1. The s orbital is the lowest energy subshell for any shell.

(A) True
(B) False

Hint: The order of the shells is s, p, d, and f.

2. Only 2 electrons are allowed in any s orbital.

(A) True
(B) False

Hint: The first shell, shell s, has only 1 slot.

2 electrons can fit into a slot so long as one is spinning in one direction and the other spins in the other direction.

3. How many electrons are allowed in a p subshell?

(A) 2
(B) 4
(C) 6
(D) 8

Hint: The p orbital has 3 slots, so it can handle 6 electrons, 2 in each slot spinning in opposite directions.

4. How many electrons are allowed in a d subshell?

(A) 4
(B) 6
(C) 8
(D) 10

Hint: The d orbital has 5 slots, so it can handle 10 electrons, 2 in each slot spinning in opposite directions.

5. Subshell d has 5 slots. Which statement is true about subshell d?

(A) All of the electrons in the five slots spin in the same direction
(B) all of the electrons in the five slots have the same energy
(C) each pair of electrons in the five slots orbits the nucleus in the same shaped probability cloud but oriented at a different angle
(D) each pair of electrons in the five slots orbits the nucleus in a different shaped probability cloud

Hint: While the s, p, d, and f orbitals are at increasingly higher energy levels, every slot in each of the s, p, d, and f orbitals is at the same energy level as every other slot in that orbital.

6. An electron in subshell 2p can move to subshell 2d if _____.

(A) if all the slots between 2p and 2d are filled
(B) if a more energetic electron can take its place in the 2p subshell
(C) if the electron can shed exactly the right amount of energy to reach the 2d subshell
(D) if the electron already has the right amount of energy to reach the 2d subshell

Hint: The s, p, d, and f orbitals are at different energy levels.

The difference is measured in steps.

Each step contains Planck's constant worth of energy.

In order for an electron in one orbital to jump to a higher orbital, the electron must have the exact number of Planck's constants worth of energy -- no more, no less.

7. Electrons of increasing energy enter the next higher energy orbital. After the 3p subshell is filled, the next highest subshell is _____.

(A) 3p
(B) 3d
(C) 4s
(D) 4d

Hint: Within the orbitals 1, 2, 3, and 4 are suborbitals s, p, d, and f.

The number of the orbital indicates the number of suborbitals contained in that orbital.

Orbital 1 had 1 suborbital, s.

Orbital 2 has 2 suborbitals, s and p.

Orbital 3 has 3 suborbitals s, p, and d.

Orbital 4 has 4 suborbitals s, p, d, and f.

The first exception to the rule that each suborbital is at a higher energy level than the one before it is the 3p subshell, which is followed not by the 3d suborbital, but by the 4s suborbital.

8. The reason two electrons can both fit into the same slot of a subshell is that _____.

(A) they are moving in different axes
(B) their orbitals have different shapes
(C) they are spinning in the same direction
(D) they are spinning in opposite directions

Hint: 2 electrons in the same slot have to spin in opposite directions because a spinning electron creates a magnetic field.

If the 2 electrons spun in the opposite directions, their magnetic fields would push each other away.

9. Ionization energy is the energy needed to _____.

(A) remove an electron from an atom's outer orbit
(B) remove an electron from an atom's inner orbit
(C) add an electron to an atom's outer orbit
(D) add an electron to an atom's inner orbit

Hint: When an electron added to a neutral atom in a gaseous state makes the atom more stable, the energy released by the atom is its electron affinity in kilojoules per mole.

Electron affinity also refers to the increase in the atom's energy if it takes energy to get the atom to accept the electron.

10. Which element has the highest ionization energy?

(A) sodium
(B) gold
(C) fluorine
(D) neon

Hint: Ionization energy is the energy needed to remove a valence electron.

It takes a great deal of ionization energy to remove one of neon's valance electrons because neon is very stable with its outer ring filled.

11. The removal of electrons from an atom is called _____.

(A) isomerization
(B) oxidation
(C) reduction
(D) hybridization

Hint: An atom's oxidation number indicates how many electrons moved toward or away from its nucleus.

If, for example, 2 electrons moved toward the nucleus, the oxidation number is reduced to –2.

If the 2 electrons moved away from the nucleus, the atom was oxidized to a +2 state.

12. Metals that hold onto their electrons extremely tightly _____.

(A) are called halogen metals
(B) are called transition metals
(C) are called noble metals
(D) have the lowest ionization energies

Hint: Noble metals are fit for a king because they never tarnish.

They never tarnish because they cannot be oxidized.

They cannot be oxidized because they hold on their electrons so tightly.

13. In row 2 of the periodic table, lithium with a single valence electron has a larger electron affinity than beryllium with 2 valence electrons, because _____.

(A) removing lithium's valence electron empties the valence shell
(B) lithium is a light gas than beryllium
(C) beryllium ions are more stable than lithium ions
(D) adding an electron fills lithium's s orbital

Hint: Electron affinity is the energy given up by an atom when it receives an extra electron and becomes more stable.

The extra electron fills up lithium's S orbital, which makes lithium more stable as reflected in its release of energy.