(18)

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~~ potential the "tendency to flee".

(e) Terminal lakes are lakes with no outlet (exiting stream)

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

-1 (g) TCE is an example of point source pollution to surface water.

-1 (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 Koc from Kow was proposed by a researcher. [5]

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

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

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

$\log_{10} K_{oc}\ (0.903)(4.45) + 0.094$

$\log_{10} K_{oc} = 0.50785$

~~Koc = 3.22~~

$10^{4.11} = 12882.5$

3. The partial pressure and the Henry's Law constant at 25 °C for oxygen (MW=32 gm/mole) are 0.21 atm and 1.29×10^{-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: [5]

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

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

$PV = nRT$

$\frac{n}{V} = \frac{P}{RT} = \frac{0.21}{(0.082058)(298)} = 8.59 \times 10^{-4}\ \frac{mol}{L}$

$DO = HP$

$= \left(\frac{1.29 \times 10^{-3}\ mol}{L\ atm}\right)(0.21\ atm) = 2.71 \times 10^{-4}\ \frac{mol}{L}$

$\frac{2.71 \times 10^{-4}\ mol}{L} \times \frac{32 g}{mol} \times \frac{1000 mg}{g} = \boxed{\frac{8.67 mg}{L}}$