



ESE 2019
Prelims Paper - I



BASICS OF ENERGY ENVIRONMENT

BASICS OF
ENERGY &
ENVIRONMENT



ESE 2019
Prelims Paper - I

REVISED & UPDATED
215+ Objective Questions

Basics of Energy and Environment

*New Pattern
for
UPSC ESE Exam*



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Third Edition : 2018

PREFACE

The laws of nature are absolute, and if not given due respect while framing policies, programmes, and during execution of projects, can pose a serious threat to the very existence of human life. Man in his evolution stumbled upon various sources of energy. Starting from wood, coal, gasoline, nuclear energy to renewable energy, every paradigm shift in energy brought about new challenges in limiting the damage caused to the environment.

This revised edition of book **Basics of Energy & Environment** builds upon your understanding about the complexities in addressing environmental issues, bit by bit, through detailed diagrams, natural cycles, analysis, linkages and statistics. Starting with the basic definitions of the fundamental units of environment, the book builds upon the complex web of ecosystem and ecology. Further, it goes on to map the ecological depletion, change in climate, and its impact on the various environmental processes.

No individual, country, or society howsoever powerful can survive the challenge of climate change on its own. This wisdom, arrived through various international conventions and treaties, has been beautifully constructed in a timeline while decoding and analysing every single move, which built upon our collective consciousness to this day.

The book organically builds upon the thought process, where you learn the complex interchanges of energy and environment in an effortless manner. Thus, you will be able to derive upon correct answers whatever be the spin given to the questions by UPSC. Energy and environment is a hot topic, and this book ensures that you do not miss out on any question in Engineering Services Exam (ESE).

In this revised edition, some new topics have been added and a few existing chapters on subjects have been updated and elaborated; and have thus endeavoured to render it more complete and more worthy of the indulgent reception by ESE aspirants by whom it has been favoured so far.

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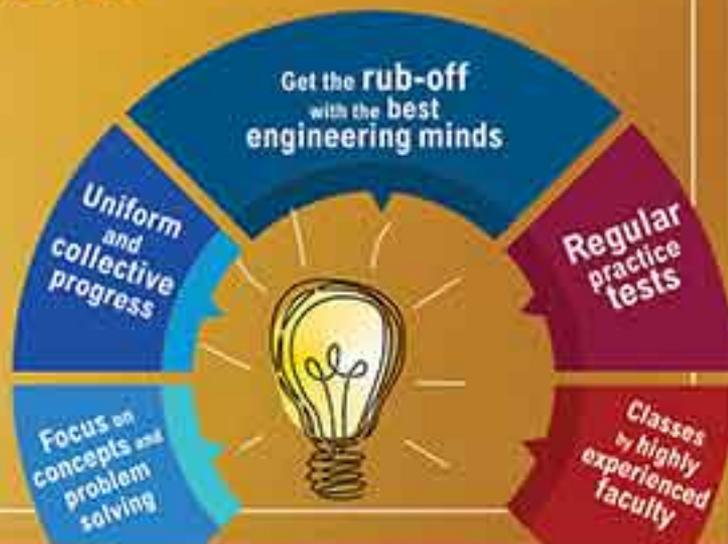
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CHAPTER

1

Ecology and Biodiversity

1.1 ENVIRONMENT

INSIDE

- 1.1 Environment
- 1.2 Layers of Atmosphere
- 1.3 Levels of Ecological Organization
- 1.4 Nutrients Cycle and Geochemical Cycles
- 1.5 Ecosystem
- 1.6 Biodiversity
- 1.7 Biomes
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- 1.12 Wildlife
- 1.13 Animal Welfare Board of India
- 1.14 Conservation of Biodiversity

- Environment is defined as, “the sum total of living and non-living components, influences and events surrounding an organism”.
- German biologist **Ernst Haeckel** coined ‘**ecology**’ in 1869. It is the scientific study of reciprocal relationship between living organisms with their environment namely abiotic and biotic components.
- Each and every living organism has a specific surrounding with which it continuously interacts, derives its sustenance and fully adapts. This surrounding is the ‘**natural environment**’.
- According to Environment Protection Act 1986, environment is sum of total water, air and land, inter-relationship among themselves and also with human beings, other living organism and property.

