



## IDX G9 Biology H

### Study Guide Issue S1 Midterms

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#### Contents:

1. [Chapter 4.1](#)
2. [Chapter 4.2](#)
3. [Chapter 4.3](#)
4. [Chapter 4.4](#)
5. [Chapter 4.5](#)

#### **Chapter 4.1: Climate**

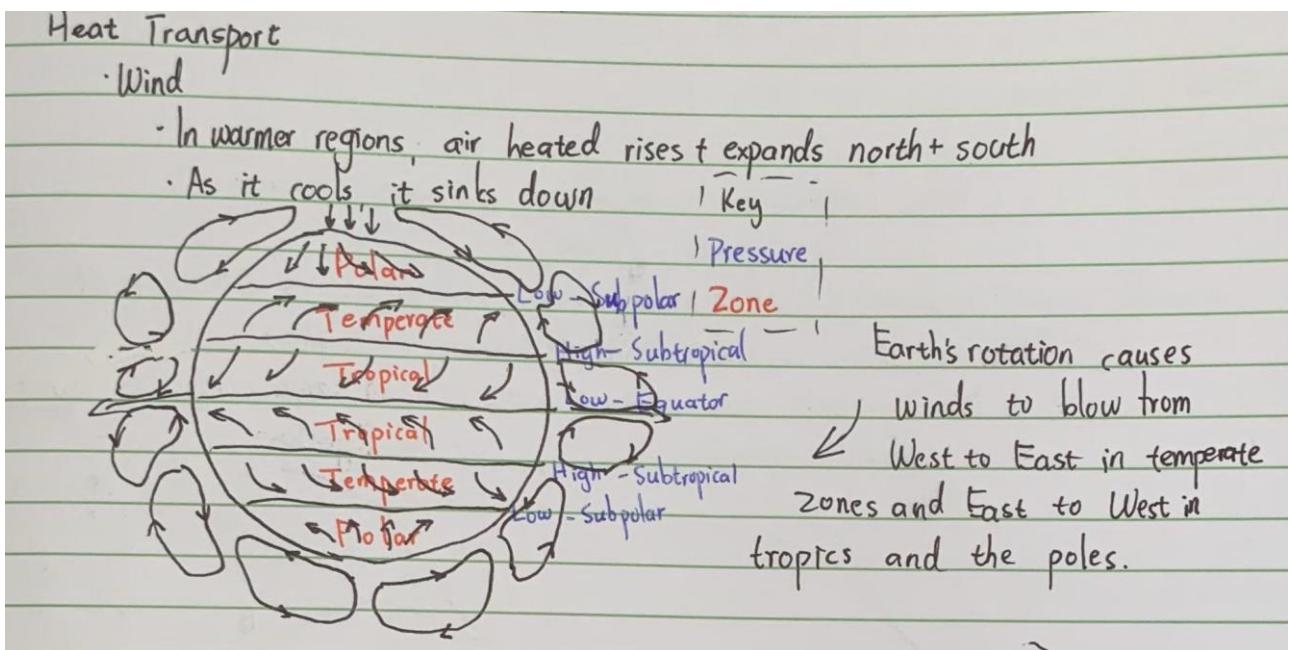
##### Weather vs. Climate

- **Weather:** Day to day conditions of Earth's atmosphere
  - Solar energy
  - Latitude
  - Transport of heat by winds and ocean currents
- **Climate:** Average conditions (annual temperature and precipitation) over long periods
  - **Microclimate** - Environmental conditions vary over small distances

##### Solar Energy and the Greenhouse Effect

- **Greenhouse Effect** - Maintains Earth's Average Temperature
  - CO<sub>2</sub>, CH<sub>4</sub> (Methane), Water Vapor, N<sub>2</sub>O
  - Human activity adds CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
- Solar energy strikes a surface
  - Some absorbed and converted to heat(radiation)

