6. Use the principles of atomic structure and/or chemical bonding to explain each of the following. In each part, your answer must include references to both substances.

   (a) The atomic radius of Li is larger than that of Be.

   (b) The second ionization energy of K is greater than the second ionization energy of Ca.

   (c) The carbon-to-carbon bond energy in C_2H_4 is greater than it is in C_2H_6.

   (d) The boiling point of Cl_2 is lower than the boiling point of Br_2.

Answer EITHER Question 7 below OR Question 8 printed on page 12. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 15 percent.

7. An environmental concern is the depletion of O_3 in Earth's upper atmosphere, where O_3 is normally in equilibrium with O_2 and O. A proposed mechanism for the depletion of O_3 in the upper atmosphere is shown below.

$$\text{Step I} \quad O_3 + Cl \rightarrow O_2 + ClO$$
$$\text{Step II} \quad ClO + O \rightarrow Cl + O_2$$

   (a) Write a balanced equation for the overall reaction represented by Step I and Step II above.

   (b) Clearly identify the catalyst in the mechanism above. Justify your answer.

   (c) Clearly identify the intermediate in the mechanism above. Justify your answer.

   (d) If the rate law for the overall reaction is found to be $rate = k[O_3][Cl]$, determine the following.

      (i) The overall order of the reaction

      (ii) Appropriate units for the rate constant, k

      (iii) The rate-determining step of the reaction, along with justification for your answer

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