State the Law of Conservation of Matter: **How does matter move through an ecosystem?**	The amount of matter/mass of an isolated system will stay constant over time. Matter will neither be created nor destroyed. With the exception of extraterrestrial inputs, matter cycles between organic and inorganic pools within ecosystems.
State the First Law of Thermodynamics: **How does energy move through an ecosystem?**	Energy can neither be created nor destroyed but may be transferred or transformed. Energy flows through ecosystems: enters as sunlight and exits as heat.
What is gross primary productivity? **What is net primary productivity?**	Gross Primary Production (GPP) = the amount of light energy that is converted into chemical energy by photosynthesis per unit time. Net Primary Production (NPP) is the gross primary production minus the energy used by producers for respiration: NPP = GPP – R
Describe patterns of primary production in aquatic ecosystems: **Do the same for terrestrial ecosystems:**	Aquatic ecosystems: highest where there is a lot of light and nutrients (especially nitrogen, and phosphorous, P) Terrestrial: Highest where there is a lot of solar input and precipitation; N and P can also increase production
What is production efficiency? **What is trophic efficiency?**	It is the percent of food energy (that was not lost as waste such as feces) that actually becomes biomass: (growth/growth + respiration) x 100 It is the percentage of production transferred from one trophic level to the next. If 10,000 J are in plants and 1000 in primary consumers: (1000/10,000)x100 = 10%
Describe the relationship that pyramids of net production show:	Only a few top-predators may be supported in an ecosystem composed of millions of primary producers. Top-predators need large territories and are thus vulnerable to extinction.
Describe the relationship that pyramids of biomass show:	Most biomass pyramids show a sharp decrease in biomass from primary producers (plants) to top-predators.
Describe the pattern in decomposition rate and temperature:	Decomposition rate increases with temperature because higher temperatures are associated with faster chemical reactions.

What is genetic diversity and why is it important to a species to have a high level?	A genetically divers population will have many different versions of alleles for any given trait, such as the immune system's MHC proteins. This allows a species to adapt (through natural selection) to environmental changes.
What is the relationship between habitat size and species richness and why?	The general trend is that the larger the habitat, the higher the species richness. Larger plots of land will likely have more microhabitats than smaller areas, thus more diversity.
What role does disturbance play in ecosystems?	A medium-level of disturbance may increase biodiversity: tree-falls in mature forests creates canopy gaps, fire recycles nutrients High-levels of disturbance tends to result in a decrease in biodiversity.
Differentiate between primary and secondary ecological succession:	Primary succession follows an event that has removed soil such as being scraped by a glacier or covered by a lava flow. Secondary succession follows a disturbance that removes vegetation (but not soil) such as a hurricane or a clear-cut
Why is habitat loss a threat to biodiversity?	As human population and our demands for resources have grown, we have replaced much of the Earth's natural habitat with cities, agriculture, industry, clear-cuts, etc. Small habitat patches, like islands can support less individuals, less species, and are less resilient to disturbances.
What is habitat fragmentation? Why are habitats becoming fragmented? What is the concern with fragmentation?	Habitat fragmentation occurs when habitat is cleared in spots for development, energy extraction, agriculture, etc. leaving unconnected habitat islands. Smaller islands can support lower biodiversity than large islands. Fragmentation results in smaller habitat islands and a lot of edge habitat.
Why are introduced species a threat to biodiversity? Give a concrete example:	Brown tree snakes cause 9 of Guam's 11 bird species to go extinct. Without birds, there are no predators on spiders and no dispersal of some seeds. Spiders dominate the forests and devastate native insects.
What is the relationship between island size and species richness and why?	Larger islands tend to have more species than smaller ones because they have more microhabitats, are "easier" to find by colonizers, and are less prone to extinction than smaller islands.
What is the relationship between species extinction rate and island size? And why?	Smaller islands tend to have larger extinction rates because disturbances (i.e. hurricanes) are more likely to affect a greater proportion of the area. Also genetic drift a factor with small populations.

What is heat? How does it relate to entropy? What kind of energy grade is it?	Heat is random molecular motion. Because it is random in motion it represents a lot of entropy. It is considered a low-grade form of energy.
What is gross primary production?	Gross Primary Production = the amount of light energy that is converted into chemical energy by photosynthesis per unit time.
What is net primary production?	Net Primary Production is the gross primary production minus the energy used by producers for respiration: NPP = GPP - R
What limits primary production in aquatic ecosystems?	Light availability and nutrient availability
How is carbon dioxide removed from the atmosphere? **How is carbon dioxide returned to the atmosphere?**	Photosynthesis removes CO_2 from the air and fixes it in organic molecules. Cellular respiration breaks down food molecules to extract energy and releases CO_2 as waste. The carbon stored by photosynthesis long ago is currently being released when we burn fossil fuels.
What is a limiting nutrient and how do you determine which nutrient is limiting?	A limiting nutrient is the nutrient that must be added in order for production (plant/algae growth) to increase.
What tends to be the limiting nutrient in marine environment? What tends to be the limiting nutrient in fresh-water ecosystems?	Marine = nitrogen Fresh-water = phosphorous
What tends to limit primary production in terrestrial ecosystems?	Solar-input (temperature and light-availability for photosynthesis), moisture-availability, and nutrient-availability (N and P, usually N more limiting)
What is the general pattern seen in pyramids of production (amount of biomass in each trophic level)?	Most biomass pyramids show a sharp decrease in biomass from primary producers (plants) to tertiary consumers.

What is the pattern shown in pyramids of numbers and what is the significance?	Only a few top-carnivores may be supported in an ecosystem composed of millions of primary producers. Top-predators need large home-ranges and are thus vulnerable to extinction.
What percentage of available sunlight to primary producers convert into biomass?	About 1%
In a pyramid of net production that has a trophic efficiency of 10%, how much the energy found in primary producers is found in secondary consumers? Tertiary consumers?	1/100 1/1000
How do photosynthesis and cellular respiration affect the carbon cycle?	Photosynthesis removes CO2 from the air and fixes it in organic molecules. Cellular respiration breaks down food molecules to extract energy and releases CO2 as waste.
Although the Earth's atmosphere is 80% nitrogen it is unavailable to plants. How do plants get their nitrogen?	New nitrogen is fixed by lightning and volcanic emission dissolves in rain and settles. Some plants have nitrogen-fixing bacteria as root nodules. Most nitrogen is recycled in ecosystem.
Why is nitrogen needed? And how do animals get their nitrogen?	Nitrogen is needed for making amino acids, which are the building blocks of proteins and for the nitrogenous bases of DNA. Animals get their nitrogen from eating plants.
What do nitrifying and denitrifying bacteria do?	Nitrifying bacteria turn ammonium into nitrite and nitrate (plants can assimilate nitrate best). Denitrifying bacteria convert nitrate back to nitrogen gas.
Why do organisms need phosphorous?	Phosphorous is in ATP (adenosine triphosphate) energy currency, phospholipid membranes, and part of the sugar-phosphate back-bone of DNA.
What is the influence of vegetation on nutrient-cycling?	Decomposition, for example, tropical rainforests have nutrient-poor soils because rapid decomposition returns nutrients quickly to living vegetation.