Name:	
Period:	Seat #:

Chapter #3

Electrons

WS # ✓ *if there*		Stamped?		Finished *Includes work being shown!*		*Leave for Mrs. Farmer*
1		YES	NO	YES	NO	
2		YES	NO	YES	NO	
3		YES	NO	YES	NO	
4		YES	NO	YES	NO	
5		YES	NO	YES	NO	
6 *						
7		*Lab sheet*		*Lab sheet*		
8		YES	NO	YES	NO	
9		YES	NO	YES	NO	**NOT DONE THIS YEAR**

* means doing the problems was optional, but the handout must be in the packet. If you did any of the problems, please include the binder paper after the worksheet handout!

<u>During Remote Learning</u> – if you did not print the worksheets then you will do the work directly on binder paper. CLEARLY label the heading of all binder paper so I know what I am looking at. Including Worksheet Number and Title. If you did not print the (*) optional worksheets then include a blank piece of paper with Worksheet Number and Title as a place holder.

Dougherty Valley HS Chemistry
Orbitals

Worksheet #1

Name: **Period:** **Seat#:**

1) An orbital is:

2) What is the difference between an orbital and an orbit (Bohr Model)?

3) What are the four things we need to adequately describe where an electron is inside an atom?

a.
b.
c.
d.

4) Fill in the following chart:

Orbital Type	Description of Shape	# of orbitals in a set	# electrons allowed in one of the orbitals	# electrons allowed in a set of the orbitals
s				
p				
d	Complex lobes			
f	Even more complex			

5) Describe each rule for writing the "address" of an electron - in your own words! Then draw a visual representation for this rule. If we were to try and make a little classroom poster to remind us of the rule what would it look like? Think of how things like road signs and warning signs are drawn – bold pictures with minimal words.

Rule	Written Description	Visual Representation
Aufbau Principle		
Pauli Exclusion Principle		
Hund's Rule		

Dougherty Valley HS Chemistry
Orbital Diagrams

Worksheet #2

Name: **Period:** **Seat#:**

Fill in the chart below using an ↑and ↓ as electrons - find the total number of electrons and use that as well as the Periodic Table to find the identity of each element.

Element	**Total # e-**	**Orbital Filling**																		**Electron Config.**
		1s	2s	$2p_x$	$2p_y$	$2p_z$	3s	$3p_x$	$3p_y$	$3p_z$	4s	$3d_1$	$3d_2$	$3d_3$	$3d_4$	$3d_5$	$4p_x$	$4p_y$	$4p_z$	
Na																				
																				$1s^2 2s^2 2p^5$
H																				
S																				
																				$1s^2 2s^2 2p^6 3s^2 3p^1$
																				$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
Ca																				
Mg																				
																				$1s^2 2s^2 2p^6$

Element	# e-	1s	2s	$2p_x$	$2p_y$	$2p_z$	3s	$3p_x$	$3p_y$	$3p_z$	4s	$3d_1$	$3d_2$	$3d_3$	$3d_4$	$3d_5$	$4p_x$	$4p_y$	$4p_z$	**Electron Config.**
																				$1s^22s^22p^63s^23p^2$
C																				
																				$1s^22s^22p^63s^23p^64s^23d^6$
Br																				

1) Circle which of the following orbital destinations are possible.

a) 7s b) 1p c) 5d d) 2d e) 4f f) 5g g) 6i

2) Circle which of the following electron configurations is ruled out by the Pauli exclusion principle.

a) $1s^22s^22p^7$ b) $1s^22s^22p^63s^3$ c) $1s^22s^22p^63s^23p^64s^23d^{12}$ d) $1s^22s^22p^63s^23p^6$

3) Explain why the following ground-state electron configurations are not possible:

Q	Config.	Reason it is wrong
a)	$1s^22s^32p^3$	
b)	$1s^22s^22p^33s^6$	
c)	$1s^22s^22p^73s^23p^8$	
d)	$1s^22s^22p^63s^23p^14s^23d^{14}$	

