

APES End of Year Review

*****Check the Index at the back of the textbook or the glossary to find what pages the following items are located on*****

Basic Info

- **Human Population Growth is the # 1 problem.** ALL other environmental problems stem from this. *Poverty contributes greatly to many environmental problems.*
- **Gaia hypothesis** – originated by James Lovelock – Living organisms & nonliving substances are interdependent upon one another
- **Definition of ecology, conservationists, environmentalists**
- **Give examples of perpetual, renewable and nonrenewable resource**
- **Contributions by Thoreau, Muir, Teddy Roosevelt, Rachel Carson, Aldo Leopold, Gifford Pinchot**
- **Create an experiment:** Include hypothesis (If... then...), a **detailed** procedure that includes independent and dependent variables, controls, **how & what instruments** you would use to collect **quantitative** data, length of experiment, and projected conclusions
- **List of Biotic and Abiotic factors that can affect the environment**
- **Positive & Negative Feedback, Synergistic effects**
- **Open System (energy flows only in ONE direction) vs Closed system (matter can be recycled)**
- The parts of the Electromagnetic spectrum – infrared (IR, micro, TV, radio), visible, ultraviolet (UV, Xrays, gamma, cosmic)
- **The chemical equations for BOTH photosynthesis & respiration**
- Measuring pollutants -**ppm** (one part per 1,000,000 parts, one part in 10^6), **ppb** (one part per 1,000,000,000 parts, one part in 10^9), **ppt** (one part per 1,000,000,000,000 parts, one part in 10^{12})

Human Population & Health

- Synergistic effects
- **Doubling Time (Rule of 70):** $70 \div \% \text{ growth rate} = \# \text{ of years it would take for the population to double}$
- **% Change (either increase or decrease):** $[(\text{Old \#} - \text{New \#}) \div \text{Old \#}] = \% \text{ change}$ (a decrease would show as a negative number)
- **Growth Rate = [(BR +I)– (DR+E)] ÷ Population**
- **Annual rate of natural pop change:** $(\text{BR} - \text{DR}) \div 10 = \% \text{ annual change}$
- **Environmental Impact = Population x Affluence x Technology (I = P x A x T)** – the formula is not as important as knowing that people in developed countries have a *much greater* impact on the environment than people in developing countries.
- **Define the following terms** – age structure diagram (alias histogram, population pyramid), demographic transition, total fertility rate, replacement level fertility, infant mortality, crude birth rates, crude death rates, growth rates (including how to find growth rate for population or per 1000), education, and standard of living
- **Explain what happens during each stage of Demographic Transition: Pre-Industrial, Transitional, Industrial, Post-Industrial**
- **Indicators of overall health of a country: life expectancy & infant mortality rate**
- *Change of reliance on renewable energy to nonrenewable energy during transition from agrarian to industrial society*
- **Be able to interpret Age Structure diagrams** – growing (increasing), stable (static), declining (decreasing), **the age range of each of the 3 age groups** (pre-reproductive years, reproductive years, post-reproductive years)
- **List reasons why many third world countries have high numbers of children per family**
- **List policies that the following countries have done to bring about a decline in the number of births per family: Thailand, India, China**
- **List the different health effects from POPs (Persistent Organic Pollutants –see notes from Agriculture Unit 11)**
- **List the different diseases found in developing countries: their names, the cause, the vector, and the health effects**

