SECTION 4.3 DISTINGUISHING BETWEEN ATOMS

1. How many protons are found in an atom of each of the following?
   a. boron   c. neon

   b. sulfur   d. lithium

2. Complete the table for the following elements.

Element	Number of Protons	Number of Electrons	Number of Neutrons	Atomic Number	Mass Number
Manganese	25	25	30	25	55
Sodium	11	11	12	11	23
Bromine	35	35	45	35	80
Yttrium	39	39	50	39	89
Arsenic	33	33	42	33	75
Actinium	89	89	138	89	227

3. How many neutrons are in each atom?
   a. $^{23}_{11}Na$ 12   c. $^{81}_{35}Br$ 46

   b. $^{238}_{92}U$ 146   d. $^{19}_{9}F$ 10

4. The two most abundant isotopes of carbon are carbon-12 (mass = 12.00 amu) and carbon-13 (mass = 13.00 amu). Their relative abundances are 98.9% and 1.10%, respectively. Calculate the atomic mass of carbon.

   $(12.00)(0.989) + (13.00)(0.011) = 12.011$ amu

5. How many electrons do the following ions have?
   a. Pb^{2+} 80
   b. N^{3-} 10
   c. Th^{6+} 84

Practice Problems

In your notebook, solve the following problems.

SECTION 5.1 MODELS OF THE ATOM

1. How many sublevels are in the following principal energy levels?

   a. $n = 1$ 1
   b. $n = 2$ 2
   c. $n = 3$ 3
   d. $n = 4$ 4
   e. $n = 5$ 4
   f. $n = 6$ 4

2. How many orbitals are in the following sublevels?

   a. 1s sublevel 1
   b. 5s sublevel 1
   c. 4d sublevel 5
   d. 4f sublevel 7
   e. 7s sublevel 1
   f. 3p sublevel 3
   g. fifth principal energy level 11
   h. 6d sublevel 5

3. What are the types of sublevels and number of orbitals in the following energy levels? **See last page**

   a. $n = 1$
   b. $n = 2$
   c. $n = 3$
   d. $n = 4$
   e. $n = 5$

SECTION 5.2 ELECTRON ARRANGEMENT IN ATOMS

1. Write a complete electron configuration of each atom. **See last page**

   a. hydrogen
   b. vanadium
   c. magnesium
   d. barium
   e. bromine
   f. sulfur
   g. krypton
   h. arsenic
   i. radon

SECTION 5.3 PHYSICS AND THE QUANTUM MECHANICAL MODEL

1. What is the wavelength of the radiation whose frequency is 5.00×10^{15} s^{-1}? In what region of the electromagnetic spectrum is this radiation? $\lambda = 6 \times 10^{-8} m$; UV

2. An inexpensive laser that is available to the public emits light that has a wavelength of 670 nm. What are the color and frequency of the radiation? $\nu = 4.45 \times 10^{14} s^{-1}$; red

3. What is the energy of a photon whose frequency is 2.22×10^{14} s^{-1}? $E = 1.47 \times 10^{-19} J$

4. What is the frequency of a photon whose energy is 6.00×10^{-15} J? $\nu = 9.05 \times 10^{18} s^{-1}$

5. Arrange the following types of electromagnetic radiation in order of increasing frequency.

   a. infrared 3
   b. ~~cosmic~~ rays / gamma 6
   c. visible light 4
   d. radio waves 1
   e. microwaves 2
   f. ultraviolet 5

6. Suppose that your favorite AM radio station broadcasts at a frequency of 1600 kHz. What is the wavelength in meters of the radiation from the station? 187.5 m

7. What do the spectral lines on atomic emission spectra correspond to? If spectral line A represents moving from the 6th energy level to the 1st and spectral line B represents moving from the 2nd energy level to the 1st, which is going to give off more energy? Which will emit light of higher frequency?

Spectral lines ⇒ correspond to e⁻ returning to ground state

Spectral line A will give off more energy & be at higher ν

5.1

a. 1s → 1 orbital

b. 2s → 1 orbital

   2p → 3 orbitals

c. 3s → 1

   3p → 3

   3d → 5

d. 4s → 1

   4p → 3

   4d → 5

   4f → 7

e. 5s → 1

   5p → 3

   5d → 5

   5f → 7

5.2

a. $1s^2$

b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$

c. $1s^2 2s^2 2p^6 3s^2$

d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2$

e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

f. $1s^2 2s^2 2p^6 3s^2 3p^4$

g. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

h. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$

i. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6$