**APES- Chapter #9**

***Biological Productivity and Energy Flow Due Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Learning Objectives:**

* *That energy flow determines the upper limit on the production of biological resources*
* *How the first and second laws of thermodynamics affect energy and production*
* *That energy flow is one way through the ecosystem*
* *That a basic quality of life is its ability to create order from energy on a local scale*
* *What determines the efficiency of biological production*

1: **Explain** the idea of sustainable harvesting using the two examples of *(Northern Michigan and Medieval England).*

2: **Define:**

* *Biomass-*
* *Biological Production-*
* *What 3 measures are used for biological production?*
* *Chemoautotrophs-*
* *Respiration-*

3: **Explain** the difference between **NET** and **GROSS** energy production

***Read: Working it Out 9.1 on Pg. 164***

4: Write the general relation between **biomass** and **net production**: *(Explain all of the parts)*

5: ***How much energy*** do the following contain?

* *Vegetation-*
* *Woody Tissue-*
* *Fat-*
* *Muscle-*
* *Leaves and Shoots-*
* *Roots-*

6: How much is a **Kilojoule?** What is a **Kilocalorie?**

***Read: Working it Out 9.2 on Pg. 165***

7: What is the equation for **photosynthesis**? *(Make sure you KNOW this)*

8: What is the equation for **respiration**? *(Hint: It is the opposite of photosynthesis)*

9: *Write out and define* the equations for **Net Production for Autotrophs**:

and **Secondary Production for a Population:**

10: *Define* the **First Law of Thermodynamics:**

11: Using the definitions of the **1st and 2nd Laws of Thermodynamics**, Why is it impossible for energy to be a closed system? *Explain.*

12: **Explain** why an ecosystem must be an **intermediate system** *(one that lies between a source of usable energy and a sink for degraded energy.*

13: Define **Energy Efficiency**:

14: **Explain the problem with Trophic-Level Efficieny** **calculations.** How much energy is transferred from one trophic level to another *in natural ecosystems*? *In managed ecosystems?*

15: Define **Detritivores** and *explain how they contribute to the trophic system.*

***Read: Should People Eat Lower on the Food Chain? on Pg. 171. Answer the following questions.***

16: Why does the energy content decrease at each higher level of a food chain? *What happens to the energy that is lost at each level?*

17. The pyramid diagram uses mass as an indirect measure of the energy value for each level of the pyramid. *Why it is appropriate to use mass to represent energy content?*

18: Use the average of 21 kJ of energy to equal 1g of completely dried vegetation and assuming that wheat is 80% water, *what is the energy content of the 333,000 kg of wheat shown in the pyramid? (Show your math!)*

19: Make a list of the environmental arguments for and against **(make a T-chart)** an entirely vegetarian diet for people. *What might be the consequences for U.S. Agriculture if everyone in the country began to eat lower on the food chain?*

20: How low do you eat on the food chain? *Would you be willing to eat lower?* **Explain.**