RDCH 702 Last Name:_____
Quiz 3
Assigned 14 October 15 First Name:_____
Due 21 October 15
Post questions to the blog (http://rdch702.blogspot.com/2015/10/fall-2015-rdch-702-quiz-3.html)

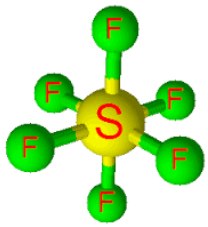
Quiz Topics
Lecture 4 Electronic Orbitals and Energetics, Lecture 5 Nuclear Models, and Lecture 6 Decay Kinetics

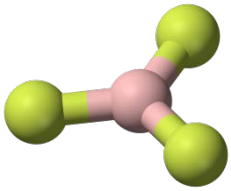
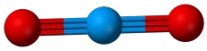
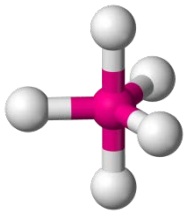
Use the lecture notes, chart of the nuclides, table of the isotopes, and web links to answer the following questions.

1. (10 Points) What is the relationship between the point group of a molecule and its IR spectroscopy?

_____

2. (10 Points) Provide the point group for the following



_____ _____ _____ _____

3. (5 Points) Define a ligand in Lewis acid-base terms

_____

4. (5 Points) In terms of Lewis acid-base theory, what are properties of hard metals?

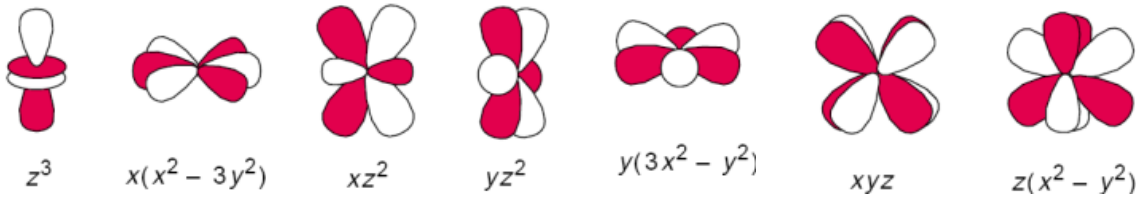
❒ Non-ionizing ❒ Small ionic radius ❒ Low positive charge ❒ Noble gas like structure

❒ High positive charge ❒ closed shell configurations ❒ Preferential bonding with F^-

5. (10 Points) In Lewis acid-base terms, which are softer metals, lanthanides or actinides?
   5.1. How is this fact used in separations of lanthanides from actinides?

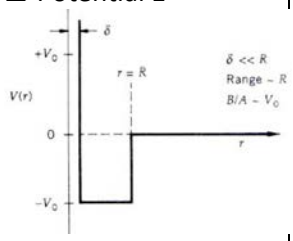
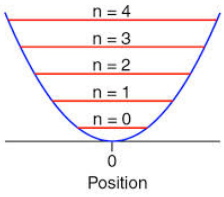
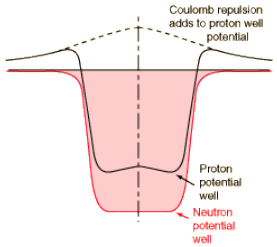
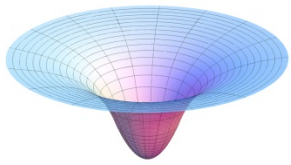
_____

6. (10 Points) Select the uranium atomic f-orbitals that form the molecular orbitals for UO_2^{2+}. The oxygens contribute 1 s and 3 p orbitals, so there must be 4 f-orbitals from uranium that can mix with the oxygen orbitals.



10.1 ❒ 10.2 ❒ 10.3 ❒ 10.4 ❒ 10.5 ❒ 10.6 ❒ 10.7 ❒

7. (5 Points) What is the nuclear potential used in the shell model?

❒ Potential 1	❒ Potential 2	❒ Potential 3	❒ Potential 4
			

8. (15 Points) Consider the nucleus ^{75}As.

8.1. Spin and parity from shell model: _____

8.2. Spin and parity from chart of the nuclides: _____

8.3. Based on the actual spin and parity from the chart of the nuclides use the Nilsson diagram on the next page to answer the following questions. You can check your work at: http://radchem.nevada.edu/classes/rdch702/readings/As%20level%20schemes.pdf

8.4. Indicate which location on the Nilsson diagram (next page) would be occupied by the 33rd unpaired proton**.** The red dots indicate the possible locations. _ _

