Problem-Specific Instructions for TFs:

Question 1: They can use noble gas configuration, especially for those doing Se or Br. If you have a smaller section, you can do groups of 2 students and ask them to do Se and Br while you do S and Cl on the board.

Question 2: You can ask them to draw the trendlines for the other properties as well.

Question 3: Give them question (a) before you show them question (b). It's important they understand qualitatively why the answer is true.

For question (b), make sure they understand that they are solving for the reciprocal of the wavelength if they use the equation as given – remind them to check their units. You can ask each person in the group to calculate one of the transitions and then ask them to compare.

For question (c), it may be useful to give them an EM radiation spectrum.

Question 4: Similar to question 1(c), you may want to define the quantum numbers again. In particular, they should understand the numerical bounds of the quantum numbers.

Question 5: I would give them (a) and (b) first because those are more straightforward. Then I would ask them to figure out (c)-(e) in their groups. Take the time to qualitatively explain why the answers are correct.

1. Form a group of 4 students. Divide the 4 elements (**S, Cl, Se, Br**) such that every member of your group has one of the 4 elements. Answer the following questions for your individual element, and then share your answers.

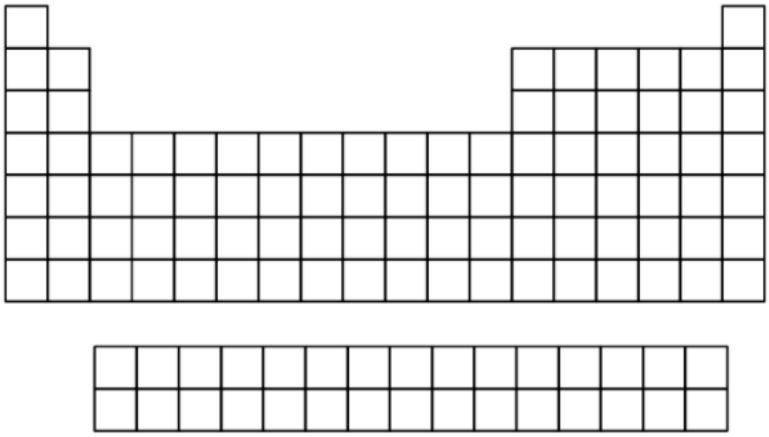
   (a) Write the ground-state electronic configuration and orbital diagram for a neutral atom of your element.

   (b) How many valence electrons does a neutral atom of your element have?

   (c) For your element, write all four quantum numbers for an electron in the valence shell.

   (d) How many unpaired electrons does a neutral atom of your element have?

2. On the empty periodic table below, draw arrows corresponding to the general trends for **ionization energies** going across a period and down a group.



3. Consider the following four electron transitions:

   (i) From $n = 1$ to $n = 2$
   (ii) From $n = 2$ to $n = 3$
   (iii) From $n = 3$ to $n = 4$
   (iv) From $n = 4$ to $n = 5$

   (a) Without any calculations, which of the electron transitions in a hydrogen atom would be associated with **radiation with the shortest wavelength**? Can you draw an energy diagram to support your answer?

(b) Now, calculate the wavelengths for the transitions based on the equation to check your answers.

$$\frac{1}{\lambda} = [1.097 \times 10^{-2}\ \text{nm}^{-1}]\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

(c) What kind of electromagnetic radiation (visible, IR, etc.) are these photons?

4. Which of these is not a possible orbital?
Explain your answer using the definitions of the different quantum numbers.

(a) 3*p* (b) 2*p* (c) 5*s* (d) 2*d*

5. For each pair of atoms/ions, identify which one has a larger radius.

(a) Na or K

(b) K or Ca

(c) Kr or Kr^+

(d) Rb^+ or Kr

(e) Cl^- or Ar