

Ion formation

Answer all the questions below as fully as you can then check your answers

1. Write out the electron configuration for the following:
 - a. Al and Al^{3+}
 - b. Sc and Sc^{2+}
 - c. Mg and Mg^{2+}
 - d. Fe and Fe^{2+} and Fe^{3+}
2. Write out the electronic configuration of Cu and also for the following two ions:
 Cu^+ and Cu^{2+}
 - b. Which of the ions do you think is the more stable? Explain your choice.
 - c. Manganese has many ions. Two common ions are Mn^{2+} and Mn^{3+} , write out the electronic configuration of these two ions and explain which is likely to be the most stable.
3. Use your knowledge of electron configurations to name a cation, an anion and an atom with the electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6$

Answers

1. Write out the electron configuration for the following:

a. Al and Al^{3+} b. Sc and Sc^{2+} c. Mg and Mg^{2+} d. Fe and Fe^{2+} and Fe^{3+}

1a. Al: $1s^2 2s^2 2p^6 3s^2 3p^1$ Al^{3+} : $1s^2 2s^2 2p^6$ same as neon

1b. Sc: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$ Sc^{2+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$

1c. Mg: $1s^2 2s^2 2p^6 3s^2$ 1a. Mg^{2+} : $1s^2 2s^2 2p^6$ same as neon

1d. Fe: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

Fe^{2+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

Fe^{3+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$ this ion has half-filled d-orbitals and will be more stable than the Fe^{2+} ion.

2. Write out the electronic configuration of Cu and also for the following two ions:

Cu^+ and Cu^{2+}

Cu: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

Cu^+ : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$

Cu^{2+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$

b. Which of the ions do you think is the more stable? Explain your choice.

The Cu^+ ion has a full d-orbitals and will be more stable than the Cu^{2+} ion.

c. Manganese has many ions. Two common ions are Mn^{2+} and Mn^{3+} , write out the electronic configuration of these two ions and explain which is likely to be the most stable.

Mn: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Mn^{2+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

Mn^{3+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

same argument as with copper, the ion with either full or half-full d-orbitals will be more stable. In this case its Mn^{2+}

3. Use your knowledge of electron configurations to name a cation, an anion and an atom with the electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6$

Cation: could be K^+ , Ca^{2+} or any cation with 18 electrons.

Anion could be S^{2-} , Cl^- , P^{3-} or any anion with 18 electrons.

Atom is Kr