Problem Set 2: Bohr, Quantum Theory, and Electron Configurations

1	2
6.32 (a) In terms of the Bohr theory of the hydrogen atom, what process is occurring when excited hydrogen atoms emit radiant energy of certain wavelengths and only those wavelengths? (b) Does a hydrogen atom "expand" or "contract" as it moves from its ground state to an excited state?	59. Using vertical lines, indicate the transitions on an energy-level diagram for the hydrogen atom a. $n = 3 \rightarrow n = 2$ b. $n = 4 \rightarrow n = 2$ c. $n = 2 \rightarrow n = 1$
3	**4**
64. An electron is excited from the $n = 1$ ground state to the $n = 3$ state in a hydrogen atom. Which of the following statements are true? Correct the false statements to make them true. a. It takes more energy to ionize (completely remove) the electron from $n = 3$ than from the ground state. b. The electron is farther from the nucleus on average in the $n = 3$ state than in the $n = 1$ state. c. The wavelength of light emitted if the electron drops from $n = 3$ to $n = 2$ will be shorter than the wavelength of light emitted if the electron falls from $n = 3$ to $n = 1$. d. The wavelength of light emitted when the electron returns to the ground state from $n = 3$ will be the same as the wavelength of light absorbed to go from $n = 1$ to $n = 3$. e. For $n = 3$, the electron is in the first excited state.	Answer the following questions about orbitals: a) What are the similarities between the 1s and 2s orbitals of the hydrogen atom? b) What can you say about the average distance from the nucleus of an electron in the 2s orbital as compared with a 3s orbital? c) For the hydrogen atom, list the following orbitals in order of increasing energy (that is, most stable ones first): 4f, 6s, 3d, 1s, 2p
5	**6**
State where in the periodic table these elements appear: a) elements with the valence-shell electron configuration ns^2np^5 b) the elements that have three unpaired p electrons c) an element whose valence electrons are $4s^24p^1$ d) the d-block elements	Write complete ground state electron configurations for each of the following atoms and circle the valence electrons in each case. Cl, Sb, Sr, W, Pb, Cf
7	**8**
6.67 Write the condensed electron configurations for the following atoms, using the appropriate noble-gas core abbreviations: (a) Cs, (b) Ni, (c) Se, (d) Cd, (e) U, (f) Pb.	6.71 Identify the specific element that corresponds to each of the following electron configurations: (a) $1s^22s^2$, (b) $1s^22s^22p^4$, (c) $[Ar]4s^13d^5$, (d) $[Kr]5s^24d^{10}5p^4$, (e) $1s^1$.
9	**10**
92. Identify the following elements. a. An excited state of this element has the electron configuration $1s^22s^22p^53s^1$. b. The ground-state electron configuration is $[Ne]3s^23p^4$. c. An excited state of this element has the electron configuration $[Kr]5s^24d^65p^26s^1$. d. The ground-state electron configuration contains three unpaired $6p$ electrons.	90. Using only the periodic table inside the front cover of the text, write the expected ground-state electron configurations for a. the third element in Group 5A. b. element number 116. c. an element with three unpaired $5d$ electrons. d. the halogen with electrons in the $6p$ atomic orbitals.

11	12
100. Which of the following electron configurations correspond to an excited state? Identify the atoms and write the ground-state electron configuration where appropriate. a. $1s^2 2s^2 3p^1$ c. $1s^2 2s^2 2p^4 3s^1$ b. $1s^2 2s^2 2p^6$ d. $[Ar] 4s^2 3d^5 4p^1$ How many unpaired electrons are present in each of these species?	Draw orbital diagrams and circle the valence electrons in each case for the following elements: a. Ca d. In b. O e. Ar c. element 117 f. Bi

Electron Configuration Practice Worksheet

In the space below, write the full (unabbreviated) electron configurations of the following elements:

1) sodium _____

2) iron _____

3) bromine _____

4) barium _____

5) neptunium _____

In the space below, write the Noble Gas (abbreviated) electron configurations of the following elements:

6) cobalt _____

7) silver _____

8) tellurium _____

9) radium _____

10) lawrencium _____

Determine what elements are denoted by the following electron configurations:

11) $1s^2 2s^2 2p^6 3s^2 3p^4$ _____

12) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$ _____

13) [Kr] $5s^2 4d^{10} 5p^3$ _____

14) [Xe] $6s^2 4f^{14} 5d^6$ _____

15) [Rn] $7s^2 5f^{11}$ _____

Determine which of the following electron configurations are not valid: State which rule has been violated.

16) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$ _____

17) $1s^2 2s^2 2p^6 3s^3 3d^5$ _____

18) [Ra] $7s^2 5f^8$ _____

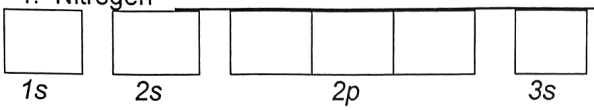
19) [Kr] $5s^2 4d^{10} 5p^5$ _____

20) [Xe] _____

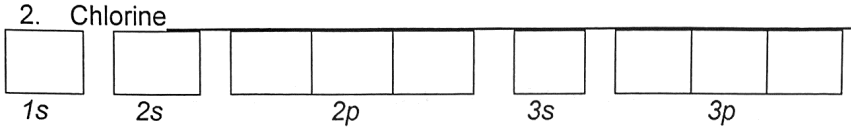
Where are the Electrons?

Write the full electron configuration, short-hand electron configuration, and fill in the orbital diagrams, for the following elements.

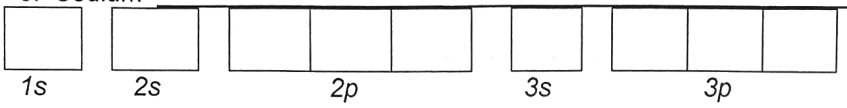
1. Nitrogen _____



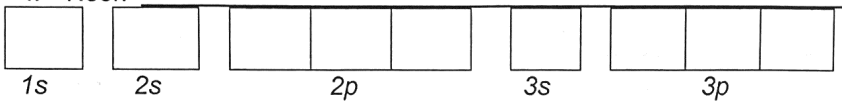
2. Chlorine _____



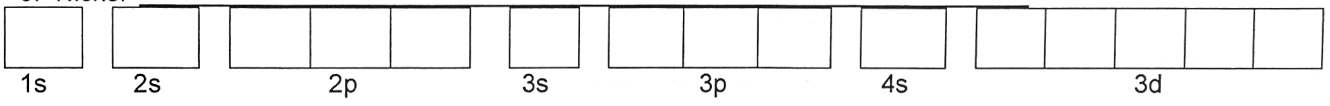
3. Sodium _____



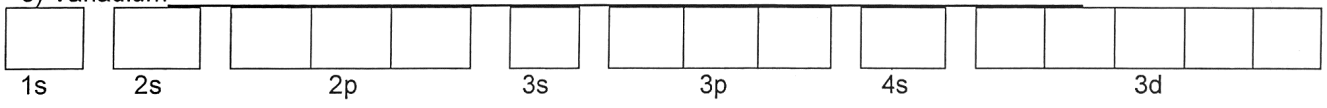
4. Neon _____



5. Nickel _____



6) Vanadium _____



7) Copper _____