4) Draw a section of an orbital diagram that would violate each of the following rules

Aufbau Principle	Pauli Exclusion Principle	Hund's Rule

Dougherty Valley HS Chemistry
Electron Configuration - Basic

Worksheet #3

Name: **Period:** **Seat#:**

An electron configuration is a method of indicating the arrangement of electrons about a nucleus. A typical electron configuration consists of numbers, letters, and superscripts with the following format:

1) A number indicates the energy level (The number is called the principal quantum number, and is represented by an n typically).
2) A letter indicates the type of orbital: s, p, d, f.
3) A superscript indicates the number of electrons in the orbital. Example $1s^2$ means that there are two electrons in the "s" orbital in the first energy level. That element would be Helium.

To write an electron configuration:

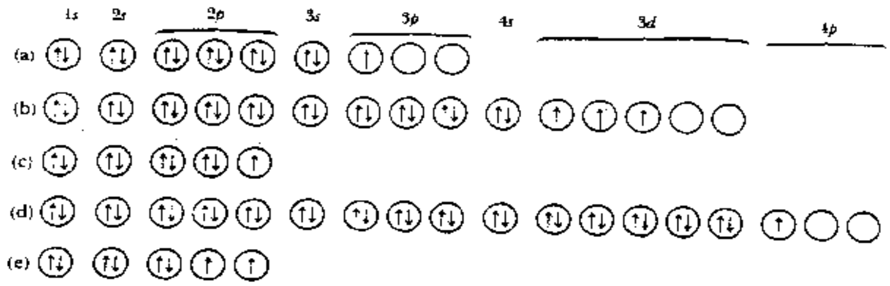
1) Determine the total number of electrons to be represented.
2) Use the Aufbau principal to fill the orbitals with electrons. The Aufbau principal requires that the electrons fill the lowest energy orbitals first. In other words, atoms are built from the "ground up." You can use an orbital diagram to help you determine the order that the orbitals come in. You can also use a periodic table to tell you the same information based on the patterns on the table.
3) List the energy level, orbital type, and number of electrons used for each orbital filled with electrons. This list is the "electron configuration."
4) The sum of the superscripts should equal the total number of electrons. For example: $1s^2 2s^2 2p^6 3s^2$ is Magnesium because it has 12 electrons (2+2+6+2=12)

Configuration Writing Practice

Write a "ground state" electron configuration for each neutral atom. Ground state means that all of the lowest possible energy levels are filled – in other words, it means that the Aufbau principle is being followed. If an atom is in an "excited state" it means that the atom was given extra energy and it caused some electrons to be pushed to higher energy levels/orbitals which actually breaks the Aufbau principle. We will learn more about "excited states" later in the chapter. Ground state configurations are often just called "normal" configurations.

Q#	Total # e-	Electron Configuration
1) Na		
2) Pb		
3) Sr		
4) U		
5) N		
6) Ag		
7) Ti		
8) Ce		
9) Cl		
10) Hg		

11) Write the corresponding electron configuration for each of the following pictorial representations. Name the element that each picture represents, assuming they are neutral atoms



Q	Total # e-	Name	Electron Configuration
a			
b			
c			
d			
e			

12) Indicate which groups of elements have an outer configuration indicated below. **you can just list which atomic numbers fulfill each requirement. Some chemists call these various elements the s-block, p-block, d-block and f-block*

s electron configuration	
p electron configuration	
d electron configuration	
f electron configuration	

13) Determine the element of the lowest atomic number whose "ground state" contains:

Three d electrons	
A complete d set/subshell	
Ten total p electrons	
An f electron	
13 d electrons	
23 p electrons	
7 s electrons	

14) How many total p electrons are there in the ground state of a phosphorus atom?

15) What is the maximum number of electrons that can be accommodated in an energy level of n=3? In other words, how many electrons can the third energy level hold all together?

