6.10

Why do we speak of probabilities when describing an electron's position (2 reasons)?	1) It allows us to conceptualize the electron as a particle, 2) it is appropriate given Heisenberg's uncertainty principle.
According to Heisenberg's uncertainty principle, what two things cannot be measured at the same time?	The velocity and position of a particle (radar example given in class).
What is the probability of finding the electron at a given position related to?	It is related to the square of the electron's amplitude (squared so that the sign of the amplitude becomes irrelevant).
What is meant by electron cloud?	The probability of finding an electron around the nucleus, expressed as a series of dots.
What idea is related to electron cloud? What is meant by this?	Electron density. It's the same as electron cloud, except that now we are equating an electron's position to it's charge.
What aspects of electron density (as represented by orbitals) are we interested in?	The shape, size and orientation of the density/orbital.
How is an orbital commonly defined?	The area in which 90% of the electron density is found.
Why is it useful to think of orbitals in this way?	Because the electron cloud/density does not stop, it just gets weaker as it moves away from the centre of the nucleus.
What is the shape and orientation of an s orbital?	An s orbital is spherical. Thus, it is also completely symmetrical and is the same no matter what the orientation (therefore orientation is irrelevant for s orbitals).
How does a 1s orbital compare to a 2s and 3s?	See figure 6.24. Note the increase in size. Also note that the diagram of the 2s orbital DOES NOT include the 1s orbital. The 2 s orbital has a centre section, that is similar to a 1s orbital, plus a larger sphere around this. Unlike the 1s orbital the 2s has a node where the electron cannot be found. The outer portion of the 2s continues indefinitely.
Define nodal plane.	A plane (i.e. 2 dimensional surface) where the probability of finding an electron is zero.
Describe a p subshell with respect to shape, orientation, and size.	Shape: like two balloons attached at their tips. Orientation: the three p orbitals are at right angles to one another on an xyz axis. Size: increases with the value of n.
What are the shapes and names for the d orbitals?	dxy, dxz, dxy are orbitals that resemble four balloons attached at their tips. These orbitals are at right angles to one another, between the x, y, and z axes. The dx2-y2 is the same as the dxy except that it is rotated 45 degrees on the xy plane. The dz2 is on the z-axis and resembles a p orbital surrounded by a donut (see fig. 6.26 and 6.27).

6.11

How are the sizes of atoms discerned? Give an example.	By examining the distance between nuclei in various compounds. In many hydrocarbons the distance between C and H is about 110 pm (picometers).
What is the distance, in meters, of 1) a nanometer (nm), 2) a picometer (pm), 3) an angstrom (A). Which are SI units?	1 nm = $1x10^{-9}$ m, 1 pm = $1x10^{-12}$ m, 1 A = $1x10^{-10}$ m. nm and pm are SI units.
How do atomic sizes vary over the periodic table?	Top to bottom: Size increases, Left to right: size decreases.
What two factors are important in determining atomic size?	1) The n (principle quantum number) of valence electrons, 2) the strength of attraction between the valence electrons and the centre of the atom.
How does valence electron quantum number influence size?	The greater the value on n, the larger the orbital (see fig 6.4 showing the size of 1s, 2s and 3s orbitals).
What is meant by effective nuclear charge (ENC). What is the ENC for lithium and why?	ENC is the charge on the nucleus plus the charge on the core electrons. Li has an ENC of +1 because the nucleus has 3 protons (+3) and there are 2 core electrons in the 1s subshell (-2).
What happens to the ENC across a period, and why?	It essentially increases by +1 for every increase of Z by 1. This is because while the number of protons in the nucleus is increasing the number of core electrons remains unchanged. The additional electrons, associated with increasing atomic number, are placed in the valence shell, and therefore do not effectively shield the positive nuclear charge.