Honors Chemistry Midterm Exam 2018-2019   Name _____

Part 1. Complete the multiple choice portion of the exam.
Part 2. Short Answer and Problem Solving.

1. **Consider a neutral atom of Bromine (Br)**
   a. Draw an Aufbau orbital diagram for Br

   b. Give the electron configuration using the noble gas abbreviation: _____

   c. An atom of bromine has a larger atomic radius than an atom of oxygen. Justify this statement.

   d. When an atom of bromine forms an ion, will it be larger, smaller, or the same size as the neutral atom?
      Include the charge on the ion that forms as part of your explanation. How did the atomic structure
      change from the atom to the ion?

2. **A neutral atom, X, has 83 protons, 127 neutrons, and 83 electrons.**
   a. Write the nuclear symbol for this atom in the space to the right.

   □
   □ **X**
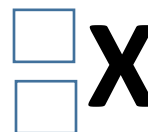
   b. There is one other isotope of element X, with 124 neutrons that makes up 35.0 % of
      naturally occurring X.   Calculate the average atomic mass of element X.

3. **Ytterbium-175 undergoes alpha decay.**
   a. Write the nuclear reaction for this process.

   b. The product of this reaction, in addition to the alpha particle, will undergo many other radioactive decay
      processes until finally producing an isotope of Iodine-127. Why does the process stop when Iodine-127
      is produced? Use a calculation comparing neutrons to protons to support your answer.

c. One of the reactions in this decay series involves a conversion from Terbium-160 to an isotope of tin. Terbium-160 has a half-life of 3.25 hours. If 5.0 g of lead-210 is present initially, how much will remain after 26 hours?

4. **A student collects the following data in order to determine the specific heat capacity of chromium.**
   a. Use the data in the table to the right to calculate the experimental value for the specific heat capacity of chromium. Round your answers to the appropriate number of significant figures and include units.

Mass of metal sample	62.0 g
Mass of water in calorimeter	74.0 g
Initial temperature of heated metal	98 °C
Initial temperature of water in calorimeter	21.9 °C
Final temperature of mixture	26.3 °C

   b. The accepted value for the specific heat of chromium is 0.42 J/g°C. Calculate the student's percent error.

5. **The black cylinder in the diagram to the right is suspended in a sample of ethanol. The 3.0 cm long cylinder has a mass of 17.0 g. What is the diameter of the cylinder in centimeters? Round your answers to the appropriate number of significant figures and include units.** (The density of ethanol is 0.78 g/mL) ($V_{cylinder} = \pi r^2 h$)