

普通高等院校环境科学与工程类系列规划教材

HUANJING KEXUE YU  
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# 环境科学与工程 专业英语

主 编 党秀丽 梁彦秋  
副主编 张 园 王忠强 徐向华 刘 畅

中国建材工业出版社

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## 内 容 简 介

本书是根据《大学英语教学大纲》(理工科本科用)专业阅读部分的要求编写的。全书共分为9个部分(Part),每个部分含若干个单元(Unit)。其中第1部分由4个Unit组成,介绍环境科学与工程概述和历史;第2部分由5个Unit组成,介绍水污染来源种类、水化学、各种污水处理技术、处理单元设备等;第3部分由5个Unit组成,介绍大气化学和空气污染及其防治;第4部分由5个Unit组成,为固体废弃物处理及处置方法;第5部分由5个Unit组成,介绍土壤污染及控制技术;第6部分由5个Unit组成,介绍环境监测,包括水样采集程序、水质指标及分析;第7部分由5个Unit组成,为环境生态学,介绍生态系统与生物多样性、生态恢复的方法等;第8、9部分作为拓展,分别介绍环境科学与工程专业科技英语的特点及翻译技巧以及学术性论文的摘要写作要领。全书最后为附录,使环境科学与工程专业学生能够更好地阅读、翻译专业文献,深入学习,并提高实际应用英语的能力。

本书可作为普通高等院校环境科学、环境工程或相关专业的教材,也可供同等英语程度环境科学工作者及环境工程师或相关领域的科技人员使用。

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# 前 言

随着环境问题的国际化,掌握和运用一门专业外语是高等院校环境科学与工程专业学生及科研工作者的必备素质之一。编写《环境科学与工程专业英语》的目的,就是让环境科学与工程专业的大学本科生在完成了公共英语的学习之后,继续提高本专业的英语实际应用能力,达到熟悉和掌握本专业的专业用语和用法、熟练阅读本专业的英文书籍、文献的水平。通过阅读本书,不仅能开阔视野,也可为继续深造的学生参与国际学术交流奠定良好的基础。

本教材围绕环境科学与工程专业领域的内容进行选材,全书共分9个部分,涵盖了环境科学与工程的基本原理与技术,包括大气、水体、土壤、固体废弃物以及相关的污染防治技术,同时还涵盖了生态学、可持续发展理论的相关知识。课文均选自原版英文教科书、科技报告、著作、专业期刊、国际会议论文集等,内容新颖、丰富,具有全球视野。本教材不仅强调阅读能力,而且注重写作、翻译等各方面能力的均衡发展,指导学生熟悉学术论文的写作格式,学术论文英文摘要所应包含的内容以及常用的句型及表达方式。为便于学生自学,本书每课配有单词和词组表,并对课文的难点做必要的注释。本教材可作为普通高等院校环境科学与工程类专业高年级本、专科生专业英语教材,也可供相关专业研究生、科研人员参考使用。

参加本书编写工作的有以下人员:党秀丽(沈阳农业大学,编写第1部分、第5部分第1、2单元,第8部分、第9部分)、梁彦秋(沈阳化工大学,编写第2、3、6、8部分和附录)、张园(苏州科技学院,编写第4部分)、王忠强(东北师范大学,编写第7部分)、徐向华(南京信息工程大学,编写第5部分第

4、5单元)、刘畅(沈阳农业大学,编写第5部分第3单元、第9部分)、范庆锋、赵野(沈阳农业大学,参与了第8部分的编写工作)。全书由党秀丽负责统稿和校对。中国科学院博士研究生薛媛媛,沈阳农业大学研究生王凤、王梦露,东北师范大学研究生杨琇楦参与了部分章节的编写和校稿工作。教材编写参考了国内外有关的资料和成果,在此谨向有关作者深表谢意。编写过程中得到了中国建材工业出版社和全体参编人员的大力支持,在此,一并表示诚挚的谢意。