- Some radiated back
- Some trapped by gases
- Latitude and Solar Energy
  - Polar areas receive less intense sunlight
  - Solar more intense near equator
  - Climate zones
    - Tropical zones: between 23.5 N and 23.5 S
    - Temperate zones: between 23.5 S and 66.5 S & 23.5 N and 66.5 N
    - Polar zones: below 66.5 S or above 66.5 N



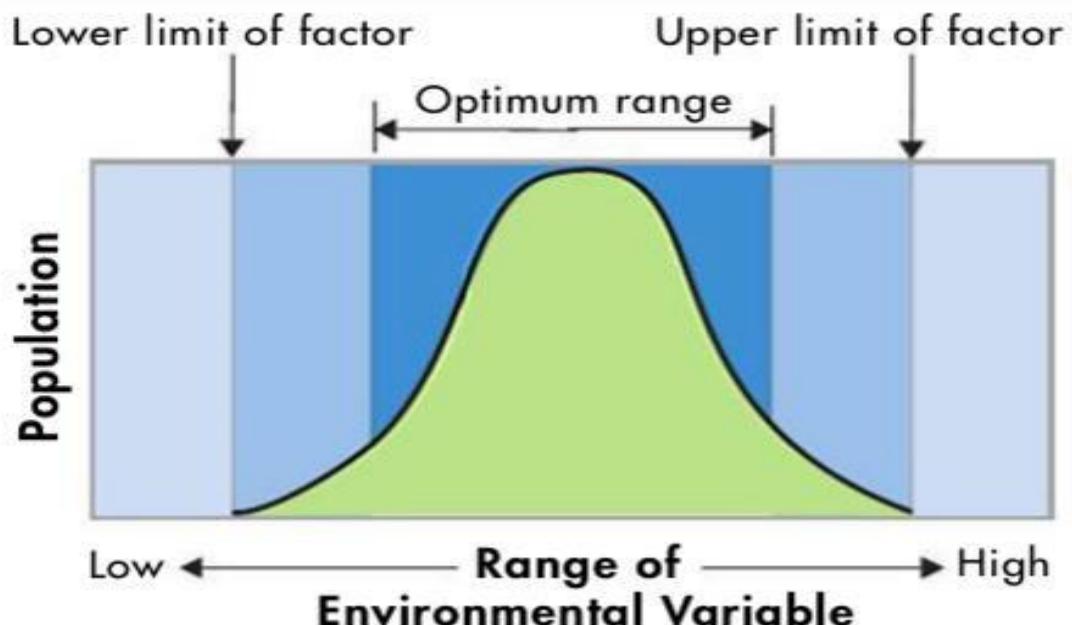
### Heat Transport in the Biosphere

- Ocean Currents: Surface currents affect climate of neighbouring landmasses
  - Deep ocean currents: Caused by cold water near poles sinking and flowing along the ocean floor
  - Upwelling: Water rises in warm regions
    - Wind drags surface water away, so water beneath moves up to substitute, temperature near surface decreases
- Warm air: Less dense and rises, expands out and sinks
- Air
  - Over warm currents: Adds moisture and heat
  - Over cool currents: Cool the air above

## Chapter 4.2: Niches and Community Interactions

### Vocabulary

- **Tolerance:** The ability to survive and reproduce under a range of environmental circumstances
  - Species have different tolerance for different environments



- The optimum range shows the range where the organism is most comfortable in
- **Habitat:** Place where an organism lives
  - Determined by the range of tolerance(optimum range)
- **Niche:** Role/Position of an organism in its environment
  - **Resources**, Abiotic factors, Biotic factors
- Competition: When organisms try to use the same limited resource **at the same time and in the same place**
  - Intraspecific (within same species) & Interspecific competition (Between different species)
  - Shape communities
    - Determine number and kinds of species
    - Determine niches
    - Divide resource

- **Competitive Exclusion Principle:** No two species can occupy exactly the same niche in the same habitat at the exactly same time for long. If two species attempt to occupy the same niche, one species will be better at competing for limited resources and will eventually exclude the other species.
- **Dividing Resources:** some species divide up the resources in order to survive. For example the warbler divide up the resources on the tree by dividing the tree into three different regions.