1.1.1 Components of Environment

Abiotic components	Biotic components
Soil/Land	Plants
Water	Animals
Air	Decomposers
Light	Parasites
Heat etc.	Symbionts

Components of Environment

Atmosphere

- It is a layer of gases (air) surrounding the planet. Atmosphere is of vital significance to life as all components of air (except inert gases) serve as key metabolites for living organisms.
- According to temperature, the atmosphere contains four different layers:

Gases	Percentage by volume
Nitrogen	78.08
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.03

Composition of Atmosphere

- The first layer is called the **troposphere** (8 to 16 kms)
- The layer above troposphere is the **stratosphere** (varies from 11 to 50 kms). Ozone is found in the atmosphere at varying



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concentration between the altitudes of (10 to 50 kms). This layer is also called the ozone layer.

- Above stratosphere, lies **mesosphere** (upto 80 kms)
- The last atmospheric layer has an altitude greater than 80 kms and is called **thermosphere**

Lithosphere

- It is the solid, outer part of the Earth and includes the brittle upper portion of the mantle and the crust (the outermost layers of Earth's structure). It is bounded by the atmosphere above and the asthenosphere (another part of the upper mantle) below. It is the most rigid of Earth's layers.
- The most well-known feature associated with Earth's lithosphere is tectonic activity. Tectonic activity describes the interaction of the huge slabs of lithosphere called tectonic plates.
- Most tectonic activity takes place at the boundaries of these plates, where they may collide, tear apart, or slide against each other. The movement of tectonic plates is made possible by thermal energy (heat) from the mantle part of the lithosphere. Thermal energy makes the rocks of the lithosphere more elastic.
- Tectonic activity is responsible for some of Earth's most dramatic geologic events: earthquakes, volcanoes, orogeny (mountain-building), and deep ocean trenches can all be formed by tectonic activity in the lithosphere.

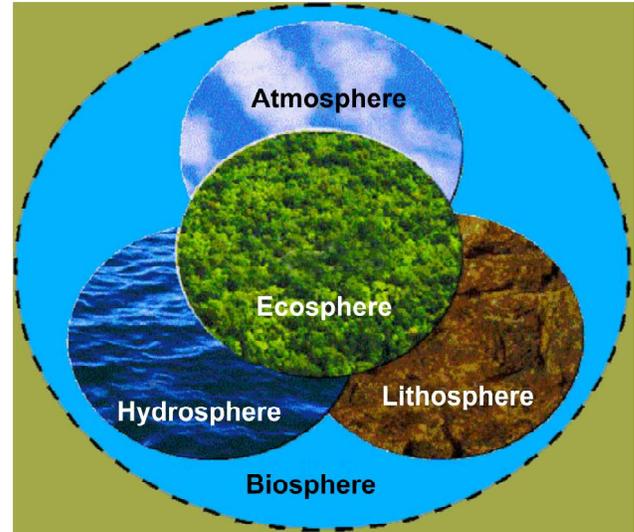
Hydrosphere

- The hydrosphere is composed of all of the water on or near the earth.
- It ranges from 10 to 20 kms in thickness.
- Ninety seven percent of earth's water is salty. The remaining three percent is fresh water, three quarters of the **fresh water** is solid and **exists in ice sheets**.
- It includes water that is on the surface of the planet, underground, and in the air. A planet's hydrosphere can be liquid, vapour, or ice.
- Water moves through the hydrosphere in a cycle. Water collects in clouds, then falls to Earth in the form of rain or snow. This water collects in rivers, lakes and oceans. Then it evaporates into the atmosphere to start the cycle all over again. This is called the water cycle.

Biosphere

- The biosphere is composed of all living organism. The biosphere is responsible for the grand scale recycling of energy and matter on Earth.

- The mobilization of matter by biota is by no means restricted to small geographic regions.
- The periodic burning of forests and savannas, not only change the chemical form of matter, but also result in long-range atmospheric transport and deposition.



1.2 LAYERS OF ATMOSPHERE

- Basing on the temperature, the atmosphere can be divided into four layers: troposphere, stratosphere, mesosphere, and thermosphere.
- The temperature drops as we go up through the troposphere, but it rises as we move through the next layer, the stratosphere. The farther away from earth, the thinner the atmosphere gets.

