

### Quantum: Light and Energy Homework

1. The relationship between wavelength and frequency is \_\_\_\_\_.
2. Why does infrared radiation give off more energy than radiowaves?
3. What color light is emitted when an electron moves from the 6<sup>th</sup> energy level to the 2<sup>nd</sup> energy level in the hydrogen atom? \_\_\_\_\_
4. How much energy is emitted if a wave has a frequency of  $1.6 \times 10^{11}$  Hz
5. What is the frequency of a wave with a wavelength of  $1.4 \times 10^{-7}$  m?
6. Convert 460 nm to meters.
7. Circle the radiation with the longer wavelength for each of the pairs below.
  - a) Blue or violet
  - b) X-ray or ultraviolet
  - c) Microwaves or radio waves
8. What amount of energy is released when an electron falls from  $n=6$  to  $n=3$ ?
9. What type of radiation is either emitted or absorbed in the following? Indicate the type and circle whether it is emitted or absorbed.
  - a)  $n=4$  to  $n=1$                       absorbed or emitted
  - b)  $n=4$  to  $n=3$                       absorbed or emitted
  - c)  $n=2$  to  $n=3$                       absorbed or emitted
10. How much energy is found in a wave with a wavelength of  $2.1 \times 10^{-6}$  m?

## Quantum Numbers

1. State the four quantum numbers and the possible values they may have.

2. Name the orbitals described by the following quantum numbers

a.  $n = 3, \ell = 0$

c.  $n = 3, \ell = 2$

b.  $n = 3, \ell = 1$

d.  $n = 5, \ell = 0$

3. Give the  $n$  and  $\ell$  values for the following orbitals

a. 1s

d. 4d

b. 3s

e. 5f

c. 2p

4. Place the following orbitals in order of increasing energy:

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

5. What are the possible  $m_\ell$  values for the following types of orbitals?

a. s

c. d

b. p

d. f

7. How many electrons can inhabit all of the  $n=4$  orbitals?

8. Which of the following represents a permissible set of quantum numbers? (answer "yes" if permissible and "no" if no permissible)

a. 2, 2, +1, -1/2 \_\_\_\_\_

d. 7, 0, 0, -1/2 \_\_\_\_\_

b. 5, 1, 0, +1/2 \_\_\_\_\_

e. 4, 1, 8, +1/2 \_\_\_\_\_

c. 6, 3, -2, +1/2 \_\_\_\_\_

9. Tabulate all the possible orbitals (by name, i.e. 4s) and give the three quantum numbers which define each orbital.

## Electron Configurations

Write the electron configuration for each of the following:

1. Be
2. Si
3. K
4. Fe
5. Bi
6. Oxide ion
7. Calcium ion
8. Bromide ion

Write the noble gas configuration for each of the following:

9. Cl
10. Pt
11. Sr
12. Phosphide ion

## Orbital Notations

Write the orbital notation for the following:

1. Li

2. Al

3. Ne

4. Cr

5. Na

6. Sodium ion

7. Fluoride ion

8. Zn

## Valence Electrons and Valence Dot Diagrams

For each, determine how many valence electrons there would be and draw a valence dot diagram.

1. H

2. Be

3. Ga

4. C

5. Ti

6. P

7. O

8. Ar

9. Co

Determine the charge and draw a valence dot diagram for each of the following ions.

1. Hydrogen ion

2. Beryllium ion

3. Aluminum ion

4. Nitride ion

5. Sulfide ion

6. Iodide ion



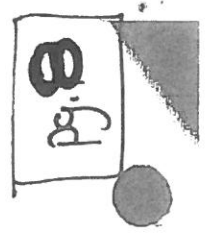
# the Periodic Table

**DIRECTIONS:** Write on the line at the right of each statement the letter preceding the word or expression that best completes the statement.

