CHM151 Quiz 7a 25 Pts Spring 2013 Name: Key

Formulas: $e = mc^2$ $E = hv$ $c = \lambda v$ $\Delta E = -R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ $R_H = 2.178 \times 10^{-18}$

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

SHOW ALL WORK TO RECEIVE CREDIT

1. (4Pts) Calcualte the frequency of light having a wavelength of 680 nm. ($n = 10^{-9}$)

$\nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m}}{\text{s}} \Big| \frac{1}{680 \times 10^{-9} \text{ m}} = 4.4 \times 10^{14} \text{ s}^{-1}$

2.(3Pts) What is the wavelength for a photon of light with an energy of 3.20×10^{-19} J/photon?

$E = h\nu$, $\nu = \frac{c}{\lambda}$ $E = h\frac{c}{\lambda}$ $\lambda = \frac{hc}{E} = 6.22 \times 10^{-7}$ m

3.(4 Pts) Write the **complete** electron configuration for Ni and state whether Ni would be diamagnetic or paramagnetic.

Ni $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$ paramagnetic

4.(3Pts) Write the ground state electron configuration for the selenium atom using shorthand notation and state whether Se would be diamagnetic or paramagnetic.

Se [Ar] $4s^2 3d^{10} 4p^4$ paramagnetic

5.(3 Pts) What is the total number of electrons possible in the 2*p* orbitals?

3 orbitals 6 e⁻'s

6.(3Pts) Calculate the energy of a photon of light with a wavelength of 460 nm. ($n = 10^{-9}$)

$E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}{460 \times 10^{-9} \text{ m}} \Big| \frac{3.00 \times 10^8 \text{ m}}{\text{s}} = 4.32 \times 10^{-19}$ J

7.(5Pts) Calculate the energy, in joules, required to excite a hydrogen atom by causing an electronic transition from the n = 1 to the n = 3 principal energy level. Recall that the energy levels of the H atom are given by: $E_n = -2.18 \times 10^{-18}$ J$(1/n^2)$

$E_1 = \frac{-2.18 \times 10^{-18}}{1^2} = -2.18 \times 10^{-18}$ J

$E_3 = -\frac{2.18 \times 10^{-18}}{3^2} = -2.42 \times 10^{-19}$ J

$\Delta E = 1.94 \times 10^{-18}$ J

CHM151 Quiz 7b 25 Pts Spring 2013 Name: Key

Formulas: $e = mc^2$ $E = h\nu$ $c = \lambda\nu$ $\Delta E = -R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ $R_H = 2.178 \times 10^{-18}$

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

SHOW ALL WORK TO RECEIVE CREDIT

1. (4Pts) What is the wavelength for a photon of light with an energy of 3.20×10^{-19} J/photon?

$E = h\nu$

$\nu = \frac{c}{\lambda}$ $E = h\frac{c}{\lambda}$ $\lambda = \frac{hc}{E} = 6.22 \times 10^{-7}$ m

2.(3Pts) Calcualte the frequency of light having a wavelength of 680 nm. ($n = 10^{-9}$)

$\nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m}}{\text{s}} \Big/ 6.80 \times 10^{-7} \text{ m} = 4.4 \times 10^{14} \text{ s}^{-1}$

3.(4 Pts) Write the **complete** electron configuration for Co and state whether Co would be diamagnetic or paramagnetic.

Co $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$ paramagnetic

4.(3Pts) Write the ground state electron configuration for the selenium atom using shorthand notation and state whether Se would be diamagnetic or paramagnetic.

Se [Ar] $4s^2 3d^{10} 4p^4$ paramagnetic

5.(3 Pts) What is the total number of electrons possible in the 2*p* orbitals?

3 orbitals 6 e⁻s

6.(3Pts) Calculate the energy of a photon of light with a wavelength of 360 nm. ($n = 10^{-9}$)

$E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}{360 \times 10^{-9} \text{ m}} \Big| \frac{3.00 \times 10^8 \text{ m}}{\text{s}} = 5.5 \times 10^{-19}$ J

7.(5Pts) Calculate the energy, in joules, required to excite a hydrogen atom by causing an electronic transition from the n = 1 to the n = 4 principal energy level. Recall that the energy levels of the H atom are given by: $E_n = -2.18 \times 10^{-18}$ J$(1/n^2)$

$E_1 = \frac{-2.18 \times 10^{-18}}{1^2} = -2.18 \times 10^{-18}$ J

$E_4 = \frac{-2.18 \times 10^{-18}}{4^2} = -1.36 \times 10^{-19}$ J

$\Delta E = 2.04 \times 10^{-18}$ J