### Predation, Herbivory, and Keystone Species

- **Predator-Prey Relations:** Feeding by preying
- **Herbivore-Plant relations**
  - Affect size, species, and distribution of plants in community
  - Determine where plants can grow
- **Keystone Species**
  - Population of keystone species decrease, whole ecosystem impacted **significantly**
  - i.e. Kelp - Sea Urchin - Otter: Sea Otters are the only species that feed on urchins, so if their population decreases, the urchins would consume all the kelp and lead to ecosystem collapse

### Symbioses

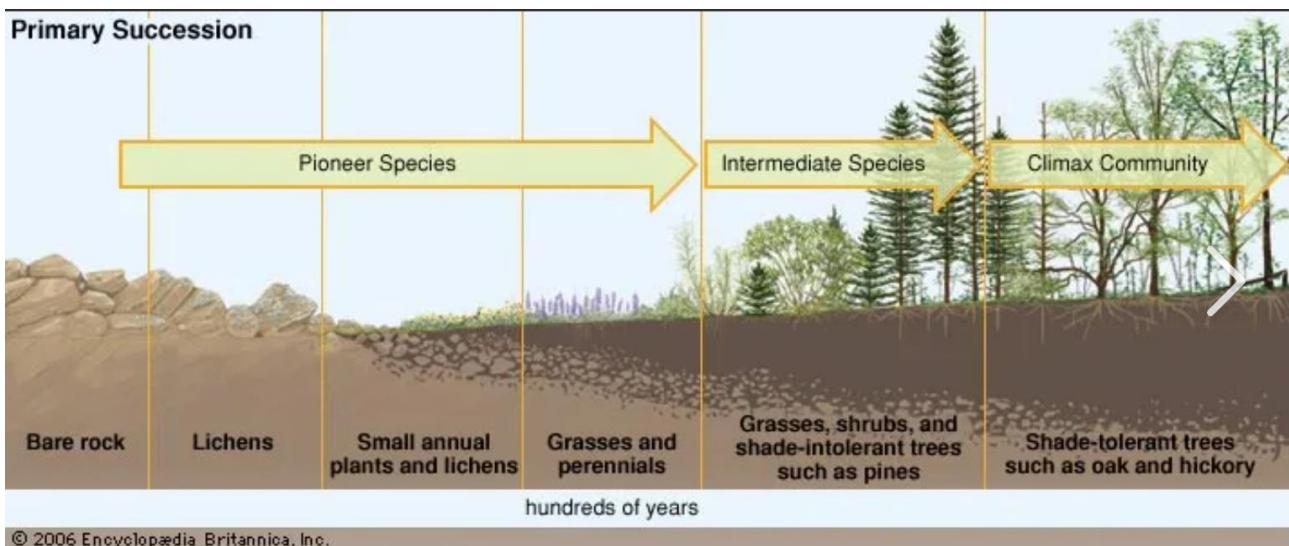
- Def: Close relationship when  $\geq 2$  Species live together
- **Mutualism:** Both organisms benefitted
  - i.e. sea anemones & clownfish
  - Coral bleaching
    - Coral reefs are symbiotic relationship between coral polyp and algae
    - Temperature increases, algae expelled and coral loses color
- **Parasitism:** Parasite lives on/in host and harms it
  - i.e. tapeworms & humans
- **Commensalism:** One benefitted, no effects on the other
  - i.e. barnacles & whales

### Chapter 4.3: Succession

- **Ecological Succession:** Set of predictable changes in a community over time
  - Ecosystems change after disturbances

