COURSE GUIDE

CRD 204
MAN & HIS ENVIRONMENT

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Published by
National Open University of Nigeria

ISBN:

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INTRODUCTION

CDR 204: Man & His Environment as a course consists of 15 units covering the entire facets of Man and his environment.

The connection between human being and the environment is quite unique and completely similar to that of the animal world with remarkable difference. The existence of human beings follows a specific phenomenology which is more paramount to them only and this provoke questions on the natural habitat in which they live.

In the context of the phenomenological discussion, human being can adapt to one other based on understanding and intention. Second, language provides a mechanism where human beings communicate with each other through universal and symbolic forms. Third, human beings have the innate ability to develop abstract thoughts relevant for their instructive life. Fourth, human beings can predict and transform the environment in respect of their needs and acquisition of knowledge. Fifth, human beings have the ability to produce culture from religious dimension and this attribute placed human being ahead of animals. This led to Aristotle's definition which defines human beings as "rational animal".

It should be noted that the historical reconstruction of the appearance and development of human beings generated different shades of debate particularly from religion and science angle. Some strands of studies have approached the discussion from pale anthropological and evolutionary framework. The debate continued further in the Western culture where common front was sought in order to harmonize the biblical tale on the origin of human beings and scientific expositions.

It is important to point out that environment is the place where man lives in. It constitutes his dwelling place. Therefore, man and the environment has a symbiotic relationship and significant connection which entails that man cannot be detached from the environment. Human beings acquire knowledge, awareness and experience from the immediate surroundings, which is environment.

The course guides tells you what CDR 204 is all about and the materials you need to make the reading successful. Other information in this course guide include information on the Tutor Marked Assignment questions.

The course contents consist of man and his environment, scientific methodology, science and technology in the society and service of man,

renewable and non-renewable resources, environmental effects of chemical materials and chemical hazards.

COURSE AIMS

The aim of this course is to expose the students to man's activities in relation to the cosmic environment. The course will identify the renewable and non-renewable resources as well as environmental effects chemical materials and their implications of man' welfare.

COURSE OBJECTIVES

At the end of this course students should be able to:

- understand the role of man in an environment
- identify the behavioral patterns of human beings compared to the animal world
- develop the skills and knowledge required in solving problems an environment
- understand environmental risks and chemical hazards in the immediate surroundings
- understand the role of renewable and non-renewable resources in an environment.

STUDY UNITS

There are 15 units of this course which include the following:

MODULE 1

Unit 1	Origin and nature of man
Unit 2	Man and his Cosmic Environment
Unit 3	Scientific Methodology
Unit 4	Science and Technology in the Society and Service of Man
Unit 5	Renewable and Non-renewable Resources

MODULE 2

Unit 1	Man Technology and Resources
Unit.2	Environmental Effects of Chemical Plastics
Unit 3	Environmental Effects of Textiles, wastes and Other Materials
Unit 4	Chemical and Radiochemical Hazards
Unit 5	Introduction to various areas of Science and Technology

MODULE 3

Unit 1	Elements of Environmental Studies
Unit 2	Business Development and Evolution of Natural Endowment
Unit 3	Nature and Resources
Unit 4	Meaning and Value of Resources
Unit 5	Natural Resources Scarcity and Indicators of Scarcity

Each study unit will take at least 2 hours and it includes the introduction, objectives, main content, exercises, conclusion, summary and references. Others are the Tutor Marked Assignment (TMA). You are required to study the materials, reflect on it and do the exercises.

ASSIGNMENT/EXERCISES

In each unit, you will find exercises which you are expected to do. The exercises will enable you to understand better what you have learned.

TUTOR MARKED ASSIGNMENT

In doing the tutor marked assignment, you are expected to apply what you have learnt in the contents of the study unit. The assignments are expected to be turned in to your tutor for grading.

SUMMARY

This course make you understand and explain the origin of man. It discusses and explains the nature of man and the complex relationship between man and its environment.

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MODULE 1

Unit 1 Origin and nature of man
Unit 2 Man and his Cosmic Environment
Unit 3 Scientific Methodology
Unit 4 Science and Technology in the Society and Service of Man
Unit 5 Renewable and Non-renewable Resources

UNIT 1 ORIGIN AND NATURE OF MAN

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4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
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1.0 INTRODUCTION

Man is functionally related to his environment. Each is adjusted to the other in such a way that one could say the environment is the lock and man is the key. The relationship between environment and human beings cannot be separated from one another. The environment has considerably affected human beings right from his evolution.

Man lives in the environment and acquires knowledge and skills from it. Consequently, man tries to settle himself in his environment, both social, economic and physical, in order to be able to live productively and efficiently.

2.0 OBJECTIVES

At the end of this course students should be able to:

- understand and explain the origin of man
- understand and explain the nature of man
- explain the complex relationship between man and environment

3.0 MAIN CONTENT

3.1 Origin of Man

Whenever one is seeking to find out the origin of something, one may be tempted to ask the following questions such as: "when did it start?", "how did it start?" and "where did it start? Our major concern here is to find out about the origin of man. How did man start on? How did man race started off? Who are man's ancestors? Additional questions which might bothers the minds of every man, woman, boy or girl are that "where did human beings come from?" and how did man originate? The answers to these questions are not farfetched. If you ask a boy or a girl where does he/she comes from, the boy or girl would say he/she actually comes from his/her parents and they originate from them. But one may be tempted to ask further where do the parents come from? Truly, one may say they came from grandparents. Again, where do the grandparents came from? They came from great grandparents. All these answers are correct but they do not truly reflect the origin of man.

The puzzle which requires answer is that "has man always been in existence? "has mankind been around forever?" Is man eternal, or was there a time when man was not here? Specifically, there was a time when there was no man on earth and a time when there was no earth. But today, there are billions of men, women and children on the planet earth. The question is how do these people get there? Where do they originate from?

The origin of man can be explained under three basic ideas. The first idea is that man evolved from evolutional theory. Evolution theory teaches that man gradually evolved from lower animals (such as apelike creatures) in a bit by bit changing process. Therefore, the evolutionists say that man is nothing more than a highly intelligent animal. The second idea of man's origin is that man owes his existence to "unidentified flying objects"(UFOs). UFOLOGISTS explained the origin of man in different way. These people do not believed in biblical and evolutionists explanations of man's origin. The first two ideas are not appropriately positioned. The third idea about man's origin can be

found in the Holy Bible, Genesis 1 verses 26-27, Genesis 2 verse 7 and Genesis 2 verses 21-23. This has been proven to be correct.

3.2 Nature of Man

God created man and animals with both internal and external senses, but man has a more sophisticated sense of reasoning than the animals. Man has knowledge and will power. Man has a good sense of generalization, ability to coin out abstract ideas and possess intellectual truths. The will power that man has means that man has a strong desire to compare two or more objects after due consideration of their consequences and actions and ability to reason which among the objects are good. Animals cannot reason the way man does.

