**APES REVIEW: "140 WAYS TO GO APE(S)"**

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

1. Ionizing radiation: enough energy to dislodge electrons from atoms, forming ions; capable of causing cancer (gamma, X-rays, UV)
2. High Quality Energy: organized & concentrated; can perform useful work (fossil fuel & nuclear)
3. Low Quality Energy: disorganized, dispersed (heat in ocean or air wind, solar)
4. First Law of Thermodynamics: energy is neither created nor destroyed, but may be converted from one form to another (Law of Conservation of Energy)
5. 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
6. Natural radioactive decay: unstable radioisotopes decay releasing gamma rays, alpha particles, and beta particles
7. Half-life: the time it takes for ½ the mass of a radioisotope to decay
8. Estimate of how long a radioactive isotope must be stored until it decays to a safe level: approximately 10 half-lives
9. Nuclear Fission: nuclei of isotopes split apart when struck by neutrons
10. 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
11. Ore: a rock that contains a large enough concentration of a mineral making it profitable to mine
12. Organic fertilizer: slow-acting & long-lasting because the organic remains need time to be decomposed
13. Best solutions to energy shortage: conservation, increase efficiency, explore alternative energy options
14. Surface mining: cheaper and can remove more minerals; less hazardous to workers
15. Humus: organic, dark material remaining after decomposition by microorganisms
16. Leaching: removal of dissolved materials from soil by water moving downwards
17. Illuviation: deposit of leached material in lower soil layers (B horizon)
18. Loam: perfect agricultural soil with optimal portions of sand, silt, clay (40%, 40%, 20%)
19. Conservation: allowing the use of resources in a responsible manner
    Preservation: setting aside areas and protecting them from human activities
20. Parts of the hydrologic cycle: evaporation, transpiration, runoff, condensation, precipitation, infiltration
21. Aquifer: any water-bearing layer in the ground
22. Cone of depression: lowering of the water table around a pumping well
23. Salt water intrusion: near the coast, over-pumping of groundwater causes saltwater to move into the aquifer
24. ENSO: El Niño Southern Oscillation, see-sawing of air pressure over the S. Pacific
25. During an El Niño year: trade winds weaken & warm water sloshed back to SA
    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
26. Effects of El Niño: upwelling decreases disrupting food chains; N U.S. has mild winters, SW U.S. has increased rainfall, less Atlantic hurricanes
27. Nitrogen fixing: because atmospheric $N_2$ cannot be used directly by plants it must first be converted into ammonia ($NH_3$) by bacteria (*rhizobium*)
28. Ammonification: decomposers convert organic waste into ammonia
29. Nitrification: ammonia ($NH_3$) is converted to nitrate ions $(NO_3)^-$
30. Assimilation: inorganic nitrogen is converted into organic molecules such as DNA/amino acids & proteins
31. Denitrification: bacteria convert nitrate $(NO_3)^-$ and nitrite $(NO_2)^-$ back into $N_2$ gas
32. 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
33. Sustainability: the ability to meet the current needs of humanity without compromising the ability of future generations to meet their needs
34. How excess phosphorus is added to aquatic ecosystems: runoff of animal wastes, fertilizer, discharge of sewage
35. Photosynthesis: plants convert atmospheric carbon ($CO_2$) into complex carbohydrates (glucose $C_6H_{12}O_6$)
36. Aerobic respiration: $O_2$-consuming producers, consumers & decomposers break down complex organic compounds & convert C back into $CO_2$
37. Largest reservoirs of C: carbonate $(CO_3)^{2-}$ rocks first, oceans second
38. Biotic and abiotic: living and nonliving components of an ecosystem
39. Producer/Autotroph: photosynthetic or chemosynthetic life
40. Fecal coliform/*Enterococcus* bacteria: indicator of sewage contamination
41. Energy flow in food webs: 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
42. Chlorine: good= disinfection of water; bad = forms trihalomethanes
43. 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); begins with lichen action
    Secondary succession: life progresses where soil remains (clear-cut forest, fire)
44. Cogeneration: using waste heat to make electricity

