Name: _____ Class: _____ Date: _____ ID: A

Electron Arrangement and Periodicity Review

Multiple Choice

Identify the choice that best completes the statement or answers the question.

B 1. The product of the frequency and the wavelength of a wave equals the
   a. number of waves passing a point in a second.
   b. speed of the wave.
   c. distance between wave crests.
   d. time for one full wave to pass.

C 2. Because *c*, the speed of electromagnetic radiation, is a constant, the wavelength of the radiation is
   a. proportional to its frequency.
   b. equal to its frequency.
   c. inversely proportional to its frequency.
   d. double its frequency.

D 3. The wave model of light does not explain
   a. the frequency of light.
   b. the continuous spectrum.
   c. interference.
   d. the photoelectric effect.

A 4. Max Planck proposed that a hot object radiated energy in small, specific amounts called
   a. quanta.
   b. waves.
   c. hertz.
   d. electrons.

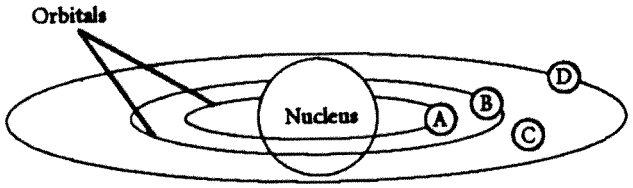
A 5. The specific wavelengths of light seen through a prism that are made when high-voltage current is passed through a tube of hydrogen gas at low pressure is a
   a. line-emission spectrum.
   b. electron configuration.
   c. photoelectric effect.
   d. continuous electromagnetic spectrum.

B 6. A line spectrum is produced when an electron moves from one energy level
   a. to a higher energy level.
   b. to a lower energy level.
   c. into the nucleus.
   d. to another position in the same sublevel.

C 7. Because excited hydrogen atoms always produce the same line-emission spectrum, scientists concluded that hydrogen
   a. had no electrons.
   b. did not release photons.
   c. released photons of only certain energies.
   d. could only exist in the ground state.

A 8. If electrons in an atom have the lowest possible energies, the atom is in the
   a. ground state.
   b. inert state.
   c. excited state.
   d. radiation-emitting state.

C 9. According to Bohr, electrons cannot reside at ____ in the figure below.



a. point A
b. point B
c. point C
d. point D

A 10. The French scientist Louis de Broglie theorized that
a. electrons could have a dual wave-particle nature.
b. light waves did not have a dual wave-particle nature.
c. the natures of light and quantized electron orbits were not similar.
d. Bohr's model of the hydrogen atom was completely correct.

B 11. Which model of the atom explains the orbitals of electrons as waves?
a. the Bohr model
b. the quantum model
c. Rutherford's model
d. Planck's theory

D 12. The size and shape of an electron cloud are most closely related to the electron's
a. charge.
b. mass.
c. spin.
d. energy.

D 13. All of the following describe the Heisenberg uncertainly principle *except*
a. it states that it is impossible to determine simultaneously both the position and velocity of an electron or any other particle.
b. it is one of the fundamental principles of our present understanding of light and matter.
c. it helped lay the foundation for the modern quantum theory.
d. it helps to locate an electron in an atom.

C 14. A three-dimensional region around a nucleus where an electron may be found is called a(n)
a. spectral line.
b. electron path.
c. orbital.
d. orbit.

C 15. The quantum number that indicates the position of an orbital about the three axes in space is the
a. principal quantum number.
b. angular momentum quantum number.
c. magnetic quantum number.
d. spin quantum number.

B 16. The angular momentum (azimuthal) quantum number indicates the
a. orientation of an orbital around the nucleus.
b. shape of an orbital.
c. direction of the spin of the electron in its orbital.
d. main energy level of an orbital.

D 17. Each atomic orbital is described by its principal quantum number followed by the
a. value of the electron's spin state.
b. magnetic quantum number.
c. number of electrons in the sublevel.
d. letter of the sublevel.

