

2005 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS

Answer EITHER Question 7 below OR Question 8 printed on page 14. 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. Use principles of atomic structure, bonding, and/or intermolecular forces to respond to each of the following. Your responses must include specific information about all substances referred to in each question.

- (a) At a pressure of 1 atm, the boiling point of $\text{NH}_3(l)$ is 240 K, whereas the boiling point of $\text{NF}_3(l)$ is 144 K.
- Identify the intermolecular force(s) in each substance.
 - Account for the difference in the boiling points of the substances.
- (b) The melting point of $\text{KCl}(s)$ is 776°C , whereas the melting point of $\text{NaCl}(s)$ is 801°C .
- Identify the type of bonding in each substance.
 - Account for the difference in the melting points of the substances.
- (c) As shown in the table below, the first ionization energies of Si, P, and Cl show a trend.

Element	First Ionization Energy (kJ mol^{-1})
Si	786
P	1,012
Cl	1,251

- For each of the three elements, identify the quantum level (e.g., $n = 1$, $n = 2$, etc.) of the valence electrons in the atom.
 - Explain the reasons for the trend in first ionization energies.
- (d) A certain element has two stable isotopes. The mass of one of the isotopes is 62.93 amu and the mass of the other isotope is 64.93 amu.
- Identify the element. Justify your answer.
 - Which isotope is more abundant? Justify your answer.