Module 7:
Basics of Chemical Feed Systems
Answer Key

☑ Chemical Usage Table Exercise

[Refer to the Chemical Usage Table to answer the following questions.]

1. List the chemicals you might add to wastewater to control odor. Include the chemical name and best feeding form for each.
   Ans:
   [($KMnO_4$) Potassium Permanganate. Best feeding form: dry to form solution.
   (H_2O_2) Hydrogen Peroxide. Best feeding form: liquid.
   ($FeSO_4 \cdot 7\ H_2O$) Ferrous Sulfate (Odophos). Best feeding form: dry granular to form solution.]

2. List several chemicals that might be added to wastewater to promote phosphorus removal. Include examples of both dry and liquid chemicals and identify the normal batch strength of the food solution.
   Ans:
   ($Al_2(SO_4)_3 \cdot 14\ H_2O$) Aluminum Sulfate (Alum). Batch strength: 0.5 lb/gal
   ($Al_2(SO_4)_3 \cdot X\ H_2O$)Aluminum Sulfate (Liquid Alum). Batch strength: Neat
   (FeCl3) Ferric Chloride. Batch strength: Neat
   ($Fe_2(SO_4)_3 \cdot X\ H_2O$) Ferric Sulfate. Batch strength: 5.5 lb/gal max.
   ($FeSO_4 \cdot 7\ H_2O$) Ferrous Sulfate (Odophos). Batch strength: 0.5 lb/gal

3. Synthetic organic polymers can be used to enhance the flocculation process in wastewater treatment plants.

   a. ___X___ True b. ____ False

4. In a lime stabilization process, if the pH is allowed to fall below 9.0, _biological_ activity could resume and create the potential for offensive odors.

5. Which of the following chemicals are commonly used to supplement alkalinity in wastewater treatment processes? (Check all that apply.)

   a. ___X___ Lime

   b. ___X___ Sodium Hydroxide

   c. ____ Sulfuric Acid

   d. __X__ Magnesium Hydroxide

e. ____ None of the above.

Exercise for UNIT 2 – SAFETY AND HANDLING

[Use the MSDS on pages 2-3 through 2-6 to complete the following.]

1. MSDS stands for

Ans: Material Safety Data Sheet

2. This MSDS is for what chemical?

Ans: Aluminum Sulfate, Liquid

3. What protective clothing precautions should you take when working with this chemical?

Ans: At least: Chemically protective gloves, boots, aprons, and gauntlets, protective chemical safety goggles, per OSHA eye-and face protection regulations. (Section 8)

Preferred – All of the above and – Seek professional advice prior to respirator selection and use. Respiratory protection following OSHA regulations, and if necessary wear a MSHA/NIOSH-approved respirator.]

4. List the five components of chemical handling equipment.

Ans: Selection of equipment
Labels and warning signs
Breathing Protection
Protective Clothing
Protective Equipment

Exercise for UNIT 3 – CHEMICAL DOSAGE CALCULATION

1. 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 chemical 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 alum feed pump in the class problem.

Solution:

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

Feed Rate (R) (#/day) = 1.0 (mgd) x 2.5 (mg/l) x (8.34 #/gal)

= 20.85 #/day

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

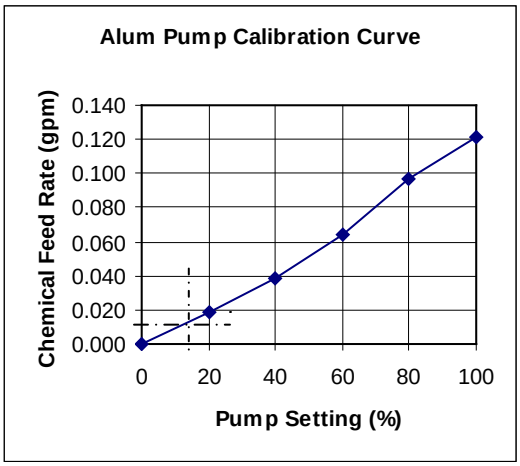
Solution feed (gal/day) = 20.85 #/day ÷ 1.04 #/gal