由于时间仓促,编者水平有限,书中难免存在一些不当和疏漏之处,敬请广大读者批评指正。

编者

2015年6月

# 目 录

Part 1	General Introduction to Environmental Science and Engineering .....	1
<hr/>		
Unit 1	Components and Subcomponents of Environment .....	1
Unit 2	Environmental Stresses—Causes, Classification and Impact .....	5
Unit 3	Environmental Protection and Sustainable Development .....	9
Unit 4	Environmental Engineering As a Tool For Managing the Human Environment .....	13
Part 2	Water Pollution and Wastewater Treatment .....	17
<hr/>		
Unit 1	Water Problems .....	17
Unit 2	Types of Water Supply and Classification of Water Contaminants .....	21
Unit 3	Water Pollution and Water Pollutant .....	25
Unit 4	Municipal Sewage Treatment .....	29
Unit 5	Principle of Wastewater Treatment .....	34
Part 3	Air Pollution and Control Technology .....	38
<hr/>		
Unit 1	Composition, Structure and Pollution of the Atmosphere .....	38
Unit 2	Major Air Pollutants .....	43
Unit 3	Global Warming: the Greenhouse Effect .....	48
Unit 4	Conventional Technology of Air Pollution Control .....	53
Unit 5	Control of SO <sub>2</sub> —Absorption Techniques .....	58
Part 4	Solid Wastes and Disposal .....	62
<hr/>		
Unit 1	Municipal Solid Waste Generation, Recycling and Disposal in the United States .....	62
Unit 2	Economic and Environmental Evaluations of Waste Treatment and Disposal Technologies for Municipal Solid Waste .....	70
Unit 3	Solid Waste Treatment and Disposal: Effects on Public Health and Environmental Safety .....	74
Unit 4	Integrated Technologies For Solid Waste Monitoring System .....	78
Unit 5	Municipal Solid Waste Management in China .....	82



Part 5 Soil .....	89
-----	
Unit 1 Soil Resource .....	89
Unit 2 Soil Pollution .....	94
Unit 3 Phytoremediation of Heavy Metal Contaminated Soils .....	98
Unit 4 Soil Degradation: an Ecosystem Service Perspective .....	103
Unit 5 Arsenic in the Soil Environment .....	108
Part 6 Environmental Monitoring .....	112
-----	
Unit 1 Design of Environmental Monitoring Programs .....	112
Unit 2 Water Sampling Procedures .....	117
Unit 3 Important Parameters in Water Monitoring .....	120
Unit 4 Determination of Chemical Oxygen Demand .....	123
Unit 5 Atomic Absorption Spectrophotometry Monitoring .....	128
Part 7 Environmental Ecology .....	133
-----	
Unit 1 Environmental Ecology .....	133
Unit 2 Biology and Environment .....	136
Unit 3 Conditions and Resources: Major Determinants of Ecology .....	139
Unit 4 Ecological Balance .....	143
Unit 5 Methods to Restore Ecosystem Environment .....	146
Part 8 EST (English of Science and Technology) Features and Translating Skills .....	150
-----	
Part 9 Abstract Writing of Scientific Research Paper .....	155
-----	
Appendixes .....	161
-----	
附录 1 数学符号及数学公式 .....	161
附录 2 环境优先污染物 .....	164

# Part 1 General Introduction to Environmental Science and Engineering

## Unit 1 Components and Subcomponents of Environment

### 1. Classification of Environment

The term Environment can be broadly defined as one's surroundings. To be more specific we can say that it is the physical and biological habitat that surrounds us, which can be felt by our physical faculties (seen, heard, touched, smelled and tasted.)

The two major classifications of environment are:

**(A) Physical Environment:** External physical factors like Air, Water and Land etc. This is also called the **Abiotic Environment**.

**(B) Living Environment:** All living organisms around us viz. plants, animals and microorganisms. This is also called the **Biotic Environment**.

Earth's environment can be further subdivided into the following four segments:

- (1) Lithosphere
- (2) Hydrosphere
- (3) Atmosphere
- (4) Biosphere

#### **Lithosphere**

The earth's crust consisting of the soil and rocks is the lithosphere. The soil is made up of inorganic and organic matter and water. The main mineral constituents are compounds or mixtures derived from the elements of Si, Ca, K, Al, Fe, Mn, Ti, O etc. (Oxides, Silicates and Carbonates). The organic constituents are mainly **polysaccharides**, organo compounds of N, P and S. The organic constituents even though form only around 4%~6% of the lithosphere, they are responsible for the fertility of the soil and hence its productivity.<sup>1</sup>

#### **Hydrosphere**

This comprises all water resources both surface and ground water. The world's water is found in oceans and seas, lakes and reservoirs, rivers and streams, **glaciers** and snowcaps in the Polar Regions in addition to ground water below the land areas.

The water locked up in the Oceans and Seas are too salty and cannot be used directly for human consumption, domestic, agriculture or industrial purposes. Only less than 1% of

water resources are available for human exploitation. Water is considered to be a common compound with uncommon properties. These uncommon properties (e. g. anomalous expansion of water) are mainly responsible for supporting terrestrial and aquatic life on earth.