There are four elements in man' nature. The elements produce four attributes in man. First, man can be so horrible, nasty and unpleasant. This implies that man is an advanced animal especially one that is large or dangerous, or one that is unusual. Second, man can be brutal, violent and cruel. The third attribute of man is that man is satanic and connected with the worship of the devil. The fourth attribute of man is that man can be so connected with God or a god. Man's behavior could be likened to the following animals, the pig, the dog, the devil and the saint. The pig has outlook causing a feeling of strong dislike, very unpleasant and eats too much. The dog is often kept as a pet or trained for work, barks and bites, causing harm to others. The dog and pig sense of reasoning are beclouded by the devil from reasoning in a divine form. Divine reason, if properly positioned would contain the evil by exposing its character. But when a man cannot reason appropriately, the attributes of dog, pig and devil prevail over him and cause his ruin.

The pig attributes results into shamelessness, lust and slander. The dog attributes results into pride, vanity, ridicule, wrath and tyranny. The two attributes are controlled by satanic power of deceit, treachery, perfidy and self-centeredness but if divinity in man is more dominant, it produces knowledge, wisdom, faith and truth.

3.3 Human Evolution

Human evolution is the evolutionary process that led to the emergence of anatomically modern humans, beginning with the evolutionary history of primates – in particular genus *Homo* – and leading to the emergence of *Homo sapiens* as a distinct species of the hominid family, the great apes.

The study of human evolution involves many scientific disciplines, including physical anthropology, primatology, archaeology,

paleontology, neurobiology, ethology, linguistics, evolutionary psychology, embryology and genetics. Genetic studies show that primates diverged from other mammals about 85 million years ago, in the Late Cretaceous period, and the earliest fossils appear in the Paleocene, around 55 million years ago.

Within the Hominoidea (apes) super family, the Hominidae family diverged from the Hylobatidae (gibbon) family some 15–20 million years ago; African great apes (subfamily Homininae) diverged from orangutans (Ponginae) about 14 million years ago; the Hominini tribe (humans, *Australopithecines* and other extinct biped genera, and chimpanzee) parted from the Gorillini tribe (gorillas) between 9 million years ago and 8 million years ago; and, in turn, the sub tribes Hominina (humans and biped ancestors) and Panina (chimps) separated about 7.5 million years ago to 5.6 million years ago.

Human evolution is an age long phenomenon. Scientists have established that the physical and behavioral traits about human beings shared by all people originated from apelike ancestors. Human traits are categorized as:

i. ability to walk on two legs
ii. ability to reason appropriately
iii. ability to produce and use tools and equipments
iv. ability to communicate effectively with language
v. ability to develop complex symbolic expression
vi. ability to develop culture and other forms of arts.

Human belongs to the group of mammals which have apes and monkeys as member. Humans developed gradually, especially from a simple to a more complicated form in Africa. The remains of early humans who lived between 6 and 2 million years ago come entirely from Africa. Scientists recognized different species of early humans but there was no unanimity of agreement whether the species are related or which among the species died out. Scientists also faced the challenge of how to identify and classify particular species of early humans, and about what factors influenced the evolution and extinction of each species. Evidence have shown that early humans first migrated out of Africa into Asia. They found their way into Europe and other parts of the world.

3.4 The process of Evolution

The process of evolution requires biological transformation that causes natural change in human species. Mammals reproduce themselves sexually and as such called *Homo sapiens*. Evolution occurs when there is change in the genetic material (DNA).The DNA is inherited from the

parents. Genes is a branch of DNA that affect the process of mutation. Genes affect body development and behavior of an organism during its life time and this affects the likelihood of whether an organism will survival and reproduce.

Evolution does not have any impact on individual behavior. Instead, it transform the inherited means of growth and development of a group of individuals of similar species living in a particular habitat. Parents in most cases pass adaptive genetic changes to their offspring, and ultimately these changes become common throughout a population. The offspring therefore inherit those genetic characteristics. The genetic characteristics may enhance the offspring chances of survival and ability to give birth.

The evolution process is given below:

3.4.1 Anatomical changes

Human evolution from its first separation from the last common ancestor of humans and chimpanzees is characterized by a number of morphological, developmental, physiological, and behavioral changes. The most significant of these adaptations are bipedalism, increased brain size, lengthened ontogeny (gestation and infancy), and decreased sexual dimorphism. The relationship between these changes is the subject of ongoing debate. Other significant morphological changes included the evolution of a power and precision grip, a change first occurring in *H. erectus*.

3.4.2 Bipedalism

Bipedalism is the basic adaptation of the hominin and is considered the main cause behind a suite of skeletal changes shared by all bipedal hominins. The earliest hominin, of presumably primitive bipedalism, is considered to be either *Sahelanthropus* or *Orrorin*, both of which arose some 6 to 7 million years ago. The non-bipedal knuckle-walkers, the gorilla and chimpanzee, diverged from the hominin line over a period covering the same time, so either of *Sahelanthropus* or *Orrorin* may be our last shared ancestor. *Ardipithecus*, a full biped, arose somewhat later.

The early bipeds eventually evolved into the australopithecines and still later into the genus *Homo*. There are several theories of the adaptation value of bipedalism. It is possible that bipedalism was favored because it freed the hands for reaching and carrying food, saved energy during locomotion, enabled long distance running and hunting, provided an enhanced field of vision, and helped avoid hyperthermia by reducing the

surface area exposed to direct sun; features all advantageous for thriving in the new savanna and woodland environment created as a result of the East African Rift Valley uplift versus the previous closed forest habitat. A new study provides support for the hypothesis that walking on two legs, or bipedalism, evolved because it used less energy than quadrupedal knuckle-walking. However, recent studies suggest that bipedality without the ability to use fire would not have allowed global dispersal. This change in gait saw a lengthening of the legs proportionately when compared to the length of the arms, which were shortened through the removal of the need for brachiation. Another change is the shape of the big toe. Recent studies suggest that Australopithecines still lived part of the time in trees as a result of maintaining a grasping big toe. This was progressively lost in Habilines. Anatomically, the evolution of bipedalism has been accompanied by a large number of skeletal changes, not just to the legs and pelvis, but also to the vertebral column, feet and ankles, and skull. The femur evolved into a slightly more angular position to move the center of gravity toward the geometric center of the body. The knee and ankle joints became increasingly robust to better support increased weight. To support the increased weight on each vertebra in the upright position, the human vertebral column became S-shaped and the lumbar vertebrae became shorter and wider. In the feet the big toe moved into alignment with the other toes to help in forward locomotion. The arms and forearms shortened relative to the legs making it easier to run. The foramen magnum migrated under the skull and more anterior.

The most significant changes occurred in the pelvic region, where the long downward facing iliac blade was shortened and widened as a requirement for keeping the center of gravity stable while walking; bipedal hominids have a shorter but broader, bowl-like pelvis due to this. A drawback is that the birth canal of bipedal apes is smaller than in knuckle-walking apes, though there has been a widening of it in comparison to that of australopithecine and modern humans, permitting the passage of newborns due to the increase in cranial size but this is limited to the upper portion, since further increase can hinder normal bipedal movement.

