

NOTES: GEORGIA HIGH SCHOOL SCIENCE TEST
ECOLOGY

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Cells and Heredity (approximately 25%)

Ecology (approximately 17%)

Structure and Properties of matter (approximately 26%)

Energy Transformation (approximately 16%)

Forces, Waves, and Electricity (approximately 16%)

GEORGIA HIGH SCHOOL GRADUATION REQUIREMENTS:

Biology (33-35%) Items test knowledge of the cellular basis of life, animal and plant systems, reproduction, genetics, classification schemes, ecology, and principles of environmental conservation.

Cells and Heredity

* What is DNA? (Deoxyribonucleic acid). One of two types of molecules that encode genetic information. (The other is RNA. In humans DNA is the genetic material; RNA is transcribed from it. In some other organisms, RNA is the genetic material and, in reverse fashion, the DNA is transcribed from it.)

There are four **nucleotides** in DNA. Each **nucleotide** contains a base: adenine (A), guanine (G), cytosine (C), or thymine (T).

nucleotide: A subunit of DNA or RNA consisting of a nitrogenous base (adenine, guanine, thymine, or cytosine in DNA; adenine, guanine, uracil, or cytosine in RNA), a phosphate molecule, and a sugar molecule (deoxyribose in DNA and ribose in RNA). Thousands of nucleotides are linked to form a DNA or RNA molecule.

nitrogenous: A term used to describe chemical compounds (usually organic) containing nitrogen in combined forms. Proteins and nitrates are nitrogenous compounds.

RNA (ribonucleic acid) - this molecule is present in the cells of all living beings and plays an essential role in the synthesis of proteins.

* What are some things DNA determines? (Color of hair, height, etc.-- DNA determines everything about our bodies.)

* Where is DNA? (The nucleus of almost every cell.)

* What are chromosomes made of? (They are formed from DNA and contain the information for building more cells.)

* What makes up DNA? **B SEE ABOVE FOR THE CHEMICALS**

* How do scientists do sequencing? (Using x-ray films. Each dark band on the X ray matches a colored base and each row of bands corresponds to one of the four bases.)

Evolution, diversity, and biogeography.

1. Ecology as a way of understanding the natural world, how organisms are influenced by their environment, and why a species is in a certain location.

2. Levels of biological hierarchy: (1) Individual organism; (2) Populations; (3) Communities and the interactions between the species. (4) Ecosystems and how nutrients are cycled.

3. Ecological scientists detect interesting patterns in nature; ask 'why'; develop hypotheses about what causes these patterns; test hypotheses, to determine which produces the pattern.

4. Types of study: (1) Observations; (2) Experiments; (3) Comparative or literature-based study; (4) Purely theoretical model.

5. EXAMPLE:. Duckling survival increases with initial brood size. Hypothesis 1 = safety in numbers. Hypothesis 2 = a healthier/stronger mom has more offspring who are (in turn) healthier.

Biodiversity

1. Biodiversity:

1. ecologically it appears in the variety of form and function (# of herbivores, flying creatures, etc.).

2. taxonomic diversity shown in classification of species and evolutionary divisions. (e.g. animals [mammals, birds etc.] , plants, protists ---).

2. How is diversity distributed around the world? And why? Distribution is not uniform and not ubiquitous (one time only), but in limited ranges with some overlap.

3. Distribution results from evolutionary history (long-term) and ecological factors (short-term).

4. Natural selection (N.s.): a process through which organisms adapt to their environment. N.s. acts on individuals, to determine whether they survive and whether they pass on their genes. But N.s. affects the makeup of populations.

Climates and Biomes: planet-wide influence on plants, animals, and resulting communities of:

1. Geographic variation in conditions, such as the 40% less solar radiation at the poles.

2. Seasonal variation due to 23.5° tilt in Earth's axis.

3. Low pressure and high rainfall at the equator; high pressure and low rainfall about 30° (where deserts tend to be) from the equator; trade winds, etc. result from the pressure difference.

Nine Biomes:

1. Tundra. Extreme temperature range, no trees, permafrost half a meter down, very short (can be two months) growing season, low diversity.

2. Boreal (northern coniferous) forest. Dramatic population cycles, fierce biting insects.

3. Temperate deciduous forest. Trees shed leaves in fall; low diversity of trees; ephemeral spring flowers in under-story; shady under-story in summer.

4. Temperate rain forest. Wetter than temperate deciduous forest; conifers dominate.

5. Tropical rain forest. Enormous diversity; complex interactions between species; high predation; poor soil with nutrients locked in the trees.