1. Troposphere

- This layer of the atmosphere closest to the Earth's surface, extending up to about 10-15 km above the Earth's surface. It contains 75% of the atmosphere's mass.
- The troposphere is wider at the equator than at the poles. Temperature and pressure drops as we go higher up the troposphere.
- **Tropopause:** At the very top of the troposphere is the tropopause, where the temperature reaches a (stable) minimum. the tropopause is a "**thermal layer**" or "**cold trap**" because is this the maximum limit to which water vapour can rise, as it changes into ice and gets trapped. If there is no cold trap, Earth would lose all its water. Most of weather phenomena occurs in the troposphere.

2. Stratosphere

- This layer lies directly above the troposphere and is about 35 km deep. It extends from about 15 to 50 km above the Earth's surface.

Questions

1. Which of the following ecological pyramid is always upright?
 - (a) Pyramid of number
 - (b) Pyramid of biomass
 - (c) Pyramid of energy
 - (d) None
2. Which of the biogeochemical cycle match with their prime representatives?
 - (a) Sedimentary cycle- Carbon cycle
 - (b) Gaseous cycle – nitrogen cycle
 - (c) Sedimentary cycle- nitrogen cycle
 - (d) Gaseous cycle – phosphorous cycle
3. The basic level of ecological organization starts with _____
 - (a) Population
 - (b) Community
 - (c) Individual
 - (d) Ecosystem
4. Which among the following is the coldest layer of Earth's atmosphere?
 - (a) Mesosphere
 - (b) Stratosphere
 - (c) Troposphere
 - (d) Ionosphere
5. What is the range of electromagnetic spectrum for visible region?
 - (a) 400-700 nm
 - (b) 0.4-0.7 nm
 - (c) 0.1-0.2 nm
 - (d) 20-25 nm
6. Which among the following soil water is available and utilized by plants?
 - (a) Hygroscopic water
 - (b) Capillary water
 - (c) Gravitational water
 - (d) Chemically bound water
7. What is correct for the term "lapse rate"?
 - (a) It is vertical temperature gradient over earth's surface.
 - (b) Its value is 6.5 degree Celsius/1000m elevation.
 - (c) Both A and B are correct.
 - (d) None of the above.
8. Habitat is _____
 - (a) A place where organisms live.
 - (b) Niche is habitat.
 - (c) Both A and B.
 - (d) None.
9. Choose the correct order
 - (a) Organism-population-ecosystem-community-landscape-biome-biosphere
 - (b) Organism-population-community-ecosystem-landscape-biome-biosphere
 - (c) Organism-community-population-ecosystem-landscape-biome-biosphere
 - (d) Organism-community-population-ecosystem-biome-landscape- biosphere
10. Animals who can maintain their body temperature at constant level irrespective of atmosphere are known as____
 - (a) Poikilothermic animals
 - (b) Warm blooded animals
 - (c) Cold blooded animals
 - (d) Both A and C
11. Which among the following is incorrect?
 - (a) Oceans cover 2/3rd of the earth's surface
 - (b) Tropical rain forest and savannas together account for 60% of terrestrial Net Primary Productivity.
 - (c) Rate of biomass production per unit area is called productivity.
 - (d) None
12. Choose the correct statement :
 - (a) Food chain is relatively short
 - (b) Food chain have 3-5 trophic links with 15-20 species
 - (c) 10% of the energy store in organic matter of each trophic levels is converted to organic matter at next trophic level
 - (d) All of the above