The shortening of the pelvis and smaller birth canal evolved as a requirement for bipedalism and had significant effects on the process of human birth which is much more difficult in modern humans than in other primates. During human birth, because of the variation in size of the pelvic region, the fetal head must be in a transverse position (compared to the mother) during entry into the birth canal and rotate about 90 degrees upon exit. The smaller birth canal became a limiting factor to brain size increases in early humans and prompted a shorter gestation period leading to the relative immaturity of human offspring,

who are unable to walk much before 12 months and have greater neoteny, compared to other primates, who are mobile at a much earlier age. The increased brain growth after birth and the increased dependency of children on mothers had a big effect upon the female reproductive cycle, and the more frequent appearance of all parenting in humans when compared with other hominids. Delayed human sexual maturity also led to the evolution of menopause with one explanation providing that elderly women could better pass on their genes by taking care of their daughter's offspring, as compared to having more children of their own.

3.4.3 Encephalization

The human species eventually developed a much larger brain than that of other primates—typically 1,330 cm^3 in modern humans, nearly three times the size of that of a chimpanzee or gorilla. The pattern of encephalization started with *Homo habilis*, after a hiatus with Anamensis and Ardipithecus species which had smaller brains as a result of their bipedal locomotion which at approximately 600 cm^3 Homo habilus had a brain slightly larger than that of chimpanzees, and this evolution continued with *Homo erectus* (800–1,100 cm^3), reaching a maximum in Neanderthals with an average size of (1,200–1,900 cm^3), larger even than modern *Homo sapiens*. This pattern of brain increase happened through the pattern of human postnatal brain growth which differs from that of other apes (heterochrony). It also allows for extended periods of social learning and language acquisition in juvenile humans which may have begun 2 million years ago. However, the differences between the structure of human brains and those of other apes may be even more significant than differences in size.

The increase in volume over time has affected areas within the brain unequally—the temporal lobes, which contain centers for language processing, have increased disproportionately, and seems to favor a belief that there was evolution after leaving Africa, as has the prefrontal cortex which has been related to complex decision-making and moderating social behavior. Encephalization has been tied to an increasing emphasis on meat in the diet, or with the development of cooking, and it has been proposed that intelligence increased as a response to an increased necessity for solving social problems as human society became more complex. The human brain was able to expand because of the changes in the morphology of smaller mandibles and mandible muscle attachments to the skull into allowing more room for the brain to grow.

The increase in volume of the neocortex also included a rapid increase in size of the cerebellum. Traditionally the cerebellum has been

associated with a paleocerebellum and archicerebellum as well as a neocerebellum. Its function has also traditionally been associated with balance, fine motor control but more recently speech and cognition. The great apes including humans and its antecessors had a more pronounced development of the cerebellum relative to the neocortex than other primates. It has been suggested that because of its function of sensory-motor control and assisting in learning complex muscular action sequences, the cerebellum may have underpinned the evolution of human's technological adaptations including the preadaptation of speech.

The reason for this encephalization is difficult to discern, as the major changes from Homo erectus to Homo heidelbergensis were not associated with major changes in technology. It has been suggested that the changes have been associated with social changes, increased empathic abilities and increases in size of social groupings.

3.4.4 Sexual Dimorphism

The reduced degree of sexual dimorphism is visible primarily in the reduction of the male canine tooth relative to other ape species (except gibbons) and reduced brow ridges and general robustness of males. Another important physiological change related to sexuality in humans was the evolution of hidden estrus. Humans and bonobos are the only apes in which the female is fertile year round and in which no special signals of fertility are produced by the body (such as genital swelling during estrus).

Nonetheless, humans retain a degree of sexual dimorphism in the distribution of body hair and subcutaneous fat, and in the overall size, males being around 15% larger than females. These changes taken together have been interpreted as a result of an increased emphasis on pair bonding as a possible solution to the requirement for increased parental investment due to the prolonged infancy of offspring.

3.5 Other changes

A number of other changes have also characterized the evolution of humans, among them an increased importance on vision rather than smell; a smaller gut; loss of body hair; evolution of sweat glands; a change in the shape of the dental arcade from being u-shaped to being parabolic; development of a chin (found in *Homo sapiens* alone); development of styloid processes; and the development of a descended larynx.

SELF ASSESSMENT EXERCISE

Explain the categorization of human traits.

4.0 CONCLUSION

This unit treats the origin and nature of man. It discusses the human evolution and processes involved in human evolution.

5.0 SUMMARY

We have discussed the origin and nature of man and this provides a background for our study.

6.0 TUTOR MARKED ASSIGNMENT

1. Discuss the origin and nature of man
2. Explain the evolution and process of evolution of man (Hints: do not forget the role of Paleoanthropologists).

ANSWER TO THE EXERCISE

Human traits are categorized as:

i. ability to walk on two legs
ii. ability to reason appropriately
iii. ability to produce and use tools and equipments
iv. ability to communicate effectively with language
v. ability to develop complex symbolic expression
vi. ability to develop culture and other forms of arts.

7.0 REFERENCES AND FURTHER READINGS

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UNIT 2 MAN AND HIS COSMIC ENVIRONMENT

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    3.2 Structure and functions of universal environment
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment Question
7.0 References and further reading

1.0 INTRODUCTION

In the last unit (Unit 1), we have discussed the origin of man, human evolution, the scientific study of human evolution and the process of evolution. In this module, we will focus attention on man's cosmic environment and how it affects its activities. Advancement in scientific frontiers and technological growth and development have led to increasing attention on man and the environment he lives in.

There is a symbiotic relationship between environment and man. The environment impacted significantly on man. Man's development takes place in the environment. A better understanding of human cosmic environment can be of help to equip our analysis of man's activities and with different components of environment. The explanation of human cosmic environment will provide a clear understanding of the structure and functions of the universal environment.

2.0 OBJECTIVES

At the end of this course students should be able to:

- understand and explain the relationship between man and the environment he lives in.
- explain the structure and functions of universal environment
- explain in detail the various types of environment.
- understand the various factors of cultural environment.

3.0 MAIN CONTENT

3.1 Definition of Concepts

There is need to define some key basic concepts such as: man, cosmic, and environment Man can simply be referred to as human race. Cosmic refers to the outer space or a part of universe other than the earth, while the environment simply embrace the external factors affecting an organism. The external factors can be living organism (biotic) or non-living organism (abiotic factors) such as temperature, rainfall e.t.c. Man and his cosmic environment constantly work together and are both affected by this interaction. The cosmic structure of man includes the earth, planets and their satellites.

The term environment can conceptually refers to all the sound up which man live and work and those supportive inhibitive to his immediate existence. People in different parts of the world differ greatly in physical appearance, dress, manners and ideals. They eat different kinds of food, build houses that range from grass huts to skyscrapers and enjoy pleasures as divers, as skinning and cockfights. They differ specially in their way of work and the kinds of occupations by which they earn a living. Differences in language, government, education and religion are quite obvious. Then, some people are active and inventive while other are passive, and they merely know how to copy their ancestors. Some of these differences are biological; people are born with a certain complexion others are cultural because people have invented and developed certain ideas in some places and not in others. Some other differences also result from contrasts in the natural or physical environment. People can mine iron ore only when iron ore is in the ground. The geographer is interested in finding out how all sorts of human conditions are distributed over the surface of hearth and why they are distributed in that particular fashion. He finds that in many cases the distribution is directly connected with physical features such as oceans, mountains, rainfall or forests.

