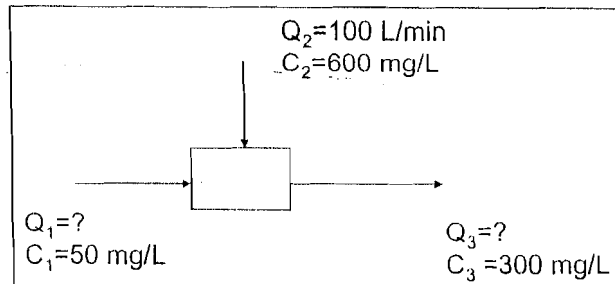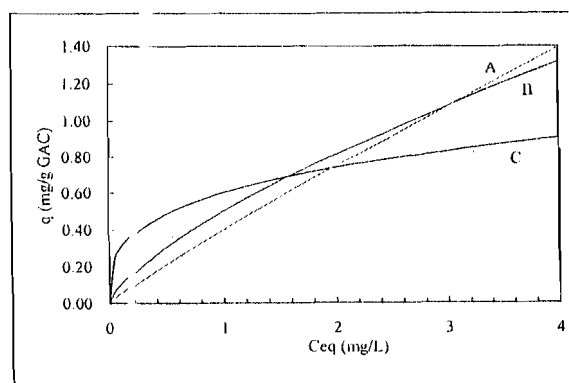系別：水資源及環境工程學系　　　科目：環境工程（含噪音污染、空氣污染、固體廢棄物）

1. What're the flow rates for wastewater Q_1 and Q_3 for Figure shown on the right? (10%). Assume that no reaction in the reactor and steady-state condition.

$Q_2=100$ L/min
$C_2=600$ mg/L

$Q_1=?$
$C_1=50$ mg/L

$Q_3=?$
$C_3=300$ mg/L

2. A wastewater treatment plant discharges a flow of 1000 m^3 per day with solid concentration of 0.003% by weight. How many kilograms of solids doest it discharge per day? Assuming that wastewater density of 1 g/cm^3. (10%)

3. A 90% of a radioactive nuclide can be reduced in 10 minutes. What's the half-life? (5%) How long will it takes for 99.9% of reduction? (5%) Assume first order reaction kinetic.

4. A chemical reaction was studied in a batch reactor and a good linear correlation was found for $1/C$ (i.e, 1/concentration) versus reaction time. What's the reaction order for this reaction? (5%)

5. A coal-fired power plant used 100 kg of coal per day. The energy value of coal is 28000 kJ/kg, and the plant produced 2.6×10^6 kWh of electricity per day. What's the efficiency of the power plant? (10%) (1kWh= 3.6×10^6 J)

6. What's superadiabatic lapse rate? (5%)

7. What would the sound pressure level be 100 m from a sound source of 100 db? (10%)

8. Adsorption of phenol onto three different GACs is studied, yielding good fits to the isotherms shown in the graph. You wish to reduce the phenol concentration from 20 to 1 mg/L by adsorption to the best of these GAC. In this case, "best" means the one that can achieve the treatment using the lease amount of GAC. (a) Which GAC would be preferred? (10%) (b) What GAC dose (g/L) is required? (10%)

9. Cationic exchange resins can be classified as strong or weak acid cationic exchangers. What's the difference on the pH dependence of exchange capacity for these two types of resins? (5%) What're the typical functional groups for these two types of resins? (5%) Draw a flowsheet for ion exchange demineralization process (10%).