University of Massachusetts Boston

Department of Chemistry

Chemistry Doctoral Program

Green Chemistry Track

**Written Qualifying Exam**

**Physical Chemistry II**

Questions are based on the following article:

“Temperature-Induced Water Release and Uptake in Organic Porous Networks ” by Natalia Perez-Hernandez etc, J. Phys. Chem. B 114(2010)5694-5699.

1. (4pts)Explain how Thermal Gravimetric Analysis (TGA) works, the difference between TGA and Differential Scanning Calorimetry (DSC). If a sample shows exothermic peak at 120 degree C, but shows no weight change at the same temperature, what assumption can be made. Can variable-temperature X-ray Diffraction (VT-PXRD) be used to ratify the assumption? How?
2. (3pts)Please explain how you understand the following conclusion from the paper “The ability to wet the pore surface was found to correlate with the size of the cavity and the strength of the interaction between water molecules and the walls of the cavity, which in turn can be modulated by changes in temperature.” Please describe the origin of the driving force for water molecules to wet the inner surface of a pore and why the wettability is temperature related.
3. (1pts)Please explain the meanings and origins (from the intermolecular interaction stands of points) of “hydrophobicity” and “hydrophilicity”.
4. (2pts)To minimize the damage of the massive oil spill in the gulf of Mexico, especially close to the coastal line, a chemical will be used to disperse the thick oil. Please explain how such chemical works, you may draw a diagram to illustrate how the agents disperse oil.