APES REVIEW: "THE MANY WAYS TO GO APE(S)"

Put these facts on index cards. Study them throughout the year.
The underlined term or phrase goes on one side, and the definition/explanation goes on the other side.

BIODIVERSITY

1) Conservation: allowing the use of resources in a responsible manner

2) Preservation: setting aside areas and protecting them from human activities

3) Keystone species: species whose role in an ecosystem are more important than others (sea otters, sea stars, grizzly bears, prairie dogs)

4) Indicator species: species that serve as early warnings that an ecosystem is being damaged ex. trout

5) Characteristics of endangered species: small range, large territory, or live on an island

6) Endangered species: a group of organisms in danger of becoming extinct if the situation is not improved; population numbers have dropped below the critical number of organisms; North spotted Owl (loss of old growth forest), Bald Eagle (thinning of eggs caused by DDT), Piping Plover (nesting areas threatened by development), and many others

7) Invasive/Alien/Exotic species: non-native species to an area; often thrive and disrupt the ecosystem balance; examples: kudzu vine, purple loosestrife, African honeybee "killer bee", water hyacinth, fire ant, zebra mussel, gypsy moth, Asian Long Horned Beetle

CYCLES/PROCESSES

8) Parts of the hydrologic cycle: evaporation, transpiration, runoff, condensation, precipitation, infiltration

9) Nitrogen fixing: because atmospheric N_2 cannot be used directly by plants it must first be converted into ammonia (NH_3) by bacteria (*rhizobium* or cyanobacteria)

10) Ammonification: nitrogen is converted into ammonia by ammonifying bacteria; may occur when nitrogen in organic wastes in the soil are converted to ammonia or when atmospheric nitrogen (N_2) is converted to NH_3

11) Nitrification: ammonia (NH_3) is converted to nitrate ions $(NO_3)^-$

12) Assimilation: inorganic N_2 is converted into organic molecules such as DNA/amino acids & proteins - plants assimilate nitrogen as NH_4^+ or NO_3^- through their roots; animals (herbivores) assimilate organic nitrogen compounds by eating plants

13) Denitrification: bacteria convert nitrate $(NO_3)^-$ and nitrite $(NO_2)^-$ back into N_2 gas; bacteria convert ammonia (NH_3) back into N_2 or N_2O – typically accomplished by anaerobic bacteria

14) Phosphorus does not circulate as easily as nitrogen because: it does not exist as a gas, but is released by weathering of phosphate $(PO_4)^{3-}$ rocks; this is a SEDIMENTARY cycle – it is never found as a gas

15) How excess phosphorus is added to aquatic ecosystems: runoff of animal wastes, fertilizer, discharge of sewage; limiting factor in freshwater ecosystems; excess P leads to eutrophication

16) Photosynthesis: plants convert atmospheric carbon (CO_2) into complex carbohydrates (glucose $C_6H_{12}O_6$); energy is consumed and oxygen is released as a waste product

17) Aerobic respiration: O_2-consuming producers, consumers & decomposers break down complex organic compounds & convert C back into CO_2; energy is released and oxygen is consumed in the process

18) Anaerobic Respiration: break down of carbohydrates without oxygen – products are methane (CH_4), alcohols and other organics

19) Transpiration – process where water is absorbed by plant roots, moves up through plants, passes through pores (stomata) in leaves or other parts, evaporates into atm. as water vapor

20) Largest reservoirs of C: carbonate $(CO_3)^{2-}$ rocks first, oceans second

ECOLOGY

21) Sustainability: the ability to meet the current needs of humanity without compromising the ability of future generations to meet their needs

22) The Tragedy of the Commons: (1968 paper by ecologist Garret Hardin) "Freedom to breed" is bringing ruin to all. Global commons such as atmosphere & oceans are used by all and owned by none. When no individual has ownership, no one takes responsibility. Examples: overfishing in the oceans, over pumping of the Ogallala Aquifer

23) Natural selection: organisms that possess favorable adaptations survive and pass them onto the next generation

24) Energy flow in food webs or chains, through trophic systems: only 10% of the usable energy is transferred because usable energy lost as heat (second law); not all biomass is digested and absorbed; predators expend energy to catch prey; the 10% value is an average value

25) Biotic and abiotic: living and nonliving components of an ecosystem

26) Competition – a type of population interaction, usually over a limited resource – may be intraspecific or interspecific

27) Producer/Autotroph: photosynthetic or chemosynthetic life; Chemotroph – organism undergoing chemosynthesis – usually carried out by sulfur bacteria in aphotic zones in the ocean (deep ocean vents, etc.)

