ERRATA for

PE Environmental Practice Exam

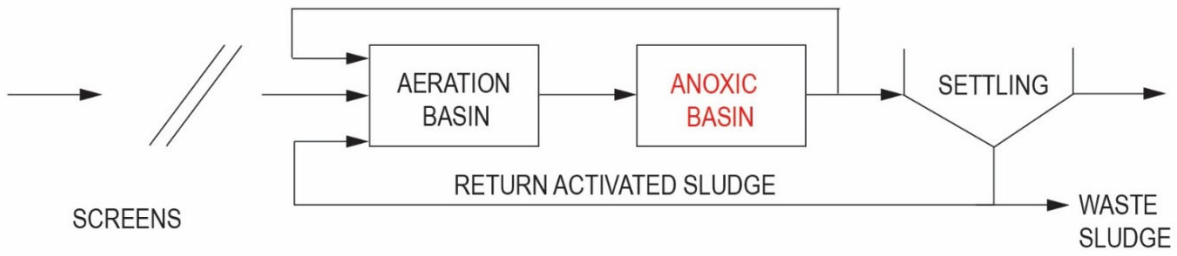
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Revisions are shown in red.

Question 2:



Option D

Question 9:

Disinfection is to be added to a wastewater treatment plant with an average daily flow of 16 MGD and an hourly peaking factor of 2.5. The planned facility will use a gas chlorinator. Code requires that a feed rate of 15 mg/L is supplied at average daily flow and an available total free chlorine residual of at least 0.5 mg/L is supplied at all times. At average daily design flow the chlorine demand is 11 mg/L. At peak hour design flow the demand is 7.0 mg/L. The smallest commercially available chlorinator (lb/hr) that can provide the required total dosage is most nearly:

[Figure removed.]

- ○ A. 50
- ○ B. 75
- ○ C. 100
- ○ D. 125

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Question 16:

Water with the following analysis is to be softened by excess lime treatment in a two-stage system.

CO_2	10 mg/L as CO_2
Ca^{2+}	60 mg/L
Mg^{2+}	8.8 mg/L
Na^{+}	5.0 mg/L
Alkalinity (HCO_3^{-})	110 mg/L as $CaCO_3$
SO_4^{2-}	89 mg/L
Cl^{-}	8.0 mg/L
Excess lime	35 mg/L as CaO

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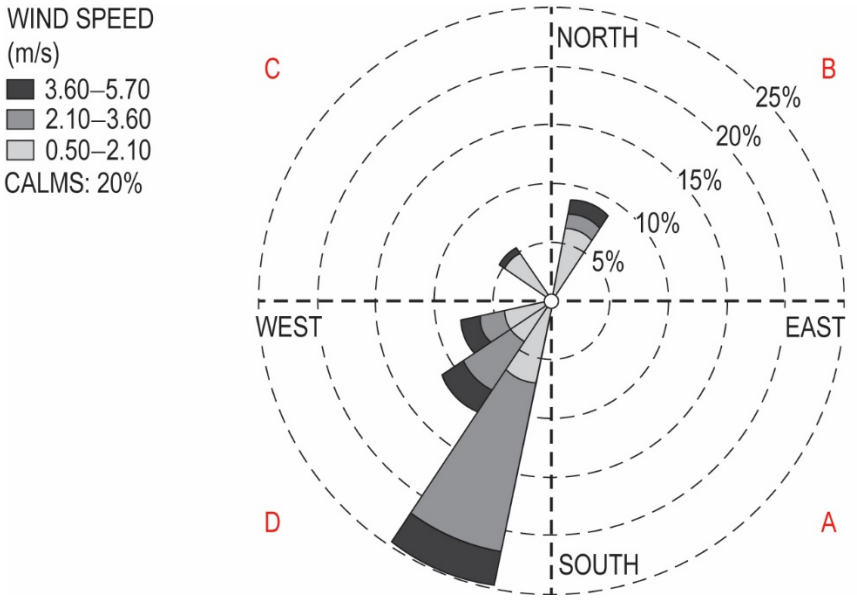
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Question 58:

The following wind rose diagram shows transport of PFAS/PFOA at a manufacturing facility that is an air emission source. PFAS/PFOA is being emitted at a constant rate of 24 hours per day.

Identify the area (A, B, C, or D) with the highest probability of PFAS/PFOA concentrations in soil.



Solution 2:

Option C shows a suitable configuration for the treatment plant.