Dougherty Valley HS Chemistry
Electron Configuration – Noble Gas Configuration

Worksheet #4

Name: **Period:** **Seat#:**

1) Neon

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

2) Magnesium

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

3) Chlorine

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

4) Potassium

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

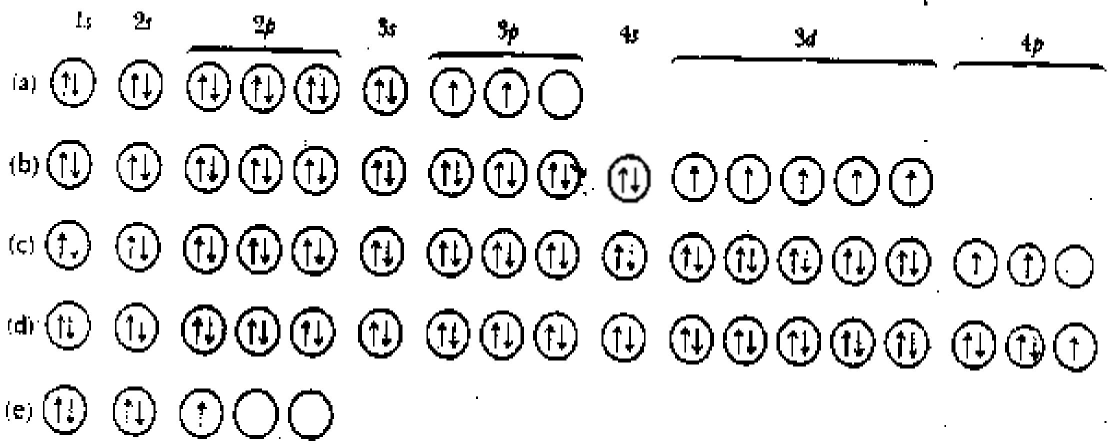
5) Iron

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

6) Krypton

Orbital diagram																		
Electron configuration																		
E.C. using noble gas notation																		

7) Write the corresponding NOBLE GASS configuration for each of the following pictorial representations. Name the element assuming that the configuration describes a neutral atom.



Q	Total # e-	Name	Noble Gas Configuration
a			
b			
c			
d			
e			

8) Which group of elements has a noble gas configuration that ends in ns^2?

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Worksheet #5

Name: **Period:** **Seat#:**

An atom has the tendency to lose electrons (to another atom) or to gain electrons (from another atom) in order to make the outer shell (valence shell) complete with eight electrons. This is called a "full valence shell." Not all orbitals are full with 8, but 8 is the common number to be considered full. Atoms with a complete outer shell are considered stable. Some atoms naturally have eight electrons in their outer shell and are very stable – these are the "Noble Gases" and they are typically unreactive or "inert." He, Ne, Ar, Kr, Xe and Rn are these very stable Noble Gases. (Helium is an exception to the "8 is great" stability rule because it is stable with only two electrons in its outer shell.) **Complete the following chart:**

Element	Atomic number	Electron Configuration	Number electrons in each energy level	Number e^- probably lost or gained	# e- left after loss or gain	Charge on ion
O	8	$1s^2\ 2s^2 2p^4$	2, 6	Gain 2	10	–2
Na	11	$1s^2 2s^2 2p^6 3s^1$	2, 8, 1	Lose 1	10	+1
S						
K						
Al						
Cl						
Xe						
Ca						
F						
Br						
N						
Ar						
I						
Sr						

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Write the ground state electron configurations for the following ions.
Remember that ions have a change in their total number of electrons. Positive ions have lost electrons, and negative ions have gained electrons. Use the chart you just made on the front to help you do this faster (you figured out the ion charge on the front and the starting configuration already!)

