Quantum Model Worksheet

1. List four possible quantum numbers for the highest energy electron in the Cl⁻ ion.

   \[ n = 3 \quad l = 1 \quad m_l = \pm 1, 0 \quad m_s = \pm \frac{1}{2} \]

   Then indicate which number relates to the orientation of the orbital, the main shell, the direction of the spin, and the shape of the orbital.

   \[ n \text{ relates to: MAIN SHELL} \]
   \[ l \text{ relates to: SHAPE OF ORBITAL / SUBLEVEL} \]
   \[ m_l \text{ relates to: ORIENTATION} \]
   \[ m_s \text{ relates to: SPIN} \]

2. Sketch a box diagram for the electronic ground state of Cu⁺. Label as paramagnetic or diamagnetic.

   \[ \text{Cu: } [Ar] 3d^{10} 4s^1 \quad \text{Cu}^+: [Ar] 3d^{10} \]
   \[ \text{DIAMAGNETIC} \]

3. Circle the largest & give the reason for your choice below each line.

   \begin{align*}
   \text{Size} & \quad \text{Sr} \quad \text{Ca} \quad \text{K} \quad \text{Rb} \quad \downarrow \\
   \text{Size} & \quad \text{Rb}^+ \quad \text{Sr}^{2+} \quad \text{Br} \quad \text{K}^+ \quad \text{Rb}^+, \text{Sr}^{2+}, \text{Br}^- \text{ have same # of } e^- \text{, Br}^- \text{Fence p}^+ \\
   1^{st} \text{ I.E.} & \quad \text{Br} \quad \text{O} \quad \text{C} \quad \text{P} \quad \rightarrow \\
   2^{nd} \text{ I.E.} & \quad \text{K} \quad \text{Rb} \quad \text{Sr} \quad \text{Ca} \quad \text{Both have noble gas config with removal of 1e}^- \text{, So removal of 2e}^- \text{ is hard. K is smaller so nucleus can pull harder} \\
   \text{E.A.} & \quad \text{O} \quad \text{K} \quad \text{B} \quad \text{Na} \quad \text{(largest=most exothermic)} \quad \rightarrow \quad \uparrow
   \end{align*}