6. Tropical dry or seasonal forest. Higher proportion of deciduous trees than rain

forest.

7. Grasslands. No trees; often has high diversity or density of grazing mammals.

8. Tropical savanna. Sparse trees and grasslands; abundant, diverse herbivores; predators.

9. Desert. Dry.

Consumers and predators

1. Types of consumers:

1. Predators remove prey from the prey population.

2. Parasitoids capture prey, lay eggs on or in it, and the offspring feed on the prey and kill it. e.g. wasps and flies will use caterpillars and spiders.

3. Herbivores eat plants, seeds, or leaves: they do not consume the entire plant.

4. Parasites consume part of an organism.

5. Social parasites steal caretaking of other species, e.g. brood parasites in birds, fish, insects.

2. Predators regulate prey:

1. Predator-removal studies lead to an increase in prey density (usually).

2. Regulation is through density-dependence in per capita growth rate. Predation increases with increase in prey density. Therefore the death rate (d) increases with prey density, due to predation.

3. Many predator and prey populations show very regular fluctuations in density.

Ten Minute Ecologist

1. How do we humans view the world? (1) We are large and tend to see big things and miss small things. (2) We are short-sighted and tend to see and be concerned with things that are close in space and time, rather than distant factors. We share this with most species. Our language and culture (inherited from our human ancestors) gives us some power to act over longer distances and time.

2. What is a species? Initially defined by physical structure or by interbreeding ability. Might eventually be distinguished by DNA. "Taxonomy is the science of classification; systematics is the science of classification as it is applied to questions of evolutionary relationships."

3. What is biodiversity? "It is easier to preserve the diversity of an area by preserving the habitat than to focus on the welfare of one or a few endangered species" as long as the habitat is large enough. The diversity index reflects the number of species in a habitat as well as the relative distribution of those species. As the earth's population increases, humans take over more land for agriculture, replacing the variety of species with a single crop (e.g. Zea mays or corn in the USA's Midwest).

4. What is dirt? Soil, a complex mixture of organic and inorganic material.

5. What is water? Fresh, brackish, and salt. The water cycle is "the movement of water through and over the ground, through living organisms and into the air, and back into the ground, where it again becomes available for use by organisms. "

6. What is air? Not just the gases but the particles. Variations in pressure of air leads to winds. Tendency of organisms to lose moisture in air has led to water-conserving features like skin, exoskeletons, and kidneys.

7. Who eats whom?

* Producers. Plants.

* Consumers. Carnivores (animals, etc) eat the producers and other consumers.

Primary consumers are herbivores.

* Decomposers. Bacteria and fungi break down dead producers and consumers

8. Who beats whom? "Usually we compete most strongly with those most like us." "The species utilizing a common resource are called guilds" and members of the guild

compete for the common resource. "Competition is still considered one of the causes of evolutionary diversification, although certainly not the only cause."

9. What is an ecosystem? "A combination of all the biological and physical properties of the natural world." It is characterized by flow and cycle.

Why is the arctic so fragile? By 'fragile' it means "easily disrupted and slow to recover from a large disturbance". Its recovery from disturbance is short compared with the human attention span of weeks and months rather than centuries and millennia.

How is real estate really divided up? Into biomes, "one of several major kinds of ecological communities, dominated by certain plant types." Be observant.

What good is a swamp?

1. "Swamps are places where ... billions and billions of ... organisms live, breathe, and die. Nature's terrestrial food pyramid ... rests in part on the wetlands." "Insects are the glue that holds life on earth together."

2. Many migrating birds succeed because of swamps, leading to subsequent breeding success, with eco-tourism benefits.

3. In swamps, we learn how "nature replenishes and detoxifies our wastes."

SOME HANDY DEFINITIONS:

Ecology is the study of living organisms and their environment. Its aim is to explain why organisms live where they do. To do this ecologists study ecosystems, areas that can vary in size from a pond to the whole planet.

Ecosystem A reasonably self-contained area together with all its living organisms.

Habitat The physical or abiotic part of an ecosystem, i.e. a defined area with specific characteristics where the organisms live, e.g. oak forest, deep sea, sand dune, rocky shore, moorland, hedgerow, garden pond, etc.

Community The living or biotic part of an ecosystem, i.e. all the populations of all the different species living in one habitat.

Biotic Any living or biological factor.

Abiotic Any non-living or physical factor.

Population The members of the same species living in one habitat.

Species A group of organisms that can interbreed and produce fertile offspring.