

Formulas: $e = mc^2$ $E = h\nu$ $c = \lambda\nu$ $\Delta E = -R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ $R_H = 2.178 \times 10^{-18}$
 $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$ $c = 3.00 \times 10^8 \text{ m/s}$

SHOW ALL WORK TO RECEIVE CREDIT

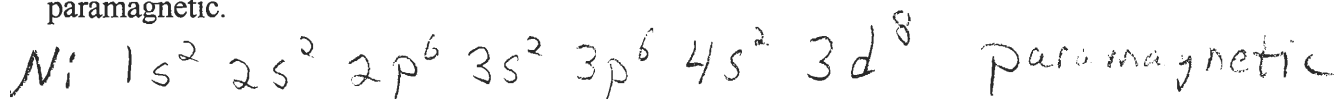
1. (4Pts) Calculate the frequency of light having a wavelength of 680 nm. ($n = 10^{-9}$)

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

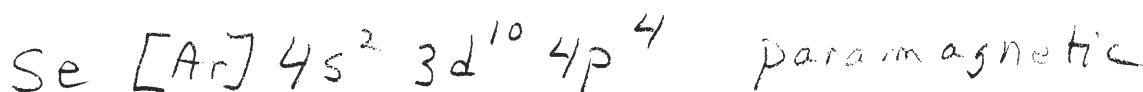
2. (3Pts) What is the wavelength for a photon of light with an energy of $3.20 \times 10^{-19} \text{ J/photon}$?

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

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



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

3 orbitals $6e^-$

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

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

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

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

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

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

Formulas: $e = mc^2$ $E = h\nu$ $c = \lambda\nu$ $\Delta E = -R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$ $R_H = 2.178 \times 10^{-18}$
 $h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$ $c = 3.00 \times 10^8 \text{ m/s}$

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

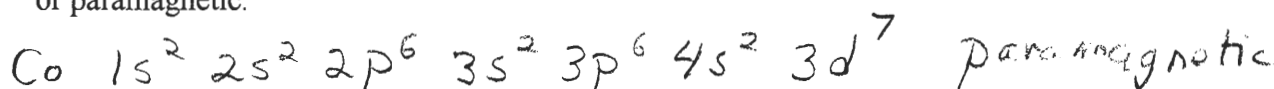
$$E = h\nu$$

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

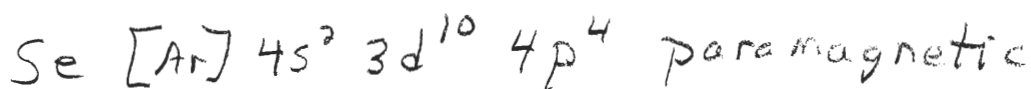
2. (3Pts) Calculate the frequency of light having a wavelength of 680 nm. ($n = 10^{-9}$)

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

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



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



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

3 orbitals $6e^-$

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

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

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

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

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

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