45. Mutualism: symbiotic relationship where both partners benefit
46. Commensalism: symbiotic relationship where one partner benefits & the other is unaffected
47. Parasitism: relationship in which one partner obtains nutrients at the expense of the host
48. Biome: large distinct terrestrial region having similar climate, soil, plants & animals
49. Carrying capacity: the number of individuals that can be sustained in an area
50. R strategist: reproduce early in life; many small unprotected offspring
    K strategist: reproduce late in life; few offspring; care for offspring
51. 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)
52. 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)
53. Malthus: said human population cannot continue to increase exponentially; consequences will be war, famine & disease
54. Doubling time: rule of 70; 70 divided by the percent growth rate
55. Replacement level fertility: the number of children a couple must have to replace themselves (2.1 in developed countries)
56. World Population: ~ 6.7 billion U.S. Population: ~ 305 million
57. Preindustrial stage: (demographic transition) birth & death rates high, population grows slowly, infant mortality high
58. Transitional stage: (demographic transition) death rate lower, better health care, population grows fast
59. Industrial stage: (demographic transition) decline in birth rate, population growth slows
60. Postindustrial stage: (demographic transition) low birth & death rates
61. Age structure diagrams: broad base = rapid growth; narrow base = negative growth; uniform shape = zero growth
62. First, second and third most populated countries: China, India, U.S.
63. Most important thing affecting population growth: low status of women
64. Ways to decrease birth rate: family planning, contraception, economic rewards and penalties
65. Percent water on earth by type: 97.5% seawater, 2.5% freshwater
66. Salinization of soil: in arid regions, water evaporates leaving salts behind
67. Ways to conserve water: agriculture = drip/trickle irrigation; industry = recycling; home = use gray water, repair leaks, low flow fixtures
68. Point vs. non point sources: Point, from specific location such as a pipe. Non-point, from over an area such as runoff
69. BOD: biological oxygen demand, amount of dissolved oxygen needed by aerobic decomposers to break down organic materials
70. Eutrophication: rapid algal growth caused by an excess of nitrates $(NO_3)^-$ and phosphates $(PO_4)^{3-}$ in water
71. Hypoxia: when aquatic plants die, the BOD rises as aerobic decomposers break down the plants, the DO drops & the water cannot support life
72. Minamata disease: (1932-1968, Japan) mental impairments caused by methylmercury $(CH_3Hg)^+$ poisoning
73. Primary air pollutants: produced by humans & nature ($CO$,$CO_2$,$SO_x$,$NO_x$, hydrocarbons, particulates)
74. Natural selection: organisms that possess favorable adaptations pass them onto the next generation
75. Particulate matter:
    Source: burning fossil fuels and diesel exhaust
    Effect: reduces visibility & respiratory irritation
    Reduction: filtering, electrostatic precipitators, alternative energy)
76. Nitrogen Oxides ($NO_x$):
    Source: auto exhaust
    Effects: acidification of lakes, respiratory irritation, leads to smog & ozone
    Equation for acid formation: $NO + O_2 = NO_2 + H_2O = HNO_3$
    Reduction: catalytic converter
77. 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)
78. 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, emission testing, oxygenated fuel, mass transit
79. Ozone ($O_3$):
    Formation: secondary pollutant,
    $NO_2 + uv = NO + O^*$ $O^* + O_2 = O_3$, with VOCs (volatile organic compounds)
    Effects: respiratory irritant, plant damage
    Reduction: reduce NO and VOC emissions
80. 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 lung cancer
81. Photochemical smog: formed by chemical reactions involving sunlight (NO, VOC, O*)
82. Acid deposition: caused by sulfuric and nitric acids ($H_2SO_4$, $HNO_3$), resulting in lowered pH of surface waters

