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.

   S: $1s^22s^22p^63s^23p^4$ or [Ne] $3s^23p^4$

   Cl: $1s^22s^22p^63s^23p^5$ or [Ne] $3s^23p^5$

   Se: $1s^22s^22p^63s^23p^64s^23d^{10}4p^4$ or [Ar] $4s^23d^{10}4p^4$

   Br: $1s^22s^22p^63s^23p^64s^23d^{10}4p^5$ or [Ar] $4s^23d^{10}4p^5$

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

   S: 6 Cl: 7 Se: 6 Br: 7

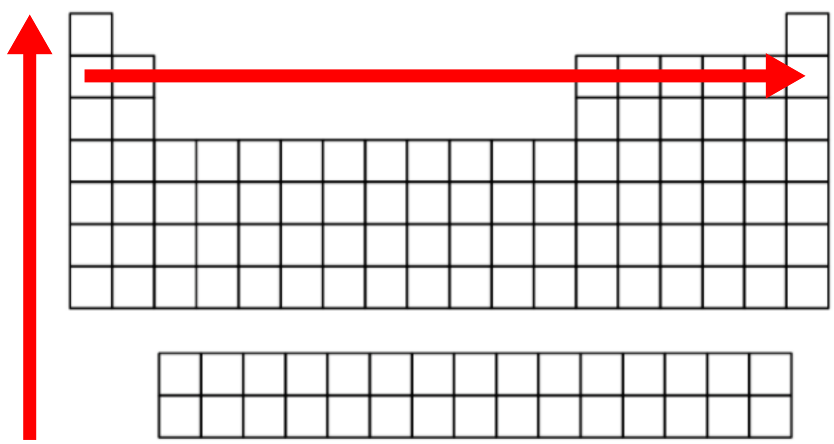
   (c) For your element, write all four quantum numbers for an electron in the valence shell.

   For example, Cl: $n = 2$, $\ell = 1$, $m_\ell = -1$ (or 0 or +1), $m_s = +½$ (or $-½$)

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

   S: 2 Cl: 1 Se: 2 Br: 1

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?

   (i) From $n = 1$ to $n = 2$ (See Figure 7 on page 344 of 5th of textbook)

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

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

Transitions	$1/\lambda$ (nm^{-1})	λ (nm)	λ (m)
From $n = 1$ to $n = 2$	0.008228	121.5	1.215×10^{-7}
From $n = 2$ to $n = 3$	0.001524	656.3	6.563×10^{-7}
From $n = 3$ to $n = 4$	0.0005333	1875	1.875×10^{-6}
From $n = 4$ to $n = 5$	0.0002468	4051	4.051×10^{-6}

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

Ultraviolet (UV)

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*

For $n = 2$, the largest possible value of ℓ is 1, which is a *p*-orbital.

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