28) Primary succession: development of communities in a lifeless area not previously inhabited by life or those in which the soil profile is totally destroyed (lava flows); no soil substrate present; begins with lichen action

29) Secondary succession: life progresses where soil remains (clear-cut forest, fire, disturbed areas)

30) Mutualism: symbiotic relationship where both partners benefit and both participate

31) Commensalism: symbiotic relationship where one partner benefits & the other is unaffected or may benefit

32) Parasitism: relationship in which one partner obtains nutrients at the expense of the host

33) Biome: large distinct terrestrial region having similar climate, soil, plants & animals; terrestrial biomes determining factors are temperature and precipitation

34) Carrying capacity: the number of individuals (size of the population) that can be sustained in an area (supported by available resources in the environment)

35) R strategist: reproduce early in life; many small unprotected offspring; tend to be generalists, short lifespan

36) K strategist: reproduce late in life; few offspring; care for offspring; tend to be specialists, longer lifespan

37) Positive feedback: when a change in some condition triggers a response that intensifies the changing condition (warmer Earth - snow melts - less sunlight is reflected & more is absorbed, therefore warmer Earth)

38) Negative feedback: when a changing in some condition triggers a response that counteracts the changed condition (warmer Earth - more ocean evaporation - more stratus clouds - less sunlight reaches the ground - therefore cooler Earth)

39) Malthus: said human population increases exponentially, while food supplies increase arithmetically; factors that keep the population in check include war, famine & disease

40) Doubling time: rule of 70; 70 divided by the percent growth rate

41) Replacement level fertility: the number of children a couple must have to replace themselves (2.1 developed, 2.7 developing); biotic potential; total fertility rate (TFR)

42) World Population: ~ 6.8 billion U.S. Population: ~ 310 million

43) Preindustrial stage: (demographic transition) birth & death rates high, population grows slowly, infant mortality high

44) Transitional stage: (demographic transition) death rate lower, better health care, population grows fast

45) Industrial stage: (demographic transition) decline in birth rate, population growth slows

46) Postindustrial stage: (demographic transition) low birth & death rates

47) Age structure diagrams: broad base = rapid growth; narrow base = negative growth; uniform shape = zero growth; Major Age Cohorts → pre-reproductives, reproductives, post-reproductives

48) First and second most populated countries: China and India

49) Most important thing affecting population growth: low status of women

50) Ways to decrease birth rate: family planning, contraception, economic rewards and penalties

51) True cost / External costs: harmful environmental side effects that are not reflected in a product's price

ELECTRICITY

52) Cogeneration: using waste heat to make electricity

53) Electricity generated by fossil fuels, biomass or nuclear power: heat is produced which creates steam → steam turns a turbine → the mechanical energy from the turbine is converted to electrical energy in a generator and that energy is transmitted to homes through power lines

54) Hydroelectric power: potential energy of stored water is used to turn a turbine → the mechanical energy from the turbine is converted to electrical energy in a generator and that energy is transmitted to homes through power lines

ENERGY, GENERAL

55) Thermal gradient: spontaneous flow of heat from warmer to cooler bodies

56) Ionizing radiation: enough energy to dislodge electrons from atoms, forming ions; capable of causing cancer (gamma, X-rays, UV)

57) High Quality Energy: organized & concentrated; can perform useful work (fossil fuel & nuclear)

58) Low Quality Energy: disorganized, dispersed (heat in ocean or air wind, solar)

59) First Law of Thermodynamics: energy is neither created nor destroyed, but may be converted from one form to another (Law of Conservation of Energy)

60) Second Law of Thermodynamics: when energy is changed from one form to another, some useful energy is always degraded into lower quality energy, usually heat

61) Best solutions to energy shortage: conservation, increase efficiency, explore alternative energy options

62) Alternate energy sources: wind, solar, waves, biomass, geothermal, fuel cells

ENERGY, NUCLEAR

63) Natural radioactive decay: unstable radioisotopes decay releasing gamma rays, alpha particles, and beta particles

64) Half-life: the time it takes for ½ the mass of a radioisotope to decay

65) Estimate of how long a radioactive isotope must be stored until it decays to a safe level: approximately 10 half-lives

66) Nuclear Fission: nuclei of isotopes split apart when struck by neutrons

67) Nuclear Fusion: two isotopes of light elements (H) forced together at high temperatures till they fuse to form a heavier nucleus (He). Process is expensive; break-even point not reached yet; $D + D \rightarrow He$ or $D + T \rightarrow He$

68) Mass deficit: not all matter is converted into matter in a fusion reaction – some (the mass deficit) is converted into energy. $E = mc^2$. Explains the energy released in a fusion reaction.