83. Greenhouse gases: Examples: $H_2O$, $CO_2$, $O_3$, chlorofluorocarbons (CFCs), methane ($CH_4$). Effect: they trap outgoing infrared (heat) energy, causing Earth to warm
84. Effects of global warming: rising sea level (thermal expansion), extreme weather, drought, famine, extinctions
85. Causes of ozone depletion: CFCs, methyl chloroform or trichloromethane ($CHCl_3$), carbon tetrachloride ($CCl_4$), halon (haloalkanes), methyl bromide ($CH_3Br$)— all of which attack stratospheric ozone
86. Effects of ozone depletion: increased UV, skin cancer, cataracts, decreased plant growth
87. Love Canal, NY: (1950s +) chemicals buried in old canal; school and homes built over it; caused birth defects and cancer
88. Main component of municipal solid waste (MSW): paper; most is landfilled
89. True cost / External costs: harmful environmental side effects that are not reflected in a product's price
90. 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
91. Incineration advantages: volume of waste reduced by 90%, and waste heat can be used
92. Incineration disadvantages: toxic emissions (polyvinyl chloride, dioxins), scrubbers and electrostatic precipitators needed, ash disposal (contains heavy metals)
93. Best way to solve waste problem: reduce the amounts of waste at the source
94. Keystone species: species whose role in an ecosystem are more important than others, such as a sea otter, sea stars, grizzly bear, prairie dogs
95. Indicator species: species that serve as early warnings that an ecosystem is being damaged ex. trout
96. Characteristics of endangered species: small range, large territory, or live on an island
97. In natural ecosystems, methods which control 50-90% of pests: predators, diseases, parasites
98. Major insecticide groups (and examples): chlorinated hydrocarbons (DDT); organophosphates (malathion); carbamates (aldicarb)
99. Pesticide pros: saves lives from insect-transmitted disease, increases food supply, increases profits for farmers
100. Pesticide cons: genetic resistance, ecosystem imbalance, pesticide treadmill, persistence, bioaccumulation, biological magnification
101. Natural pest control: better agricultural practices, genetically resistant plants, natural enemies, biopesticides, sex attractants
102. Electricity generation methods: using steam from water boiled by fossils fuels or nuclear reactions; falling water to turn a turbine to power a generator
103. Petroleum formation: microscopic aquatic organisms in sediments converted by heat and pressure into a mixture of hydrocarbons
104. Pros of petroleum: relatively cheap, easily transported, high-quality energy
105. Cons of petroleum: reserves will be depleted soon; pollution during drilling, transport and refining; burning makes $CO_2$
106. Steps in coal formation: peat, lignite, bituminous, anthracite
107. Major parts of a nuclear reactor: core, control rods, steam generator, turbine, containment building
108. Two most serious nuclear accidents: Chernobyl, Ukraine (1986) and Three Mile Island, PA (1979)
109. Alternate energy sources: wind, solar, waves, biomass, geothermal, fuel cells
110. LD50 (LD-50, $LD_{50}$): the amount of a chemical that kills 50% of the animals in a test population
111. Mutagen; Teratogen; Carcinogen: (in order) causes hereditary changes through mutations; causes fetus deformities; causes cancer
112. 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, Arctic polar bear, many others…
113. 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
114. The Tragedy of the Commons: (1968 paper by ecologist Garret Hardin) global commons such as atmosphere and oceans are used by all and owned by none
115. Volcano and Earthquake occurrence: at plate boundaries (divergent= spreading, mid-ocean ridges) (convergent= trenches) (transform= sliding, San Andreas)
116. Sources of mercury: burning coal, compact fluorescent bulbs
117. Major source of sulfur: burning coal
118. Threshold dose: the maximum dose that has no measurable effect.
119. 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.
120. 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
121. Monoculture – cultivation of a single crop, usually in a large area
122. Food Wheat, rice and corn provide more than ½ of the calories in the food consumed by the world's people.
123. 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**

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

**WATER**

126. Safe Drinking Water Act: (SDWA, 1974) set maximum contaminant levels for pollutants in drinking water that may have adverse effects on human health
127. 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
128. Ocean Dumping Ban Act: (1988) bans ocean dumping of sewage sludge and industrial waste in the ocean

**AIR**

129. Clean Air Act: (CAA, 1970) set emission standards for cars and limits for release of air pollutants
130. Kyoto Protocol: (2005) controlling global warming by setting greenhouse gas emissions targets for developed countries
131. Montreal Protocol: (1987) phase-out of ozone depleting substances

**WASTE**

132. Resource Conservation & Recovery Act (RCRA): (1976) controls hazardous waste with a cradle to grave system
133. Comprehensive Environmental Response, Compensation & Liability Act (CERCLA): (1980) "Superfund," designed to identify and clean up abandoned hazardous waste dump sites
134. Nuclear Waste Policy Act: (1982) U.S. government must develop a high level nuclear waste site (Yucca Mtn)

**LIFE**

135. Endangered Species Act: (1973) identifies threatened and endangered species in the U.S., and puts their protection ahead of economic considerations
136. Convention on International Trade in Endangered Species (CITES): (1973) lists species that cannot be commercially traded as live specimens or wildlife products
137. Magnuson-Stevens Act: (1976) Management of marine fisheries
138. Food Quality Protection Act: (1996) set pesticide limits in food, & all active and inactive ingredients must be screened for estrogenic/endocrine effects

**GENERAL**

139. National Environmental Policy Act: (1969) Environmental Impact Statements must be done before any project affecting federal lands can be started
140. 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)