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

Transition metal ions

1. Write out the full electron configuration for the following atoms and ions:
   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. 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. 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+} : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

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 Ar