C 18. An electron for which $n = 4$ has more ____ than an electron for which $n = 2$.
a. spin
b. particle nature
c. energy
d. wave nature

C 19. The major difference between a 1*s* orbital and a 2*s* orbital is that
a. the 2*s* orbital can hold more electrons.
b. the 2*s* orbital has a slightly different shape.
c. the 2*s* orbital is at a higher energy level.
d. the 1*s* orbital can have only one electron.

C 20. The letter designations for the first four sublevels with the maximum number of electrons that can be accommodated in each sublevel are
a. *s*:2, *p*:4, *d*:6, and *f*:8.
b. *s*:1, *p*:3, *d*:5, and *f*:7.
c. *s*:2, *p*:6, *d*:10, and *f*:14.
d. *s*:1, *p*:2, *d*:3, and *f*:4.

C 21. The number of orbitals for the *d* sublevel is
a. 1.
b. 3.
c. 5.
d. 7.

C 22. The *total* number of orbitals that can exist at the second main energy level is
a. 2.
b. 3.
c. 4.
d. 8.

1=2
2=8
3=18
4=32

D 23. If n is the principal quantum number of a main energy level, the number of electrons in that energy level is
a. n.
b. $2n$.
c. n^2.
d. $2n^2$.

C 24. If the third main energy level contains 15 electrons, how many more could it possibly hold?
a. 0
b. 1
c. 3
d. 17

B 25. A single orbital in the 3*d* level can hold ____ electrons.
a. 10
b. 2
c. 3
d. 6

D 26. "Orbitals of equal energy are each occupied by one electron before any is occupied by a second electron, and all electrons in singly occupied orbitals must have the same spin" is a statement of
a. the Pauli exclusion principle.
b. the Aufbau principle.
c. the quantum effect.
d. Hund's rule.

C 27. Two electrons in the 1*s* orbital must have different spin quantum numbers to satisfy
a. quantum rule.
b. the magnetic rule.
c. the Pauli exclusion principle.
d. the Aufbau principle.

B 28. The Aufbau principle states that an electron
a. can have only one spin number.
b. occupies the lowest available energy level.
c. must be paired with another electron.
d. must enter an *s* orbital.

A 29. In the electron configuration for scandium (atomic number 21), what is the notation for the three highest-energy electrons?
a. $3d^1\ 4s^2$
b. $4s^3$
c. $3d^3$
d. $4s^2\ 4p^1$

B 30. Which of the following lists atomic orbitals in the correct order they are filled according to the Aufbau principle?
a. 1*s* 2*s* 2*p* 3*s* 4*s* 3*p* 3*d* 4*p* 5*s*
b. 1*s* 2*s* 2*p* 3*s* 3*p* 4*s* 3*d* 4*p* 5*s*
c. 1*s* 2*s* 2*p* 3*s* 3*p* 4*s* 4*p* 3*d* 4*d*
d. 1*s* 2*s* 2*p* 3*s* 3*p* 3*d* 4*s* 4*p* 5*s*

D 31. The element with electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$ is
a. Mg ($Z = 12$).
b. C ($Z = 6$).
c. S ($Z = 16$).
d. Si ($Z = 14$).

B 32. If the *s* and *p* orbitals of the highest main energy level of an atom are filled with electrons, the atom has a(n)
a. electron pair.
b. octet.
c. empty *d* orbital.
d. electron in an excited state.

A 33. The idea of arranging the elements in the periodic table according to their chemical and physical properties is attributed to
a. Mendeleev.
b. Moseley.
c. Bohr.
d. Ramsay.

D 34. Mendeleev predicted that the spaces in his periodic table represented
a. isotopes.
b. radioactive elements.
c. unstable elements.
d. undiscovered elements.

