Advanced Water Chemistry and Treatment (3 ov). 17.4.2000.
Maximum points: 34 p. Questions 3-5, you can answer in English or in
Finnish.

Munter:

1. Determine the 2nd order reaction rate constant for the following batch reactor experimental data:
   $d[A]/dt = - k\ [A]^2$

Time (min)	[A], mole/l
0	10
1	5
2	3.7
3	2.9
4	2.3
5	2.0
6	1.7
7	1.5

   (6 p)

2. Give some examples of using O_3/GAC or UV/H_2O_2/GAC processes for water treatment. What are advantages of these systems? (6p)

Hirvonen: (answers in separate papers, please.)

3. Explain what could happen to the following species (or response of analysis) in aqueous solution in irradiation by a **low-pressure mercury lamp**. You can handle each cases separately.

   How about when a **medium-pressure mercury** lamp is used as a source of radiation? (10 p)

   a) humic substance
   b) poliovirus
   c) nitrite (NO_2)
   d) agnesium
   e) ferrioxalate
   h) ioassay
   i) carbon tetrachloride
   j) entachlorophenol

4. A waterborne epidemic breaks out in a small community. The source of the drinking water is well-quality groundwater, and it has not previously disinfected before distribution to the consumers. Now the disinfection seems to be essential to solve the water quality problem. How you can evaluate the feasibity of the UV disinfection? What kind of factors are needed to consider? What additional information is needed? (6 p).

5. The fraction of UV absorbed by a component, f_c, to that absorbed by all the components of the solution can be formulated:

   $f_c = \varepsilon_c[C] / \Sigma\ \varepsilon_i[C_i]$

   Compound C has quite high absorptivity at 254 nm ($10\ 000\ M^{-1}cm^{-1}$) in aqueous solution, thus direct photolysis can be assumed to be the principal route for its degradation in UV treatment. Describe how you can shift the reaction mechanism from direct photolysis to OH radical mediated oxidation by using UV/hydrogen peroxide system. What kind of factors are involved in maintaining of steady state concentration of OH radicals in the UV/hydrogen peroxide system? (6 p).