

Answer EITHER Question 7 below OR Question 8 printed on page 24. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 15 percent.

7. Answer the following questions about the element selenium, Se (atomic number 34).

- (a) Samples of natural selenium contain six stable isotopes. In terms of atomic structure, explain what these isotopes have in common, and how they differ.
- (b) Write the complete electron configuration (e.g., $1s^2 2s^2 \dots$ etc.) for a selenium atom in the ground state. Indicate the number of unpaired electrons in the ground-state atom, and explain your reasoning.
- (c) In terms of atomic structure, explain why the first ionization energy of selenium is
- less than that of bromine (atomic number 35), and
 - greater than that of tellurium (atomic number 52).
- (d) Selenium reacts with fluorine to form SeF_4 . Draw the complete Lewis electron-dot structure for SeF_4 and sketch the molecular structure. Indicate whether the molecule is polar or nonpolar, and justify your answer.

A. All six of selenium's isotopes will have 34 protons and 34 electrons. The difference in the six is in the different numbers of neutrons each possesses. This gives each a different atomic mass, but the atomic number, charge, and oxidation numbers stay the same.

B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

There will be two unpaired electrons in the ground-state atom - both in the $4p$ level. These e^- are unpaired because remaining so gives them a lower energy level. The p sub-level contains 3 orbitals. Not all 3 of these can be filled; since a $1/2$ -full orbital is most desirable after a full orbital, the e^- will fill one orbital and half-fill the other two.