Inorganic Cumulative Exam, March 4, 2010

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(total 5 questions, 100 points)

1. (30%) Calculate the binding energy and radius of the 1s orbital of a positronium.

2. (15%) A positronium has two spin states. Describe the two spin states.

3. (15%) A hydrogen molecule also has two spin states. Describe the two spin states and their approximate ratios at room temperature and at 20 ºK.

4. (10%) How many spin states would a dipositronium molecule have?

5. (30%) Construct qualitative molecular orbital diagrams for (a) dihydrogen; (b) positronium hydride; and (c) dipositronium molecules. Indicate the relative energetics of the three molecules based on the expected electronegativities of their constituents.