ERRATA for

PE Environmental Practice Exam

ISBN 978-1-947801-23-3

Errata posted 3-15-2024

Revisions are shown in red.

Question 1, p. 8:
If the flow is 2 cfs, at minimum specific energy, the critical depth (ft) is most nearly:

Question 15, p. 16:
The question was replaced by the following:
A 4-MGD public water system (PWS) stores product water in the clear well prior to distribution. In the winter, the product water averages a pH value of 7.8 at 5°C. Final chlorine concentration in the product water is 1.2 mg/L.

Assume no other applicable factors. To achieve 3-log inactivation of giardia, the **minimum** volume (MG) of the clear well should be:

○ A. 0.42

○ B. 0.48

○ C. 0.57

○ D. 0.72

Question 16, p. 16:
○ D. 1,780

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Question 23, p. 22:
A 4.0-MGD wastewater treatment plant discharges a secondary-treated effluent into a receiving stream. The wastewater has the following characteristics:

BOD_5	20.0 mg/L
Dissolved oxygen	5.0 mg/L
Water temperature	24°C

The receiving stream upstream from the point of wastewater discharge has the following characteristics:

Flow rate	18 cfs
BOD5	4.0 mg/L
Dissolved oxygen	8.0 mg/L
Water temperature	27°C
Cross-sectional area	36 ft^2 (uniform)

The reaeration rate is estimated to be 0.4 day^{-1} (base e at 20°C), and the temperature correction coefficient is 1.024. The deoxygenation rate constant is estimated to be 0.23 day^{-1} (base e at 20°C), and the temperature correction coefficient is 1.047. Reaeration and deoxygenation are the only major factors affecting the dissolved oxygen concentration in the stream after mixing with wastewater effluent. Assume the time of travel in the stream to reach the maximum dissolved oxygen deficit is 2.0 days. The dissolved oxygen deficit (mg/L) at this location downstream from the point of discharge is most nearly:

○ A. 3.7

○ B. 5.2

○ C. 5.5

○ D. 7.2

Question 67, p. 43:
A 40-ft-thick confined aquifer has a piezometric surface 85 ft above the bottom-confining layer. Groundwater is being extracted from a 4-in.-radius fully penetrating well. The pumping rate is 35 gpm. The aquifer is relatively sandy with a hydraulic conductivity of 175 gpd/ft^2. Steady-state drawdown of 5 ft is observed in a monitoring well 10 ft from the pumping well. The drawdown (ft) in the pumping well is most nearly:

Solution Table p. 54:
15: B
16: D

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Solution 15, p. 60:
The solution was replaced by the following:
Reference: NCEES *PE Environmental Reference Handbook*

Applicable CT value to achieve 3-log inactivation giardia:
CT value at pH = 7.8 by interpolation at 5°C and at 1.2 mg/L chlorine concentration:
CT = 183 + 22.8 = 205.8 min·mg/L or ~ 206 min·mg/L

Detention time of product water at clear well:
CT/C = (206 min·mg/L) / (1.2 mg/L) = 171.7 min or ~ 172 min

Volume = flow rate × time
Volume of clear well = [(4 MGD)(1 day/24 hr)(1 hr/60 min)] × (172 min) = 0.48 MG

THE CORRECT ANSWER IS: B

Solution 16, p. 61:

Lime required = (0.45 + 3.0 + 0.72 + 2.2) meq/L (28 mg/meq) + 35 mg/L

= 213.36 mg/L as CaO

= 1,779 lb per million gallons

THE CORRECT ANSWER IS: D

Solution 18, p. 62:
The column in the last chart should read as follows:

Pipe	*Q* (gpm)	*HL* (ft)	*HL/Q* (ft/gpm)	Corrected *Q* (gpm)
AB	+3,000	0.7851	0.000262	+3,775
BC	+500	0.0856	0.000171	+1,275
CD	–500	–0.8222	0.001644	+275
AD	–2,000	–10.6856	0.005343	–1,225
		–10.64	0.007420	

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Solution 19, p. 63:

Convert the cation and anion concentrations to meq/L.

Cations:

Calcium:	(51 mg/L) / (20 mg/meq)	= 2.55 meq/L
Magnesium:	(12 mg/L) / (12.2 mg/meq)	= 0.98 meq/L
Sodium:	(25 mg/L) / (23 mg/meq)	= 1.09 meq/L
Sum of cations		= 4.62 meq/L

Anions:

Sulfate:	(65 mg/L) / (48 mg/meq)	= 1.35 meq/L
Chloride	(25 mg/L) / (35.5 mg/meq)	= 0.70 meq/L
Nitrate as N:	(14 mg/L) / (14 mg/meq)	= 1.00 meq/L
Bicarbonate as C_aCO_3:	(84 mg/L) / (50 mg/meq)	= 1.68 meq/L
Sum of anions		= 4.73 meq/L

4.73 meq/L – 4.62 meq/L = 0.11 meq/L

Note: Fluoride can be omitted since the concentration is ~ 0.02 meq/L.

