AP Environmental Science

Revision Sheet · 考前速记

Learn these by heart before the exam. 考试前把这些内容背熟。

The Living World - Ecosystems

Trophic levels: producer, primary consumer, secondary, tertiary. About 10% of energy passes up, so pyramids narrow fast.

$\text{GPP} - R = \text{NPP}$ NPP is the energy actually available to consumers 净初级生产力

Carbon cycle: photosynthesis removes CO_2; respiration, decomposition and combustion return it. Fossil fuels are a slow sink released fast.

Nitrogen cycle: fixation (bacteria, lightning), nitrification, assimilation, ammonification, denitrification. N_2 is unusable directly.

Phosphorus has NO gas phase. It cycles through rock, soil and water, which is why it limits growth and drives eutrophication.

Biomes are set by temperature and precipitation. Symbiosis: mutualism, commensalism, parasitism.

The Living World - Biodiversity

Biodiversity: genetic, species, ecosystem. Higher diversity means greater resilience to disturbance.

Ecosystem services: provisioning, regulating, supporting, cultural.

Island biogeography: LARGE islands CLOSE to the mainland hold the most species (bigger target, easier immigration).

Succession: primary on bare rock with no soil (lichens first); secondary after a disturbance where soil survives.

Keystone species 关键种: an outsized effect relative to its abundance; removing it restructures the whole community

Populations

$\frac{dN}{dt} = rN, \quad \frac{dN}{dt} = rN\frac{K-N}{K}$ 指数与逻辑斯蒂增长

rule of 70: $\text{doubling time} = \frac{70}{\%\ \text{growth rate}}$ 70 法则

r-selected: many offspring, little care, early maturity, boom and bust. K-selected: few offspring, much care, near carrying capacity.

DTM stages 1-5; a wide-based pyramid means rapid growth. TFR near 2.1 is replacement.

Overshoot means exceeding carrying capacity; a die-off follows.

Earth Systems and Resources

Plate boundaries: divergent (new crust), convergent (subduction, mountains, volcanoes), transform (earthquakes).

Soil horizons O, A, E, B, C, R. Loam (roughly equal sand, silt, clay) is best for agriculture. Sand drains fast; clay holds water.

Atmosphere layers: troposphere (weather), stratosphere (ozone), mesosphere, thermosphere.

Coriolis effect deflects right in the north, left in the south, driving global wind belts and gyres.

El Nino weakens the trade winds: warm water shifts east, upwelling off South America stops, and fisheries collapse.

Watershed, rain shadow, and the difference between weather and climate.

Land and Water Use

The Tragedy of the Commons: a shared, unregulated resource is over-used because the cost is spread but the benefit is private.

Clearcutting is cheap but causes erosion and habitat loss. Selective cutting costs more and preserves structure.

Overgrazing compacts soil and causes desertification. Contour ploughing, terracing, windbreaks, no-till and crop rotation prevent erosion.

Irrigation: flood is wasteful; drip is efficient. Over-irrigation causes salinisation and waterlogging.

Integrated pest management combines biological control, crop rotation and targeted pesticide, cutting resistance.

Mining: surface (strip, open pit, mountaintop removal) vs subsurface. Acid mine drainage and tailings are the legacy.

Energy Resources and Consumption

Non-renewable: coal, oil, natural gas, nuclear. Coal is the most carbon-intensive; natural gas the least of the fossils.

Nuclear: fission of U-235; no CO_2, but waste stays radioactive for millennia. Chernobyl and Fukushima shaped policy.

Renewables: solar, wind, hydro, geothermal, biomass, tidal. Wind and solar are INTERMITTENT, which is the storage problem.

Hydro provides steady power but floods habitat, blocks fish, and traps sediment.

Energy conservation and efficiency (insulation,

CFL/LED, hybrids) is the cheapest 'source' of all.

$$\text{efficiency} = \frac{\text{useful energy out}}{\text{energy in}} \times 100\% \qquad \text{能量效率}$$

Atmospheric Pollution

Six criteria pollutants: CO, SO_2, NO_x, particulates, ground-level ozone, lead.

Photochemical smog: NO_x + VOCs + sunlight make ozone. Worst on hot, sunny, still afternoons.

Thermal inversion traps pollution under a warm layer, so concentrations spike in a valley.

Acid deposition from SO_2 and NO_x lowers lake pH, leaches aluminium, and damages leaves. Liming treats the symptom.

Indoor air: radon, asbestos, CO, VOCs, mould. Indoor concentrations often exceed outdoor.

Controls: catalytic converters, scrubbers, electrostatic precipitators, the Clean Air Act.

Aquatic and Terrestrial Pollution

Point source is identifiable (a pipe); non-point is diffuse (farm run-off) and much harder to regulate.

Eutrophication: nutrient run-off, algal bloom, bloom dies, decomposers use the oxygen, hypoxia kills fish. Learn this chain in order.

Bioaccumulation vs biomagnification 生物累积与生物放大: accumulation builds up within ONE organism; magnification concentrates UP the food chain, so top predators suffer most

BOD high BOD means much organic waste and low dissolved oxygen 生化需氧量

Solid waste: sanitary landfill (liner, leachate collection) vs incineration (reduces volume, releases pollutants). Reduce, reuse, recycle, in that order.

LD_{50} the dose that kills 50%; LOWER means MORE toxic 半数致死量

Global Change

Ozone depletion: CFCs release chlorine in the stratosphere, destroying O_3 and admitting UV-B. The Montreal Protocol fixed it and it is recovering.

Greenhouse gases: CO_2, CH_4 (higher potency, shorter life), N_2O, water vapour, CFCs. Do NOT confuse the ozone hole with global warming.

Consequences: sea-level rise (thermal expansion plus melting), ocean acidification (dissolved CO_2 makes carbonic acid), range shifts, more extreme weather.

Ocean acidification dissolves carbonate shells and bleaches coral.

Invasive species have no natural predator and outcompete natives. Extinction drivers, HIPPO: Habitat loss, Invasives, Pollution, Population, Overharvesting.

Exam technique

Every FRQ needs a specific example and a real number where possible. Vague answers score low.

Show the full calculation with units, and keep the dimensional analysis visible: examiners credit the setup.

PROPOSE a solution then EXPLAIN why it works AND one drawback. Nearly every APES FRQ ends this way.