Homework solvation of ions

1) What does Bockris & Reddy (the text in our packet) like and dislike about the Born model?

2) For an ion with a radius of 2.5 Å being transferred from a medium with a dielectric constant of 2 to one of 80.

- Write out the thermodynamic box for this transfer (discharge in vacuum, put the empty ion into water, recharge ion in water).
- For each step:
  write out the equation for the free energy of that transfer reaction;
  give a short description of the transfer reaction for that transfer;
  give the amount of energy of the transfer reaction (in kcal/mol) for each step.
  give the energy to transfer the ion from ε=2 to water.

3) What's the energy for transfer from
   ε=1 to water with r=2.5Å
   ε=1 to water with r=5Å.

4) Use the paper Science 1999 July 2; 285: 100-102 The Cavity and Pore Helices in the KcsA K+ Channel: Electrostatic Stabilization of Monovalent Cations Benoît Roux and Roderick MacKinnon .

- Why is it hard (energetically unfavorable) to transfer an ion into a membrane.
- What would it cost to transfer a K+ ion into the membrane (use necessary numbers from the paper).
- Why does having a water filled cavity help? Describe this in words and also tell me what parameters change in the Born equation to reduce the energy cost.