Chemistry 1.2 Spring 2003 Quiz 1

Physical Constants

$c = 3.00 \times 10^{8}$ m/s $h = 6.63 \times 10^{-34}$ J.s

I. According to Bohr's model of the hydrogen atom, the energy of an electron in the n^{th} quantum level or "shell" is given by

$$E_n = -2.18 \times 10^{-18} \text{ J } (1/n^2)$$

where n is the principal quantum number.

a) Calculate the energy involved in an electron moving from n = 3 to n = 2. Show your work. (5 points)

b) Is the energy absorbed or emitted by the atom? Why? (2 points)

c) Calculate both the frequency and wavelength of the photon of light that is associated with this process. Show formulas used and your setup. (6 points)

d) An electron and a proton are moving at the same velocity. Write the formula for the De Broglie wavelength. Which of the two particles should exhibit the greater wavelength? Why? (3 points)

e) According to Heisenberg's Uncertainty Principle there are 2 measured quantities which can't both be known simultaneously with 100% accuracy for a moving particle. What are they? (2 points)

(over)

II Multiple Choice—2 points each. Circle the correct choice.

1 Which one of the following statements about hydrogen orbitals is incorrect?

a. Both 1s and 2s orbitals have spherical shapes.
b. Both 1s and 2s orbitals have "*l*" quantum numbers of zero.
c. Because of its larger principal quantum number, the 2s orbital has a larger radius than the 1s orbital.
d. The energy of the 2s orbital is less than the energy of the 1s orbital.
e. Both 1s and 2s orbitals have a maximum electron occupancy of 2 electrons.

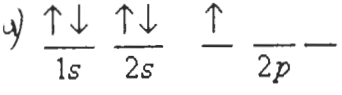
2 Which one of the following atoms has two unpaired electrons?

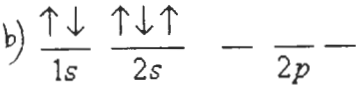
a. Si
b. Al
c. Mg
d. Na
e. P

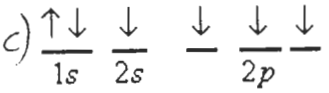
3 What is the correct electronic configuration for Ti?

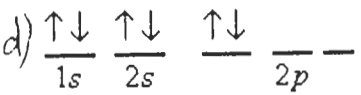
a. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$
b. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$
c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$
e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^2$

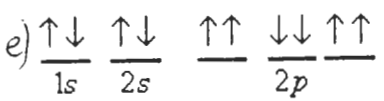
4 Which of the following electron configurations is possible for an atom in its ground electronic state?

a) 

b) 

c) 

d) 

e) 

5. Which of the following sets of quantum numbers is **NOT** allowed?

A) n = 1, l = 0, ml = 0, ms = +1/2
B) n = 8, l = 4, ml = –2, ms = –1/2
C) n = 3, l = 1, ml = 0, ms = +1/2
D) n = 5, l = 4, ml = 3, ms = –1/2
E) n = 2, l = 2, ml = –1, ms = +1/2