Option A is incorrect as F_eCl_2 is not required for nitrogen removal.

Option B is incorrect as it will not remove nitrogen.

Option D is incorrect as it shows anoxic and aeration basins in the wrong order.

THE CORRECT ANSWER IS: C

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Solution 9:

At average flow, possible doses are 11 mg/L dose + 0.5 mg/L residual for 11.5 mg/L or the regulatory 15 mg/L. 15 mg/L is larger. Flow is:

$$16 \text{ MGD} \times 15 \text{ mg/L} \times \frac{8.34}{24} = 83.4 \text{ lb/hr}$$

At peak hour, dose is 7 mg/L demand + 0.5 mg/L residual = 7.5 mg/L. Flow is:

$$16 \text{ MGD} \times 2.5 = 40 \text{ MGD}$$

$$40 \text{ MGD} \times 7.5 \text{ mg/L} \times \frac{8.34}{24} = 104.25 \text{ lb/hr} \rightarrow \text{Round up to next larger size to meet critical demand}$$

THE CORRECT ANSWER IS: D

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Solution 16:

The lime required is the sum of the components needed to react with CO_2, carbonate hardness, and magnesium, plus the excess:

Lime = [CO_2] + [CH] + [Mg^{2+}] + [Excess]

[CO_2] = carbon dioxide concentration as $CaCO_3$

[CH] = carbonate hardness as $CaCO_3$ = alkalinity

[Mg^{2+}] = magnesium harness as $CaCO_3$

[Excess] = 35 mg/L as CaO

Molecular weight of lime: CaO = 40 + 15 = 56

CaO equivalent weight = 56/2 = 28

Component	Concentration (mg/L)	Eq. Wt.	meq/L	Lime Required	Lime Required (CaO) as mg/L
CO_2	10 as CO_2	22.0	0.45	0.45 × 28 =	12.6
Ca^{2+}	60	20.0	3.0		
Mg^{2+}	8.8	12.2	0.72	0.72 × 28 =	20.2
Na^{+}	5.0	23.0	0.217		
Alkalinity	110 as $CaCO_3$	50.0	2.2	2.2 × 28 =	61.6
SO_4^{2-}	89	48.0	1.85		
Cl^{-}	8.0	35.5	0.225		
CaO (Excess)	35 as CaO				35.0
Total CaO Needed (mg/L)					**129.4**

Lime required = (0.45 + 0.72 + 2.2) meq/L (28 mg/meq) + 35 mg/L = 129.4 mg/L

Lime required = (129.4 mg/L)(1 MG) (8.34) = 1,079.2 lb ≈ 1,080 lb CaO/MG

THE CORRECT ANSWER IS: C

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Solution 23:

Calculate the temperature in the stream:

$$\text{Temp.} = \frac{4\ \text{MGD} \times \frac{1.547\ \text{cfs}}{\text{MGD}} \times 24°\text{C} + 18\ \text{cfs} \times 27°\text{C}}{4\ \text{MGD} \times \frac{1.547\ \text{cfs}}{\text{MGD}} + 18\ \text{cfs}} = 26.2°\text{C}$$

Correct the rate constants:

$k_1 = k_d = 0.23(1.047)^{26.2\ -\ 20} = 0.306$

$k_2 = k_r = 0.4(1.024)^{26.2\ -\ 20} = 0.463$

Calculate BOD_5 of mixture (effluent and stream):

$$BOD_5 = \frac{20\ \text{mg/L} \times 4\ \text{MGD} \times 1.547 + 18\ \text{cfs} \times 4\ \text{mg/L}}{4\ \text{MGD} \times 1.547 + 18\ \text{cfs}} = 8.09\ \text{mg/L}$$

Calculate L_o, $BOD_{ultimate}$, of mixture:

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

$L_o = 10.33$ mg/L

Calculate the dissolved oxygen deficit:

$$D = \frac{k_1}{k_2}\left(L_o \times e^{-kt}\right) = \frac{0.306}{0.463}\left(10.33 \times e^{-0.306(2.0)}\right) = 3.7\ \text{mg/L}$$

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Solution 58:

The American Meteorological Society (AMS) description of a wind rose states that the length of each line is proportional to the frequency of wind from the direction. The large petal of wind in the southeast quadrant indicates that wind primarily flows from the southeast. Therefore, the downwind direction in this area is the northeast quadrant, Area B.