Element	Ion Symbol	Electron Configuration for the ION	Number electrons in The VALENCE SHELL now that it is an ion
O	O^{2-}	$1s^2\ 2s^22p^6$	8
Na	Na^{+}	$1s^22s^22p^6$	8
S			
K			
Al			
Cl			
Xe	NA	NA	NA
Ca			
F			
Br			
N			
Ar	NA	NA	NA
I			
Sr			

Dougherty Valley HS Chemistry
Electron Configuration – Ions

Write the ground state electron configuration for the following ions:

1) O^{+}	
2) C^{-}	
3) F^{+}	
4) Ar^{+}	
5) Look at the configurations that you wrote in Q#1 – are those ions that those atoms would ***want*** to make? Why or why not?	

Write the NOBLE GAS configuration for the following ions:

6) Cl^{-}	
7) P^{3-}	
8) Br^{-}	
9) Se^{2-}	
10) Na^{+}	
11) Ba^{2+}	
12) Fe^{3+}	
13) Ag^{+}	
14) Ni^{2+}	
15) Cr^{3+}	

Determine the number of unpaired electrons in the ground state of the following ions.
You can use an orbital diagram to help you, but you can also just use the periodic table!

16) F^{+}		**20)** Describe why atoms like to make certain ions. Also describe the pattern on the periodic table that lets us find the preferred ion quickly!
17) Sn^{2+}		
18) Bi^{3+}		
19) Ar^{+}		

Dougherty Valley HS Chemistry
Electrons – Extra Practice

Worksheet #6*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

1) Write the electron configuration for each atom.
a) Na b) Pb c) Sr d) U e) N f) Ag g) Ti h) Ce i) Cl j)Hg

2) If each orbital can hold a maximum of two electrons, how many electrons can each of the following sets hold?
a) 2s b) 5p c) 4f d) 3d e) 4d

3) What is the shape of an s orbital?

4) How many s orbitals can there be in an energy level?

5) How many electrons can occupy an s orbital?

6) What is the shape of a p orbital?

7) How many p orbitals can there be in an energy level?

8) Which is the lowest energy level that can have a s orbital?

9) Which is the lowest energy level that can have a p orbital?

10) Is it possible for two electrons in the same atom to have exactly the same set of quantum numbers? Which rule tells you yes or no?

11) How many d orbitals can there be in an energy level?

12) How many d electrons can there be in an energy level?

13) Which is the lowest energy level having d orbitals?

14) How many f electrons can there be in an energy level?

15) Which is the lowest energy level having f orbitals?

16) How many f orbitals can there be in an energy level?

17) How many unpaired electrons are in each of the following atoms?
a) K b) C c) P d) Ag e) Xe

18) Why do the fourth and fifth rows of elements contain 18 elements, rather than 8 as do the second and third series?

19) Which atoms are represented by the following electron configurations?
a. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^2$
b. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^4$
c. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^5$
d. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6$
e. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14} 5d^{10} 6p^6\ 7s^1$
f. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2 4\ d^{10}\ 5p^6\ 6s^2\ 4f^{14} 5d^{10} 6p^6\ 7s^2\ 5f^{14}\ 6d^8$
g. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{10}$
h. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14} 5d^{10}\ 6p^4$
i. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^5$

20) What is wrong with the following configurations?
a. $1s^2 2s^2 2p^6 3s^2 3p^0$
b. $1s^2 2s^2 2p^5 3s^2$
c. $1s^2 2s^2 3s^2 3p^6$

21) What is atomic absorption?

22) What is atomic emission?

23) Describe how you can identify an element based on a line spectra

24) Describe how the elements were formed in the universe

25) How do we use absorption spectra to identify the chemical makeup of stars?