### **Biosphere**

The biosphere is a capsule encircling the earth's surface wherein all the living things exist. This portion extends from 10000m below sea level to 6000m above sea level. Life forms do not exist outside this zone. The biosphere covers parts of other segments of the environment viz. Lithosphere, Hydrosphere and Atmosphere. Life sustaining resources like food, water and oxygen present in the biosphere are being withdrawn and waste products in increasing quantities are being dumped.<sup>2</sup> The biosphere has been absorbing this and assimilating them. However the rate of waste dumping has gone beyond the assimilating capability of the biosphere and signals of this stress is becoming evident.

### **Atmosphere**

It is the gaseous envelope surrounding the earth and extends up to 500km above the earth's surface. The atmosphere, which is a gaseous cover, protects the earth from cosmic radiations and provides life sustaining Oxygen, the macronutrient Nitrogen and Carbon dioxide needed for photosynthesis.<sup>3</sup> The atmosphere screens the dangerous UV radiations from the sun and allows only radiations in the range of 300~2500nm (near UV to near IR) and radio waves. The atmosphere plays a major role in maintaining the heat balance of the earth by absorbing the re-emitted radiation from the earth. In addition the atmosphere is the medium of carriage of water from the oceans to the land in the hydrological cycle.

## 2. Inter-relationship Between the Components and Subcomponents

Matter (chemicals) as well as living beings on earth are distributed among the four major Environmental Components viz. Lithosphere, Hydrosphere, Atmosphere and Biosphere. While for the purpose of studying and understanding the Global Environment this division may be convenient, constant interaction by way of mass and energy transfer between these components and subcomponents is constantly taking place.

Every sphere has a flow of matter and energy to every other sphere, which is a two-way linkage as shown in the figure. Such two-way interactions are also taking place within individual spheres. This indicates movement of matter/energy from one location to another without exiting the sphere. Environmental problems are hence not confined only to the component/system where they arise but spread to other components as well. A clear example of this is the Acid Rain. Emissions of air pollutants like oxides of Sulfur and Nitrogen are transported over long distances where they are brought down to land and fresh water bodies by rain, creating damage to crops, lands, fresh water resources including ground water, properties and aquatic life. Another classical example is the build up of gases like Carbon dioxide in the atmosphere. The emissions may be localized but the impact is massive and global in nature leading to global warming which has far reaching consequences in terms of

both area and time.

### 3. Structure and Functional Components of the Ecosystem

#### Ecology and Ecosystem

The study and understanding of Ecology is an integral part of Environment Science learning. Every living being however small or big depends on the environment for its existence and also competes with others for essentials in life. For survival, living beings form groups and different groups compete with each other for survival. The study of interrelationships between organisms and group of organisms is called the science of Ecology. The word Ecology has its roots from two Greek words “ikos” meaning a house or dwelling or place of living or habitat and “logos” meaning study. Ecology is hence the study of interrelationship among plants and animals and their interactions with the physical environment.

There are two important divisions of Ecology. They are:

**(1) Autoecology or Species Ecology;** This is the study of an individual species. i. e. behavior, adaptation and interaction of a particular species in its environment.

**(2) Synecology or Ecology of Communities;** This is the study of Communities and their interaction with the environment.

An Ecosystem is defined as a group of plants, animals or living organisms living together and interacting with the physical environment in which they live. An Eco system has a more or less a closed boundary and the flow of mass in and out of the system is very less as compared to the internal movement of mass. Ecosystems can be large or small. Examples of large ecosystems are rain forests, deserts, salt marshes, coral reefs, lakes and ponds, open ocean, grass lands etc.

### Reference

- [1] Saravanan K. , Ramachandran S. , and Baskar R. Principles of Environmental Science & Technology[M]. New Age International (P) Ltd. , 2005:3-7.

### Vocabularies

abiotic [ˌaɪbiəˈɒtɪk] adj. [生态] 非生物的；无生命的

abiotic environment: 非生物环境，无生命环境，非生命环境

polysaccharides [ˈpɒliˈsækərəɪdiːz] n. [有化] 多糖，多聚糖，水解多糖(polysaccharide 的复数)

glaciers [ˈglæsiəz] n. [地理][水文] 冰川，冰河(glacier 的复数)

cosmic [ˈkɒzɪk] adj. [高能] 宇宙的

cosmic radiation: 宇宙辐射, 宇宙射线, 宇宙辐射线

autoecology [ɔ:təʊ'kɒlədʒɪ] n. 个体生态学

Synecology [sɪnɪ'kɒlədʒɪ] n. 群体生态学; 群落生态学; 环境生态学

## Notes

1. The organic constituents even though form only around 4%~6% of the lithosphere, they are responsible for the fertility of the soil and hence its productivity.