69) Major parts of a nuclear reactor: core, control rods, steam generator, turbine, containment building

70) Two most serious nuclear accidents: Chernobyl, Ukraine (1986) and Three Mile Island, PA (1979)

FOSSIL FUELS

71) Petroleum formation: microscopic aquatic organisms in sediments converted by heat and pressure into a mixture of hydrocarbons (animal remains)

72) Pros of petroleum: relatively cheap, easily transported, high-quality energy

73) Cons of petroleum: reserves will be depleted soon; pollution during drilling, transport and refining; burning makes CO_2

74) Steps in coal formation: peat, lignite, bituminous, anthracite

PESTS

75) Major insecticide groups (and examples): chlorinated hydrocarbons (DDT); organophosphates (malathion); carbamates (aldicarb)

76) Pesticide pros: saves lives from insect-transmitted disease, increases food supply, increases profits for farmers

77) Pesticide cons: genetic resistance, ecosystem imbalance, pesticide treadmill, persistence, bioaccumulation, biological magnification

78) Natural pest control: better agricultural practices, genetically resistant plants, natural enemies, biopesticides, sex attractants

79) In natural ecosystems, methods which control 50-90% of pests: predators, diseases, parasites

POLLUTION, AIR

80) Particulate matter:
    Source: burning fossil fuels and diesel exhaust
    Effect: reduces visibility & respiratory irritation
    Reduction: filtering, electrostatic precipitators, alternative energy)

81) Nitrogen Oxides (NO_x):
    Source: ~50% from transportation (exhaust), ~50% from industry
    Effects: acidification of lakes, respiratory irritation, leads to photochemical smog & ozone formation
    Equation for acid formation: $NO + O_2 \rightarrow NO_2 + H_2O \rightarrow HNO_3$
    Reduction: selective catalytic reduction unit, more efficient combustion processes like FBC (fluidized bed combustion), lower combustion temperatures, find alternatives to fossil fuels

82) Sulfur oxides (SO_x):
Source: coal burning
Effects: acid deposition, respiratory irritation, damages plants
Equation for acid formation: $SO_2 + O_2 = SO_3 + H_2O = H_2SO_4$
Reduction: scrubbers, burn low sulfur fuel)

83) Carbon oxides (CO and CO_2):
Source: auto exhaust, incomplete combustion
Effects: CO binds to hemoglobin, reducing blood's ability to carry O_2; CO_2 contributes to global warming
Reduction: catalytic converter, emissions testing, oxygenated fuel, mass transit, increase efficiencies, find alternatives to fossil fuels

84) Ozone (O_3):
Formation: secondary pollutant,
$NO_2 + uv \rightarrow NO + O^*$ $O^* + O_2 \rightarrow O_3$, with VOCs (volatile organic compounds)
Effects: respiratory irritant, plant damage
Reduction: reduce NO and VOC emissions
Tropospheric ozone is BAD, stratospheric ozone is GOOD

85) Radon (Rn): naturally occurring colorless, odorless, radioactive gas, found in some types of soil and rock, can seep into homes and buildings, formed from the decay of uranium (U), causes cancer and is a problem in the Reading Prong area of PA. Radon decays to Polonium (Po), which is a solid. Po particles sit in lung tissue and are alpha (α) emitters. This leads to lung cancer.

86) Photochemical smog: formed by chemical reactions involving sunlight (NO, VOC, O*); associated with automobile traffic

87) Acid deposition: caused by sulfuric and nitric acids (H_2SO_4, HNO_3), resulting in lowered pH of surface waters, soil acidification and destruction of building materials

88) Greenhouse gases: Examples: H_2O, CO_2, O_3, chlorofluorocarbons (CFCs), methane (CH_4). Effect: they trap outgoing infrared (IR, heat) energy, causing Earth to warm

89) Effects of global warming: rising sea level (thermal expansion), extreme weather, drought, famine, extinctions