However, distribution depends upon factors, such as density of population, stage of civilization and policy of the government. Even where human conditions are directly responsible for the distinction of man's activities yet indirectly the geographical or physical or natural environment affects them. Environment may also be refers to surrounding in which man lives and works. An environment is the place or surroundings in which people are living. The environment of all mankind is the surface of the Earth, and this consists of the lands on the surface of the Earth. Besides the land, the oceans and the air are very important parts of the environment of mankind. Without these, we would not be able to live at all.

Types of Environment

The environment of man is constituted of two broad types:

(a) Natural or physical environment; and (b) Cultural environment

Natural Environment: It includes various elements like location, land forms, water bodies climate soils, and mineral deposits, natural vegetation, forests and wild life. Climate is the most significant of all the above elements of nature environment. All these elements are provided by nature and man has to utilize all these resources in the best possible manner to suit his needs.

Cultural Environment: Cultural environment comprises man, made features and human talents. Human skill applied to the natural environment or surroundings and constitute of the sphere of cultural landscape. In other words, a cultural landscape would imply a complete substitution of the features of the original natural landscape and their replacement by man-made features. However, there are still certain areas of this Earth where man has affected no change to natural landscape. Similarly, there are certain areas which have not been completely replaced by man but man has started to exploit resources of nature in certain areas of Canada and Siberia and Atlantic region which till recently were considered as inaccessible regions. Time and place are important in cultural environment. The various elements of cultural environment are races, religions, system of political governments, density and distribution of population.

Factors of Cultural Environment

The following are the factors of Cultural environment of man.

(i) **Different in level of usage of resources by man:** Man has not been able to exploit all the resources given in his environment in the same way in all parts of the world. The difference in exploitation of resources means that there are certain parts of the world where man has; by his superior skill and hard work, exploited the resources in a better manner than the areas where man has, by his ignorance and dormant attitude, not been able to exploit the resources given in his environment to that extent.

(ii) **Different in level of** development: This reveals the differences in the levels of economic development of countries. Still, there are some countries where man is still a primitive hunter with his traditional outlook and thinking, whereas in certain countries, people have reach a high standard of living and output per capita and they are termed as economically advanced nations of the

world. Most of the countries of Asia (excluding: Japan and India). South America, Central Africa belongs to the group of undeveloped countries of the world, whereas North America and North Western Europe, Japan, Australia, New Zealand belongs to the group of developed countries of the world.

3.2 Structure and Functions of Universal Environment

- The Universe

This refers to all of space and its contents. The space of the universe is dotted with galaxies. It is believed to be expanding because the galaxies are observed to be continuously moving apart from each other at a rate which increases with their distance apart. Cosmology, the study of the universe, is the main source of information in this direction.

- The Galaxies

These are congregations of billions of stars held together by the force of gravity. Three types of galaxies can be identified:

a. **Spiral Galaxies:** These are flat shaped galaxies with bulging centres made up of old stars surrounded by a disc of young stars arranged in about three spiral arms. The Milky Way otherwise called "The Galaxy" is a good example. It is within the Milky Way that the solar system is found. Many types of spiral galaxies exist. Those which interest us are called the Barred galaxies. They are made up of spiral arms and a straight bar of stars across their centre. At the ends of the bar there are spiral arms which contain gas and dust necessary for the continuous formation of new stars. That means as old stars wane and fade away, new ones are "born" within the spiral arms of the galaxy.

b. **Elliptical Galaxies:** These have been observed to contain billions and trillions of old stars and very little gas. They are also usually quite massive in size compared with the other galaxies.

c. **Irregular Galaxies:** These cannot be classified because they have irregular shapes and sizes and are completely different from each other.

SELF ASSESSMENT EXERCISE

List three types of galaxies.

4.0 CONCLUSION

This unit treats man and his cosmic environment. It discusses the structure and functions of universal environment.

5.0 SUMMARY

We have discussed man and his cosmic environment. This provides further analysis of man's activities in the challenging environment.

ANSWER TO THE EXERCISE

Types of Galaxies

i. Spiral galaxies
ii. Elliptical galaxies
iii. Irregular galaxies

6.0 TUTOR MARKED ASSIGNMENT QUESTION

Discuss the types of galaxies known to you.

7.0 REFERENCES AND FURTHER READING

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UNIT 3 SCIENTIFIC METHODOLOGY

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4.0 Conclusion
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7.0 References and further reading

1.0 INTRODUCTION

In the last unit (unit 2), we have discussed man and his cosmic environment. In this unit, we shall focus on scientific methodology of carrying out a research work. The scientific methodology is a techniques used for investigating phenomena acquiring new knowledge, or correcting and integrating previous knowledge. To be scientific, a method of inquiry is based on empirical or measurable evidence, subject to specific principles of reasoning. The most important part of the scientific method is the experiment.

2.0 OBJECTIVES

At the end of this course students should be able to:

- explain and understand what scientific methodology means
- discuss the process of carrying out scientific enquiry about a phenomenon.

3.0 MAIN CONTENTS

3.1 Introduction

The scientific method is a continuous process, which usually begins with observations about the natural world. Human beings are naturally inquisitive. They ask questions about things they see or hear and also develop ideas about why things are the way they are. The best hypotheses lead to predictions that can be tested in various ways, including making further observations about nature. In general, the strongest tests of hypotheses come from carefully controlled and replicated experiments that gather empirical data. The tests to be

conducted must match with the predictions of the phenomenon under observation. Otherwise, the test may reject the hypothesis. If an hypothesis is appropriately specified, then a general theory may be developed.

Scientific enquiry varies from one discipline to another. The overall process of scientific enquiry involves making conjectures (hypotheses), deriving predictions from them as logical consequences, and then carrying out experiments based on those predictions.