Ecosystems, Biogeochemical cycles, Energy Flow

- Growth Patterns – **Exponential growth** (J curve), **Logistic growth** (S curve), **Arithmetic** (linear – a straight line)
- **Know the forms of carbon in the Carbon cycle** – in the **atmosphere** (CO_2), in the **water** (CaCO_3 -limestone), in the **biota** (organic compounds \rightarrow fossil fuels), in the **soil** (CO_3^{2-} or organic cmpds)
- **Know the forms of nitrogen in the Nitrogen cycle** – **Nitrogen fixation** ($\text{N}_2 \rightarrow \text{NH}_3$), **nitrification** ($\text{NH}_3 \rightarrow \text{NO}_3$), **assimilation** ($\text{NO}_3 \rightarrow$ organic nitrogen as protein etc.), **ammonification** (organic nitrogen $\rightarrow \text{NH}_3$), **denitrification** ($\text{NO}_3 \rightarrow \text{N}_2$) (the chemical reactants and products formed).
- **Know the forms of sulfur in the Sulfur cycle** – in the **atmosphere** ($\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$), in the **biota** (SO_4^{2-}), in the **soil** (SO_4^{2-} or H_2S or S).
- **Know the forms of phosphate in the Phosphate cycle** – PO_4^{3-} found in water & soil ONLY (*not found in the atmosphere*).
- **Sources of Carbon** (fossil fuels, living things (biota – mostly trees); **Sink for Carbon** (atmosphere, oceans)
- **Explain the parts of the Water cycle** – complete cycle, including transpiration
- **List the Trophic Levels** and where each of the following terms fit into them: **autotrophs**, **heterotrophs**, **herbivores**, **carnivores**, **producer**, **primary consumer**, **secondary consumer**, **tertiary consumer**, **decomposers**
- The higher the trophic level the **LESS energy** and **LESS biomass** available (even though organisms are larger in size there are fewer of them)
- Eating lower on the food chain provides for more food to be distributed to more people since the food would not have to be given to the cattle before they were themselves slaughtered for food
- **Define the terms:** Gross primary production (GPP), net primary production (NPP)
- **Describe the stages of primary and secondary succession** – include general types of plants and animals found in the different stages
- **Define:** Intermediate Disturbance Hypothesis, Ecological Gradient

Evolution, Biodiversity, Population Dynamics, Biomes

- **Population Dynamics** includes knowing the density, size, and age distribution of the population being studied
- **Describe the 3 types of dispersion** that populations are usually found in. Which is the most common?
- **Describe the relationship of “biotic potential”** with fundamental niche and realized niche
- **Draw the 4 types of population change curves** – stable, irruptive, cyclic, irregular
- **Describe and give examples of the types & examples of survivorship curves** – early loss, late loss, constant loss
- Ecosystems and **homeostasis** (steady state), sustainability
- **Sampling methods** – mark & recapture
- **Carrying capacity**
- **List Density Independent Factors vs. Density Dependent Factors** affecting populations
- **Keystone species** (definition & examples)
- **Indicator species** (definition & examples)
- **List characteristics of Generalist** (r selected species) vs. **Specialist species** (k selected species – also endangered species)
- **Invasive (alien, or exotic) species** (definition & examples)
- **Define or describe the following** processes that lead to evolution – **mutation**, **natural selection**, **migration**, **genetic drift**, **adaptive radiation**
- **List examples of Endangered species** (1 plant and 1 animal)
- **Explain the 3 parts of Species diversity** – richness, evenness, dominance
- **Factors affecting the extinction of a species by man** (hunting, habitat loss, alien species, specific pollutants)
- **Island biogeography:** Larger island = greater biodiversity, Closer to mainland = greater immigration

- Give examples of the following types of Symbiosis: parasitism, commensalism, mutualism
- Define: Competitive Exclusion Principle , Resource partitioning
- Ways prey can defend themselves: examples of – camouflage, chemical warfare, coloration, mimicry, deceptive looks, deceptive behavior
- Explain the differences between directional, stabilizing and diversifying natural selection
- Explain the difference between Geographic isolation vs Reproductive isolation
- List the Factors that increase diversity vs. Factors that decrease diversity
- Describe how species are affected through the use of - Migration corridors, mitigation parks, and the edge effect
- Divergent evolution: When one species evolves into several new species because they have been separated due to geographic isolation
- Convergent evolution: When several species on different continents, that were NEVER part of the same species, begin to have similar characteristics due to similar climates
- List general characteristics plus rainfall and temperature patterns for the following Biomes: Tundra (permafrost), Boreal (Taiga, Coniferous), Temperate Deciduous Forest, Temperate Grasslands (Steppes, Veldt, Pampas), Tropical Rain Forest, Chaparral, Desert
- Convention on International Trade of Endangered Species (CITES) – prohibits the international trade of any endangered species
- Endangered Species Act – protection of the endangered species *and its habitat*
- National Environmental Policy Act (NEPA) - requires federal agencies to consider the environmental impacts of proposed federal projects which could significantly affect the environment and any endangered species near those proposed projects

