7. Microwave ovens heat food by the energy given off by microwaves. These microwaves have a wavelength of 5.00×10^{6}nm.

(a) How much energy in kilojoules per mole is given off by a microwave oven?

$$E_{particle} = h\nu = h\frac{c}{\lambda}$$

$$E = E_{particle} N_A = h\frac{c}{\lambda} N_A = (6.626\times10^{-34} J\cdot s)\frac{(2.998\times10^{8} m/s)}{5.00\times10^{-3} m}(6.022\times10^{23} mol^{-1})$$

$$= \underline{2.39\times10^{-2} kJ/mol}$$

(b) Compare the energy obtained in (a) with that given off by the ultraviolet rays ($\lambda \approx$100nm) of the Sun that you absorb when you try to get a tan.

$$E = E_{particle} N_A = h\frac{c}{\lambda} N_A = (6.626\times10^{-34} J\cdot s)\frac{(2.998\times10^{8} m/s)}{1.00\times10^{-7} m}(6.022\times10^{23} mol^{-1})$$

$$= \underline{1.2\times10^{3} kJ/mol}$$

Much Larger!!!

37. Which of the following electron configurations are for atoms in the ground state? In the excited state? Which are impossible?

(a) $1s^2 2s^2 2p^1$ Ground

(b) $1s^2 1p^1 2s^1$ Impossible (1p is not existed)

(c) $1s^2 2s^2 2p^3 3s^1$ Excited (Ground state is $1s^2 2s^2 2p^4$)

(d) $1s^2 2s^2 2p^6 3d^{10}$ Excited (Ground state is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$)

(e) $1s^2 2s^2 2p^5 3s^1$ Excited (Ground state is $1s^2 2s^2 2p^6$)

45. Give the number of unpaired electrons in an atom of

(a) Phosphorus [Ne] $3s^2 3p^3$ 3

(b) Potassium [Ar] $4s^1$ 1

(c) Plutonium (Pu) [Rn] $7s^2\ 5f^6$ 6

49. Write the ground state electron configuration for

(a) Mg $1s^2\ 2s^2\ 2p^6\ 3s^2$
Mg^{2+} $1s^2\ 2s^2\ 2p^6$

(b) N $1s^2\ 2s^2\ 2p^3$
N^{3-} $1s^2\ 2s^2\ 2p^6$

(c) Ti $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^2$
Ti^{4+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

(d) Sn^{2+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}$
Sn^{4+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 4d^{10}$

63. A carbon dioxide laser produces radiation of wavelength 10.6 micrometers (1 micrometer = 10^{-6}meter). If the laser produces about one joule of energy per pulse, how many photons are produced per pulse?

$$1.00\boldsymbol{J} = \frac{(6.626\times10^{-34}\boldsymbol{J\cdot s})(2.998\times10^{8}\boldsymbol{m/s})\times \boldsymbol{N}}{10.6\times10^{-6}\boldsymbol{m}}$$

$$\boldsymbol{N} = \frac{(1.00\boldsymbol{J})(1.06\times10^{-5}\boldsymbol{m})}{(6.626\times10^{-34}\boldsymbol{J\cdot s})(2.998\times10^{8}\boldsymbol{m/s})} = \underline{5.34\times10^{19}\ \boldsymbol{photons}}$$

67. Write the symbol of each element described below.

(a)	Largest atomic radius in Group17	At
(b)	smallest atomic radius in period 3	Ar
(c)	largest first ionization energy in Group 2	Li, Be, Ne
(d)	abbreviated electron configuration is [Ar] 4s23d3	V
(e)	A +2 ion with abbreviated electron configuration [Ar] 3d5	Mn^{2+}
(f)	A transition metal in period 4 forming 1 +2 ion with no unpaired electrons	Zn

71. Indicate whether each of the following statements is true or false. If false, correct the statement.

(a) An electron transition from n=3 to n=1 gives off energy. T

(b) Light emitted by an n=4 to n=2 transition will have a longer wavelength than that from an a=5 to n=2 transition. T

(c) A sublevel of *l*=3 has a capacity of ten electrons. F; *l*=2 or $14e^-$

(d) An atom of Group 13 has three unpaired electron. F; Group 15 or 1 unpaired e^-

75. Explain why

(a) Negative ions are larger than their corresponding atoms.

The repulsion between outer eletrons make larger radius

(b) scandium, a transition metal, forms an ion with a noble gas structure.

Sc^{3+} is isoelectronic with Ar

(c) electronegativity decreases down a group in the periodic table.

Atomic radius increases → Ionization energy decreases → Elements become more metallic

80. In the photoelectric effect, electrons are ejected from a metal surface when light strikes it. A certain minimum energy, E_{min}, is required to eject an electron. Any energy absorbed beyond that minimum gives kinetic energy to the electron. It is found that when light at a wavelength of 540nm falls on a cesium surface, an electron is ejected with a kinetic energy of 2.60×10^{-20}J. When the wavelength is 400nm, the kinetic energy is 1.54×10^{-19}J.

(a) Calculate E_{min} for cesium in joules.

$$E_{540} = \frac{(6.626\times10^{-34}\,J\cdot s)(2.998\times10^{8}\,m/s)}{540\times10^{-9}\,m} = 3.68\times10^{-19}\,J$$

$$E_{ejected} = E_{540} - E_{\min} \Rightarrow E_{\min} = E_{540} - E_{ejected}$$

$$E_{\min} = 3.68\times10^{-19}\,J - 0.26\times10^{-19}\,J = \underline{3.42\times10^{-19}\,J}$$

(b) Calculate the longest wavelength, in nanometers, that will eject electrons from cesium.

$$l = \frac{(6.626\times10^{-34}\,J\cdot s)(2.998\times10^{8}\,m/s)}{3.42\times10^{-19}\,J} = 5.81\times10^{-7}\,m = \underline{581nm}$$