

Topics 1.7 – 1.8: MCQ Practice

Element	Atomic Radius	First Ionization Energy
Calcium	194 pm	590 kJ/mol
Potassium	–	–

- Based on periodic trends and the data in the table above, which of the following are the most probable values of the atomic radius and the first ionization energy for potassium, respectively?
 - 242 pm, 633 kJ/mol
 - 242 pm, 419 kJ/mol
 - 120 pm, 633 kJ/mol
 - 120 pm, 419 kJ/mol
- Which of the following correctly identifies which has the higher first-ionization energy, Cl or Ar, and supplies the best justification?
 - Cl, because of its higher electronegativity
 - Cl, because of its higher electron affinity
 - Ar, because of its completely filled valence shell
 - Ar, because of its higher effective nuclear charge
- Which of the following correctly compares periodic properties of two elements and provides an accurate explanation for that difference?
 - The first ionization energy of Si is greater than that of C because Si has a greater number of protons in its nucleus than C has.
 - The first ionization energy of Cl is greater than that of S because S has a higher electronegativity than Cl has.
 - The atomic radius of Br is larger than that of Cl because Br has one more occupied electron shell, which increases the distance between the valence electrons and the nucleus.
 - The atomic radius of Ca is smaller than that of Mg because Ca has a larger nuclear charge than Mg does.

Element	First Ionization Energy (kJ/mol)	Atomic Radius (pm)
B	801	85
C	1086	77
N	1400	75
O	1314	73
F	1680	72
Ne	2080	70

4. The table above shows the first ionization energy and atomic radius of several elements. Which of the following best helps to explain the deviation of the first ionization energy of oxygen from the overall trend?
- (A) The atomic radius of oxygen is greater than the atomic radius of fluorine.
- (B) The atomic radius of oxygen is less than the atomic radius of nitrogen.
- (C) There is repulsion between paired electrons in oxygen's $2p$ orbitals.
- (D) There is attraction between paired electrons in oxygen's $2p$ orbitals.

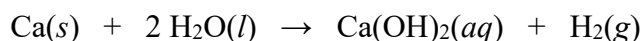
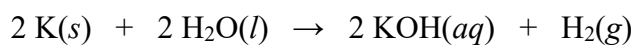
	Ionization Energy (kJ/mol)
First	801
Second	2,430
Third	3,660
Fourth	25,000
Fifth	32,820

5. The first five ionization energies of a second-period element are listed in the table above. Which of the following correctly identifies the element and best explains the data in the table?
- (A) B, because it has five core electrons
- (B) B, because it has three valence electrons
- (C) N, because it has five valence electrons
- (D) N, because it has three electrons in the p sublevel

	Ionization Energy (kJ/mol)
First	738
Second	1,451
Third	7,733
Fourth	10,543
Fifth	13,630

6. Based on the ionization energies of element X given in the table above, which of the following is most likely to be the empirical formula of an oxide of element X?

- (A) XO
- (B) XO₂
- (C) X₂O
- (D) X₂O₃



7. Both K(s) and Ca(s) react with water according to the equations shown above. Which of the following identifies the element that reacts more vigorously with water and provides the correct justification?

	Element that reacts more vigorously with water	Justification
(A)	K	The first ionization energy of K is less than that of Ca.
(B)	K	In aqueous solution, the attraction between K ⁺ (aq) and H ₂ O molecules is stronger than the attraction between Ca ²⁺ (aq) and H ₂ O molecules.
(C)	Ca	The first ionization energy of K is less than that of Ca.
(D)	Ca	In aqueous solution, the attraction between Ca ²⁺ (aq) and H ₂ O molecules is stronger than the attraction between K ⁺ (aq) and H ₂ O molecules.

Appearance	white powder
Solubility	75 g CaCl ₂ per 100 mL H ₂ O
Melting point	772°C

8. Properties of the compound CaCl₂ are listed in the table above. On the basis of periodic properties, which of the following compounds should have properties that are most similar to those of CaCl₂?
- (A) SCl₂
- (B) BaCl₂
- (C) BCl₃
- (D) CCl₄
9. Based on the positions of elements in the periodic table, which of the following pairs contains compounds that are most likely to have similar chemical properties?
- (A) SeO₂ and TiO₂
- (B) CaC₂ and CaF₂
- (C) MgCl₂ and MgBr₂
- (D) ScCl₃ and PCl₃