5.1

	Sublevel Type	# of orbitals
a) n=1	s	1
b) n=2	s, p	1+3=4
c) n=3	s, p, d	1+3+5=9
d) n=4	s, p, d, f	1+3+5+7=16
e) n=5	s, p, d, f	16

5.2

① a) H $1s^1$ b) Vanadium (23) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$ OR $[Ar]\,3d^3 4s^2$

c) Mg (12) $1s^2 2s^2 2p^6 3s^2$ $[Ne]\,3s^2$ d) Ba (56) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2 4p^6 4d^{10} 5s^2 5p^6 6s^2$ $[Xe]\,6s^2$

e) Br (35) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$ $[Ar]\,3d^{10} 4s^2 4p^5$

f) S (16) $1s^2 2s^2 2p^6 3s^2 3p^4$ $[Ne]\,3s^2 3p^4$

5.3

① $\lambda = ?$ $f = 5.00\times10^{15}\,s^{-1}$ $c = \lambda f$ $3.00\times10^8 = \lambda(5.00\times10^{15})$ $\lambda = 6\times10^{-8}\,m = 6\times10^{-8}\times10^9 = 6\times10^1 =$ 60nm Radio

② $\lambda = 670nm = 670\times10^{-9}\,m$ $f = ?$ $c = \lambda f$ $3.00\times10^8 = 670\times10^{-9} f$ ORANGE $f = 4.48\times10^{14}\,s^{-1}$

③ $E = ?$ $f = 2.22\times10^{14}\,s^{-1}$ $E = 6.63\times10^{-34}(2.22\times10^{14}) =$ $1.47\times10^{-19}\,J$

④ $f = ?$ $E = 6.00\times10^{-15}\,J$ $6.00\times10^{-15} = 6.63\times10^{-34} f$ $f = 9.05\times10^{18}\,s^{-1}$

⑤ radio, microwaves, infrared, visible, ultraviolet, gamma rays

Name STURMAN key!! Date _____ Class _____

5 ELECTRONS IN ATOMS

1s 2s 2p 3s 3p 3d 4s 4p 4d 4f 5s 5p 5d 5f 6s 6p 6d 6f 7s 7p 7d 7f

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. $n = 5$ 5 f. $n = 6$ 6
2. How many orbitals are in the following sublevels?
   a. 1*s* sublevel 1 b. 5*s* sublevel 1 c. 4*d* sublevel 5 d. 4*f* sublevel 7 e. 7*s* sublevel 1 f. 3*p* sublevel 3 g. fifth principal energy level 13 h. 6*d* sublevel 5
3. What are the types of sublevels and number of orbitals in the following energy levels?
   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.
   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 $5.00 \times 10^{15}\ s^{-1}$? In what region of the electromagnetic spectrum is this radiation?
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?
3. What is the energy of a photon whose frequency is $2.22 \times 10^{14}\ s^{-1}$?
4. What is the frequency of a photon whose energy is 6.00×10^{-15} J?
5. Arrange the following types of electromagnetic radiation in order of increasing frequency.
   a. infrared b. gamma rays c. visible light d. radio waves e. microwaves f. ultraviolet
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?

⑥ $f = 1600\,kHz = 1600\times10^3\,Hz$ $\lambda = ?$ $c = \lambda f$ $3.00\times10^8 = \lambda(1600\times10^3)$ $\lambda = 187.5\,m$