Name _____

Student Number _____

Recitation Instructor _____

Chemistry 483

Practice Examination 3

Fall 2009

- 1. (40 points) Define and/or characterize
 - a. Born-Oppenheimer Approximation

b. Hamiltonian for H₂ in the Born-Oppenheimer Approximation

c. Photoelectron Spectroscopy

d g and u orbitals

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e Overlap integral

f σ and π molecular orbital for a diatomic molecule.

g Hund's Rules

h Hartree-Fock Method

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2. (15 points) The dipole moment of HCl is 3.697x10⁻³⁰Cm and the bond length is 127.5 pm. Using these data estimate the charges on H and Cl.

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3. (15 points) Use molecular orbital theory to explain why the dissociation energy of N_2 is greater than that of N_2^+ , but the dissociation energy of O_2^+ is greater than that of O_2 .

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4. (15 points) Normalize the spin wavefunction. Show all steps.

 $\Psi(1,2) = \alpha(1)\beta(2) - \beta(1)\alpha(2)$

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5. (15 points) The term symbols for an np^3 electron configuration are ²P, ²D, and ⁴S. Calculate the values of J associated with each of these term symbols. Which term represents the ground state?

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