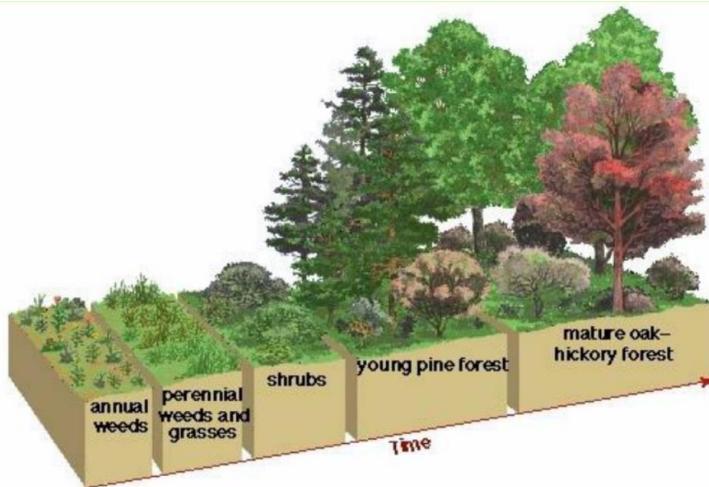
- Primary Succession

- Establishing a community in area of exposed rock with no topsoil, very slow at first
- Can happen after volcanic eruptions and glacier retreat, leaving bare rock
- Bare rock -> lichens -> small annual plants, lichens -> perennial herbs, grasses -> grasses, shrubs, shade-intolerant trees -> shade tolerant trees
- Pioneer Species
  - First organisms to appear - moss and lichen
  - Break down rock into soil for more complex plants to grow



- Secondary Succession

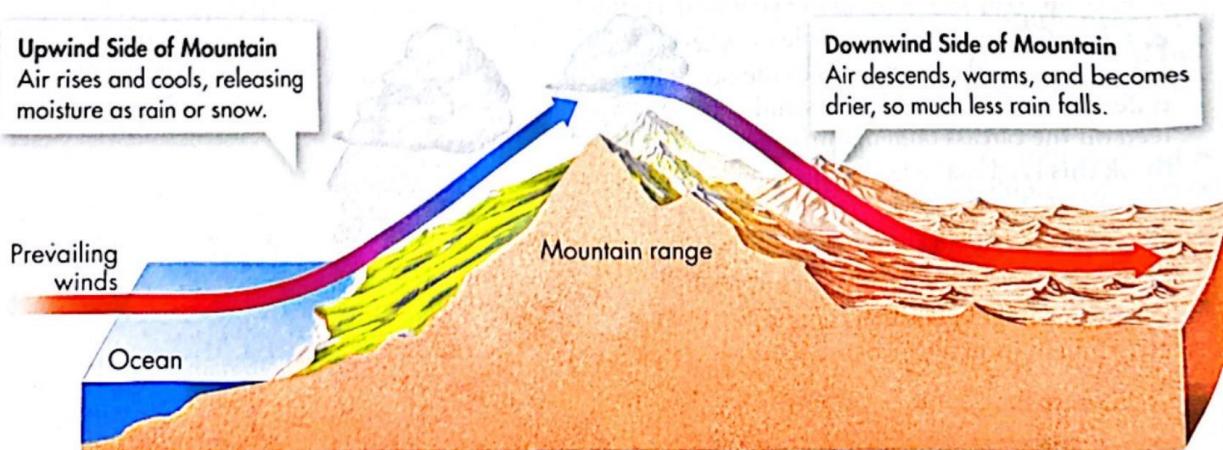
- Existing communities not completely destroyed, soil remains, faster than primary
- Follows wildfire, hurricanes, logging and farming
- i.e. Fire -> annual plants (1~2 years) -> grasses and perennials (3~4 years) -> grasses, shrubs, pines, young oak and hickory (5~150 years) -> mature oak and hickory forest (150+ years)



- Climax Communities
  - Ecological community in final stage of succession
  - High biodiversity, stable species composition
  - Secondary succession may not completely recover from human disturbances

## Chapter 4.4: Biomes

- The Major Biomes
  - Biomes are large regional communities of plants and animals, defined by their **abiotic factors** (like climate and soil) and **biotic factors** (the organisms living there).
  - **Climate** is shaped not just by latitude, but also by geography. For example, coastal mountains force moist air to rise, causing rain on the windward side and creating a dry rain shadow on the leeward side.