Solution 23, p. 65:

Calculate BOD_L of mixture:

$BOD_5 = BOD_L(1 - e^{-kt}) = 8.09 = BOD_L(1 - e^{-0.306(5)})$

BOD_L = 10.33 mg/L

Calculate the dissolved oxygen deficit:

$$D = \frac{k_d}{k_r}\left(L \times e^{-kt}\right) = \frac{0.306}{0.463}\left(10.33 \times e^{-0.306(2.0)}\right) = 3.7 \text{ mg/L}$$

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Solution 28, p. 67:

Dispersion modeling along the centerline for downwind.
Ground-level concentration can be expressed as:

$C(x,y) = [Q / (3.14 (\sigma_y \sigma_z)\ u)]\ \exp\{-1/2(H/\sigma_z)^2\}$

where

Q = emission rate

σ_y and σ_z = dispersion coefficients

u = mean wind speed

H = stack height

As the stack height increases, the concentration decreases at the ground surface.

THE CORRECT ANSWER IS: A

Solution 29, p. 67:

The standard flow rate can be calculated as follows:

$$Q = A \times V \times (P_s/P_{std}) \times (T_{std}\ °R/T_s\ °R) \times (1 - (\text{moisture fraction})) \times 60 \text{ sec/min}$$

$$= \left[\frac{(92/12)^2}{4} \times \pi \text{ ft}^2\right] (28.84 \text{ fps}) \left(\frac{23.56}{29.92}\right) \left(\frac{460 + 70}{460 + 355}\right) (1 - 0.1225)\ (60 \text{ sec/min})$$

= 35,895 dry standard cubic feet per minute (DSCFM)

The emission rate of NO_x (lb/hr) can be calculated as:

$= 117.27 \text{ ppmv} \times 1.194 \times 10^{-7} \text{ lb } NO_x \text{ / scf ppmv} \times Q \text{ scf/min} \times 60 \text{ min/hr}$

$= 30 \text{ lb } NO_x \text{ /hr}$

The heat input rate for the boiler can be calculated as:

$= 149.9 \times 10^3 \text{ scf/hr} \times 1{,}000 \text{ Btu/scf} = 149.9 \times 10^6 \text{ Btu/hr}$

The emissions per 10^6 Btu then become:

$= 30 \text{ lb/hr} / 149.9 \times 10^6 \text{ Btu/hr} = 0.2012 \text{ lb } NO_x / 10^6 \text{ Btu}$, which exceeds the standard

THE CORRECT ANSWER IS: B

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Solution 40, p. 71:

$$22.4\ \frac{\text{L}}{\text{g mole}} \times \frac{(273+15)\text{K}}{273\text{K}} = 23.6\ \text{L/g mole}$$

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Solution 61, p. 77:

$$CW = \frac{BW \times LRF}{CSF \times (IR_{water} + IR_{fish})}$$

$$BW = 170 \text{ lb} = 77.11 \text{ kg}$$

$$LRF = 10^{-5}$$

$$CSF = 0.01\left[\text{mg}/\left(\text{kg}\bullet\text{day}\right)\right]^{-1}$$

$$IR_{water} = 0.5 \text{ gal/day} = 1.893 \text{ L/day}$$

$$IR_{fish} = 0.015 \text{ lb/day} = 0.0068 \text{ kg/day}$$

$$BCF = 10 \text{ L/kg}$$

$$IR_{fish} = \left(0.0068 \text{ kg/day}\right)\left(10 \text{ L/kg}\right) = 0.068 \text{ L/day}$$

$$\begin{aligned} CW &= \frac{77.11 \times 10^{-5}}{0.01\,(1.893 + 0.068)} \\ &= 0.04 \text{ mg/L} \end{aligned}$$

Solution 78, p. 82:

$$\begin{aligned} \Delta h_r &= h_{f,CO_2} + 2h_{f,H_2O} - h_{f,CH_4} - 2h_{f,O_2} \\ &= \left(-394,088\right) + 2\left(-242,174\right) - \left(-74,980\right) \\ &= -803,456 \text{ J/mol} \end{aligned}$$