8.5. Is ^{75}As oblate or prolate? _____

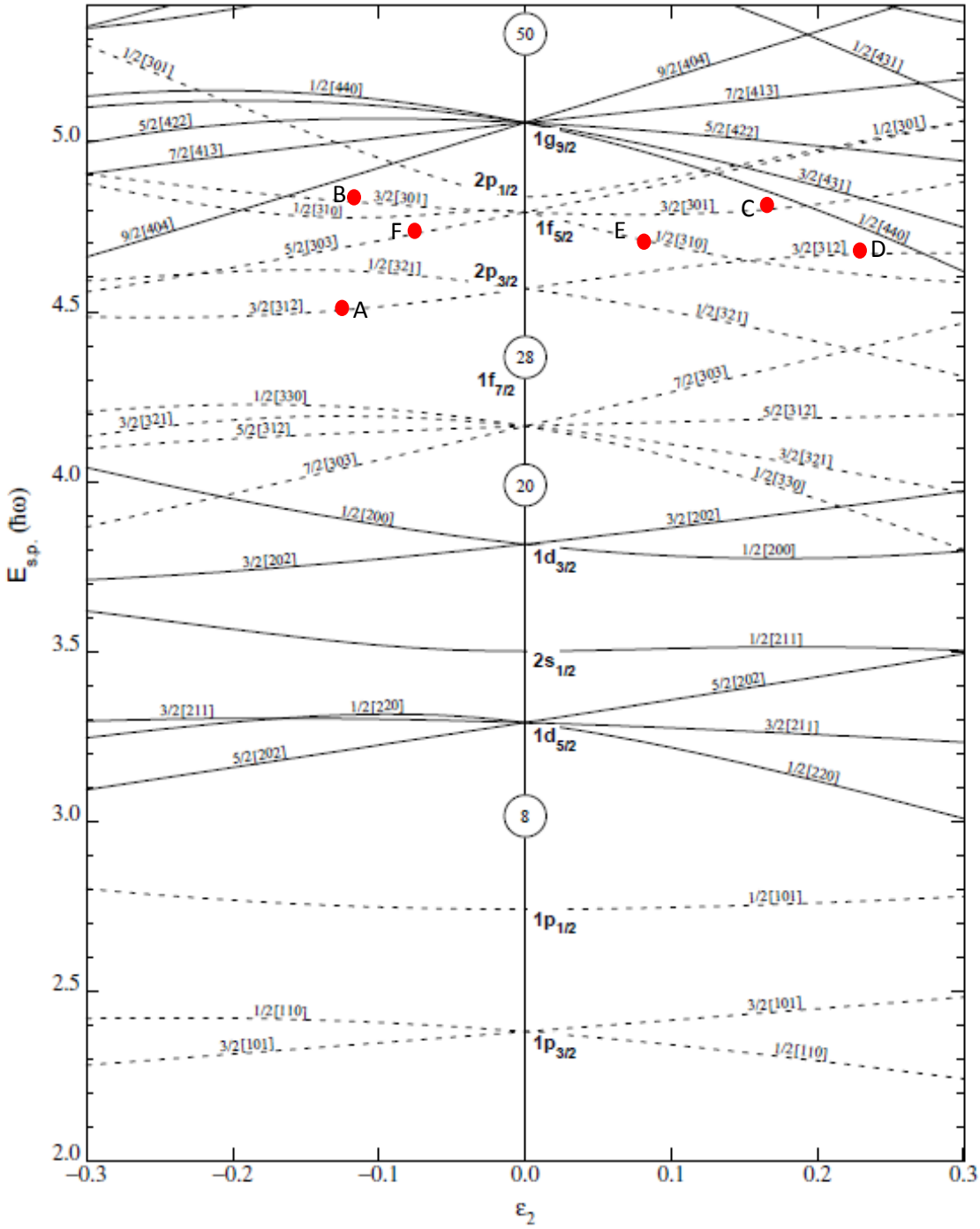
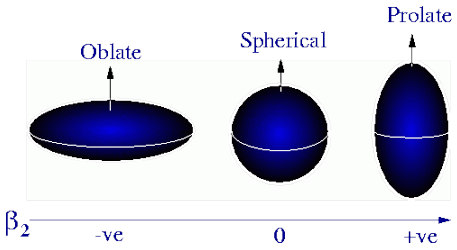


Figure 4. Nilsson diagram for protons or neutrons, Z or N ≤ 50 (ε_4 = 0).



9. (10 Points) Consider the isotope ^{233}U. What neutron flux is needed so the fission rate of ^{233}U is equal to its alpha decay rate? The flux unit is neutrons cm^{-2} s^{-1}.

Neutron flux (neutrons cm^{-2} s^{-1}): _____

10. (20 Points) At time 0 you have 1E9 atoms of ^{95}Zr. Provide the number of ^{95}Zr, ^{95}Nb, and ^{95}Mo atoms at the times listed in the table below. The ERG nuclides tool is useful for this question.

	Atoms of isotopes at given time		
Time (hours)	^{95}Zr	^{95}Nb	^{95}Mo
0	**1E9**	_____	_____
10	_____	_____	_____
50	_____	_____	_____
75	_____	_____	_____
100	_____	_____	_____
150	_____	_____	_____
200	_____	_____	_____

10.1. Provide the activity in Bq for the isotopes at 100 hours.

^{95}Zr_____ Bq ^{95}Nb_____ Bq ^{95}Mo_____ Bq