- Characteristics of the Ten Major Biomes
  - Tropical Rain Forest

- Abiotic: Hot and wet year-round; nutrient-poor soils due to the large biodiversity and the rainfall.
- Biotic:
  - Plants: Tall trees form a dense, leafy covering called a **canopy**, shorter trees and vines form a layer called the **understory**.
  - Animals: Many animals use **camouflage**, some can change color, animals that live in the canopy have adaptations for climbing, jumping, and/or flight.
- Tropical Dry Forest
  - Abiotic: warm year-round; alternating wet and dry seasons; rich soils due to the dry weather.
  - Biotic:
    - Plants: Adaptations to survive the dry season include seasonal loss of leaves. A plant that sheds its leaves is called **deciduous**.
    - Animals: Many animals reduce their need for water by entering long periods of inactivity called **estivation**.
- Tropical Grassland/Savanna/Shrubland
  - Abiotic: warm; seasonal rainfall; compact soils; frequent fires.
  - Biotic:
    - Plants: Some grasses have a high silica content, grasses grow from their bases, not their tips, so they can continue to grow after being grazed.
    - Animals: Many animals migrate during the dry season in search of water.
- Desert
  - Abiotic: low precipitation; variable temperatures; soils rich in minerals but poor in organic material.
  - Biotic:
    - Plants: Many plants have adapted to store water with thin leaves and the ability to store water in stems.

- Animals: Many desert animals are **nocturnal**, have adaptations for conserving water.
- Temperate Grassland
  - Abiotic: warm to hot summers; cold winters; moderate seasonal precipitation; fertile soils; occasional fires.
  - Biotic:
    - Plants: Grassland plants are resistant to grazing and fire.
    - Animals: Camouflage and burrowing are two common protective adaptations.
- Temperate Woodland and Shrubland
  - Abiotic: hot dry summers; cool moist winters; thin, nutrient-poor soils; periodic fires.
  - Biotic:
    - Plants: Woody chaparral plants have tough waxy leaves that resist water loss, the seeds of some plants need fire to germinate.
    - Animals: Animals tend to be browsers where they eat on a variety of food, camouflage is common.
- Temperate Forest
  - Abiotic: cold to moderate winters; warm summers; year-round precipitation; fertile soils.
  - Biotic:
    - Plants: Mostly made up of **deciduous** and evergreen **coniferous** trees soils are often rich in **humus** which is usually made of dead leaves.
    - Animals: Some hibernate; others migrate, may be camouflaged to escape predation.
- Northwestern Coniferous Forest
  - Abiotic: mild temperatures; abundant precipitation in fall, winter, and spring; cool dry summers; rocky acidic nutrients rich soils.
  - Biotic:
    - Plants: Because of its lush vegetation, the northwestern coniferous forest is sometimes called a temperate rain forest.

