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

**Modern Atomic Theory Practice**

1. Shape characterizes different
   1. sublevels
   2. energy levels
   3. spins
   4. orbitals
2. Write the letters of the particles below which would be found in the same isoelectronic series as Krypton.

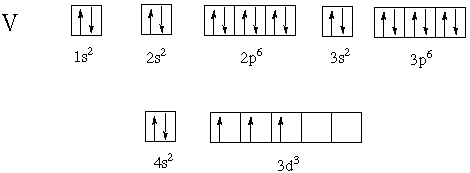
|  |  |
| --- | --- |
| a. K1+ | f. Br- |
| b. Ca2+ | g. Te2- |
| c. Ga3+ | h. Rb1+ |
| d. Ge4+ | i. Pd2+ |
| e. As3- | j. Zr2+ |

1. Which statements are consistent with the fact that the lithium ion has a 1+ charge?
   * 1. It has 1 p electron
     2. It has gained one electron
     3. It has lost one electron
     4. The change in its number of electrons promotes stability
     5. It is isoelectronic to helium

a. i and iii b. ii and iv c. i, iii, and v d. i, ii, and iii e. iii, iv, and v f. all of the above

1. Which element has the electron configuration 1s22s22p3?

* 1. Al b. C c. P d. N e. none of the choices

1. Consider the **last electron placed** in Se. What is its energy level, sublevel, orbital and spin?
2. Which element has **two more** electrons than the element represented by the diagram below? 

a. Mn b. V c. Tc d. Cr e. none of the choices

1. Consider the last electron placed in ruthenium (Ru). What is its energy level, sublevel, orbital and spin?

**8.** Which is the proper electron configuration for molybdenum?

* 1. 1s22s22p63s23p64s23d104p65s25p4
  2. 1s22s22p63s23p64s24p65s24d4
  3. 1s22s22p63s23p64s24p65s14d53d10
  4. 1s22s22p63s23p64s24d104p65s25d4
  5. none of the choices

**9.** Which Lewis structure matches that of polonium?

a. [Xe]6s25d106p4 b. Po c. Po d. Po e. cannot be determined

**10.** Identify the element and state (ground/excited) for the following electron configuration:

1s22s22p63s23p64s23d104p65s24d95p66s1 (Symbol, ground/excited)

**11.** Write the noble gas configuration for tellurium.

**12.** Distance from the nucleus is the main distinguishing characteristic of different

a. sublevels

b. energy levels

c. spins

d. orbitals

**13.** How many valence electrons are in an atom of gallium (Ga)?

**14.** What is the maximum number of electrons that can occupy the 3d orbitals?

**15.** How many f orbitals are there in the 4th energy level?

**16.** An excited atom may

* + 1. contain a different number of electrons than its ground state counterpart
    2. temporarily violate the Aufbau principle
    3. contain electrons in a different number of energy levels than its ground state counterpart
    4. contain a different number of protons than its ionic counterpart

a. i and ii b. ii and iii c. iii and iv d. all of the above e. none of the above

**17.** What element has its last electron in energy level 4, the d sublevel, the 0 orbital, and

counterclockwise spin?

**18.** Which of the following statements is false?

a. Atoms gain or lose electrons to become ions.

b. Atoms gain or lose electrons to obtain an octet.

c. Valence electrons can be in any sublevel.

d. Valence electrons are the electrons in the highest energy level

e. Metals always lose electrons when forming ions

**19.** An orbital shaped like this, , is a \_\_\_\_\_\_\_\_\_\_ (s, p, d, or f) orbital.

**20.** In orbital notation, what do the individual boxes represent?

**21.** In orbital notation, what does an upward pointing arrow represent?

**22.** The Aufbau Principle sets rules for

a. measuring an electron’s location and momentum

b. how electrons are distributed among orbitals

c. how many electrons can occupy a single space

d. how an atom is filled with electrons from the nucleus outward

**23.** The Pauli exclusion principle supports the idea that

a. the last three electrons added to antimony are in different orbitals

b. the fifth electron added to nitrogen cannot be measured for its position in space and its

momentum simultaneously

c. the quantum numbers for lithium’s first and second electrons are different

d. the third electron added to chlorine has more energy than its second electron

e. none of the above

**24.** Write the noble gas electron configurations for tungsten and gold and show the orbital notation for

their 6s, 4f, and 5d orbitals.

**25.** Look at the following table. Fill in the missing information.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Particle** | **Atomic Number** | **Electron Configuration** | **Charge on Particle** |
| **Oxide ion (O2-)** |  |  |  |
|  | **11** | **1s22s22p6** |  |
|  | **18** |  | **0** |
| **Phosphide ion (P3-)** |  |  | **-3** |

**26.** Write the symbol for each of the following atoms when it becomes an ion.

A. aluminum atom

B. bromine atom

C. hydrogen atom

D. calcium atom

E. sulfur atom

**27.** What determines the number of electrons gained or lost by an atom?

**28.** The following particles constitute an isoelectronic series. What does this mean? Write the electron configuration for particles.

Ne, Na+, Mg2+, Al3+

**29.** Place the particles in #29 in order from smallest to largest atomic radius. Explain why you placed

them in this order.

**30.** Place the following particles in order from largest to smallest atomic radius. Explain why you placed

them in this order.

S2-, Ar, P3-, Cl-

**31.**  For each of the following electron configurations of neutral atoms, determine the name of the element and decide if the configuration as written is in the ground state or the excited state.

A. 1s22s22p63s24s1

B. 1s22s22p63s23p64s23d3

C. 1s22s22p63s23p64s13d5

D. 1s22s22p63s23p64s23d104p64d1

**32.** What was the **main contribution** of Bohr to the development of the atomic model? (He had

experimental evidence to support this idea.)