Energy

- Practice math problem concerning energy. Using factor labeling. Also finding % increase or decrease.
- Examples and differences between high-quality energy and low-quality energy
- Describe the 1st and 2nd Laws of Thermodynamics
- Transfer of energy efficiency (higher order to lower order)
- Extraction & Refining methods for fossil fuels: surface, subsurface, in-situ, smelters, fractional distillation, fluidized bed combustion
- List the problems associated with Acid mine drainage
- List the Pros and Cons of fossil fuel use (coal, oil, natural gas)
- Describe the function of each of the parts to the nuclear reactor core
- Explain nuclear fission and nuclear fusion. Include what fuels are used in each.
- List the Pros and Cons of nuclear energy
- List the Pros and Cons of renewable energy - wind, hydroelectric, biomass, solar (passive, active and photovoltaic), biofuels, geothermal, tidal, earth tubes
- Explain cogeneration
- List the Pros & Cons of Alternative Fuels – gasohol, ethanol, electric, solar, hydrogen –fuel cell, biodiesel
- Process and locations of mineral formation – along subduction zones or hot spots
- Resources vs. Reserves; Resources can be extracted *cheaply* ; Reserves may be identified but cost too much to extract OR they haven't been found yet
- Know what was the problem concerning Love Canal in New York
- Resource Conservation & Recovery Act (RCRA) - RCRA gave the EPA the authority to control hazardous waste from the "cradle-to-grave" including generation, transportation, treatment, storage, and disposal.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – commonly called the “Superfund” act – taxes from chemical and petroleum industries provided funds to clean up abandoned hazardous waste sites like Love Canal
- Oil Pollution Act - to provide enhanced capabilities for oil spill response and natural resource damage assessment
- Surface Mining Control and Reclamation Act (SMCRA) – required mine owners to reclaim the land (filling it in, putting on topsoil and reseeded it) after extracting the mineral. It also provided money to help clean up abandoned mines.

Geology, Winds, Currents

- Rock cycle – sedimentary, igneous, metamorphic
- **Plate Tectonics (3 types of plate movement): Diverging, Converging (with subduction), Transform Fault**
- **Explain El Nino & upwelling**
- **Parts of the atmosphere: Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere**
- **Rain-shadow effect – less rain on the leeward (backside) of the mountain**
- **What 3 factors create the winds? What 4 factors create surface water currents? What 2 factors create subsurface water currents? What are the names of the 3 convection cells in the atmosphere and where are they found?**
- **Urban Heat Island (Urban Dust Dome) – Cities have higher temps due to greater surfaces with a higher albedo (reflectivity), higher particulates, less wind and there is higher rainfall downwind of the city**

Agriculture, Soils, Pesticides, Fishing & Forests

- **Problems associated with the Green Revolution: Monoculture crop, Intense irrigation, fertilizer use, pesticide use, machinery use**
- **Pros and Cons of Traditional Subsistence Farming vs. Modern Intensive Farming (Industrial Farming)**
- **List at least 4 Pros and 4 Cons of Genetically Modified Organisms (GMO) – (usually in crops)**
- **Pros and Cons associated with aquaculture (fish farming in ponds)**
- **Factors that contribute to producing *maximum sustainable yields***
- **Soil horizons (O,A, etc), soil types (sand, clay, silt)**
- **Effects of pH, nitrates, phosphates on crops and soil (Know the numerical values from the water parameter sheet)**
- **Define: contour plowing, no-till agriculture, strip cropping, polyculture, polyvariety cultivation, alley cropping, agroforestry, green manure, humus, loam**
- **Define: Desertification, Salinization, Biomagnification (or Bioaccumulation)**
- **List methods for improving agricultural irrigation to reduce water usage**
- **List 6 different Integrated Pest Management (IPM) practices**
- **4 Types of Insecticides, (Chlorinated Hydrocarbons, Organochlorines, Carbamates, Botanicals) Examples of each and persistence in the environment (how long do they remain toxic) and whether they bioaccumulate**
- **Pesticide Treadmill**
- **How you find an LD-50 of a pesticide, Interpreting a Dose-Response Curve (whether it has a threshold or not)**
- **Describe the different methods of timber harvesting (clear cutting, shelterwood cutting, selective cutting, seed tree cutting) Know whether they are best for creating even-aged stands or promoting old-growth (uneven aged stand) forests**
- **List 3 Pros and 3 Cons of “even-aged stand” management (silviculture)**
- **Methods of commercial fish harvesting – purse seine nets, bottom trawling, long-line, gill nets**
- **Tragedy of the Commons associated with commercial fishing**
- ***Federal Food, Drug & Cosmetic Act* - protect food from adding any known carcinogens**
- ***Federal Insecticide, Fungicide & Rodenticide Act* ((FIFRA) – provided for the regulation, sale, distribution and use of pesticides by the EPA. EPA also set tolerance limits in pesticides.**
- ***Toxic Substances Control Act*- the EPA can track and require testing of industrial chemicals that pose a human health risk.**
- ***Food Securities Act (Farm Bill)*- contains provisions designed to discourage the conversion of wetlands into non-wetland areas for the use of farming.**
- ***Fish & Wildlife Act* –provides money for acquisition of wildlife refuge areas for fish, shellfish, etc (this protects more wetlands), regulate commercial fishing stock and commercial fishing vessels.**

