Chapter 6

hertz, (Hz) is a unit of frequency. s^{-1} or 1/sec.

I. Given the frequency or wavelength, determine the wavelength or frequency of the following. Also classify each according to its region, gamma, x rays, ultraviolet, visible light, infrared radiation, micro waves, radar waves, TV, radio

a 2.7×10^{14} Hz **b** 1.54 Å **c** 25 MHz
d 1.50 km **e** 7256 μm **f** 124 cm

II. For the various lines of the hydrogen spectrum given, find nf, ni or . Also determine the series (Lyman, Balmer, Paschen, if it is none of these, use NA)

a nf = 3, 656.5 nm **b** nf = 1, 102.6 nm **c** nf=2, ni= 10
d nf= 3, ni= 4 **e** ni = 4 486.3 nm **f** nf= 2, 434.2 nm

III. Determine three of the following given one of them: frequency, wavelength, energy per photon, energy per mole of photon

a 1.345 km **b** ΔE mol = 536 J/mol **c** = 512 kHz **d** $E = 3.14 \times 10^{-17}$ J
e 6.15 cm **f** E mol = 725 J/mol **g** $= 34.2 \times 10^{15}$ Hz **h** $E = 1.24 \times 10^{-13}$ J

IV. Give the set of magnetic quantum numbers (ml) for the orbitals in each of the following sub-shells

a. 1 s **b** 3p **c** 4d **d.** 5s **e.** 4f
f. 4p **g.** 3s **h.** 2p **i.** 5d **j.** 3d

V. The symbol for each element is followed by an electron configuration that violates one of the following principles: Order of filling or Aufbau; the Pauli exclusion principle, Hund's rule of maximum multiplicity; Hund's rule extended—stability of full and half full subshells; Allowed quantum numbers. State which principle is violated by each configuration and give the correct configuration for each atom

a. N $1a^2 2s^2 2p_x^2 \; 2p_y^1$ **b.** Al $1s^2 2s^2 2p^6 2d^3$ **c.** B $1s^2 2s^3$
d. P $1s^2 2s^2 2p^6 3p^5$ **e.** Cu $[Ar]4s^2 3d^9$ **f.** Be $1s^2 1p^2$
g. Mg Ne ✕ **h.** C $1s^2 2s^1 2p_x^1 \; 2p_x^1 \; p_x^1$ **i.** V $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

VI. Give the symbol of the element of lowest atomic number that has the characteristics listed in each of the following parts. Also give the electron configuration of the element.

a. one electron ml = 2 **b.** two unpaired electrons
c. four pairs of electrons **d.** two electrons with n = 3 l = 2
e. three electrons with n = 3 **f.** eleven p electrons

VII. The last few quantum numbers of the electrons or the last part of the electron configuration of different elements is given in each part below. Identify each element based on its electron configuration: for example, boron might be n = 2, l = 1, ml =-1, ms = 11

g. $3s^2 3p^4$ **h.** n = 4, l = 0 , ml = 0, ms = –1; n= 3, l = 2, ml = -2 ms = +1
i. $5s^2 4d^2$ **j.** n=5,l= 2, ml =2, ms = –1/2; n= 6, l= 1, ml = -1/2, ms = +1/2

VIII. Give the electron configuration of each of the following elements with both the abbreviated spdf configuration and also an abbreviated orbital diagram

a. Cl **b.** Si **c.** Cu **d.** N **e.** S
f. Na **g.** Cs **h.** Ce **i.** Sc **j.** Fe

IX. Give the general valence electron configuration for each of the following groups of elements. Use n to designate the principal quantum number. Use x as a superscript if the number of electrons in a subshell can have different values.

a. transition elements **b.** Alkaline earth **c.** halogens
d. group 4A **e.** Group 3A **f.** Group 6A
g. alkali metals **h.** noble gases **i.** group 5A

Answer Key: chapter 6

hertz, (Hz) is a unit of frequency. s^{-1} or 1/sec.

I. Given the frequency or wavelength, determine the wavelength or frequency of the following. Also classify each according to its region, gamma, x rays, ultraviolet, visible light, infrared radiation, micro waves, radar waves, TV, radio

a =1.1 x 10^3 nm,ir
b 1.9 x 10^{18} Hz,g ray
c = 12 m
d 0.200 MHz, radar
e 4.13 x10^{10} Hz, microwave
f 242 MHz, radar

II. For the various lines of the hydrogen spectrum given, find n, m or . Also determine the series (Lyman, Balmer, Paschen, if it is none of these, use NA)

a 2, Balmer, visible
b 3, Lyman, UV
c 379.9nm,Balmer, vis
d 1875 nm, Paschen, ir
e 2, Balmer, vis
f 5, Balmer, vis