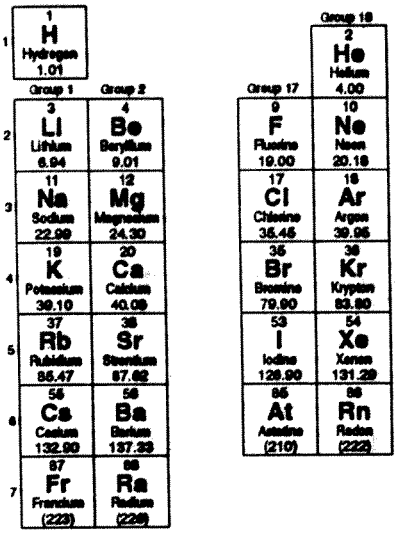
A 35. The person whose work led to a periodic table based on increasing atomic number was
a. Moseley.
b. Mendeleev.
c. Rutherford.
d. Cannizzaro.

A 36. The discovery of what elements added a new column to Mendeleev's periodic table?
a. noble gases
b. radioactive elements
c. transition elements
d. metalloids

B 37. The periodic law states that the physical and chemical properties of elements are periodic functions of their atomic
a. masses.
b. numbers.
c. radii.
d. charges.

D 38. Elements in a group or column in the periodic table can be expected to have the same
a. atomic masses.
b. atomic numbers.
c. numbers of neutrons.
d. number of valence electrons.

C 39. Refer to the figure below. To which group do fluorine and chlorine belong?



a. alkaline-earth metals
b. transition elements
c. halogens
d. actinides

B 40. A horizontal row of blocks in the periodic table is called a(n)
a. group.
b. period.
c. family.
d. octet.

A 41. Refer to the figure above. Potassium and bromine belong to
a. Period 4.
b. Group 4.
c. Period 1.
d. Group 1.

D 42. The electron configuration of aluminum, atomic number 13, is [Ne] $3s^2\ 3p^1$. Aluminum is in Period
a. 2.
b. 3.
c. 6.
d. 13. or 3A

I II III

B 43. How many elements are in a period in which only the *s* and *p* sublevels are filled?
a. 2
b. 8 (have e⁻ going into s or p)
c. 18
d. 32 1 - Only the noble gas

B 44. Elements to the right side of the periodic table (*p*-block elements) have properties most associated with
a. gases.
b. nonmetals.
c. metals.
d. metalloids.

D 45. Neutral atoms with an s^2p^6 electron configuration in the highest energy level belong to which family of the periodic table?
a. *alkali metals*
b. *alkaline earth metals*
c. *halogens*
d. *noble gases*

B 46. Elements in which the *p*-sublevel is being filled have the properties of
a. metals.
b. nonmetals.
c. metalloids.
d. all of the above

> D1&P.

D 47. Hydrogen is placed separately from other elements in the periodic table because it
a. is a gas.
b. does not exist as a free element in nature.
c. has atomic number one.
d. has many unique properties.

C 48. To which block do the actinide elements belong?
a. *d* block
b. *s* block
c. *f* block
d. *p* block

B 49. The elements whose electron configurations end with $s^2 p^5$ in the highest occupied energy level belong to Group
a. 3 (IIIA).
b. 17(VIIA).
c. 1 (IA).
d. 2 (IIA).

C 50. If *n* stands for the highest occupied energy level, the outer configuration for all *d* sublevel elements is
a. ns^1.
b. $2n$.
c. $n - l$.
d. np^1.

B 51. In nature, the alkali metals occur as
a. elements.
b. compounds.
c. complex ions.
d. gases.

C 52. The first member of the noble gas family, whose highest energy level consists of an octet of electrons, is
a. helium.
b. argon.
c. neon.
d. krypton.

A 53. Compared to the alkali metals, the alkaline-earth metals
a. are less reactive.
b. have lower melting points.
c. are less dense.
d. combine more readily with nonmetals.

D 54. The energy required to remove an electron from an atom is the atom's
a. electron affinity.
b. electron energy.
c. electronegativity.
d. ionization energy.

C 55. A measure of the ability of an atom in a chemical compound to attract electrons from another atom in the compound is called
a. electron affinity.
b. electron configuration.
c. electronegativity.
d. ionization potential.

A 56. One-half the distance between the nuclei of identical atoms that are bonded together is called the
a. atomic radius.
b. atomic diameter.
c. atomic volume.
d. electron cloud.

A 57. In a row in the periodic table, as the atomic number increases, the atomic radius generally
a. decreases.
b. remains constant.
c. increases.
d. becomes immeasurable.

