Chem 151B Inorganic Chemistry II Spring 2018

Problem Set #2

Due: Monday, June 4th at noon

- 15 marks 1. Consider the paramagnetic cluster compound $Co_3(CO)_9S$, where the cobalt atoms define a triangular geometry, the chalcogenide caps the cluster, and the unpaired electron resides in an antibonding MO localized in the plane of the three cobalt atoms (Co: I = 7/2). How many EPR lines would you expect if: (i) all cobalts are equivalent; (ii) only two are equivalent; (iii) all three are non-equivalent. The sample is diluted in diamagnetic FeCo₂(CO)₉Se, and you do not need to give the intensity ratio.
- 15 marks 2. Describe the basics of the Mössbauer instrument, its selection rules and the possible hyperfine splitting.
- 20 marks
 3. Describe (in words or sketch) the Mössbauer spectrum of the following compounds:
 (i) FeSO₄ in the absence of a magnetic field; (ii) FeSO₄ in a magnetic field;
 (iii) KFeS₂ at room temperature; (iv) KFeS₂ at –145°C.
- 15 marks 4. Consider the perovskite structure (general formula ABX₃), where A resides at the center, B at the corners and X at the edge centers of the unit cell. Give the coordination number, account for the unit cell count, and give the description of the structure in terms of the BX_n polyhedra. Give the same details for when B is instead at the center.
- 10 marks 5. How does a solid electrolyte differ from an insertion/injection compound?

Total: 75 marks