尽管岩石圈中只有4%~6%的有机成分,但是这些有机成分对土壤肥力及生产力具有至关重要的作用。

2. Life sustaining resources like food, water and oxygen present in the biosphere are being withdrawn and waste products in increasing quantities are being dumped.

维持生命的资源,如食物、水、氧气在生物圈中得以回收,同时,越来越多的废弃物被倾倒入生物圈中。

3. The atmosphere, which is a gaseous cover, protects the earth from cosmic radiations and provides life sustaining Oxygen, the macronutrient Nitrogen and Carbon dioxide needed for photosynthesis.

大气圈是覆盖在地球表面的一层气体,它保护地球以免受到宇宙辐射的影响。维持生命所需要的氧气、氮素及光合作用需要的二氧化碳都是由大气圈提供的。

## Unit 2 Environmental Stresses—Causes, Classification and Impact

We can view environment as all the external conditions that influence the life of a person or society. Environment ultimately determines the quality and quantity of life. An environmental stress may be defined as a condition of intense strain or pressure or any agent that threatens the integrity of the system or survival of life.<sup>1</sup> The environmental stresses may be caused due to any one of the following reasons;

- *Population growth*: Higher population results in the requirement of more food, water, industrial commodities, and literally more of everything and results in increased generation of wastes of toxic nature and therefore more pollution.

- *Urbanization*: Concentration of people in smaller land areas such as cities results in increased demand on resources increases volume of wastewaters, solid wastes, problems of residential environment and air pollution.

- *Industrialization*: Urbanization is closely related to industrialization which results in additional environmental stresses.

- Increase in hazardous nature, complexity and number of the wastes
- Problems of occupational environment/hazards
- Increased demand on resources
- Toxic, *carcinogenic*, cumulative and *synergistic* chemicals

- *Advances in agriculture*: The following impacts are likely to occur: **Desertification**, Dams and ecological disasters, **Salinity** problems, soil and ground water pollution due to use of fertilizers and pesticides, Infectious diseases transmitted from animals to humans (zoonoses).

- *Ignorance, misinformation and disinformation*

The environmental stresses are broadly classified into two types which are given in Table 1-1.

**Table 1-1 Classification of Environmental Stresses**

Type of Environmental stress		Examples
Natural		Volcanic eruptions
		Earthquakes
		Drought
		Floods
		Forest fires
Human-Induced (Anthropogenic)	Air	Pollution of Air Acid rain
	Water	Pesticide poisoning
	Land	Deforestation

Based on the nature of the stress causing agents the environmental stresses are classified as below:

#### Physical Agents

- (1) Thermal
- (2) Radiation
- (3) Noise
- (4) Mechanical (Vibration)

#### Chemical Agents

- (1) Radio active materials
- (2) Organic Chemicals
- (3) Inorganic Chemicals
- (4) **Aerosols**
- (5) Toxic gases and vapors

#### Biological Agents

- (1) Bacteria
- (2) Viruses
- (3) Parasites

The chemical agents may present themselves in any and all the three states of matter viz. gas, liquid and solid and the biological agents may survive in any or all the three states.

#### Physical Agents

**Thermal Stress:** Extremes of hot and cold temperature must be considered as thermal agents which induces heat and cold stresses. If the environment is too cold, the body loses heat faster than it can produce and it will lead to ‘**Hypothermia**’ condition. If the environment is too hot and the body is unable to cool fast enough which results in heat stress. Heat stress affects humans in different ways, based on physical fitness, work capacity, age, health, living habits, and degree of exposure to heat.

**Radiation:** It is an important environmental stress inducing agent since absorption of energy in the body tissues causes physiological injury by means of ionization or excitation. Radiation causes cell damage by upsetting the cell chemistry/physics, and by disrupting the ability of the cell to repair itself. Radiation affects the cells and organs during the lifetime of humans (somatic damage). It also causes genetic damage, which affects future generations.

**Noise:** Excessive or unwanted sound is referred to as noise. Exposure to noise at specific range of frequencies for sufficient duration will result in damage to the auditory system and subsequent hearing loss.<sup>2</sup> Noise may also cause physical and psychological disorders, interference with voice communications, disruption in job performance, rest, relaxation and sleep.

**Vibration :** Vibration is an *oscillating motion* of a system ranging from simple harmonic motion to extremely complex movements. Continuous and over exposure to vibration while using hand tools may cause *neurotics, decalcification* of the carpal and metacarpal bones, fragmentation and *muscle atrophy*.