D 58. In the alkaline-earth group, atoms with the smallest radii
a. are the most reactive.
b. have the largest volume.
c. are all gases.
(d.) have the highest ionization energies.

D 59. The ionization energies for removing successive electrons from sodium are 496 kJ/mol, 4562 kJ/mol, 6912 kJ/mol, and 9544 kJ/mol. The great jump in ionization energy after the first electron is removed indicates that
a. sodium has four or five electrons.
b. the atomic radius has increased.
c. a *d* electron has been removed.
(d.) the noble gas configuration has been reached.

C 60. The force of attraction by Group VIIA non-metals for their valence electrons is
a. weak.
b. zero.
(c.) strong.
d. greater than that for inner shell electrons.

Electron Arrangement and Periodicity Review Continued

1. Record the electron configuration using the ***orbital box notation*** for the following, do not forget to indicate the noble gas that you are using as a short cut.

   a. Silicon [Ne] $2s^2$ $2p^2$

   b. Chromium [Ar] $4s^2$ $3d^4$

   c. Xenon [Kr] $5s^2$ $4d^{10}$ $5p^6$

2. Record the electron configuration for the following elements using the **short hand notation**.

   a. Strontium $[Kr]\ 5s^2$

   b. Aluminum $[Ne]\ 3s^2 3p^1$

   c. Lead $[Xe]\ 6s^2 4f^{14} 5d^{10} 6p^2$

3. Record the **full** electron configuration for the following elements.

   a. Nickel $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$

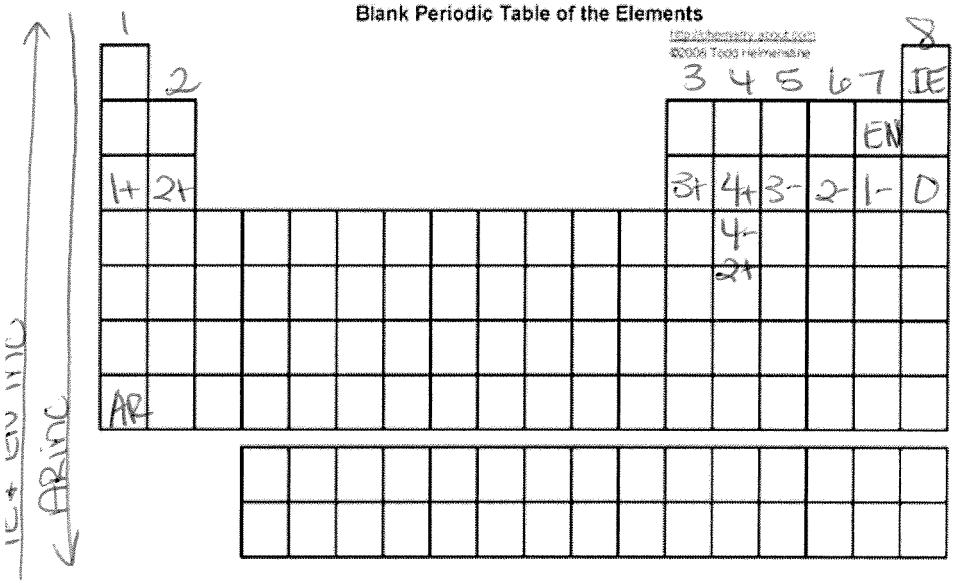
   b. Chlorine $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

   c. Potassium $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

4. Illustrate the Lewis Dot diagram for the following elements.

   a. Selenium :Se: b. tungsten •W• c. argon :Ar:

EN inc.
IE inc.
AR inc.



On the periodic to the left record arrows to represent the trends for atomic radii, ionization energy and electronegativity. Please place an "X" at the end of the arrow to show the group that does not exhibit electronegativity. Label the square of the element with the largest atomic radii with AR. Label the square for the element with the highest electronegativity with the letters EN, repeat this for ionization energy with IE.

Please record the number of valence electrons for the group A atoms above the boxes. Record the charge for the group A atoms in the third row.