DW Module 21:
Chemical Addition
Answer Key

☑ Unit 1 Exercise:

Use the Chemical Usage Table to solve for the following:

1. List the chemicals you might add to control odor. Include the chemical name and best feeding form for each.

Ans: Possible responses include:

Activated Carbon	-	Dry to form slurry
Ozone	-	Gas
Potassium Permanganate	-	Dry to form solution
Sodium Chlorite	-	Dry or solution
Chlorine	-	Gas
Sodium Hypochlorite	-	Solution

2. Name several chemicals which might be added during the coagulation process. Include examples of coagulants and other chemicals that will change the water characteristics to promote coagulation.

Ans: Possible responses include:

Aluminum Sulfate	-	Coagulant
Ferric Chloride	-	Coagulant
Ferric Sulfate	-	Coagulant
Poly Aluminum Chloride	-	Coagulant
Calcium Hydroxide	-	pH Adjustment
Calcium Oxide	-	pH Adjustment
Sodium Bicarbonate	-	pH Adjustment
Sodium Carbonate	-	pH Adjustment
Sodium Hydroxide	-	pH Adjustment
Polymers	-	Coagulant Aid

☑ Activity — Reading an MSDS:

[Use the MSDS on the previous pages of the workbook to complete the following.]

1. The chemical composition of Liquid Aluminum Sulfate consists of _____ % wt. water and _____ % wt. aluminum sulfate

Ans: Water 72.2%
Aluminum Sulfate 27.8%

2. The boiling point of Liquid Aluminum Sulfate is _____ ^{o}F/_____ ^{o}C and the freezing point is _____ ^{o}F/_____ ^{o}C.

Ans: Boiling = 228°°F (109°° C)
Freezing= 9°F (-13° C)

3. True or False - Liquid Aluminum Sulfate supports combustion.

Ans: False

4. Protective clothing and equipment to be worn when handling Liquid Aluminum Sulfate include: protective chemical _____ _____ for eye protection, and chemically protective _____, _____, aprons, and gauntlets for skin protection.

Ans: Safety goggles, gloves, and boots.

5. True or False - Liquid Aluminum Sulfate is considered an RCRA Hazardous Waste.

Ans: False

☑ Activity – Class Problem:

Solution: Part A – Compute batching requirements

Batch strength = 0.5 lb/gal

Batch Quantity = 400 gal

$$\text{Chemical Requirement} = \left(\frac{0.5\,\text{lb}}{\text{gal}}\right)(400\,\text{gal}) = 200\,\text{lb}$$

Part B

Step 1 – Compute the chemical feed rate in lb/day

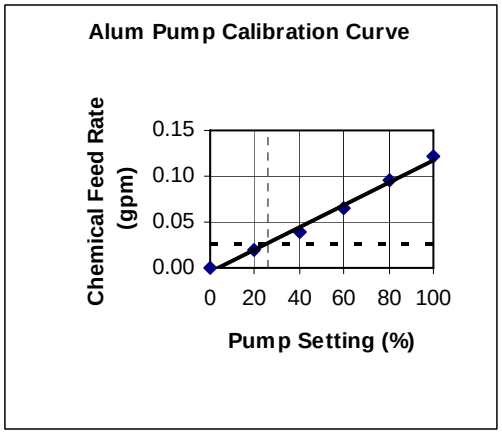
$$\text{Chemical Feed Rate} = \left(\frac{1.0\,\text{MG}}{\text{day}}\right)\left(\frac{10\,\text{mg}}{\text{l}}\right)\left(\frac{8.34\,\text{lb}\cdot\text{l}}{\text{gal}\cdot\text{mg}}\right) = 83.4\,\text{lb/day}$$

Step 2 – Compute the required solution feed rate in gal/min

$$\text{Solution Feed} = \left(\frac{83.4\,\text{lb}}{\text{day}}\right)\left(\frac{\text{gal}}{0.5\,\text{lb}}\right) = 166.8\,\text{gal/day}$$

$$\left(\frac{166.8\,\text{gal}}{\text{day}}\right)\left(\frac{\text{day}}{24\,\text{hours}}\right)\left(\frac{\text{hour}}{60\,\text{min}}\right) = 0.11\,\text{gal/min}$$

Step 3 – Establish Feed Pump Setting



= Feed Pump Setting = 100 %

Part C – Compute batch life

Batch volume = 400 gal

Feed rate = 166.8 gal/day

$$\text{Batch Life} = (400\ \text{gal})\left(\frac{\text{day}}{166.8\ \text{gal}}\right) = 2.4\ \text{days}$$

UNIT 3 OPTIONAL EXERCISE:

A 1.0 MGD treatment facility uses 12.5 % sodium hypochlorite solution for disinfection. Laboratory testing has determined that the active chemical strength of the hypochlorite is 1.04 pounds of chlorine per gallon. The desired feed rate is 2.5 mg/l.

Determine the required chemical feed pump setting assuming that the feed pump calibration curve is identical to the calibration curve for the alum feed pump in Example 3.4.

Solution:

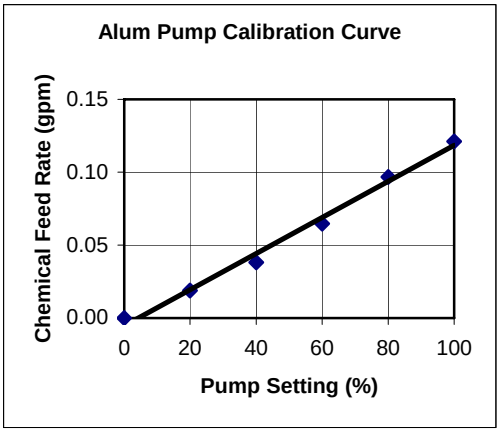
Step 1 – Compute the required chemical feed rate (lb/day).

$$\text{Feed Rate (R) (lb/day)} = \left(\frac{1.0\ \text{MG}}{\text{day}}\right)\left(\frac{2.5\ \text{mg}}{\text{l}}\right)\left(\frac{8.34\ \text{lb}\cdot\text{l}}{\text{gal}\cdot\text{mg}}\right) = 20.85\ \text{lb/day}$$

Step 2 – Compute the required solution feed rate in gal/min.

$$\text{Solution feed (gal/min)} = \left(\frac{20.85\ \text{lb}}{\text{day}}\right)\left(\frac{\text{gal}}{1.04\ \text{lb}}\right)\left(\frac{\text{day}}{24\ \text{hours}}\right)\left(\frac{\text{hour}}{60\ \text{min}}\right) = 0.014\ \text{gal/min}$$

Step 3 – Determine feed pump setting using the calibration curve from Example 3.4.



Ans: Chemical feed rate = 0.014 gal/min ➔ Feed Pump Setting = 16%