1. Mendeleev attempted to organize the chemical elements based on their (a) symbols; (b) properties; (c) atomic numbers; (d) electron configurations. \_\_\_\_\_ 1
2. Mendeleev noticed that properties of elements appeared at regular intervals when the elements were arranged in order of increasing (a) atomic number; (b) density; (c) reactivity; (d) atomic mass. \_\_\_\_\_ 2
3. The most useful source of general information about the elements associated with chemistry is (a) a calculator; (b) table of metric equivalents; (c) Periodic Table; (d) table of isotopes. \_\_\_\_\_ 3
4. Elements in a group, or column, in the Periodic Table can be expected to have similar (a) atomic masses; (b) atomic numbers; (c) numbers of neutrons; (d) properties. \_\_\_\_\_ 4
5. The radioactive elements with atomic numbers from 90 to 103 in the Periodic Table are referred to as the (a) noble gases; (b) lanthanides; (c) actinides; (d) rare-earth elements. \_\_\_\_\_ 5
6. Argon, krypton, and xenon are all (a) alkaline-earth metals; (b) noble gases; (c) actinides; (d) lanthanides. \_\_\_\_\_ 6
7. Lithium, the first element in Group 1, has an atomic number of 3. The second element in this group has an atomic number of (a) 4; (b) 10; (c) 11; (d) 18. \_\_\_\_\_ 7
8. Krypton, atomic number 36, is the fourth element in Group 18. What is the atomic number of xenon, the fifth element in Group 18? (a) 54 (b) 68 (c) 72 (d) 90 \_\_\_\_\_ 8

**DIRECTIONS:** Write on the line at the right of each statement the word or expression that best completes the meaning when substituted for the corresponding number.

9. Mendeleev left spaces in his periodic table and predicted the existence and \_\_\_\_ (9) \_\_\_\_ of several elements. \_\_\_\_\_ 9
10. The first successful \_\_\_\_ (10) \_\_\_\_ was developed by Mendeleev. \_\_\_\_\_ 10
11. "The physical and chemical properties of elements are periodic functions of their atomic \_\_\_\_ (11) \_\_\_\_" is the Periodic Law. \_\_\_\_\_ 11
12. The work of a person named \_\_\_\_ (12) \_\_\_\_ led to a Periodic Table based on increasing atomic number. \_\_\_\_\_ 12
13. A(n) \_\_\_\_ (13) \_\_\_\_ is a horizontal row of blocks in the Periodic Table. \_\_\_\_\_ 13
14. The \_\_\_\_ (14) \_\_\_\_ are the elements whose discovery added an entirely new group to Mendeleev's periodic table. \_\_\_\_\_ 14
15. For Groups 1, 2, and 18, the atomic numbers of the fourth element in the group is \_\_\_\_ (15) \_\_\_\_ more than the preceding element. \_\_\_\_\_ 15



### Periodic Table Trends

- Why does strontium have a larger atomic radius than magnesium?
- Of the elements listed, which element requires the most energy to remove an electron? Why?  
oxygen, nitrogen, carbon
- Which element is found in the **most** reactive metal family?  
Ca Fe Th Br K
- Draw the valence dot diagram for the following elements:  
a) S    b) He    c) Al
- Choose the larger element from each of the pairs below.  
a) Ca      or       $\text{Ca}^{+2}$   
b) F      or       $\text{F}^-$   
c) Br      or      I  
d) Fe      or      Zn
- Choose the element that belongs in the family or classification found in the parentheses.  
a) C      Si      Ar      Sb      (noble gas)  
b) Al      Cl      Mg      N      (metalloid)  
c) K      Li      U      H      (non-metal)  
d) Ca      Ni      B      I      (alkaline earth)
- Place the elements in order of decreasing electronegativity.  
Se                                  Cl                                  Al                                  Na
- Place the elements in order of increasing ionization energy  
I                                  Cl                                  Br                                  F
- The ability of an element to attract electrons is called \_\_\_\_\_.
- Explain the trends for the following using **words and pictures**.
  - Atomic radius
  - Ionization energy
  - Electronegativity
- The periodic table is arranged by increasing \_\_\_\_\_.



Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

## Periodic Trends – Ch. 6

1. Put the following elements in order from smallest to largest atomic radius and explain why:  
C, O, Sn, Sr.
2. Put the following elements in order from lowest to highest first ionization energy and explain why:  
Al, Ar, Cs, Na.
3. Which of the following elements most likely has the highest melting point – I, Mo, Te?  
Explain why.
4. Explain how shielding contributes to the atomic radius trend within a group.
5. Why do magnesium, phosphorus, and zinc exhibit slightly higher first ionization energies than the general trend within each of their periods?
6. Which element in the third period is best represented by the six successive ionization energies listed below? Explain your reasoning.

1 <sup>st</sup> IE	2 <sup>nd</sup> IE	3 <sup>rd</sup> IE	4 <sup>th</sup> IE	5 <sup>th</sup> IE	6 <sup>th</sup> IE
577	1,815	2,740	11,600	15,000	18,310