Dougherty Valley HS Chemistry
Electrons – Extra Practice

Full, Nobel, and Ion Configuration Practice

#	Element	Full Configuration	Nobel Gas Configuration
26	Sodium		
27	Iron		
28	Bromine		
29	Barium		
30	Tin		
31	Cobalt		
32	Silver		
33	Tellurium		
34	Radium		
35	Argon		

Configuration of Ions

#	Element	# e- lost or gained	Total # e- left after loss or gain	Element written with charge	Full Configuration after loss or gain
36	Ca				
37	F				
38	Se				
39	N				
40	I				

41) Give two examples of:

a. An atom with a half-filled orbital set (subshell)
b. An atom with a completely filled outer shell (valence shell, or outer energy level)
c. An atom with its outer electrons occupying a half-filled subshell (orbital set) and a filled subshell (orbital set)

42) How many unpaired electrons are there in the ground state of each of the following atoms? (Hint: Orbital Diagram)

a. Ge
b. Se
c. V
d. Fe
e. Si
f. Mo
g. Ag

43) How many unpaired electrons are in the ground state of each of the following particles?

a. Cl^{-}
b. O^{2-}
c. Al^{3+}
d. Ca^{2+}
e. Na^{+}
f. P^{3-}
g. Xe

44) Arrange the following species into groups that have matching electron configurations (that is called "iso-electronic" when their configurations match)

F^{-}	Rb^{+}	Ti^{4+}	He
Sc^{3+}	O^{2-}	Ar	Se^{2-}
Be^{2+}	Na^{+}	B^{3+}	Y^{3+}

Dougherty Valley HS Chemistry
Flame Tests – Atomic Emission

Worksheet #7

Name: **Period:** **Seat#:**

Required Sections: (Refer to R-5 for guidelines and requirements. Make note of any specific changes given by your teacher in class)

Prelab: *All written in your lab notebook* - Materials, Reagent Table, Procedures, Data Table (should be pre-written in your lab notebook but do not rip out carbon copy pages of data table when turning in prelab)

Post-lab: - Post Lab Two Pager, Discussion Questions

Background

Have you ever seen a fireworks display? Where do all of the colors come from?

In this activity, you will investigate the colors of flame produced by solutions of metal salts.

A flame test is a procedure used to test qualitatively for the presence of certain metals in chemical compounds. When the compound to be studied is excited by heating it in a flame, the metal ions will begin to emit light. Based on the emission spectrum of the element, the compound will turn the flame a characteristic color. This technique of using certain chemical compounds to color flames is widely used in pyrotechnics to produce the range of colors seen in a firework display.

Certain metal ions will turn the flame very distinctive colors; these colors in turn can help identify the presence of a particular metal in a compound. However, some colors are produced by several different metals, making it hard to determine the exact ion or concentration of the ion in the compound. Some colors are very weak and are easily overpowered by stronger colors.

In this activity, solutions of ionic salts are sprayed into a Bunsen burner apparatus. You will be able to see the different colored flames produced. By comparing the color given off by an unknown with the known metal salts, the identity of the metal salt can be determined.

Materials

Bunsen Burner, matches or striker, various metal containing compounds (0.1 M concentration)

- Calcium Chloride
- Copper Chloride
- Barium Chloride
- Potassium Chloride
- Sodium Chloride
- Lithium Chloride
- Copper Sulfate
- Potassium Sulfate
- Sodium Sulfate
- Calcium Sulfate
- Strontium Nitrate

Procedure:

1) Light the Bunsen burner and open the air vent to obtain a non-luminous flame with two blue cones.
   - Be sure to avoid a yellow flame.

2) Spray the first sample into the bottom of the apparatus.
   - You can spray a few times until you get an intense color, but please do not be wasteful!
   - Spray at a 45-degree angle upwards. Do NOT spray towards anyone!

3) Record the color and intensity (bright/faint) of the flame in the data table.

4) Repeat steps 2 & 3 with the other salt solutions. Be sure to record the colors as precisely as possible.

Data Table - *sample table. Yours needs a descriptive title, include all necessary rows for data collection, and to be drawn big enough and neat enough to write in!*

Chemical Formula of Metal Salt	Metal Atom Found in the Salt Compound	Flame Color and Intensity

Sample Table

Discussion questions on back!

