PROBLEM 1

A laboratory study was conducted to collect design data for an adsorption column to treat a wastewater containing 15 mg/t of ABS. The study was conducted in 1.5 in. diameter columns and the time required to reduce the ABS concentration from 15 mg/l to 1.0 mg/l was determined.

Flow Rate gpm/ft^2	Bed Depth ft	Throughput Volume. gal	Time hr
2.0	2.5	1399	950
	4.5	3277	2225
	6.0	4749	3225
4.0	2.5	1178	400
	4.5	3057	1038
	6.0	4418	1500
7.0	3.0	1031	200
	6.0	3608	700
	9.0	6185	1200

Use the Bohart-Adams approach to determine the time to exhaustion for a full-scale, 6 ft deep by 4 ft diameter bed of carbon treating a flow of 30,000 gal/day. Assume 8 hr/day operation of the column.

PROBLEM 2

A laboratory column study was conducted to ascertain the removal of color from an industrial wastewater. The following data were collected at a flow rate *of* 1.5 gpm/ft^2. Use the BDST approach to predict the depth of a 5 ft diameter bed of carbon that must operate 200 hr between regenerations when treating a flow of 4,000 gal/hr.

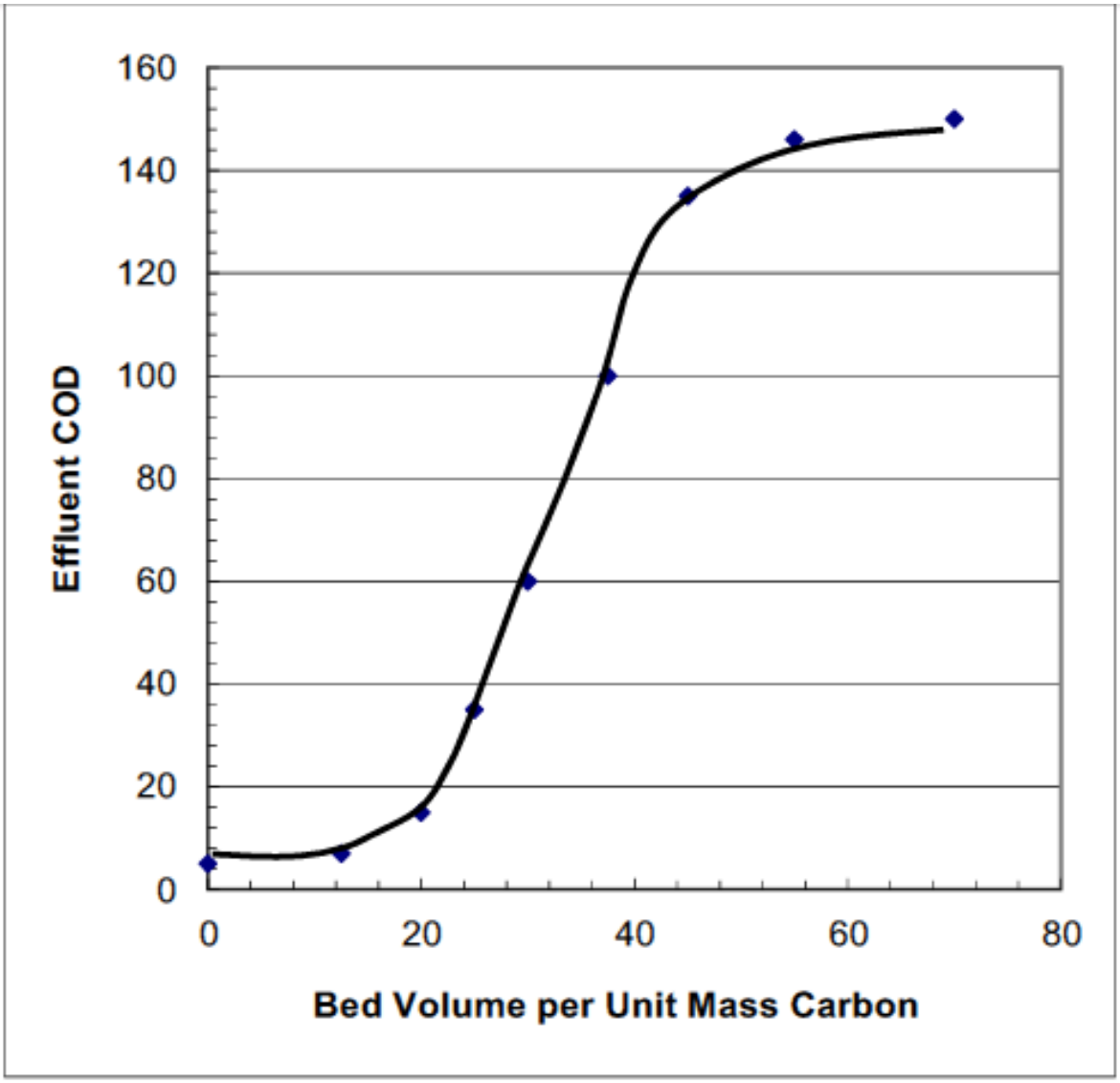
Bed Depth (ft)	Time to Breakthrough (hr)
2	110
4	317
6	525
8	735

PROBLEM 3

An industrial plant discharges 6000 gal/h of a wastewater containing 150 mg/l of COD. The plant is required to reduce the COD to 25 mg/l prior to discharge. A laboratory study indicates that the desired effluent concentration can be achieved in an adsorption column operating at 0.25 bed volumes per hour. Determine the following:

1. The volume of Carbon required to treat the wastewater.
2. The mass of Carbon required if the Carbon has a bulk density of 23 lb/ft^3.
3. The operating life of a single column under the above conditions

The breakthrough curve is shown in the following Figure.



PROBLEM 4

A small public water system is considering removing barium from its well water using ion exchange. The average daily flow rate is about 1.5 ML/d (400,000 gpd) and the influent barium concentration is 11.3 mg/L. If a SBC exchange resin is to be used, estimate the minimum daily volume of resin that would be required assuming that barium is completely removed and is the only cation exchanging on the resin.

PROBLEM 5

A small municipal water supply treats a maximum daily flow of 5.0 ML/d, maximum weekly flow of 25 ML/wk, and a maximum nitrate concentration of 18 mg/L. The plant treats 5 ML of water and operates only 7 h per day and 5 days per week and there is sufficient storage capacity for the weekend demand. The treatment objective for the ion exchange process is 0.6 mg/L NO_3–N and will be blended with untreated water at 18 mg/L NO_3–N to produce a final product water of 8 mg/L or less NO_3–N. With a standard of 10 mg/L as NO_3–N, determine the flow rate of the ion exchanger and blending rate.