Processes (problems).

1.A cellulose acetate membrane shows a water permeability coefficient of $2 \cdot 10^{-5}$ g cm^{-2} s^{-1} bar^{-1} and a NaCl permeability coefficient of $4 \cdot 10^{-6}$ cm s^{-1}. In a desalination experiment, the feed has 35 g L^{-1} of salt and 60 bar of pressure are applied. Calculate the fluxes for water and salt, the rejection and the salt concentration in the permeate.

2. The synthetic rubber is mainly used to make tires, among different reasons, due to the low air permeability. A bicycle tire contains 2400 cm^3 STP d'aire at 2 bar, how much time is required to deflate it? The tire thickness is 1.0 mm, its surface is 2400 cm^2 and the air permeability coefficient is 0.90 Barrer*.

* 1 Barrer = 10^{-10} cm^3(STP).cm.cm^{-2}.s^{-1}.$cmHg^{-1}$

Processes (problems).

3. An homogeneous membrane made from cellulose ester with a thickness of 20 μm is placed in a pervaporation cell (10 cm in diameter). In the permeate side, 1.0 mbar vacuum is kept. In steady state, during an experiment carried out at 20ºC, 12.0 g of water are collected in 2.0 hours. Calculate the water permeability coefficient in mol.m/m^2.s.Pa and in Barrer.

4. An electrodialysis cell has been used to take measures of current intensity-voltage for a CL25T membrana using a 0.15 M NaCl solution at 25ºC.

i (mA/cm^2)	4	8	12	16	20	24
V (V)	0.03	0.07	0.11	0.21	0.51	0.85

Determine the limiting intensity current, i_{lim}. If the salt concentration is increased, how does i_{lim} behave?

Processes (problems).

5. Determine the water flux for both a typical membrane of microfiltration (MF) and of ultrafiltration (UF).

	MF	**UF**
ε (porosity)	0.6	0.02
r_p (pore radius, nm)	200	2
d (thickness, μm)	100	1

6. You know that the membrane permeability for gases depends on both solubility (S) and diffusivity (D) of the membrane material

$$P_i = S_i \cdot D_i$$

Which gas shows, thus, higher permeability, a small molecule (i.e. H_2) or a large one (i.e. C_3H_8)?

7. You have to select a membrane to conduct a gas separation where only non condensable gases are involved, which kind of polymer is better? A glassy polymer or a rubber polymer?