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UGC NET Paper 2

Environmental Sciences (089)
Complete revision notes — all 10 units

10 units | Tables & formulas | Key revision points

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02 Environmental Chemistry
03 Ecology and Environmental Biology
04 Environmental Geoscience
05 Energy and Environment
06 Environmental Pollution
07 Environmental Impact Assessment and Management
08 Statistics and Modelling
09 Environmental Policy and Legislation
10 Contemporary Environmental Issues

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How to use these notes

- Read one unit at a time, then test yourself with its key revision points.
- Make your own short notes on topics you find difficult.
- Units follow the main areas of the official syllabus — the exact unit list can change between sessions.
- Always check the latest syllabus and notices on the official UGC NET portal: **ugcnet.nta.ac.in**.

UNIT 01

Fundamentals of Environmental Sciences

Scope, components of the environment, and principles of environmental science.

- Components: atmosphere, hydrosphere, lithosphere, biosphere.
- Environmental science is interdisciplinary — physics, chemistry, biology, geology, social sciences.
- Sustainable development — Brundtland Report, *Our Common Future* (1987).
- Carrying capacity; ecological footprint.

★ Key revision points

- Four spheres of the environment.
- Brundtland Report: 1987.
- Carrying capacity = maximum sustainable population.
- Ecological footprint measures demand on nature.

UNIT 02

Environmental Chemistry

Atmospheric and water chemistry, pH, BOD and COD, and toxic chemicals.

- Composition of dry air: N_2 ~78%, O_2 ~21%, Ar ~0.93%, CO_2 ~0.04%.
- Ozone depletion by CFCs (chlorine radicals) — ozone measured in Dobson units.
- Acid rain: pH below 5.6; caused by SO_2 and NO_x.
- **BOD** (biological oxygen demand) and **COD** (chemical oxygen demand) measure organic pollution; COD ⩾ BOD.
- Persistent organic pollutants (Stockholm Convention, 2001); heavy metals — Minamata (mercury), itai-itai (cadmium).

★ Key revision points

- Acid rain: pH < 5.6.
- COD ⩾ BOD.
- Minamata disease = mercury.
- Ozone in Dobson units.

UNIT 03

Ecology and Environmental Biology

Ecosystems, energy flow, biogeochemical cycles, populations and biodiversity.

- Energy flow is unidirectional; ~10% passes to the next trophic level (Lindeman, 1942).
- Ecological pyramids: numbers, biomass, energy (energy pyramid is always upright).
- Succession: pioneer → climax community; hydrosere and xerosere.
- Population growth: exponential (J-curve) and logistic (S-curve); r- and K-strategists.
- Biodiversity: genetic, species, ecosystem; hotspots (Myers); IUCN Red List categories.

★ Key revision points

- 10% law = Lindeman.
- Energy pyramid is always upright.
- Logistic growth = S-curve.
- Climax community = end of succession.

UNIT 04

Environmental Geoscience

Earth processes, soils, minerals and natural hazards.

- Rock cycle: igneous, sedimentary, metamorphic.
- Soil profile: O, A, B, C horizons; soil erosion and conservation.
- Natural hazards: earthquakes (Richter and moment magnitude scales), tsunamis, landslides, floods, cyclones.
- Hydrological cycle; groundwater (aquifers).

★ Key revision points

- Three rock types.
- Soil horizons O–A–B–C.
- Earthquake magnitude: Richter / moment magnitude.
- Aquifers store groundwater.

UNIT 05

Energy and Environment

Conventional and renewable energy sources and their impacts.

Source	Note
Coal, oil, gas	Non-renewable; CO_2 emissions
Nuclear	Fission of uranium-235; radioactive waste
Solar	Photovoltaic and thermal
Wind, hydro, tidal, geothermal, biomass	Renewable
Green hydrogen	Hydrogen from renewable-powered electrolysis

India: National Solar Mission (2010, under NAPCC); International Solar Alliance (2015).

★ Key revision points

- Nuclear power uses U-235 fission.
- National Solar Mission: 2010.
- International Solar Alliance: 2015.
- Green hydrogen uses renewable electricity.

UNIT 06

Environmental Pollution

Air, water, soil, noise, solid waste and radioactive pollution and their control.

- Air pollutants: PM2.5, PM10, SO_2, NO_2, CO, O_3, lead; Air Quality Index (India, 2014).
- Control devices: electrostatic precipitators, scrubbers, cyclone separators, catalytic converters.
- Water treatment: primary (physical), secondary (biological), tertiary (advanced).
- Noise measured in decibels; Noise Pollution Rules 2000.
- Solid Waste Management Rules 2016; e-waste and plastic waste rules.

★ Key revision points

- Electrostatic precipitators remove particulates.
- Secondary treatment is biological.
- India's AQI: 2014.
- Noise rules: 2000.

UNIT 07

Environmental Impact Assessment and Management

EIA process, environmental management systems and audits.

- EIA Notification: 1994, revised **2006** (Category A — central, Category B — state).
- EIA steps: screening → scoping → baseline study → impact prediction → mitigation → public hearing → appraisal → decision → monitoring.
- Environmental management systems: **ISO 14001**; life-cycle assessment (ISO 14040).

★ Key revision points

- EIA Notification 2006.
- Screening decides whether EIA is needed.
- ISO 14001 = EMS.
- Public hearing is part of EIA.

UNIT 08

Statistics and Modelling

Statistical methods and models used in environmental science.

- Descriptive statistics; correlation and regression; hypothesis tests (t, chi-square, ANOVA).
- Population models: exponential, logistic (Verhulst), Lotka–Volterra (predator–prey).
- Air dispersion: Gaussian plume model.
- Remote sensing and GIS for environmental monitoring.

★ Key revision points

- Predator–prey = Lotka–Volterra.
- Logistic model = Verhulst.
- Gaussian plume = air dispersion.
- GIS supports environmental mapping.

UNIT 09

Environmental Policy and Legislation

Indian environmental laws and international conventions.

Instrument	Year
Wildlife (Protection) Act	1972
Water Act / Air Act	1974 / 1981
Environment (Protection) Act	1986
Biological Diversity Act	2002
NGT Act	2010
Ramsar / CITES / Montreal / CBD	1971 / 1973 / 1987 / 1992
Kyoto / Paris	1997 / 2015

★ Key revision points

- EPA 1986 is an umbrella act.
- NGT: 2010.
- Montreal Protocol = ozone.
- Paris Agreement: 2015.

UNIT 10

Contemporary Environmental Issues

Climate change, biodiversity loss, and global environmental initiatives.

- Greenhouse gases: CO_2, CH_4, N_2O, fluorinated gases; global warming potential.
- IPCC (1988) assessment reports; net-zero targets (India: 2070).
- Carbon credits and carbon markets; LiFE (Lifestyle for Environment) mission.
- Biodiversity loss, desertification (UNCCD), plastic pollution.

★ Key revision points

- IPCC: 1988.
- India's net-zero target: 2070.
- Methane is a potent greenhouse gas.
- UNCCD = desertification.

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