**Quick Check (p. 293)**

1.

| Property | Family Number | Family Name |
|---|---|---|
| (a) reactive non-metals possessing 7 valence electrons | 17 | halogens |
| (b) reactive solids that form 2+ cations during reactions | 2 | alkaline earth metals |
| (c) invisible gases that are almost totally unreactive | 18 | noble gases |
| (d) soft, very reactive silvery solids with 1 valence electron | 1 | alkali metals |

2. The chemical formulas are:

(a) NaI (b) BaS (c) $GaCl_3$ (d) $Rb_2S$ (e) $Mg_3P_2$ (f) $H_2Se$

3. The two families of the periodic table containing the most reactive elements are the halogens and the alkali metals. Elements in each of these families are within one electron of being isoelectronic with the nearest noble gas and readily either gain or lose one electron respectively to achieve that electron arrangement.

**6.1 Review Questions (p. 297)**

1. The most important thing to know about the periodic table is that elements in the same chemical family have similar chemical properties.

2. In 1913, data gathered by the young British chemist Henry Moseley, combined with the discovery of isotopes, resulted in the elements of the periodic table being re-ordered according to their atomic numbers rather than their atomic masses.

3. Elements in the same chemical family have similar chemical properties because they have similar outer electron configurations and the valence electrons are the electrons involved in chemical reactions.

4. (a) The most metallic elements are located in the lower left portion of the periodic table.
(b) The most non-metallic (or least metallic) elements are located in the upper right portion of the periodic table.

5.

| Element | Properties | Letter and Symbol |
|---|---|---|
| (a) chlorine | found in carbohydrates and an elemental gas in 21% of the atmosphere | (e) O |
| (b) silver | soft conductor that reacts explosively with water producing $H_2$ gas | (d) Cs |
| (c) neon | less than 1 ounce of this solid radioactive nonconductor exists on Earth | (h) At |
| (d) cesium | waxy yellow solid non-metal found in match heads, fertilizers, and detergents | (f) P |
| (e) oxygen | blue-gray metalloid used extensively in the computer industry | (g) Si |
| (f) phosphorus | very reactive green gas used in the trenches in World War I | (a) Cl |
| (g) silicon | shiny solid that is the best conductor of heat and electricity | (b) Ag |
| (h) astatine | invisible unreactive gas used in lasers and some electric street signs | (c) Ne |

6.

| Element Properties | Family Number |
|---|---|
| unreactive gas used in electric street signs comprising 0.93 % of the atmosphere | 18 |
| shiny multivalent solid, good conductor, forms coloured compounds | 6 |
| soft silvery solid, good conductor, reacts vigorously with water | 1 |
| gray-white metalloid predicted by Mendeleev and discovered in 1886 | 14 |
| reactive metal present in bones and teeth possessing two valence electrons | 2 |
| yellow-green gaseous non-metal and the most reactive of all the elements | 17 |

7. Properties of metals include:

- solids at room temperature, except for mercury, which is a liquid
- generally shiny or lustrous when freshly cut or polished
- good conductors of heat and electricity
- generally malleable, which means they can be rolled or hammered into thin sheets
- generally ductile, which means they can be rolled or stretched into wires
- generally flexible as thin sheets or wires
- during chemical changes, tend to give up electrons relatively easily to form cations

8. Properties of non-metals include:

- usually gases or brittle solids at room temperature, except for liquid bromine
- solid non-metals can range in appearance from dull or lustrous and translucent to opaque
- poor conductors of heat and electricity
- during chemical changes, they tend to gain electrons from metals to form anions or share electrons with other non-metals.

9. Except where large ionic charges result, atoms of the main group elements will tend to give up or gain as many electrons as are necessary to acquire the valence electron configuration of the nearest noble gas.

10. The formulas for the stable ions are:
(a) $Be^{2+}$ (b) $Te^{2-}$ (c) $Cs^{+}$ (d) $Ra^{2+}$ (e) $Ga^{3+}$ (f) $Se^{2-}$ (g) $In^{3+}$

11. (a) Properties of the alkali metals include:

- all soft, silvery solids
- the most reactive of all metals
- the oxide compounds of the alkali metals dissolve in water to produce strongly basic solutions
- all corrode rapidly in air to a dull gray appearance, react vigorously with water to produce hydrogen gas
- readily form compounds with non-metals
- readily lose that outer electron to form 1+ cations and so assume the electron configuration of previous noble gas

(b) Properties of the alkaline earth metals include:

- silver-coloured reactive metals.
- not as reactive as the alkali metals, but also readily form compounds with non-metals
- their oxides are also alkaline in solution but unlike alkali compounds, a number of group 2 compounds have a low solubility in water
- readily form 2+ cations by losing those two valence electrons and so will achieve the identical electron configuration of the nearest noble gas

(c) Properties of the halogens include:

- the most reactive family of elements in the periodic table
- the only chemical family in which all three states of matter are represented
- elemental halogens exist as diatomic molecules
- readily form compounds with metals, hydrogen, carbon, and other non-metals
- when reacting with metals, halogens typically gain a single electron forming 1– anions
- when reacting with non-metals, halogens will often share valence electrons

(d) Properties of the noble gases include:

- colourless gases
- generally unreactive
- all of the noble gases, except helium, have filled s and p sublevels and thus have "stable octets"

12.

| Group 2 | Core Notation | Group 17 | Core Notation | Group 18 | Core Notation |
|---|---|---|---|---|---|
| Be | [He] $2s^2$ | F | [He]$2s^2\,2p^5$ | He | $1s^2$ (no core notation) |
| Mg | [Ne] $3s^2$ | Cl | [Ne] $3s^2 3p^5$ | Ne | [He] $2s^2 2p^6$ |
| Ca | [Ar]$4s^2$ | Br | [Ar] $4s^2 4p^5$ | Ar | [Ne] $3s^2 3p^6$ |
| Sr | [Kr] $5s^2$ | I | [Kr] $5s^2 4d^{10} 5p^5$ | Kr | [Ar] $4s^2 3d^{10} 4p^6$ |
| Ba | [Xe]$6s^2$ | At | [Xe] $6s^2\,4f^{14}\,5d^{10}\,6p^5$ | Xe | [Kr] $5s^2 4d^{10} 5p^6$ |
| Ra | [Rn] $7s^2$ | | | Rn | [Xe] $6s^2\,4f^{14}\,5d^{10}\,6p^6$ |