Air Pollution

- List 4 major sources of Indoor Air Pollutants and the health effects related to them – formaldehyde, radon, carbon monoxide, asbestos
- Point sources vs. Nonpoint or fugitive sources
- Primary pollutants – PM-10, SO₂, CO, CO₂, NO, NO₂, VOC's (hydrocarbons) – Know where they originate (what anthropogenic sources produce them)
- Secondary pollutants – tropospheric O₃, PANs, aldehydes, H₂SO₄, HNO₃ Know HOW each is produced from the primary pollutants
- NAAQS Air Quality Standards – the 6 criteria pollutants that are monitored in outdoor air - CO (NOT CO₂), O₃, NO₂, PM-10, SO₂ and Pb – Know the health effects of each
- Write the chemical equation that would result in the formation of ozone in photochemical smog.
- Acid rain – HNO₃ and H₂SO₄ – what produces it, health effects, environmental effects
- Effects of Soil buffers (limestone) on acid rain
- Solutions (types of scrubbers – baghouse filters, electrostatic precipitators, cyclone separator, wet scrubber, fluidized bed combustion to take sulfur out of coal) associated with removing particulates and sulfur from coal
- Tragedy of the Commons associated with tropospheric air pollution
- *Kyoto Protocol* to limit the amount of CO₂ in the air
- *Clean Air Act* – allowed for pollution trading credits ('cap and trade') of SO₂, created pollution levels for 6 criteria pollutants (part of the NAAQS), requiring manufacturers to build cleaner engines; refiners to produce cleaner fuels; and certain areas with air pollution problems to adopt and run passenger vehicle inspection and maintenance programs, requires states to have plans that will restrict 'down-wind' pollution, provisions for reducing haze (visibility), requiring industries to install or change production processes concerning different categories of industrial pollutants, required the phaseout of any ozone depleting chemicals, requiring any business or industry discharging anything into the atmosphere to have a permit that specified what their pollution amounts could be, and provided the funds for educating the public about air quality.

Global Warming & Stratospheric Ozone Depletion

- List all the Negative & Positive Feedback effects associated with global climate change
- Milankovitch cycles (eccentricity, obliquity, precession – explain them and know how long they last), sunspots, etc.
- Explain how the natural Greenhouse Effect works
- List all the anthropogenic pollutants that contribute to the Greenhouse Effect (this includes ozone)
- Effects of global climate change: melting glaciers, sea level rise, severe storms, decreased biodiversity, climate changes, etc.
- *Montreal Protocol* to stop the production of CFCs that destroy stratospheric ozone
- Creation of ozone in stratosphere: $UV + O_2 \rightarrow O + O_2$; $O + O_2 \rightarrow O_3$
- Destruction of ozone in stratosphere: Cl (from CFC) + $O_3 \rightarrow ClO + O_2$
- Reservoir gases for binding Cl - HCl and ClONO₂
- Shielding of UV-A and UV-B (both cause skin cancers) from Earth and total blocking of UV-C
- Explain how the ozone hole is formed during the springtime (October) – include polar vortex and polar stratospheric clouds
- 1 CFC molecule can destroy up to 100,000 ozone molecules; it takes ~20 years for CFC's to reach the stratosphere; CFC's can last ~50 years up in the stratosphere
- Measurement of ozone depletion (in Dobson units) over the Antarctic – 350 DU is average
- CFC substitutes – HFCs, HCFCs

