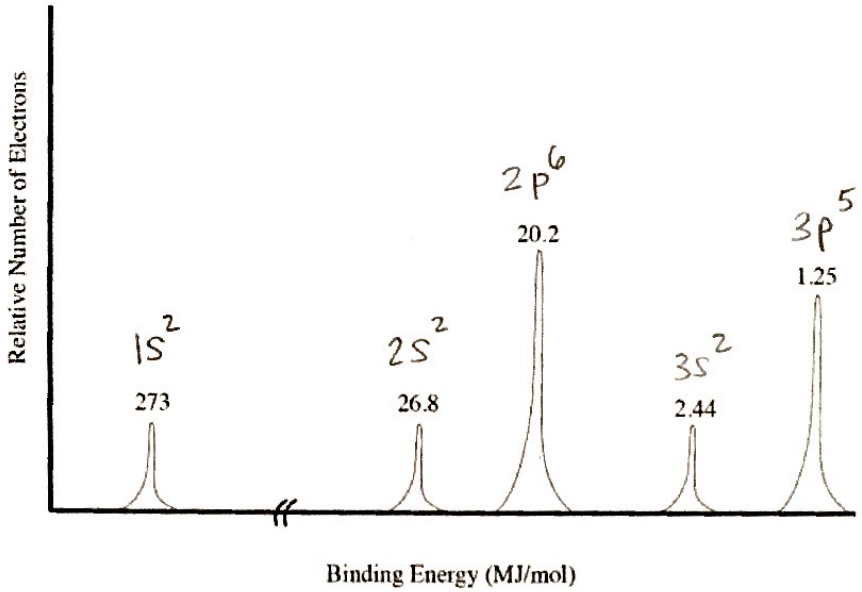
Free Response Practice (Cracking the AP Chem Exam, Practice FR #4, edited, 7 points)



1. The above PES belongs to a neutral chlorine atom.
   a. What energy of light, in MJ/mol, would be required to eject a 3*s* electron from chlorine? (1 point)
   b. What wavelength of light, in m, would be required to eject the same 3*s* electron? (2 points)

   A second PES is run, this time for a sample of chloride ions.

   c. For the PES of a chloride ion, how would the following variables compare to the peaks on the PES above? Justify your answers.
      i. Number of peaks (1 point)
      ii. Height of peaks (1 point)
   d. Draw the orbital diagram for a chloride ion. (1 point)
   e. Identify the noble gas which is isoelectronic to a chloride ion. (1 point)

(a) 2.44 MJ/mol

(b) $\frac{2.44\ MJ}{1\ mol} \times \frac{1E6\ J}{1\ MJ} \times \frac{1\ mol}{6.022E23\ electrons} = 4.05 \times 10^{-18}\ J$

$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{(6.626E{-}34\ J{\cdot}s)(2.998E8\ m/s)}{4.05E{-}18\ J}$

$= \boxed{4.90 \times 10^{-8}\ m}$

(c.) A chloride ion has 1 more e^-, which would be added to the 3p sublevel, making 6 e^- in the 3p sublevel.

(i) Since the rightmost peak already represents the 3_p sublevel, no new peaks are added ⇒ peak # remains the same.

(ii) The first 4 peaks would stay the same height, but the last 3_p peak would increase in height by 1 e^-, making it equal in height to the 2_p peak in the middle.

d.) Cl^-: $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$ $\underline{\uparrow\downarrow}$

1s 2s 2p 3s 3p

e.) Ar