III. Determine three of the following given one of them: frequency, wavelength, energy per photon, energy per mole of photon

a 2.24 X 10^5 Hz, 8.94 X10^{-8} kJ/mol: 1.48 x 10^{-28} J
b 1.32 x 10^{12} Hz, 228 nm, 8.9 x 10^{-22} J
c 0.586 km, 2.04 X 10^{-7} kJ/mol, 3.39 X 10^{-28} J
d 1.89 X 10^4 kJ/mol, 4.74 X 10^{16} Hz, 6.33 nm
e 4.88 X 10^9Hz, 1.95 X 10^{-3} kJ/mol, 3.23 X 10^{-24} J
f 1.82 X 10^{12} Hz, 0.165 mm; 1.20 X 10^{-21} J
g 8.77 nm, 1.37 X 10^4 kJ/mol, 2.26 X 10^{-17} J
h 7.47 X 10^7 J/mol, 1.87 X 10^y Hz, 1.60 pm

IV. Give the set of magnetic quantum numbers, such as 1,0 and +1) for the orbitals in each of the following sub-shells

a. ml = 0
b ml = 0,±1
c ml = ±2,±1, 0
d. ml = 0
e. ±3,±2,±1,0
f. ml = 0,±1
g. ml = 0
h. ml = 0,±1
i. ml = ±2,±1, 0
j. ml = ±2,±1, 0

V. The symbol for each element is followed by an electron configuration that violates one of the following principles: Order of filling or Aufbau; the Pauli exclusion principle, Hund's rule of maximum multiplicity; Hund's;s rule extended—stability of full and half full subshells; Allowed quantum numbers. State which principle is violated by each configuration and give the correct configuration for each atom

a. N $1s^2 2s^2 \mathbf{2p_x^2}\ 2p_y^1$
hunds rule parallel spins

b. Al $1s^2 2s^2 2p^6 2d^3$
no d subshell in n = 2

c. B $1s^2 2s^3$
too many e in s orbital

d. P $1s^2 2s^2 2p^6 3p^5$
skipped a subshell

e. Cu [Ar]$4s^2 3d^9$
promote max. spin

f. Be $1s^2 1p^2$
no p orbitals n = 1

g. Mg Ne ☒
spins must be opposite

h. C $1s^2 2s^1 2p$☒$2p$☒$2p$☒
carbon does not promote in atomic state

i. V $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
skipped 4s

VI. Give the symbol of the element of lowest atomic number that has the characteristics listed in each of the following parts. Also give the electron configuration of the element.

a. **Sc** [Ar] $3d^1 4s^2$
b. **C** [He] $2s^2 2p^2$
c. **F** [He] $2s^2 2p^5$
d. **Ti** [Ar] $3d^2 4s^2$
e. **Al [Ne]** $3s^2 3p^1$
f. **Cl [Ne]** $3s^2 3p^5$

VII. The last few quantum numbers of the electrons or the last part of the electron configuration of different elements is given in each part below. Identify each element based on its electron configuration: for example, boron might be n = 2, l = 1, ml =-1, ms = 11

g. $3s^2 3p^4$ **S**

h. n = 4, l = 0 , ml = 0, ms = ⁻1; n= 3, l = 2, ml = -2 ms = +1 **Sc**

i. $5s^2 4d^2$ **Zr**

j. n=5,l= 2, ml =2, ms = –1; n= 6, l= 1, ml = -1, ms = +1 **Tl**

VIII. Give the electron configuration of each of the following elements with both the abbreviated spdf configuration and also an abbreviated orbital diagram

a. [Ne]$3s^2 3p^5$
b. [Ne]$3s^2 3p^2$
c. Cu [Ne] $3d^{10} 4s^1$
d. N [He]$2s^2 2p^3$
e. S [He]$2s^2 2p^4$

f. Na
[Ne]$3s^2$

g. Cs
[Xe] $6s^1$

h. Ce
[Xe]$4f^2 6s^2$

i. Sc
[Ar]$3d^1 4s^2$

j. Fe
[Ar]$3d^6 4s^2$

IX. Give the general valence electron configuration for each of the following groups of elements. Use n to designate the principal quantum number. Use x as a superscript if the number of electrons in a subshell can have different values.

a. transition elements
$ns^2(n-1)dx$

b. Alkaline earth
ns^2

c. halogens
ns^2np^5

d. group 4A
ns^2np^2

e. Group 3A
ns^2np^1

f. Group 6A
ns^2np^4

g. alkali metals
ns^1

h. noble gases
ns^2np^6

i. group 5A
ns^2np^3