Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_ Ast: \_\_\_\_\_

**Physical Science Honors:**

**Electron Configuration Study Guide**

1. Explain what valence electrons are and why they are important.

***Valence electrons are the electrons located on the outer shell, farthest from the nucleus. They are important in determining how elements react with one another (chemical bonding).***

1. Describe the pattern of valence electrons on the periodic table.

***Elements in the same group have the same number of valence electrons. Going left to right across the periods, this number increases from 1 to 8, then starts over again.***

1. How do we know how many total electrons an atom of a specific element will have (*assuming it’s neutral*)?

***A neutral atom must have an equal number of protons and electrons for the charges to balance. This means that the atomic number tells us both the number of protons AND the number of electrons in a neutral atom.***

1. List the different types of orbitals and how many electrons can fit in each.

***s – up to 2 electrons***

***p – up to 6 electrons***

***d – up to 10 electrons***

***f – up to 14 electrons***

1. What do the “blocks” on the periodic table represent?

***The blocks in the periodic table represent the electron configuration.***

***Each section belongs to a certain orbital. The “s block” is groups 1 and 2; the “p block” is groups 13-18; the “d block” is groups 3-12; and the “f block” is the lanthanides and actinides in period 6 and 7.***

1. Why do the orbitals fill up in a strange order (ex: “4s” comes before “3d”)?

***In some places, the energy levels overlap each other, causing orbitals in a higher layer to begin filling before orbitals in a lower layer. The orbitals fill up in order from lower to higher energy, so where they overlap, the lower energy orbital (4s) will fill up before the higher energy orbital (3d). The order that the orbitals fill up is reflected in the electron configuration chart.***

1. The electron configuration for manganese is 1s22s22p63s23p64s23d5. Explain what this means in terms of the location of electrons in the atom. How does this influence its position on the periodic table?

***This means that a neutral atom of manganese has 2 electrons on the first energy level (****both on the s orbital****), 8 electrons on the second energy level (****2 on the s and 6 on the p orbitals****), 13 electrons on the third energy level (****2 on the s, 6 on the p, and 5 on the d orbital****), and two electrons on the fourth energy level (****both on the s orbital****).***

***This means that Mn is the 5th element in the “3d” block of the periodic table. Because the 4th energy level has begun to fill (4s), it will be in period 4. The d block is found in groups 3-12, so the 5th element in the 3d block would place it in group 7.***

1. Write the electron configuration for gallium.

***Ga31: 1s22s22p63s23p64s23d104p1*** *or* ***[Ar]4s23d104p1***

1. Write the electron configuration for einsteinium.

***Es99: 1s22s22p63s23p64s23d104p65s24d105p66s24f145d106p67s25f11*** *or*  ***[Rn]7s25f11***

1. Explain the purpose of a Bohr diagram.

***It shows the total number of electrons in the atom, and their location (which energy level or “shell”).***

1. Explain how you will know how many energy levels (“*shells”*) to draw on a Bohr diagram.

***Using the electron configuration, the coefficients (the large numbers) represent the energy levels. The highest coefficient indicates the number of energy levels for that element.***

1. Draw a Bohr diagram for fluorine.



1. Draw a Bohr diagram for sulfur.



1. Explain the purpose of an electron dot diagram (“*Lewis dot diagram”*).

***An electron dot diagram (Lewis dot diagram) shows the number of valence electrons in a neutral atom of that element. This can be useful in determining how it will bond.***

1. Explain the trick to determining the number of valence electrons an element has.

***The one’s digit of the group number for groups 1-2 and 13-18 will tell you how many valence electrons the element has. It does not apply to groups 3-12 or the lanthanides & actinides because they represent the d and f blocks, which are overlapped by s and p blocks of higher energy levels.***

1. How many valence electrons will a neutral atom of aluminum have? How do you know?

***A neutral aluminum atom will have 3 valence electrons. This is apparent because aluminum is in group 13, and all group-13 elements have 3 valence electrons.***

1. Describe the octet rule.

***The octet rule states that the outer shell is full when it has 8 valence electrons. This is important in chemical bonding, as elements will bond in order to fill their outer shell with valence electrons.***

1. Why is helium located in group 18 even though it only has 2 valence electrons instead of 8 like the rest of group 18 (*why is it an exception to the octet rule*)?

***Helium is a noble gas even though it only has 2 valence electrons because the 1st energy level only has an s orbital, which fills up with only 2 electrons (the rest have an s (2) and p (6) orbital which require 8 to fill up).***

1. Draw an electron dot diagram for iodine.



1. Draw an electron dot diagram for germanium.



1. What does the location of the dots in an electron dot diagram represent (*Why do the first two go on the right and the others on the remaining three sides*)?

***The first two dots on the right represent the s orbital, while the other six represent the p orbital.***