yield causing an increase in the production of sludge.

3. One of the important end products of anaerobic digestion is propane gas.

4. Autotrophic bacteria utilize an inorganic carbon source (like carbon dioxide) and utilize an inorganic energy source.

5. If we use a 20 mL sample in a 300 mL BOD bottle, the dilution factor is 15.

6. Urban and agricultural runoff are characterized by multiple discharge points. As such, they are known as nonpoint sources of pollution.

7. A belt filter is used in the wastewater treatment plant to remove debris such as large rocks, branches, pieces of lumber, leaves, paper, tree roots, etc. from the influent.

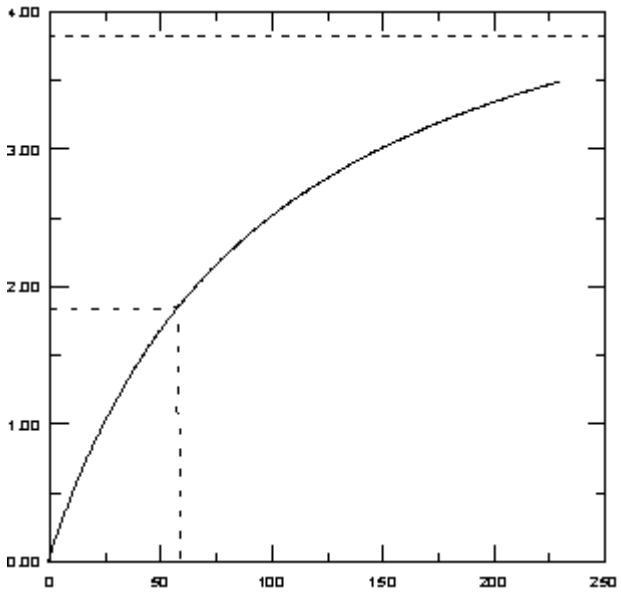
8. A typical untreated domestic wastewater will contain about 2000 mg/L of both BOD_5 and suspended solids.

9. The release of nitrate-nitrogen to a receiving stream is undesirable not only because it creates a high nitrogenous oxygen demand but it also is toxic to spawning fish.

10. The release of ammonia-nitrogen to a receiving stream is detrimental because it leads to excessive algae growth and eutrophication.

Short Answer Problems - 10 points each:

11. Define, label, and explain the significance of the following relationship in wastewater treatment.



12. Draw a sketch of a typical municipal wastewater treatment plant; label and show the important aspects.

13. Define and explain the meaning of the terms shown below:

psychrophile: _____

heterotroph: _____

assimilative capacity: _____

Numerical Problems - 20 points each

14. Calculate the return sludge flow for an activated sludge plant treating 0.2 m^3/s. The temperature is 15°C and the MLSS concentration is 3000 mg/L. The MLVSS concentration is 0.8333×MLSS.

$$X_r' Q_r = X'(Q_r + Q)$$
$$X_r' = 10^6/SVI$$

15. An industrial wastewater treatment plant discharges to a river. A fish hatchery 20 km downstream wants to use water from the river. The dissolved oxygen concentration of the fish hatchery intake has to be at least 5 mg/L to protect their hatchery operation. What DO concentration must the wastewater have to maintain this condition? Is this realistic? Show all your work on this page; use back if necessary.

		Industrial WWTP	River
Given:	Flow, m^3/s	0.15	1
	Ultimate BOD, mg/L	45	4
	DO, mg/L	?	7
	Temperature, °C	25	25
	k_d at 25°C, d^{-1}		0.4
	k_r at 25°C, d^{-1}		0.5
	Velocity, m/s		0.15
	DO saturation concentration, mg/L		8.38

$$D = \frac{k_d L_a}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_a\left(e^{-k_r t}\right)$$