**Topics 1.4 – 1.6: MCQ Practice**

1.  A student performed a gravimetric analysis experiment to determine the percentage of Ag by mass in an alloy containing a mixture of Ag and Cu. A sample of the alloy is dissolved completely in a solution of $HNO_3(aq)$, forming the aqueous ions $Ag^+(aq)$ and $Cu^{2+}(aq)$. An excess amount of $NaCl(aq)$ is added to this solution, causing the formation of a precipitate, $AgCl(s)$. The student collects the precipitate by filtration, dries it, and records its mass. Data from the experiment is shown below.

    | Mass of Ag/Cu alloy | 2.00 g |
    | --- | --- |
    | Mass of AgCl(s) precipitate | 0.72 g |

    Based on the information in the data table, which of the following best represents the percent of Ag by mass in the alloy?

    (A) 27%

    (B) 36%

    (C) 54%

    (D) 75%

2.  The mass percent of potassium in pure $K_2SO_4$ is 45 percent. A chemist analyzes an impure sample of $K_2SO_4$ and determines that the mass percent of potassium is 50 percent. Which of the following impurities could account for the high mass percent of potassium in the sample?

    (A) KBr

    (B) KI

    (C) KCN

    (D) $KMnO_4$

3.  A mixture of LiCl and NaCl is analyzed and found to contain 5.00 percent Li by mass. Which of the following best represents the mass percent of LiCl in this mixture?

    (A) 11.8%

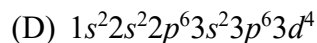    (B) 30.5%

    (C) 72.0%

    (D) 81.9%
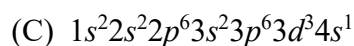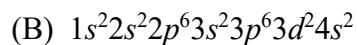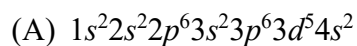
4. Which of the following represents the ground state electron configuration for an atom of tin (Sn)?

(A) $[Kr]\, 5s^2 5p^2$

(B) $[Kr]\, 4d^{10} 5s^2 5p^2$

(C) $[Kr]\, 5d^{10} 5s^2 5p^2$

(D) $[Kr]\, 4d^{10} 5p^2$
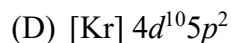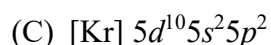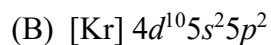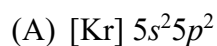
5. Which of the following choices correctly identifies the number of unpaired electrons in the ground state electron configuration for an atom of that element?

|  | Element | Number of Unpaired Electrons |
| --- | --- | --- |
| (A) | S | 1 |
| (B) | Mg | 2 |
| (C) | Co | 3 |
| (D) | Ti | 4 |

6. Which of the following represents the ground state electron configuration for the $Mn^{3+}$ ion?

(A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

(B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^2$

(C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^1$

(D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

7. The binding energy is 2.37 MJ/mol for the $1s$ electrons in a helium atom. Which of the following correctly identifies the binding energy values for the $1s$ electrons of lithium (Li) and beryllium (Be) and provides the correct justification?

|  | Binding Energy of $1s$ Electrons in Li (MJ/mol) | Binding Energy of $1s$ Electrons in Be (MJ/mol) | Justification |
| --- | --- | --- | --- |
| (A) | 6.26 | 11.5 | Li atoms have a smaller nuclear charge than Be atoms. |
| (B) | 6.26 | 11.5 | Be atoms experience greater electron-electron repulsions than Li atoms do. |
| (C) | 11.5 | 6.26 | Li atoms have a smaller nuclear charge than Be atoms. |
| (D) | 11.5 | 6.26 | Be atoms experience greater electron-electron repulsions than Li atoms do. |

Binding Energy (MJ/mol)
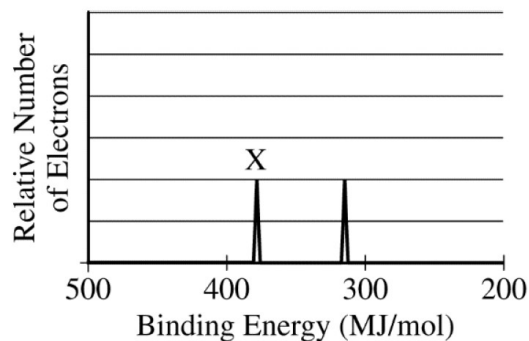
8. The photoelectron spectra of the $1s$ electrons of two isoelectronic species, $Ca^{2+}$ and Ar, are shown above. Which of the following correctly identifies the species associated with peak X and provides a valid justification?

(A) Ar, because it has completely filled energy levels

(B) Ar, because its radius is smaller than the radius of $Ca^{2+}$

(C) $Ca^{2+}$, because its nuclear mass is greater than that of Ar

(D) $Ca^{2+}$, because its nucleus has two more protons than the nucleus of Ar has



Binding Energy (MJ/mol)
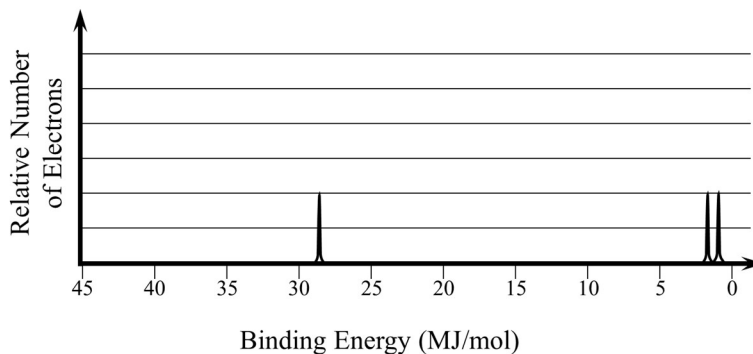
9. The complete photoelectron spectrum of a pure element is shown in the diagram above. According to the complete photoelectron spectrum, which of the following is the identity of the element?

(A) lithium (Li)

(B) boron (B)

(C) carbon (C)

(D) nitrogen (N)