90) Stratospheric ozone depletion: caused by ozone-depleting chemicals (ODCs) such as CFCs, methyl chloroform or trichloromethane ($CHCl_3$), carbon tetrachloride (CCl_4), halon (haloalkanes), methyl bromide (CH_3Br)— all of which attack stratospheric ozone. The Cl or Br atoms "attack" the ozone molecules and cause the thinning of this layer. Global Agreement to decrease ODC – Montreal Protocol (1987)

91) Effects of ozone depletion: increased UV light that results in skin cancer, cataracts, decreased plant growth (inhibits photosynthesis, decline in Antarctic and Arctic phytoplankton population), impaired immune systems

92) Primary air pollutants: produced by humans & nature (CO,CO_2,SO_x,NO_x, hydrocarbons, particulates)

93) Secondary Air Pollutants: produced as a result of reactions that primary air pollutants undergo (include photochemical pollutants O_3, PAN and NO_2, and acids such as H_2SO_4 and HNO_3)

94) Sources of mercury: burning coal (25% of atmospheric deposition), compact fluorescent bulbs

95) Major source of sulfur: coal –burning power plants

POLLUTION, GENERAL

96) Point vs. non point sources: Point, from specific location such as a pipe. Non-point, from over an area such as runoff

POLLUTION, WATER

97) Chlorine: good= disinfection of water; bad = forms trihalomethanes when organics are present in the water; many systems now use chloramines to treat waste water before it is discharged. Alternatives to chlorine disinfection – ozone

or UV light

98) Fecal coliform/*Enterococcus* bacteria: indicator of sewage contamination ; found in the intestines of all warm blooded mammals (coliform bacteria)

99) BOD: biological oxygen demand, amount of dissolved oxygen needed by aerobic decomposers to break down organic materials in water

100) Eutrophication: may result in rapid algal growth caused by an excess of nitrates $(NO_3)^-$ and phosphates $(PO_4)^{3-}$ in water

101) Hypoxia: when aquatic plants die, the BOD rises as aerobic decomposers break down the plants, the DO (dissolved O_2) drops & the water cannot support life; very low DO levels; dead zone in the Gulf of Mexico

102) Anoxic: no DO (dissolved O_2) in the water

SOIL/GEOLOGY

103) Surface mining: cheaper and can remove more minerals; less hazardous to workers

104) Ore: a rock that contains a large enough concentration of a mineral making it profitable to mine

105) Humus: organic, dark material remaining after decomposition by microorganisms

106) Leaching: removal of dissolved materials from soil by water moving downwards

107) Illuviation: deposit of leached material in lower soil layers (B horizon)

108) Loam: perfect agricultural soil with optimal portions of sand, silt, clay (40%, 40%, 20%)

109) Soil Profile, horizons in order: O – A – E – B – C –R

110) Organic fertilizer: slow-acting & long-lasting because the organic remains need time to be decomposed

111) Salinization of soil: in arid regions, water evaporates leaving salts behind

112) Volcano and Earthquake occurrence: at plate boundaries (divergent= spreading, mid-ocean ridges) (convergent= trenches) (transform= sliding, San Andreas)

113) Monoculture – cultivation of a single crop, usually in a large area

114) Food: wheat, rice and corn provide more than ½ of the calories in the food consumed by the world's people

TOXICOLOGY

115) LD50 (LD-50, LD_{50}): the amount of a chemical that kills 50% of the animals in a test population within 14 days of the initial dose

116) Threshold dose: the maximum dose that has no measurable effect on a given population

WATER

117) Percent water on earth by type: 97.5% seawater, 2.5% freshwater

118) Aquifer: any water-bearing layer in the ground; confined or artesian, unconfined or water table

119) Subsidence: land sinks as result of over pumping an aquifer

120) Cone of depression: lowering of the water table around a pumping well

121) Salt water intrusion: near the coast, over-pumping of groundwater causes saltwater to move into the aquifer

122) Ways to conserve water: agriculture = drip/trickle irrigation; industry = recycling; home = use gray water, repair leaks, low flow fixtures. reclaimed water for agriculture and golf courses

WASTE, HAZARDOUS and effects

123) Hazardous Waste (as defined by RCRA) – Mutagen, Teratogen, Carcinogen: (in order) causes hereditary changes through mutations; causes fetus deformities; causes cancer

124) Minamata Bay disease: (1932-1968, Japan) physical and mental impairments caused by methylmercury $(CH_3Hg)^+$ poisoning

