1. Define the following properties of a biosensor:
   a) Sensitivity
   b) Linear range
   c) Detection limit
   d) Response time
   e) Lifetime
   f) Accuracy.

2. Explain what means an affinity between two biomolecules. What is the reason for that? What is the size and molecular weight of a typical antibody molecule?

3. What are faradic and non-faradic processes in electrochemical sensors?

4. Biosensors based on piezoelectric resonators.

5. A Clark’s cell has a round platinum cathode (diameter 2 mm), Ag/AgCl anode, 0.1 M KCl solution as internal electrolyte, and oxygen permeable Teflon membrane. A current of 1.5 μA is measured in the cell when it is in a sample solution which is stirred strongly. Concentration of oxygen in the sample is 2.1·10^{-4} mol/l. Calculate the thickness of the Teflon membrane. Distance of the membrane from the cathode surface is 200 μm. Diffusion constant of oxygen in the electrolyte is \( D_e = 1.21 \cdot 10^{-5} \text{ cm}^2 \text{s}^{-1} \) and in the Teflon membrane \( D_m = 2.54 \cdot 10^{-6} \text{ cm}^2 \text{s}^{-1} \). \( F = 96485 \text{ C mol}^{-1} \). (Fick’s law: \( J(x,t) = -D \frac{dC(x,t)}{dx} \), electrode current \( I(t) = nF\bar{A}J(0,t) \))

6. A measurement device based on Surface Plasmon Resonance has a detection limit of 10^{-7} for the change of refractive index. Maximum amount of antibodies has been immobilized on the surface of a thin gold sensor layer. Every antibody molecule has two binding sites, the molecular weight of the antibody is 150 000, and the surface density of the antibodies on the gold layer is 400 ng/cm². The antigen molecules have a molecular weight of 80 000. The antigen to be detected has a diameter of about 4 nm and antibody about 6 nm, and the refractive index of both molecules is 1.52. The sample solution has a refractive index of 1.321. Area of the laser spot on the gold surface is 0.4 mm² and the penetration depth of the evanescent field in the sample is 350 nm. What is the smallest amount of binding antigen molecules that the sensor can detect?