

ERRATA for
PE Environmental Practice Exam
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Revisions are shown in red.

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

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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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 CO₂, carbonate hardness, and magnesium, plus the excess:

$$\text{Lime} = [\text{CO}_2] + [\text{CH}] + [\text{Mg}^{2+}] + [\text{Excess}]$$

[CO₂] = carbon dioxide concentration as CaCO₃
 [CH] = carbonate hardness as CaCO₃ = alkalinity
 [Mg²⁺] = magnesium harness as CaCO₃
 [Excess] = 35 mg/L as CaO

Molecular weight of lime: CaO = 40 + 16 = 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