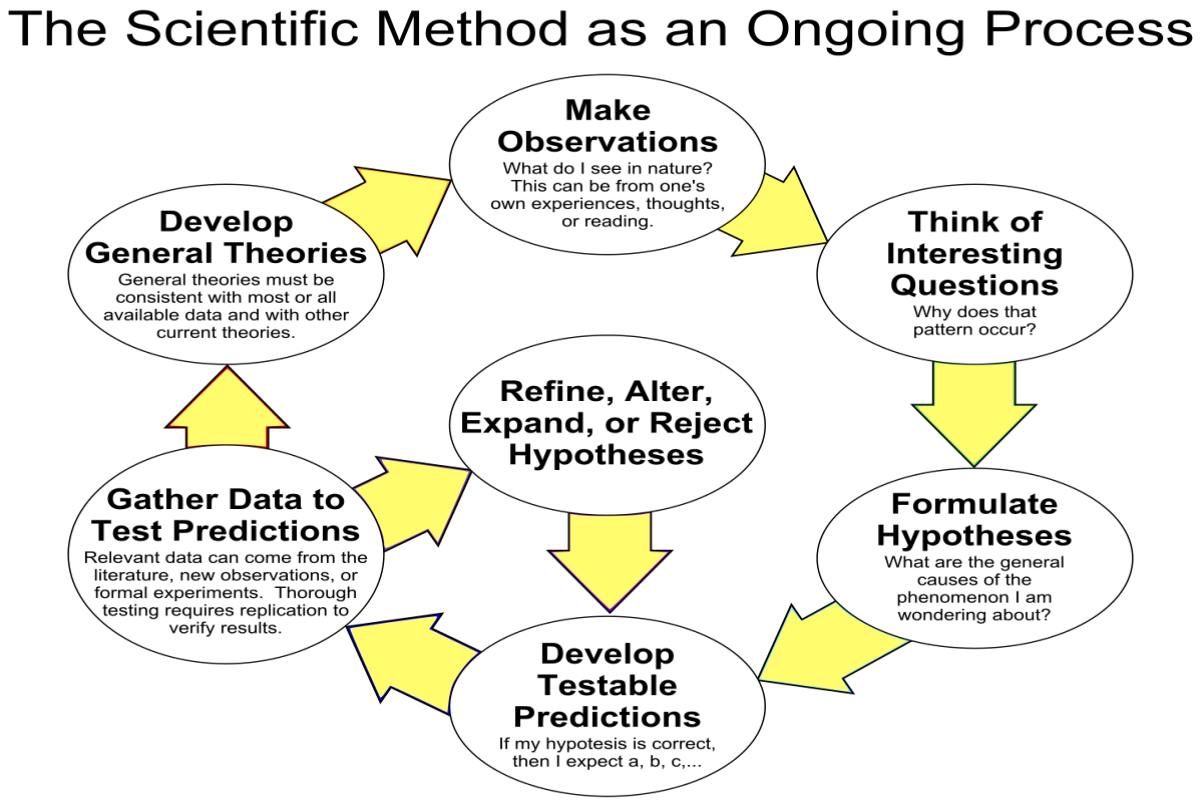
A hypothesis is a conjecture, based on knowledge obtained while formulating the question. The hypothesis might be very specific or it might be broad. Scientists then test hypotheses by conducting experiments. Under modern interpretations, a scientific hypothesis must be falsifiable, implying that it is possible to identify a possible outcome of an experiment that conflicts with predictions deduced from the hypothesis; otherwise, the hypothesis cannot be meaningfully tested. The purpose of an experiment is to determine whether observations agree with or conflict with the predictions derived from a hypothesis.

3.2 Schematic method of Scientific Methodology

The scientific method of research enquiry begins with critical observation of object of study. The researcher needs to ask questions or identify problems regarding the object of study. The next task of the researcher is to search for existing answers or solutions to the problems identified. After identifying the research answers, the researcher then formulate the likely hypothesis relating to the object of study. Experimentation any hypothesis testing stage follows. The hypothesis are either accepted or rejected based on statistical exposition. The last stage of scientific research methodology is preparation of results for assessment. Below is the schematic method of scientific methodology.

3.3 Scientific Method of an Enquiry Process

The alternative process of explaining scientific enquiry is given below.



4.0 CONCLUSION

This unit treats scientific methods on on-going phenomenon. It discusses the scientific methodology in carrying out a research work.

5.0 SUMMARY

We have discussed the scientific methodology of carrying out a research work. This provides further analysis of the usefulness of science and technology in the society.

6.0 TUTOR MARKED ASSIGNMENT

Explain the steps required in carrying out scientific enquiry.

7.0 REFERENCES AND FURTHER READING

Bauer, Henry H., Scientific Literacy and the Myth of the Scientific Method, University of Illinois Press, Champaign, IL, 1992

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UNIT 4 SCIENCE AND TECHNOLOGY IN THE SOCIETY AND SERVICE OF MAN

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Contents
    3.1 Meaning of Science and Technology
    3.2 Role of Science and Technology in Society
    3.3 Conditions for Application of Science and Development in Societal Development
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References and Further Readings

1.0 INTRODUCTION

This unit is an improvement over the last unit. Our focus here is scientific methodology of carrying out a research work. This unit explains the role of science and technology in societal development. The importance of science and technology in national development cannot be overemphasized. It is a known fact that no nation can develop without science and technology.

Developed nations of the world like the America, Germany, France etc. boast of several scientific inventions which make them to be rated as the world powers.Science and technology is the pivot of any nation's development.

A nation without science and technology is definitely a backward nation. Such nation will be considered undeveloped. Science and technology is associated with modernity and it is an essential for rapid development..

2.0 OBJECTIVES

At the end of this course students should be able to:

- explain what science and technology means
- analyze the role of science and technology in modern society
- explain the conditions for application of science and technology in modern society.

3.0 MAIN CONTENTS

3.1 Meaning of Science and Technology

Science and technology are often used interchangeably. Science aims at pursuing knowledge for its own sake while the goal of technology is to create products that solve problems and improve human life. In a simple explanation, technology is the practical application of science.

Science is a system of acquiring knowledge based on the scientific method, as well as the organized body of knowledge gained through such research. The way science is defined here is sometimes termed pure science to differentiate it from applied science, which is the application of scientific research to specific human needs.

Technology is a broad concept that deals with a species' usage and knowledge of tools and crafts, and how it affects a species' ability to control and adapt to its environment. In human society, it is a consequence of science and engineering, although several technological advances predate the two concepts.

Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena. The term science also refers to the organized body of knowledge people have gained using that system.

Fields of science are commonly classified along two major lines:

- Natural sciences, which study natural phenomena (including biological life)
- Social sciences, which study human behavior and societies.

These groupings are empirical sciences, which mean the knowledge must be based on observable phenomena and capable of being tested for its validity by other researchers working under the same conditions.

3.2 Role of Science and Technology in Society

From the beginning of time, man has strived to improve his way and quality of life. The caveman discovered how to make and use tools, developed a logical sequence for activities, and evolved processes that added value to his life. The totality of the use and application of his knowledge, skills, tools, and materials constitutes what we today describe as “technology.”

Every nation endeavors to attain development. Everyone desires development. But what does "development" means? "Development" may mean a lot of different things to a lot of different people. Therefore, the nature and character of that development and the meaning we attach to it need to be carefully spelled out. To many countries, development is simply becoming in the future of what industrialized countries are today. Development is the acceleration of economic growth, the reduction of inequality, the eradication of absolute poverty.

However, development is not purely an economic phenomenon. In an ultimate sense, development must encompass more than the material and financial side of people's lives. The role of science and technology in development should be directed toward reduction of inequalities between advanced and the developing countries and between various sections of population within a country. In doing so, science and technology should make the natural and social environment harmonious, without seriously endangering the future.

Science and technology should not be inserted as separate packages of development techniques implemented in isolation from the rest of the national evolution whether material or otherwise failure to integrate development programs based on science and technology into national concepts and ways of life may lead to their total rejection. The role of science and technology for development must be directed within the framework of the fundamental social, cultural, and economic rights in a peaceful and cooperative world.

3.3 Conditions for Application of Science and Development in Societal Development

The application of science and technology is a fundamental factor which influences the pace of economic development. Material and social benefits enlarge through the proper application of science and technology. The effective application of science and technology implies the existence of certain prerequisites, among which are the following:

- Creation of a social climate favorable to the application of science and technology;
- Role and responsibilities of the universities in the implantation of science;
- Technical and technological education and training;
- Promotion of technological sciences and applied research;
- Agricultural education and research; and
- Infrastructure of auxiliary services

4.0 CONCLUSION

This unit has explained the definition of science and technology and their role in modern society. The unit has also discussed the conditions for applications of science and technology in societal development.