## Chemical Agents

Chemical agents are classified into inorganic and organic materials and are most notable for toxicity and **flammability** which threaten life forms. Toxic chemical substance includes metals, aqueous-based acids and alkalis, petroleum based hydrocarbons etc. Chemical agents can be in the form of particulate matter like dusts, mists, fumes, fibers and smoke etc. Chemical agents induce biochemical and physiological changes in human systems following either systemic contact, via absorption into blood and tissues or local contact.

Some of the notable examples of stress causing chemical agents are listed below:

### (1) Metals

- Arsenic, cadmium, chromium, nickel and uranium are respiratory carcinogens.
- Beryllium can cause depilating lung disease—Berylliosis.
- Lead, Arsenic, Mercury and Manganese are toxic to nervous system and lead to neuromuscular effects.

### (2) Metal Oxides

Metal oxides can cause metal fume fever—a flu like illness.

### (3) Organic Solvents

- They are the pure or substituted hydrocarbons derived from petroleum and are used to dissolve other organic materials.
- Examples: **Benzene**, **Xylene**, carbon tetra chloride, methyl Chloride.
- Most of these solvents cause central nervous system depression, decreased alertness, headaches, sleepiness, and loss of consciousness. They also can damage kidneys.

### (4) Toxic gases

- Many organic and inorganic gases cause toxic effects.
- Oxides of Nitrogen, oxides of sulfur, ozone, chlorine, **formaldehyde**, hydrogen chloride, hydrogen sulfide are respiratory and ocular irritants.
- Carbon monoxide is a chemical **asphyxiant**.

## Biological Agents

Biological agents are commonly referred to as **pathogenic organisms** which may be present in the environment. When introduced into the blood stream, they disrupt biochemical and physiological functions by infection or induction of toxicity. The disruption can result in illness and death if the immune system is not able to destroy the biological agents.

## Reference

- [1] Saravanan K. , Ramachandran S. , and Baskar R. Principles of Environmental Science & Technology[M]. New Age International (P) Ltd. , 2005:45-49.



## Vocabularies

- carcinogenic [ˌkɑːs(ɪ)nəˈdʒenɪk] adj. 致癌的; 致癌物的
- synergistic [ˌsɪnəˈdʒɪstɪk] adj. 协同的; 协作的; 协同作用的 n. 蕙醌化合物
- desertification [dɪˌzɜːtɪfɪˈkeɪʃn] n. (土壤)荒漠化; 沙漠化(等于 desertization)
- salinity [seɪˈlɪnəti] n. 盐度; 盐分; 盐性
- aerosols [ˈeərəsɒl] n. [物化] 气溶胶, 喷雾器(aerosol 的复数形式)
- hypothermia [ˌhaɪpə(ʊ)ˈθɜːmiə] n. 降低体温; 低体温症
- oscillating [asəˈleɪtɪŋ] adj. [物] 振荡的
- oscillating motion: 振动; 摇摆运动; 振荡
- neurotic [njʊəˈrɒtɪk] n. 神经病患者; 神经过敏者 adj. 神经过敏的; 神经病的
- atrophy [ˈætrəfi] n. 萎缩, 萎缩症; 发育停止 vi. 萎缩; 虚脱
- muscle atrophy: 肌肉萎缩, 肌萎缩, 肌肉萎缩症
- flammability [ˌflæməˈbɪləti] n. 可燃性, 易燃性
- benzene [ˈbenziːn] n. [有化] 苯
- xylylene [ˈzaɪliːn] n. [有化] 二甲苯, 甲苯, 对二甲苯
- formaldehyde [fɔːˈmældɪhaɪd] n. 蚁醛, [有化] 甲醛, 防腐剂
- asphyxiant [æsˈfɪksɪənt] n. [军][毒物] 窒息剂; 窒息状态; 引起窒息的事物
- pathogenic [ˌpæθəˈdʒenɪk] adj. 致病的; 病原的; 发病的(等于 pathogenetic)
- Pathogenic Organisms: 病原生物学, 病原生物体, 病原有生命的物质学

## Notes

1. An environmental stress may be defined as a condition of intense strain or pressure or any agent that threatens the integrity of the system or survival of life.

环境压力可以指一种强大的压力条件,也可以是一种能够威胁系统完整性或者生命存活的化学物质。

2. Exposure to noise at specific range of frequencies for sufficient duration will result in damage to the auditory system and subsequent hearing loss.

长时间暴露在高频率噪声强度中会导致听觉系统受到伤害,严重的会引起失聪。