Name _____
Date _____
Due Date _____

Mark _____/80
Correct and Hand in Again by _____

Chemistry 11

Hand In Assignment #12 – Electronic Structure of the Atom

This Assignment will be marked and you are allowed to do one set of corrections. The material needed from this worksheet may be found on pages 151-158 of S.W. and on pages 287-300 in Heath Chemistry. You will also need access to the Internet.

1. In a "line spectrum" like the one for hydrogen, are all colours of light shown or just some? (1 mark) _____

2. Bohr proposed that the electron in hydrogen could only exist in certain _____ states. (1 mark)

3. Bohr suggested that these states corresponded to certain _____ the electron could occupy around the atom. (1 mark)

4. When an electron moves from one orbit to another, does it move gradually or instantly? (1 mark) _____

5. Draw a simple diagram like the one on page 151 of SW showing the energy levels n=1 to n=6 for the hydrogen atom. Now turn to page 287 of Heath. Draw the arrows which show the transitions which give rise to the violet, blue, green and red lines on hydrogen's line spectrum. Either colour or label these lines on your diagram. (2 marks)

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6. When an electron in a higher energy level drops down to a lower level, it _____ energy in the form of _____. (2 marks)

7. The energy difference between two levels is called a _____ of energy associated with the transition between the two levels. (1 mark)

8. What proposal of Bohr's concerning orbits was abandoned as quantum mechanics was developed? (1 mark)

9. Regions in space occupied by electrons are called (1 mark) _____

10. Draw a diagram of the "1s" orbital. This can be found on page 289 of Heath. (2 marks)

11. Draw a diagram of the "2s" orbital. This can be found on page 291 of Heath.(2 marks)

12. The "2s" orbital is the same shape as the "1s", but _____er. (1 mark)

13. Draw a diagram of the $2p_x$, $2p_y$ and $2p_z$ orbitals. These can be found on page 291 of Heath. (4 marks)

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14. Log on to a computer connected to the internet, start Internet Explorer and enter the following URL address: http://library.thinkquest.org/3659/structures/shapes.html. Scroll down until you find the shapes of the "d" orbitals. On the following, roughly sketch the shapes of the 5 "d" orbitals. (10 marks)

The five "d" orbitals	The d_{xy} orbital:	The d_{xz} orbital:
The d_{yz} orbital:	The d $x^2 - y^2$ orbital:	The dz^2 orbital:

15. Look at the diagram in the middle of page 152 of SW. The letter "n" stands for the _____ level in the atom. In the hydrogen atom, the n=1 level has ____orbital, the n=2 level has ____ orbitals, the n=3 level has ____ orbitals and the n=4 level has ____ orbitals. Can you derive a relationship between the value of "n" and the number of possible orbitals in that level? Level "n" has ____ orbitals (5 marks)

16. Each level has ___ "s" type orbital. Each level n=2 and above has ___ "p" orbitals, each level n=3 and above has ___ "d" orbitals and level n=4 has ___ "f" orbitals. (4 marks)

17. Notice that in the diagram on page 152 for the hydrogen atom, all subshells (s,p,d, f) in each shell (eg. n=3) have(*the same/different*) _____ energies. The big diagram on page 153 of SW shows the energy level diagrams for atoms with *more* than one electron (***polyelectronic*** atoms) What happens to the subshells within a shell in this diagram? _____. NOTE: You don't have to memorize this diagram, but you will have to know how to use it.(2 marks)

18. When electrons in an atom are filling energy levels, they fill the _____ possible energy levels first. (1 mark)

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19. Each single orbital can hold a maximum of _____ electrons. (1 mark)

20. An "s" subshell (1 orbital) can hold a maximum of ____ electrons (1 mark)
    A "p" subshell (3 orbitals) can hold a maximum of ____ electrons (1 mark)
    A "d" subshell (5 orbitals) can hold a maximum of ____ electrons (1 mark)
    An "f" subshell (7 orbitals) can hold a maximum of ____ electrons (1 mark)

21. After reading over the rules and the examples on page 154 of SW, use the diagram on page 153 along with the periodic table to determine the ground state electron configurations of the following elements: (9 marks)

    He

    Ne

    Na

    Mg

    Sc

    Co

    Ga

    Cl

    Ar

22. The "core" of an atom is _____ (1 mark)
23. After reading over the examples on page 156 of SW, write the "core notations" for the following elements: (5 marks)

    P

    Ca

    Rb

    Sr

    Br

____
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24. To determine the configuration for a negative ion, you must _____ electron(s) to the atom and it's configuration.(1 mark)

25. To determine the configuration for a positive ion, you must _____ electron(s) from the atom and it's configuration. Electrons in shells with the _____est "n" values are removed first. When electrons are removed, remove in the order: ____before ____ before ___. (5 marks)

26. Write electron configurations for the following ions: (6 marks)

    Li^{+}

    O^{2-}

    F^{-}

    Na^{+}

    S^{2-}

    Al^{3+}

27. How do you find the number of ***valence electrons*** in an atom? (See page 157 of SW.) (1 mark)

28. Write the configuration and then find the number of valence electrons for the following atoms: (5 marks)

    N (configuration) _____ (# of valence e^{-}'s) _____

    Si (configuration) _____ (# of valence e^{-}'s) _____

    Ca (configuration) _____ (# of valence e^{-}'s) _____

    P (configuration) _____ (# of valence e^{-}'s) _____

    Al (configuration) _____ (# of valence e^{-}'s) _____

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