125) Love Canal, NY: (1950s +) chemicals buried in old canal; school and homes built over it; caused birth defects and cancer

WASTE, SOLID

126) Main component of municipal solid waste (MSW): paper; most is landfilled

127) Sanitary landfill problems and solutions:
problem = leachate; solution = liner with collection system
problem = methane gas; solution = collect gas and burn
problem = volume of garbage; solution = compact and reduce

128) Incineration advantages: volume of waste reduced by 90%, and waste heat can be used

129) Incineration disadvantages: toxic emissions (polyvinyl chloride, dioxins), scrubbers and electrostatic precipitators needed, ash disposal (contains heavy metals)

130) Best way to solve waste problem: reduce the amounts of waste at the source (source reduction)

WEATHER/CLIMATE

131) ENSO: El Niño Southern Oscillation, see-sawing of air pressure over the S. Pacific

132) During an El Niño year: trade winds weaken & warm water sloshed back to SA

133) During a non El Niño year: easterly trade winds and ocean currents pool warm water in the western Pacific, allowing upwelling of nutrient rich water off the west coast of South America

134) Effects of El Niño: upwelling decreases disrupting food chains; N U.S. has mild winters, SW U.S. has increased rainfall, less Atlantic hurricanes

135) Temperature Inversion – layer of dense, cool air trapped under a layer of warm dense air, pollution in trapped layer may build to harmful levels; frequent in Los Angeles, California and Mexico City, Mexico

136) Forest Fires: Types – Surface, Crown, Ground (in order) usually burn only under growth and leaf litter on forest floor; hot fires, may start on ground but eventually leap from treetop to treetop; go underground, may smolder for days or weeks, difficult to detect and extinguish, i.e. peat bogs.

LEGISLATION: Note – original years of inception are included FYI

MINING

137) Surface Mining Control & Reclamation Act: (1977) requires coal strip mines to reclaim the land Madrid Protocol: (1991) Suspension of mineral exploration (mining) for 50 years in Antarctica

138) Madrid Protocol: (1991) Moratorium on mineral exploration for 50 years in Antarctica

WATER

139) Safe Drinking Water Act: (SDWA, 1974) set maximum contaminant levels for pollutants in drinking water that may have adverse effects on human health

140) Clean Water Act: (CWA, 1972) set maximum permissible amounts of water pollutants that can be discharged into waterways; aims to make surface waters swimmable and fishable

141) Ocean Dumping Ban Act: (1988) bans ocean dumping of sewage sludge and industrial waste in the ocean

AIR

142) Clean Air Act: (CAA, 1970) set emission standards for cars and limits for release of air pollutants

143) Kyoto Protocol: (2005) controlling global warming by setting greenhouse gas emissions targets for developed countries

144) Montreal Protocol: (1987) phase-out of ozone depleting substances

WASTE, SOLID AND HAZARDOUS

145) Resource Conservation & Recovery Act (RCRA): (1976) controls hazardous waste with a cradle-to-grave system

146) Comprehensive Environmental Response, Compensation & Liability Act (CERCLA): (1980) "Superfund," designed to identify and clean up abandoned hazardous waste dump sites

147) Nuclear Waste Policy Act: (1982) U.S. government must develop a high level nuclear waste site (Yucca Mtn)

148) Food Quality Protection Act (FQPA, 1996): set pesticide limits in food, & all active and inactive ingredients must be screened for estrogenic/endocrine effects

LIFE

149) Endangered Species Act: (1973) identifies threatened and endangered species in the U.S., and puts their protection ahead of economic considerations

150) Convention on International Trade in Endangered Species (CITES): (1973) lists species that cannot be commercially traded as live specimens or wildlife products

151) Magnuson-Stevens Act: (1976) Management of marine fisheries

152) Healthy Forest Initiative: (HFI, Healthy Forests Restoration Act of 2003) thin overstocked stands, clear away vegetation and trees to create shaded fuel breaks, provide funding and guidance to reduce or eliminate hazardous fuels in national forests, improve forest fire fighting, and research new methods to halt destructive insects

GENERAL

153) National Environmental Policy Act: (1969) Environmental Impact Statements must be done before any project affecting federal lands can be started

154) Stockholm Convention on Persistent Organic Pollutants: (2004) Seeks to protect human health from the 12 most toxic chemicals (includes 8 chlorinated hydrocarbon pesticides / DDT can be used for malaria control)