1. (a) Sketch the radial probability distribution for a 5d orbital in a carbon atom. You should label the axes, but do not need to include numbers. Use arrows to indicate the radial nodes.
(b) Label the most probable radius, \( r_{mp} \), on your 5d radial probability distribution with an *.

   (a) radial nodes: 2

   (b) see * on rpd

2. Provide the ground state electron configuration expected for:
   (a) Ca
   (b) V
   (c) Cu
   (d) Br\(^+\)
   (e) Fe\(^{2+}\)
   (f) Hf

   Note that you may always use the shorthand (noble gas) configuration unless specifically asked otherwise.

   Also correct if all of the core electrons are explicitly written out (correctly).
   (a) \([\text{Ar}]4s^2\)
   (b) \([\text{Ar}]4s^23d^1\)
   (c) \([\text{Ar}]4s^33d^{10}\)
   (d) \([\text{Kr}]\)
   (e) \([\text{Ar}]3d^6\)
   (f) \([\text{Xe}]6s^24f^45d^2\)

3. The binding energy for a 3s electron in technetium (\(Z = 43\)) is -1090 eV.
   (a) Calculate the effective nuclear charge, \(Z_{\text{eff}}\), experienced by a 3s electron in technetium.
   (b) Identify the most likely binding energy for a 3s electron in ruthenium (\(Z = 44\)) from the following three options: -980 eV, -1090 eV, or -1140 eV. Explain your reasoning.

   (a) \(Z_{\text{eff}} = 26.8\)
   (b) -1140 eV