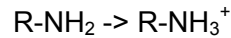


Problem Set 4

Issued: Day 13
Due: Day 15
(20 pts total)

BE.462J/3.962J
Spring 2003

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1. Re-derive the equation for equilibrium swelling of a polyelectrolyte gel where the polymer chains contain a basic ionizable group that becomes *positively* charged with *decreasing* pH:



Where R represents the polymer chain backbone. Show an example plot of the swelling ratio Q of the gel vs. pH in water for a gel that has the following parameters:

$\nu = 0.8$
 $M_c = 6000 \text{ g/mole}$
 $M = 100,000 \text{ g/mole}$
 $v_{sp,2} = 0.8$
 $\nu_{2,r} = 0.4$
 $\text{pKa} = 8.0$
ionic strength = 0.2 mM (1:1 electrolyte)

2. An anionic polyelectrolyte gel is synthesized with the physical parameters given below, and swollen in a solution with ionic strength = 0.5 mM and pH 7.4. What physical parameters of the gel you could alter to obtain the same swelling ratio at pH 7.4 if the gel is to be used in an ionic strength of 0.1 mM, assuming you must use the same polymer repeat units and you can't add organic solvents to the system? For one of the possible changes to the gel parameters, calculate what new value the parameter would take to obtain the desired swelling ratio to show that it is physically achievable.

$\nu = 0.8$
 $M_c = 12,000 \text{ g/mole}$
 $M = 75,000 \text{ g/mole}$
 $v_{sp,2} = 0.8$
 $\nu_{2,r} = 0.5$
 $\text{pKa} = 6.0$
(1:1 electrolyte)