5.0 SUMMARY

We have discussed the role of science and technology in development. The knowledge gained here would provide the background of studying the nature of resources available for human use.

6.0 Tutor Marked Assignment

1. Discuss the concept of science and technology.
2. Explain the role of science and technology in modern society.

7.0 REFERENCES AND FURTHER READING

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UNIT 5 RENEWABLE AND NON-RENEWABLE RESOURCES

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Contents
    3.1 Energy resources
    3.2 Classification of Energy sources
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

In the last unit (unit 4), we have discussed the meaning of science and technology and their role in modern society. In this unit, our focus will be on energy resources. Nature has given us varieties of resources but the ability to transform them remains a question to be worked out. Today, we might say that we are "developed," but it would not have been possible without the gifts that the nature has provided us. Virtually all resources from nature are used by human beings. Some resources are infinite and some are limited. Some resources can be used again while some will lie around unused and simply unutilized.

There are two categories of energy resources.

i. nonrenewable
ii. renewable.

Non-renewable resources are resources that cannot renew itself over a given time frame. Renewable resources are sometimes called natural resources. They are resources that are replaced by natural processes and forces persistent in the natural environment.

2.0 Objectives

At the end of this course students should be able to:

- understand and explain the meaning of natural resources
- identify which resources are renewable and non-renewable
- explain the usefulness of resources in energy generation.

3.0 MAIN CONTENT

3.1 Energy Resources

The power by which human body or material body uses to do any form of work is called energy. This implies that everything that works needs energy. Plants and animal are also included in our discussion. Plants and animals do one form of work or the other. They all need energy which exists or manifests in different forms. For example, from fire can be derived heat and small amount of light energy. Enormous quantity of light and heat energy comes in the form of solar illumination. Plants use the light energy to manufacture their food which is stored up as chemical energy; when burnt, the chemical energy turns into heat energy. When herbivorous animals eat the plants they also inherit the energy from the plants. So also do carnivores derive energy by eating other animals. That means energy can be transferred. It can also be converted from one form to another but cannot be destroyed.

Dead plants and animals have their energy returned to the earth. But every time energy changes form some heat of low level form is lost into the atmosphere or the central pool. Energy can be converted from one form to another but the total quantity remains the same in accordance with the conservation law.

Energy derived from position is potential energy (P.E.). The stretched spring, for example, has elastic potential energy. Water in the overhead tank has potential gravitational energy. Fossilized plants which come in the form of petroleum, lignite, anthracite and graphite among others and oxygen necessary for combustion have chemical potential energy due to relative positions of the atoms in them. Waves that strike the coastal rocks, running water that erode the soil and wind that bend the trees have mechanical energy. Different forms of energy therefore exist around us.

The most enduring source of energy is the sun. The earth also has an enormous store-house of energy: fossil fuel (coal, petroleum, natural gas), mineral energy (uranium), and heat or geothermal energy, among others, which are either directly or remotely related to the sun: the ultimate source of all energy forms.

3.2 Classification of Energy Sources

Energy sources can be either renewable or non-renewable.

i. Renewable resources

Renewable resources are those resources which can be renewed or replaced over time. Great examples of infinite, renewable resources are: wind, sunlight, tides, biomass, etc. Some of the renewable resources are supposed to have continuous supplies, such as wind energy and solar energy, while some others take a greater time in their renewal like wood, oxygen, etc.

Geothermal energy is another good example of renewable resources. It is the source of energy which is extracted from the heat which is stored under the surface of the Earth. This source is considered to be cost efficient and mostly sustainable. It is found in the form of inactive volcanic sites and hot springs. This form of energy may be utilized in heating, generating electricity, and heat pumps. Geothermal energy is a sustainable source as the hot water seeps down into the crust again. A biomass is also considered a renewable resource if used properly.

ii. Non-renewable resources

Non-renewable resources are those natural resources which cannot be renewed once they are completely consumed. The resources which are replenished very slowly are also considered non-renewable resources. This is because these resources will not be available again or available only after a long time. The best examples of non-renewable resources are fossil fuels such as coal, oil, and natural gases. Fossil fuels are produced by the decay of animal and plant matter. Their rate of production is very slow as compared to the rate of their extraction and consumption. Another example of a non-renewable resource is our lifetime. Once used up, any individual cannot get back lost time. Other good examples of non-renewable resources are; nuclear fuels, minerals, and shale. Water is a controversial resource which can be categorized as both a renewable and non-renewable resource. The cyclic change of water makes it a renewable resource while its unmanaged usage is making it a non-renewable resource.

4.0 CONCLUSION

This unit has explained what renewable and non-renewable resources are. The units have also provided the route of establishing the environment effects of chemical resources in the society.

5.0 SUMMARY

From the explanation of renewable and non-renewable resources, the following are the summary of our discussion:

- Renewable resources are those which can be used again and again while non-renewable resources are those which are used only for a limited time and rate.
- Renewable resources have a higher rate of decomposition than their rate of consumption.
- Non-renewable resources have a lower rate of decomposition than the rate of consumption.
- Examples of renewable resources are all the biodegradable materials and infinite, renewable resources are sunlight and wind.
- Examples of non-renewable resources are minerals and man-made products.

Other than only resources, we also have renewable sources of energy like sunlight and wind energy while non-renewable sources of energy are like batteries.

6.0 TUTOR MARKED ASSIGNMENT

Explain the differences between renewable and non-renewable resources.

7.0 REFERENCES/ FURTHER READINGS

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MODULE 2

Unit 1 Man Technology and Resources
Unit.2 Environmental Effects of Chemical Plastics
Unit 3 Environmental Effects of Textiles, wastes and Other Materials
Unit 4 Chemical and Radiochemical Hazards
Unit 5 Introduction to various areas of Science and Technology

UNIT 1 MAN TECHNOLOGY AND RESOURCES

CONTENTS

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  3.1 Man Play a Dual Role
  3.2 Technology as an Aid to Resource Creation
  3.3 Technology as a Driven Factor
  3.4 Technological Culture as an Aid to Man and Nature
  3.5 Technology as an Equalizing Agent
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

Man plays a unique role in the overall scheme of resource development. He acts both as a resource as well as a resource-creating factor. As a resource, man is an inexhaustible store of energy and skill. Most of the animate energy is supply by man and animals. In the preindustrial era, man served more as a resource than resource creating factor. Human labour was an important factor in the production process and the rate of economic development was related to the population or human resources of a particular region**.** Many regions remained economically backward on account of scarcity of population. In this respect, man was no better than an animal. He had only natural wants and natural capacities; therefore, he commanded only natural resources and was exposed to natural resistances. He was 'submerged' in an ocean' of 'neutral stuff, i.e., matter, energy, conditions, relationships, etc., of which he was unaware and which affected him neither favorably or otherwise. But such man is unknown today. Now the role of man as a resources-creating factor is very important. As already stated, nature provides most of its endowments in the form of 'neutral stuff'. It is man who by his

ingenuity, skill and initiative turns this neutral stuff into resources. Coals are no doubt, found in nature. But coal readily accessible and available for human use is rare indeed. Most of the coal would have remained mere 'neutral stuff but for the power-driven machinery, human inventions and man-made appliances. In fact, the majority of many resources are the result of human ingenuity aided by slowly, patiently painfully acquired knowledge. Knowledge is truly the mother of all resources. With the help of knowledge, man finds new resources and makes o1d ones more useful Coal is no longer the only source of inanimate energy. Inanimate energy is now derived from many other sources like petroleum, gas and waterpower as well. Similarly, one tonne of coal today is more useful than one tonne of coal 50 years ago.