= 20.05 gal/day

Solution feed (gal/min) = 20.05 gal/day ÷ 1440 min/day

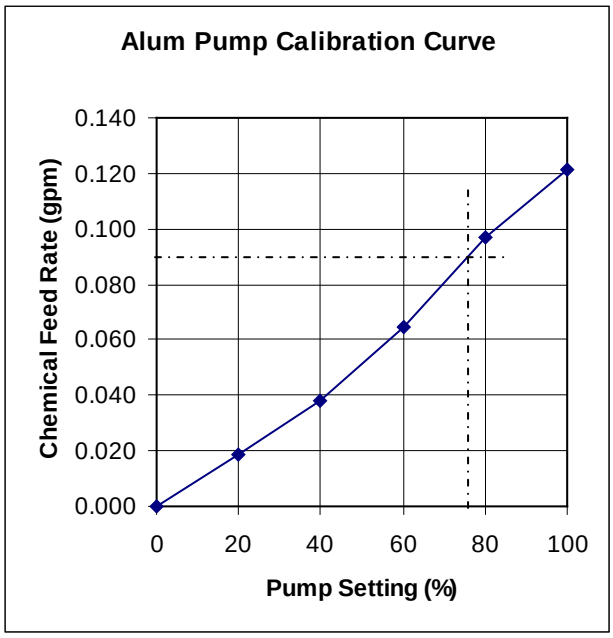
= 0.014 gal/min

Step 3 – Determine feed pump setting using the calibration curve from the class problem.



Ans: Chemical feed rate = 0.014 gal/min ➔ Feed Pump Setting = 14%

2. Use the graph in Figure 3.7 to answer this question. From the graph, determine the pump setting if you need a feed rate of 0.090 gpm.



Ans: Pump Setting = 75%

3. Match the common liquid feeders below with the range of feed rates needed.

Feeding Pump	Feed Rate
A. _c_ Positive Displacement	a. 0.1 to 10 gph
B. _a_ Solenoid Metering	b. less than 0.1 gph
C. _b_ Peristaltic Pump	c. 0.1 to 600 gph
D. _d_ Jet Pump	d. Not defined in our workbook

4. A multi-station Jar Test Stirrer lab equipment station usually has 4 to 6 beakers for simultaneous testing of various strengths of coagulant chemicals.

a. _X_ True b. ____ False

The two common types of gas feed equipment are _direct_ feed and _solution_ feed.

Exercise for UNIT 4 – CHEMICAL FEED SYSTEMS: 5 minutes

A. Identify each of the following statements with a T for true or F for false.

1. Chemical storage should be in the vicinity of feeders to avoid necessary handling.

Ans: True

2. All chemicals should be stored in spill containment areas.

Ans: False (only liquids)

3. Gaseous chemical storage is usually in an adjacent room or outside building at a location close to the feed room.

Ans: True

4. The minimum chemical amount of chemical storage is 30 days supply at average use.

Ans: False (10 days supply)

B. What type of Chemical Feed System is represented by the following schematic? Write your answer in the space provided.

Ans: Typical Bulk Liquid Chemical Feed System

C. List the two Feed Systems that require leak detection equipment.

Ans: Liquid and Gaseous

Optional Activity (page 3-13) – Class Problem

Solution: Step 1 – Compute the chemical feed rate in #/day

Phosphorous Loading = 1.0 MGD x 10 mg/l x 8.34 #/gal = 8.34 #/day

Required Aluminum Sulfate = 10 parts/part PO_4 = 10 X 8.34 #/day

= 83.4 #/day

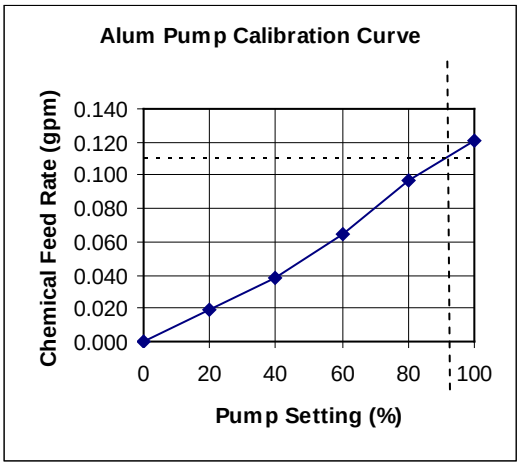
Step 2 – Compute the required solution feed rate in gal/day

= Solution feed = 83.4 #/day ÷ 0.5 #/gal

= 166.8 gal/day

= 166.8 gal/day ÷ 1440 min/day = 0.11 gal/min (Conversion from gallons per day to gallons per minute (24 hr/day x 60 min/hr = 1440 min/day)

Step 3 – Establish Feed Pump Setting



= Feed Pump Setting = 91 %

Step 4 – Compute batching requirements

= Batch strength = 0.5 #/gal\

= Batch Quantity = 400 gal

= Chemical Requirement = 0.5 #/gal x 400 gal

= 200 #

Step 5 – Compute batch life

= Batch volume = 400 gal

= Feed rate = 166.8 gal/day

= Batch life = 400 gal ÷ 166.8 gal/day

= 2.4 days