- Animals: Many animals are **browsers**—they eat a varied diet—an advantage in an environment where vegetation changes seasonally.
- Boreal Forest (Taiga)
  - Abiotic: long cold winters; short mild summers; moderate precipitation; high humidity; acidic, nutrient-poor soils.
  - Biotic:
    - Plants: Conifers are well suited. Their conical shape sheds snow, and their wax-covered needlelike leaves prevent excess water loss.
    - Animals: Staying warm is the major challenge for animals.
- Tundra
  - Abiotic: strong winds; low precipitation; short and soggy summers; long, cold, dark winters; poorly developed soils; **permafrost** which means one layer of the forest being frozen throughout the whole year.
  - Biotic:
    - Plants: By hugging the ground, mosses and other low-growing plants avoid damage from frequent strong winds.
    - Animals: Many animals migrate to avoid long harsh winters. Animals that live in the tundra year-round display adaptations, among them natural antifreeze.
- Other Land Areas
  - **Mountain Ranges:** Abiotic and biotic conditions change dramatically with elevation, creating a series of different ecological communities in one area.
  - **Polar Ice Caps:** Extremely cold year-round with ice-covered land; they support very little plant life and are not classified as a major biome.
  - **These areas are not identified as biomes because it is hard to define its biotic and abiotic factors due to its presence in several different locations throughout the world.**

## Chapter 4.5: Aquatic Ecosystem

- Conditions Underwater
  - Aquatic organisms are affected primarily by the water's depth, temperature, flow, and amount of dissolved nutrients.

- Water Depth and Sunlight
  - The **photic zone** is the sunlit region near the surface where photosynthesis can occur. Photosynthetic algae, called **phytoplankton**, live here.
  - The **aphotic zone** is permanently dark and below the photic zone; photosynthesis cannot occur here.
  - The **benthic zone** is the habitat of the **benthos**—organisms that live on the rocks and sediments at the bottom of water bodies.
- Temperature and Currents
  - Aquatic habitats are warmer near the equator and colder near the poles. Temperature often decreases with depth. Currents can carry warm or cold water to unexpected areas.
- Nurtient Availability
  - The type and availability of dissolved substances like oxygen, nitrogen, and phosphorus vary greatly and affect which organisms can survive.
- Freshwater Ecosystems
  - Freshwater ecosystems, which make up only 3% of Earth's surface water, are divided into three main categories.
  - Rivers and Streams
    - Often start in mountains with high oxygen and low plant life.
    - Downstream, they slow down, accumulate sediments, and support more plant life.
    - Animals often depend on food from the land along the banks.
  - Lakes and Ponds
    - Food webs are based on a combination of **plankton** (phytoplankton and zooplankton) and attached plants.
    - Water circulation distributes heat, oxygen, and nutrients.
  - Freshwater Wetlands
    - An ecosystem where water covers the soil or is present at the surface for part of the year.
    - They are highly productive, serve as breeding grounds, and have important functions like purifying water and preventing floods.

- The three main types are freshwater bogs, marshes, and swamps.
- Estuaries
  - An **estuary** is a special wetland formed where a river meets the sea, containing a mixture of fresh and salt water it is located in a area where the two water meet.
  - They are shallow, sunny, and support an astonishing amount of biomass.
  - **Importance:** They serve as spawning and nursery grounds for many ecologically and commercially important fish and shellfish species like bluefish, striped bass, and crabs.
  - Types include **salt marshes** (temperate zones with salt-tolerant grasses) and **mangrove swamps** (tropical zones with salt-tolerant trees).
- Marine Ecosystem
  - Ecologists divide the ocean into zones based on depth and distance from shore.
  - Intertidal Zone
    - The area between the high and low tide lines.
    - Organisms are subjected to regular and extreme changes in temperature, sunlight, and wave action (e.g., barnacles and seaweed).
  - Coastal Ocean
    - Extends from the low-tide mark to the edge of the continental shelf.
    - It is brightly lit, nutrient-rich from land runoff, and highly productive.
    - Includes kelp forests and coral reefs.
  - Open Ocean
    - Begins at the continental shelf and covers more than 90% of the ocean area.
    - **Photic Zone:** The top layer where light penetrates. It has low nutrient levels but is where most of Earth's photosynthesis occurs.
    - **Aphotic Zone:** The permanently dark deep ocean. Food webs are based on dead material from above or **chemosynthetic** organisms around deep-sea vents. Organisms face high pressure, cold, and darkness.
    -

themselves to the rocks.