2.0 OBJECTIVES

At the end of this course student should be able to:

- understand the unique role play by man in the overall scheme of resours development.
- understand the role of technology in resourse creation.
- state the corrective effort to improve the Defects of Nature

3.0 MAIN CONTENT

3.1 Man Plays a Dual Role

Man is both the most dynamic agent of production and the beneficiary of the entire process of resource development and utilization. As an agent of production, man contributes his labour, mental and physical; he builds culture to make his productive efforts more effective and to lessen the impacts or resistances; he discovers new ways and new arts. In fact, the history of human civilization is the story of man's increasing role as a producer of resources. Man has been endowed with mental faculties not granted to other living beings. Thus he is able to rise above the status of an animal. He has the unique capacity to act as the director, planner and aspirer. Aided by nature and culture, he creates resources which, in turn make his life more comfortable and worth living. But to perform this role properly, man must be physically fit and healthy. He must be properly educated and trained; therefore resource development is possible only through a planned scheme of public health education and technological development.

In the process of resource creation, man's role as a consumer is also of great importance. In fact, the human wants are the basis of all resource creation. Man wants, and wants initiate the process of resource creation. Resources have been defined as the means of attaining given ends (i.e

satisfaction of human wants) and as end (wants) change, means must change also. Thus resources must reflect every change in the purpose of the aspirer. Human wants may be divided into two categories (i) basic wants, ad (ii) cultural wants.

Basic wants relate to the basic necessities of life such as: food, clothing and shelter. These basic wants are the starting point of economic comforts and luxuries also. These are his cultural wants. There is no end to such want and they always keep on changing. Thus, resource is dynamic and change in response to every change in human wants. The prehistoric man was concerned mainly with the satisfaction of his basic needs. His activities were confined mainly to hunting, fishing or primitive type of agriculture. He mainly exploited the things provided by nature on the surface of the earth. Thus his resources were only a few, and were confined mainly to the surface of the earth, but a modern man is not satisfied merely with the satisfaction of his natural basic wants. He wants something more. He wants comforts and luxuries. These cultural wants are ever expanding. So he is always busy discovering new resources and inventing new techniques for making his life more comfortable. His resources are no longer confined to the surface of the earth. As culture is not the only occupation. He is now engaged in mining, manufacturing, trade, banking, transportation and many other activities. He is busy on finding new resources both material and non-material, and also in finding new uses of the resources already known. As he wants to live in peace, he is striving for international co-operation, an important non-material resource.

3.2 Technology as an Aid to Resource Creation

Man alone cannot create resource: Resources are not created out of vacuum. Nature provides the basis of all resource creation. It is with the help of culture and technology that man working on nature created resources. Nature provides coal in the form of 'neutral stuff. But to turn it into resource, man requires power-driven machinery and other appliances, i.e., culture and technology without the assistance of these elements therefore; man cannot turn coal found in the form of 'neutral stuff', into resource. Similarly, if nature has not provided coal in any region, any amount of labour and human ingenuity cannot create coal in that area. Thus, nature is the base, and technological culture represents the tool in the process of resource creation.

At first, there was Nature in the form of earth, rocks, water, sunshine, energy etc., then came man. Man had the power and skill to make use of the things provided by nature in the original form. But he had to struggle hard to get the right things from nature. Man therefore, developed technology to help in his struggle with nature. According to

Zimmermann, technology which he referred to as "culture" is the sum-total of all the devices produced by man, with the aid, advice and consent of nature, to assist him in the attainment of his objectives. Some of these objectives are as follows:

(i) The survival of the race in the wake of limited availability of supplies and various resistances.
(ii) Provision for increasing number of people.
(iii) Provision of greater comforts and better living
(iv) The Drive to acquire knowledge and high place in society.

Man alone can build technology because he has got the capacity to invent arts and elevate arts to the level of science. Superior skill and intellectual capacity of man gives him this power to build culture enables man to occupy or inhabit every continent of the world. With the aid of technology, man developed the systems of air-conditioning, telecommunication etc., which enabled him to inhabit hot tropical lands or cold lands of the temperate regions.

3.2 Technology as a Derived Factor

It is a joint product of nature and man, the original resource factors. Man creates technology with the aid, advice and consent of nature out of substances and products found in nature and with aid of energies supplied by nature, e.g. man produces machinery, which helps him in manufacturing activities. In producing machine man requires various substances like iron, iron, coal and power, which are provided by nature. Nature in this way aids man in developing culture. In the resource creation process, man takes the help of culture and he is able to convert various neutral stuffs into useful resources.

Man has a neutral bent for economic, Man works hard to get the utmost for his efforts. This takes the following forms:

(a) Fight against resistance: He does not always fight against the resistance of nature, rather if nature provides certain alternative courses man generally adopts them and tries to adjust with nature.
(b) He economizes in his effort and choose products with the aid and suggestion of nature.
(c) Nature advises man to produce those products, which can be easily produced under given natural conditions.
(d) Man adapts to Nature on the other hand, the tropics conditions favour the growth of rice. As such, people of the Monsoon Africa take rice as staple. So man completely adapts his habits and himself to nature.

Functions of technological culture

As a resource factor, nature possesses definite defects, which are as follows:

i. Insufficient production,
ii. Production in the wrong place,
iii. Thus technological culture helps to commit this factor as following Production at the wrong time.

i. Corrective measure on insufficient production: Man seeks to correct these defect by technological improvements, e.g., he raises agricultural production by increasing the fertility of soil, putting chemical fertilizers and manures, by putting irrigated water where natural water supply is inadequate. Animals are domesticated to raise their output of milk and meat. Industrial production is increased by the use of modern machines and scientific knowledge. In this manner, sufficient production is achieved for increasing population.

ii. Corrective measure on production at wrong places: Another technological cum cultural improvement seeks to move products of nature from 'wrong place' of occurrence to 'right place' of consumption. To achieve this, means of transportation were developed by man. Meat and dairy products from Australia and New Zealand move to countries of Western Europe, Cotton and iron-ore from Tropics and the USA to Japan. Oil from the Middle East and Africa to industrial countries of Europe and North America. A vast network of transportation automobiles, railways, ships, tankers, aeroplanes are engaged in the world to perform the task of bringing things to right places at almost right prices.

iii. Corrective measure on wrong product time: The third defect of nature, viz, production of things at wrong time, has been corrected by man by the erection of warehouses, elevators and cold storage and refrigeration systems. Nature produces a number of things in certain seasons only according to climatic and environmental conditions, e.g., food grains or vegetable and fruits etc., are produced in a part of the year only, whereas, they are required for human consumption throughout the year. Hence, they are preserved safely in storehouses so that they may be provided at right time of consumption to human beings.

