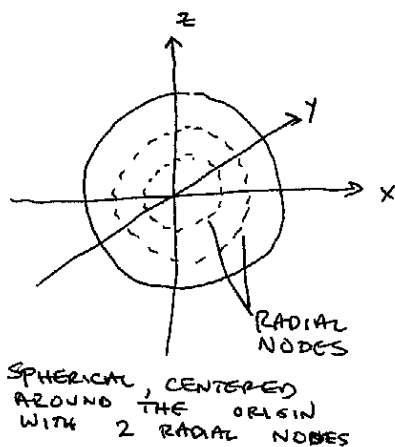


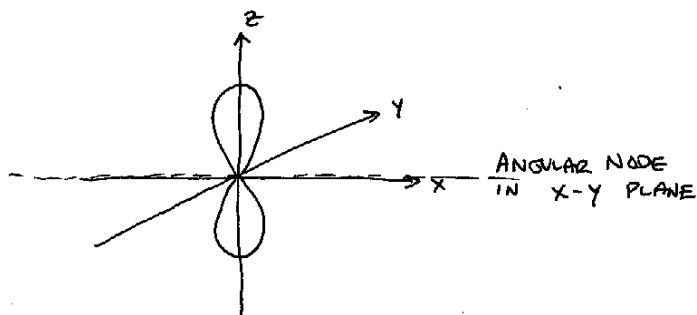
Chem E-1a
Friday Review Answers
Chapter 7: The Electronic Structure of Atoms

1. Binding Energy = $7.21 \times 10^{-19} \text{ J}$
2. a) Energy of light emitted = $4.09 \times 10^{-19} \text{ J}$
Wavelength of light emitted = $4.86 \times 10^{-7} \text{ m}$

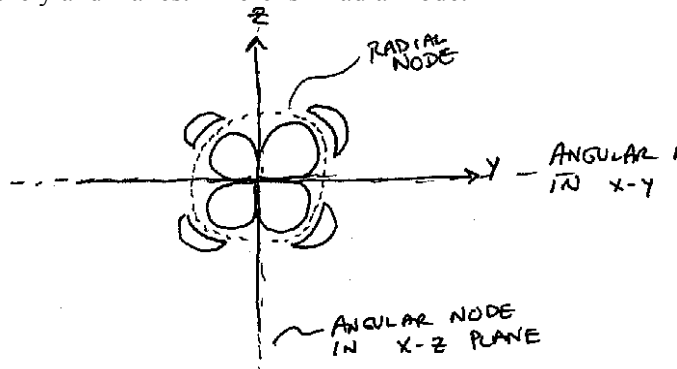
b) Energy required = $2.18 \times 10^{-18} \text{ J}$
3. a) i) $n = 3, l = 0$
ii) none
iii) 2 nodes total, 2 radial nodes, 0 angular nodes.
iv) The orbital is a sphere centered on the origin (nucleus), containing 2 radial nodes:



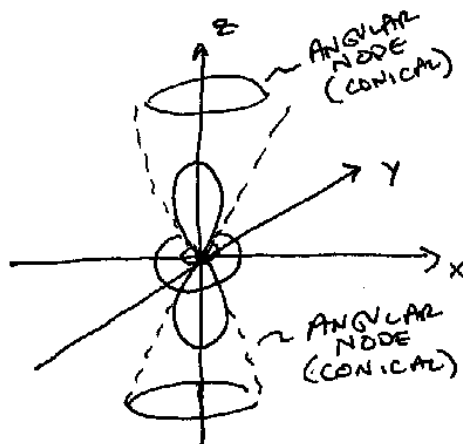
- b) i) $n = 2, l = 1$
ii) $2p_x$ and $2p_y$
iii) 1 node total, 0 radial nodes, 1 angular node. The angular node is the x-y plane
iv) A p orbital oriented along the z-axis



- c) i) $n = 4, l = 2$
 ii) $4d_{xy}$ $4d_{xz}$ $4d_{yz}$ $4d_{x^2-y^2}$
 iii) 3 nodes total, 1 radial node, 2 angular nodes. The angular nodes are located in the x-y plane and in the x-z plane.
 iv) A d-orbital shaped like a four-leaf clover, with the clover "leaves" located between the y and z axes. There is 1 radial node.



- d) i) $n = 3, l = 2$
 ii) $3d_{xy}$ $3d_{yz}$ $3d_{xz}$ $3d_{x^2-y^2}$
 iii) 2 nodes total, 0 radial nodes, 2 angular nodes. The angular nodes are cones centered around the z axis with their points at the origin (nucleus).
 iv) Shaped like a p-orbital oriented along the z-axis with a doughnut encircling the origin.



- 4 a) N: $[\text{He}]2s^22p^3$ 3 unpaired electrons, paramagnetic
 b) Mg: $[\text{Ne}]3s^2$ 0 unpaired electrons, diamagnetic
 c) Fe: $[\text{Ar}]4s^23d^6$ 4 unpaired electrons, paramagnetic
 d) Br: $[\text{Ar}]4s^23d^{10}4p^5$ 1 unpaired electron, paramagnetic
 e) Pb: $[\text{Xe}]6s^24f^{14}5d^{10}6p^2$ 2 unpaired electrons, paramagnetic