Fall 2005
CEE 432/532 Fate and Transport of Pollutants

Quiz #4

1. Fill in the blanks: [10]

(a) A reactor in which flow is neither entering nor leaving is defined as a batch reactor.

(b) In a completely mixed flow reactor, fluid particles that enter the reactor are instantaneously dispersed throughout the reactor volume.

(c) In a plug flow reactor, fluid particles pass through the reactor and are discharged in the same sequence in which they entered the reactor.

(d) Fugacity is a measure of chemical dispersion the "tendency to flee".

(e) Terminal lakes are lakes with no outlet (existing stream).

(f) In a terminal lake, water leaves through infiltration to ground water.

(g) TCE is an example of point source pollution to surface water.

(h) TCE is an example of non-point source pollution to surface water.

(i) Hydraulic radius = flow area / wetted perimeter.

(j) Manning roughness co-efficient (n) for mountain stream with rocky bed is higher than that for smooth concrete.
2. The following relationship for estimating $K_{oc}$ from $K_{ow}$ was proposed by a researcher.

$$\log_{10} K_{oc} (\text{cm}^3/\text{gm}) = 0.903 \log_{10} K_{ow} + 0.094$$

Assuming $\log_{10} K_{ow}$ for anthracene is 4.45, the $K_{oc}$ (in cm$^3$/gm) is given by:

(A) $1.29 \times 10^4$
(B) $10^{4.11}$
(C) 12952.3926
(D) all of the above.

$$\log_{10} K_{oc} = 0.903 \times 4.45 + 0.094 = 4.11$$
$$K_{oc} = 10^{4.11} = 12952.3926$$

3. The partial pressure and the Henry's Law constant at 25 °C for oxygen (MW=32 gm/mole) are 0.21 atm and $1.29 \times 10^{-3}$ mole/L-atm, respectively. The concentration of dissolved oxygen (in mg/L) in water equilibrated with the atmosphere at 25 °C is most nearly:

(A) $1.29 \times 10^{-3}$
(B) $2.79 \times 10^{-4}$
(C) 8.66
(D) none of the above

$$H = 1.29 \times 10^{-3} \text{ mol/L atm}$$
$$P = 0.21 \text{ atm}$$
$$T = 298 \text{ K}$$
$$R = 0.082058 \text{ L atm/moL K}$$

$$\text{DO} = H \frac{P}{RT} = \frac{1.29 \times 10^{-3} \text{ mol/L atm}}{0.21 \text{ atm}} \times \frac{0.082058 \text{ L atm/moL}}{298 \text{ K}} = 8.59 \times 10^{-4} \text{ moL/L}$$

$$2.71 \times 10^{-4} \text{ moL/L} \times \frac{32 \text{ g}}{\text{ moL}} \times \frac{1000 \text{ mg}}{\text{ g}} = \frac{8.67 \text{ mg}}{L}$$