Chp 8 worksheet Answers AP Chemistry

1. Atoms with partially filled orbitals are paramagnetic regardless of whether the atomic number (Z) is odd or even

2.
a. No, you can't have two "upspin" arrows in the same box
b. No, you can't have more than two arrows in any given box (orbital)
c. Yes, this one is Ok
d. Yes, this one is Ok
e) No, The 2p electrons must be parallel

3. a) The s sublevel can only have up to 2 electrons (not $2s^6$)
b) P-sublevel can only have up to 6 electrons (not $2p^7$)
c) 3s comes after 2p. There is no 2d sublevel – mostly Aufbau violation

4.
a) [Ar] [↑↓] (4s) [↑↓][↑↓][↑↓][↑↓][↑↓] (3d) [↑↓][↑↓][↑↓] (4p) = Br^-

b) [Ar] [ ] (4s) [↑↓][↑↓][↑↓][↑][↑] (3d) = Ni^{2+}

c) [Kr] [↑↓] (5s) [↑↓][↑↓][↑↓][↑↓][↑↓] (4d) = Sb^{3+}

d) [Kr] [↑↓] (5s) [↑↓][↑↓][↑↓][↑↓][↑↓] [↑↓][↑↓][↑↓] (5p) = Te^{2-}

5. a) Bi The 6s and 6p electrons are valence => [5 valence electrons]
b) 4th principal shell of Au has filled 4s, 4p, 4d, 4f => [32 electrons total]
c) 5 valence shell electrons would be all elements of group 5A (N, P, As, Sb, Bi) => [5 elements]
d) In Se there are two unpaired 4p electrons [↑↓][↑][↑] (4p)
e) The elements filling the 4d sublevel (in periods) are transition elements. There are [10 elements]

6. a) S paramagnetic (2 partially filled 3p's)
   b) Ba diamagnetic
   c) V^{2+} paramagnetic (3 unpaired 3d electrons)
   d) O^{2-} diamagnetic ("Octet")
   e) Ag paramagnetic (1 unpaired 5s electron)

7. a) S, less nuclear charge
   b) S^{2-}, greater repulsion among electrons.
   c) Mg, less nuclear charge but same period.
   d) F^- greater repulsion among electrons.

8. Ionization energy goes up as electrons are removed. The big jump between I_3 and I_4 is because you are removing an electron from the filled valence of energy level 3.

9. $1s^2 2s^2 2p^6$ goes with 2080 kJ/mol. It has noble gas configuration and its valence e^-'s are also closer to the nucleus.

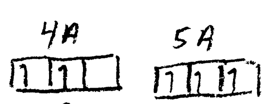
$1s^2 2s^2 2p^6 3s^1$ goes with 496 kJ/mol. It has a single 3s electron and its valence e^-'s are further from the nucleus than the other atom.

10. The level is not the same because of the greater attraction of two protons instead of one, and the repulsion of the two electrons.

$$E_1 = \frac{-2.179 \times 10^{-18} J (2)^2}{1^2} \times \frac{6.022 \times 10^{23} e^-}{1 \text{ mole}^-} \times \frac{kJ}{10^3 J} = \frac{-5.25 \times 10^3 kJ}{mol}$$

This calculation is for the level of 1s in a He^+ ion. The -2.37×10^3 kJ/mol value is for the two electrons in a He atom.

11. a) $Mg^{2+} < Na^+ < F^- < O^{2-}$ ionic radius
    b) $O^{2-} < F^- < Na^+ < Mg^{2+}$ ionization energy

12. 
The 4A group needs one more e^- to half fill its p-sublevel and achieve a semi-stable state. Adding an e^- would disrupt the half-filled p-sublevel for the 5A.

13. Phosphorus has a half-filled 3p-sublevel and is semi stable. Silicon still needs to add another e^- to be half filled.

14. $1\frac{eV}{atom} \times \frac{6.022\times10^{23}\ atoms}{1\ mol} \times \frac{1.6022\times10^{-19}\ C}{1e^-} \times \frac{1\ J}{1\ VC} \times \frac{1\ kJ}{10^3\ J} = [96.49\ kJ/mol]$

15. a) $E_1 = \frac{-2.179\times10^{-18}\ J}{1^2} \times \frac{6.022\times10^{23}\ e^-}{mole^-} \times \frac{1\ kJ}{10^3\ J} = -1.312\times10^3\ kJ/mol$

$I_1 = E_\infty - E_1 = 1.312\times10^3\ kJ/mol$

b) Shortest wavelength = largest E

For Balmer, the shortest wavelength is $\lambda_\infty - \lambda_2$

The longest wavelength for Lyman series is $\lambda_2 - \lambda_1$

In energy terms $I_1 = (E_\infty - E_2) + (E_2 - E_1)$. $I_1 = E_\infty - E_1$, which is the same value calculated above because $E_\infty = 0$

$I_1 = -Rhc \times \left(\frac{1}{\infty} - \frac{1}{2^2}\right) + -Rhc\left(\frac{1}{2^2} - \frac{1}{1^2}\right)$

$I_1 = -2.179\times10^{-18}\ J \times \left(0 - \frac{1}{4}\right) - 2.179\times10^{-18}\ J\left(\frac{1}{4} - 1\right)$

$I_1 = 0.545\times10^{-18}\ J + 1.634\times10^{-18}\ J$

$I_1 = 2.179\times10^{-18}\ J \times \frac{6.022\times10^{23}\ e^-}{mol\ e^-} \times \frac{1\ kJ}{10^3\ J}$

$I_1 = 1.312\times10^3\ kJ/mol$