

- 5.1 (a) The stopper prevents O_2 uptake during the test.
- (b) Light might fuel photosynthesis generating O_2 within the bottle.
- (c) The BOD of the sample is usually higher than DO_{SAT} so undiluted the sample would use up all the O_2 in the bottle.
- (d) The sample and dilution water may not contain enough decomposers to get thorough bio-degradation of the organic matter.
- (e) To reach 99% of ultimate BOD would require more than 23 days of incubation. Five days is quicker (and actually more reliable).

5.2 $BOD_{OUT} = BOD_{IN} (1 - R.E.)$ where R.E. = removal efficiency

$$BOD_{OUT} = 200 \text{ mg/L} (1 - 0.9) = 20 \text{ mg/L}$$

(a) $BOD = \frac{(DO_I - DO_F) V_M}{V_W} \Rightarrow V_W = \frac{(DO_I - DO_F) V_M}{BOD}$

$$V_W = \frac{(9.2 \text{ mg/L} - 2.0 \text{ mg/L}) 300 \text{ mL}}{20 \text{ mg/L}}$$

$$V_W = 108 \text{ mL}$$

(b) $BOD = \frac{(DO_I - DO_F) V_M}{V_W}$

$$DO_F = DO_I - BOD \frac{V_W}{V_M} = 9.2 \text{ mg/L} - 20 \text{ mg/L} \frac{150 \text{ mL}}{300 \text{ mL}}$$

$$DO_F = -0.8 \text{ mg/L} \Rightarrow$$

All the DO would be used up.

5.3

$$BOD = \frac{(DO_I - DO_F)}{P}$$

$$w/ P = \frac{V_w}{V_m} = \frac{1}{1.4} = 0.2$$

$$BOD = \frac{9.0 \text{ mg/L} - 1.0 \text{ mg/L}}{0.2}$$

$$BOD = 40 \text{ mg/L}$$

5.4

$$BOD = \frac{(DO_I - DO_F)}{P} \Rightarrow P = \frac{(DO_I - DO_F)}{BOD}$$

Minimum:

$$P_{\min} = \frac{2.0 \text{ mg/L}}{230 \text{ mg/L}}$$

$$P_{\min} = 0.0087$$

$$\rightarrow P = \frac{V_w}{V_m} \Rightarrow V_w = V_m P$$

$$V_w = 300 \text{ mL} \cdot 0.0087$$

$$V_w = 2.6 \text{ mL}$$

Maximum:

$$P_{\max} = \frac{(8.0 \text{ mg/L} - 2.0 \text{ mg/L})}{230 \text{ mg/L}}$$

$$P_{\max} = 0.026$$

$$V_w = 300 \text{ mL} \cdot 0.026$$

$$V_w = 7.8 \text{ mL}$$

5.5

	DO_I (mg/L)	DO_F (mg/L)	V_w (mL)	V_o (mL)	BOD
Untreated	6.0	2.0	5	295	$\frac{(6.0 - 2.0) 300}{5} = 240 \text{ mg/L}$
Treated	9.0	4.0	15	285	$\frac{(9.0 - 4.0) 300}{15} = 100 \text{ mg/L}$

$$\% RE = \frac{(BOD_U - BOD_T)}{BOD_U} \times 100\% = \frac{(240 \text{ mg/L} - 100 \text{ mg/L})}{240 \text{ mg/L}} \times 100\% = 58.3\%$$

Not too good

$$RE = 58.3\%$$