Water & Water Pollution

- Describe the different zones of the ocean
- Describe the different zones of a lake
- Define: oligotrophic, eutrophic, groundwater, aquifer, overdraft, subsidence, salt-water intrusion
- Amount of drinking water available – 0.03% Most is nonusable due to salinity, ice caps, etc.

- **Problems associated with overdraft of groundwater – salinization, uplift of land, subsidence**
- **List 6 methods for improving domestic use to reduce water usage – including ‘gray water’**
- **Water use –greatest is annual irrigation and feedlots, least is permanent irrigation and industry**
- **List 6 functions of wetlands**
- **Mitigation Banking – replacement of wetlands that are destroyed by building on them “No net loss of wetlands”**
- **Determination of health of a stream using the following tests: BOD, DO, Fecal coliform, turbidity, pH, nitrates, phosphates, streambank assessment, macroinvertebrates (check your notes – you need to know relative numerical values for what is considered GOOD and BAD)**
- **Explain the problems associated with each of the following: low DO, high BOD, high turbidity, high nitrates or phosphates, high pH, low pH, lack of mayflies or damsel flies, high fecal coliform count**
- **Problems associated with sedimentation – clogging gills of invertebrates, turbidity lowers the photosynthetic rate of algae and phytoplankton, erosion of topsoil, nutrient enrichment of waterways**
- **Methods to reduce different water pollutants & sedimentation – riparian buffers, sedimentation ponds, silt fences, reducing use of fertilizers & pesticides**
- **Explain the Oxygen Sag Curve**
- **List 3 problems associated with the Chesapeake Bay**
- **Steps in Water Treatment (for drinking)**
- **Steps in Waste Water Treatment (Sewage Treatment)**
- **Clean Water Act** - employs a variety of regulatory and nonregulatory tools to sharply reduce direct pollutant discharges into waterways (requiring NPDES permits), finance construction of municipal wastewater treatment facilities, and manage polluted runoff (fines for excessive discharge), for "nonpoint" runoff, voluntary programs, including cost-sharing with landowners are the key tool. For "wet weather point sources" like urban storm sewer systems and construction sites, a regulatory approach is being employed, under the watershed approach equal emphasis is placed on protecting healthy waters and restoring impaired ones.
- **Safe Drinking Water Act** – EPA sets national health-based standards for all public drinking water systems to protect against both naturally-occurring and man-made contaminants, this now includes recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water

Waste, Toxic Pollutants, Treatment

- **Methods of toxic cleanup (land and sea) – bioremediation, phytoremediation, baking of soils, oil booms, vapor extraction**
- **Use of IWM (Integrated Waste Management) to reduce amount of waste- Composting, Incineration, Landfilling, Reduce, Reuse, Recycle**
- **NIMBY (Not In My Backyard)**
- **List all the parts of a sanitary Landfill**
- **Problems associated with Landfills – monitoring leachate**
- **Hazardous Waste Laws – RCRA, CERCLA (Superfund) – listed above**

Economics & Cities

- **Definitions of GNP, GDP, per capita GNP**
- **Differences between city climates and rural climates – urban dust dome**
- **Direct costs** of usable goods (trees only valuable for lumber) vs. **Indirect cost** of usable goods (trees valuable for soaking up CO₂ to help prevent Global Warming)
- **Methods for controlling resource use: appeal to personal values; regulation of laws; taxes, fees, quotas; and licences**
- **Economic analysis = minimization of pollution + use of desirable resources**
- **Evaluation of environmental intangibles (aesthetic reasons) – unit, vividness, and variety**
- **City planning – maintenance of utilities, greenways, transportation, cluster housing, dissipation of heat**
- **Urban problems and Solutions**