13. Food web ____
- (a) Represents feeding relationship between organism in an ecosystem
 - (b) Consists of interlocking food chain.
 - (c) None of the above
 - (d) A and B both
14. Choose the correct match :
- (a) Autotrophs- produce own food
 - (b) Consumers- plants
 - (c) Omnivorous- producers
 - (d) Carnivorous- eat both plants and flesh
15. Depict the ecological pyramid for a situation of a single tree along with its dependent insect population :
- (a) Upright
 - (b) Always upright
 - (c) Inverted
 - (d) A and B
16. Which of the following is included in biodiversity?
- (a) Genetic and species diversity
 - (b) Climatic and species diversity
 - (c) Cultural and ecosystem diversity
 - (d) Lingual and cultural diversity
17. What was the main aim of Man and Biosphere (MAB) Program (1971)?
- (a) Improve relationship between people and environment
 - (b) Improve relationship in between man
 - (c) This program is invalid, never existed.
 - (d) Improve the water level in the biosphere
18. Which is true for natality?
- (a) Ability of an individual to produce new individual
 - (b) Refers to death of an individual
 - (c) It is the measure of death rate
 - (d) A and B.
19. Choose the incorrect definition :
- (a) Temperature- degree of hotness and coldness
 - (b) Estuary-transition area between river and sea.
 - (c) Ecology- relationship between organism and their environment
 - (d) Niche- is a habitat or place to live.
20. Cycle of which nutrient has both lithospheric and gaseous phase?
- (a) Sulphur
 - (b) Carbon
 - (c) Nitrogen
 - (d) All of the above
21. Ecotone is ____ .
- (a) A transition zone
 - (b) Zone of vegetation separating two types of community
 - (c) High diversity region
 - (d) All of the above
22. Choose the example of positive interaction (one or both benefit each other, no harm to any of the species interacting) :
- (a) Mutualism
 - (b) Ammensalism
 - (c) Commensalism
 - (d) A and C both
23. Choose the odd one out :
- (a) Mutualism
 - (b) Ammensalism
 - (c) Competition
 - (d) Parasitism
24. Tropical orchids use trees or their branches for support without harm or benefit to the tree is an example of :
- (a) Commensalism
 - (b) Mutualism
 - (c) Ammensalism
 - (d) Competition
25. Rhizobium (Nitrogen fixing bacteria) lives in root nodules of legumes and derives nutrition from host plant. In return it fixes atmospheric nitrogen and make it available to plant is an example of:
- (a) Commensalism
 - (b) Mutualism
 - (c) Ammensalism
 - (d) Competition
26. What makes a phosphorous cycle differ from carbon and nitrogen cycle?
- (a) Absence of liquid phase
 - (b) All three are same
 - (c) Absence of gaseous phase
 - (d) Presence of liquid phase
27. Which among the following is correct for succession?
- (a) Succession is unidirectional progressive series of a change
 - (b) Climax community marks the end point of succession
 - (c) Both are incorrect
 - (d) Both a and b are correct

ANSWER KEY

1. (c)	12. (d)	23. (a)	34. (d)	45. (a)	56. (d)
2. (b)	13. (d)	24. (a)	35. (c)	46. (b)	57. (a)
3. (c)	14. (a)	25. (b)	36. (b)	47. (d)	58. (a)
4. (a)	15. (c)	26. (c)	37. (d)	48. (d)	59. (b)
5. (a)	16. (a)	27. (d)	38. (c)	49. (c)	60. (c)
6. (b)	17. (a)	28. (a)	39. (b)	50. (a)	61. (a)
7. (c)	18. (a)	29. (d)	40. (b)	51. (d)	62. (a)
8. (a)	19. (d)	30. (c)	41. (a)	52. (d)	
9. (b)	20. (a)	31. (d)	42. (d)	53. (d)	
10. (b)	21. (d)	32. (d)	43. (c)	54. (b)	
11. (d)	22. (d)	33. (b)	44. (b)	55. (a)	

EXPLANATIONS

1. (c)
In Pyramid of energy some amount of energy looses when transferred from one successive level to another.
2. (b)
Carbon cycle is gaseous cycle.
Nitrogen cycle is only in gaseous phase.
Phosphorous cycle is in sedimentary/lithospheric phase only.
4. (a)
In mesosphere temperature is -90°C ; as we goes up in the mesospheric layer the temperature decreases and the top layer of mesosphere is coldest.
6. (b)
Hygroscopic water : is attached to soil not utilized by plant.
Capillary water : is water present in thin capillaries can be utilized by plants.
Gravitational water : is water percolates deep into the soil but not available to plants.
10. (b)
In Poikilothermic animals, body temperature fluctuate with change in environmental temperature.
16. (a)
Animals who maintain their body temperature are called Warm blooded animals.
18. (a)
Genetic, species diversity and ecosystem diversity are elements of biodiversity.
18. (a)
Natality is the ability of an individual to produce new individual.
19. (d)
Niche is the some of all activity and relationship of a species by which it uses the resources in its habitat for a its survival and reproduction.
22. (d)
Mutualism : both benefitted +VE interaction.
Ammensalism : 1 harm, other not affected.
Commensalism : 1 benefitted host unaffected.
26. (c)
Phosphorous is lithospheric nutrient and have sedimentary phase only while nitrogen and carbon cycle has gaseous phase.
29. (d)
Grassland ecosystem is a secondary succession because primary succession occur when there is no succession or production before.

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