Discussion Questions: - *To be done AFTER the lab is done. Remember – do not copy the questions, but make sure to paraphrase them well enough that it will remind me what the question was about!*

1) What subatomic particles are found in the chemicals that were responsible for the production of colored light?
2) What does it mean when the electrons are "excited"?
3) How were the electrons "excited" in this part of the experiment – how did we physically do it?
4) Why do different chemicals emit different colors of light?
5) What is the relationship between energy, frequency, and wavelength? (Look it up! Research your answer!)
6) List the colors observed in this lab in order from the highest energy to the lowest energy. (You don't need to know the actual wavelengths to do this, we are just ranking them from high to low).
7) List the colors observed in this lab in order from the highest frequency to the lowest frequency. (You don't need to know the actual wavelengths to do this, we are just ranking them from high to low).
8) List the colors observed in this lab in order from the highest wavelength to the shortest wavelength. (You don't need to know the actual wavelengths to do this, we are just ranking them from high to low).
9) Based on the results of your experiment, what metal was found in the unknown(s)? Explain how you know this.
10) Explain why we did not see distinct lines (like on an emission spectrum) when the metal salts were burned. In other words, what ***didn't*** we do that would have taken the colored light we saw and turned it into a line spectra.
11) Do you think we can use the flame test to determine the identity of unknowns in a mixture? Why or why not?
12) Colorful light emissions are applicable to everyday life. Where else have you observed colorful light emissions?

Dougherty Valley HS Chemistry
Post Lab Two Pager

Worksheet #8

Name: **Period:** **Seat#:**

Lab Title	**Topic**
Purpose/Question/Problem/Goal/Hypothesis	
Key Vocab Terms	**Key Equations**
Key Concept Explained	
Important or Unique Lab Equipment, Set Up, or Named Lab Techniques	**Sig Figs Related to Lab Equipment**
Your Experimental Results	
Accepted Value/Results	**Percent Error Calculation**

Sample Calculations for Each Type of Calculation Done	
Possible Lab Errors	**Mathematical Impact of Lab Errors on Results**
Example Test Question on this Topic	**Solved Example Test Question on this Topic**

Things to Turn In

- **Prelab –** Done in lab notebook, carbon papers turned in *before* the lab.
- **Post Lab** – Turned in after the lab. Due dates will be told to you in class.
  - **Page 1 – Post Lab Two Pager** – Done on this template.
  - **Page 2 – Data Tables** – Done in lab notebook, carbon papers turned in.
  - **Page 3 – Calculation Section –** Done in lab notebook, carbon papers turned in.
  - **Page 4 – Post Lab Questions** – Questions on lab sheet, answers done in lab notebook, carbon papers turned in.
  - **Page 5 – Formal Post Lab Section** - If asked for. Will be given specific instructions at the time.
- **Post Lab Quiz –** Will be done and turned in during class.

DVHS Chemistry
Video Notes – Wonders of the Universe: Stardust Episode

Worksheet #9

Name: **Period:** **Seat#:**

Directions: While you watch the video you will fill out these "Two Column Symbol Notes." Use the key below to determine which symbol you should use while watching the video. In the first column put the symbol, and in the second column put the fact that you are referring too. You need enough detail and work on this page to show that you were attentive and thinking during the video! You can also make up your own symbols as long as you write them up where the key is so I know what they are.

KEY:

+ a positive, a pro, something good	**-** a negative, a con, something bad	**?** something you are wondering about	**!** something interesting or surprising
***** general fact, information	**@** important dates/locations	**Δ** something related to change, how things used to be, something that should change, etc	

Symbol	Fact

KEY:

+ a positive, a pro, something good	**-** a negative, a con, something bad	**?** something you are wondering about	**!** something interesting or surprising
***** general fact, information	**@** important dates/locations	**Δ** something related to change, how things used to be, something that should change, etc	

Symbol	Fact

Summary/Reflection: ***Do this at the end of the day you watched the video EVEN IF YOU DIDN'T FINISH THE VIDEO!***