However, all these corrective efforts to improve the defects of nature, mentioned above, call for great risk and finance. To meet this difficulty,

man has developed E-insurance and E-banking systems and E-commerce organizations dealings in wholesale and retail businesses.

3.3 Technological Culture as an Aid to Man and Nature

Techno-culture is an aid to both man and nature. Techno-cultural devices like labour saving machines and other scientific and technical discoveries aid man in increasing his productivity. Similarly, the art of terracting, chemical fertilizers, grafting and hybridizing help nature in increasing production and productivity. Besides labour saving, devices and intangible intangible devices like efficient management, group co-operation, recreation, intellectual pursuits, education, training, improved health and sanitation are also cultural devices, which aid man in raising productivity. In this way, technically advanced countries of the West have been able to reduce the effects of scarcity by this form of technological contribution to nature.

Technology and Resistance—Human and Natural: Just as nature had both resources as well as resistances, in the same way technology also has got both resources and resistances. Good transportation arrangement is an example of technology resources whereas transport bottleneck or problem of distance, which is a resistance can be removed by provision of a good and well coordinated transport system in addition technology plays the following roles:

(a) Technology plays a dual role on the one hand, it helps in enlargement of resources and, on the other, in reduction of resistances.
(b) Technology helps in reducing the impact of natural resistance like floods, earthquakes and other natural calamities on man. It cannot abolish these natural resistance altogether. By various scientific devices; and radio apparatus, aeroplane pilots or captains of ships are warned in advance of the possibility of danger. This helps them to become cautious in voyage and avoid disaster by adopting safe course.
(c) Technology does not remove or reduce the impact of natural resistances only, but also removes the human resistances like illiteracy and poor health by providing proper education, sanitation, public health training, good government, and so on.

3.4 Technology as an Equalizing Agent

Technology is an equalizing agent and provides what is lacking at a particular place. Man lives amidst nature surrounding him and amidst culture created by him. Human economic activities are determined by the interaction of resources and resistances. Technological Culture

differs in form and function according to the character of natural environment. Natural environment in its original form is not very useful to man. Modifications and adjustments are required to make it more useful. In Asia, man has introduced irrigation systems, terracing of rice fields and such other improvements on land are designed to raise productivity of land. This is an example of how technology acting as an equalizing agent. Finally, where labour is scarce, man introduces mechanization and, with the aid of inanimate energy, raises production.

4.0 CONCLUSION

This unit have explained the concept of Man and technology and how technology is being seen has an aid to resource creation, consequently, the unit also explained the technological culture as an aid to man and nature.

5.0 SUMMARY

We have discussed the concept of Man and Technology and how Technology serves as an aid to resource creation. In addition we looked at Technological culture as an aid to Man and Nature and how Technology as serve as an Equalizing agent.

6.0 TUTOR MARKED ASSIGNMENT

1. Explain the concept of Man and Technology
2. Explain Technological Culture as an aid to Man and Nature

7.0 REFERENCES/FURTHER READING

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UNIT 2 ENVIRONMENTAL EFFECTS OF CHEMICAL PLASTICS

CONTTENTS

1.0 Introduction
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3.0 Main Contents
    3.1 Plastic pollution: Definition and meaning
    3.2 Effects on the Environment
    3.3 Environmental effects on plastic chemicals
        3.3.1 Adverse health effects of plastics
    3.3.2 Chemical Migration from Plastic Packaging into Contents
3.4 Recommendations
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
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1.0 INTRODUCTION

In this unit, our focus is on environmental issues with special attention on environmental effects on chemical plastics, Environment means surrounding external conditions influencing development or growth of people, animal or plants, living or working together conditions. In the environment, a lot of activities takes place and this have significant effects on the organisms living in it. This is called environment effect.
Environment issues are of different kinds. This include: human overpopulation, hydrology, intensive farming, land use, natural disaster, nuclear issues and ocean trash. Similarly, environmental effects are in the form of climate change, environmental degradation, environmental issues with health and energy, overpopulation, pollution, resource depletion, toxicants and wastes. .

2.0 OBJECTIVES

At the end of this course students should be able to:

- define and explain what environment means
- explain the effects of environmental hazards on various economic units.

3.0 MAIN CONTENT

3.1 Plastic pollution: Definition and meaning

Plastic pollution involves the accumulation of plastic products in the environment that adversely affects human habitat. Plastics pollution categorized into micro, meso or macro debris, based on the size pollution they generate. Plastic pollution has negative effect on land, waterways and oceans. Living organisms, particularly marine animals are also affected. Direct inhaling and ingestion of plastic waste, or through exposure to chemicals within plastics may result into biological mal-function of the body system. Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels.

3.2 Effects on the Environment

The distribution of plastic debris is influenced by a number of factors such as wind and ocean currents, coastline geography, urban areas, and trade routes. Human population is another critical factor. Plastics are more likely to be found in enclosed regions such as the Caribbean and West African and Nigeria. It serves as a means of distribution of organisms to remote coasts that are not their native environments. This could potentially increase the variability and dispersal of organisms in specific areas that are less biologically diverse. Plastics can also be used as vectors for chemical contaminants such as persistent organic pollutants and heavy metals.

i. Land

Chlorinated plastic can release harmful chemicals into the surrounding soil, which can then seep into groundwater or other surrounding water sources and also the ecosystem. This can cause serious harm to the species that drink the water.

Landfill areas contain many different types of plastics. In these landfills, there are many microorganisms which speed up the biodegradation of plastics. The microorganisms include bacteria such as Pseudomonas, nylon-eating bacteria, and Flavobacteria. These bacteria break down nylon through the activity of the nylonase enzyme. Breakdown of biodegradable plastics releases methane, is a very powerful greenhouse gas that contributes significantly to global warming.

ii. Ocean

In 2012, it was estimated that there was approximately 165 million tons of plastic pollution in the world's oceans. One type of plastic that is of concern in terms of ocean plastic pollution is nurdles. Nurdles are manufactured plastic pellets (a type of micro-plastic) used in the creation of plastic products and are often shipped via cargo ship. Many billions of nurdles are spilled into oceans each year, and it has been estimated that globally, around 10% of beach litter consists of nurdles. Plastics in oceans typically degrade within a year, but not entirely. In the process, toxic chemicals such as bisphenol A and polystyrene can leach into waters from some plastics. Polystyrene pieces and nurdles are the most common types of plastic pollution in oceans, and combined with plastic bags and food containers make up the majority of oceanic debris. One study estimated that there are more than 5 trillion plastic pieces (defined into the four classes of small micro-plastics, large micro-plastics, meso- and macro-plastics) afloat at sea.

The litter that is being delivered into the oceans is toxic to marine life, and humans. The toxins that are components of plastic include diethylhexyl phthalate, which is a toxic carcinogen, as well as lead, cadmium, and mercury.

Plankton, fish, and ultimately the human race, through the food chain, ingest these highly toxic carcinogens and chemicals. Consuming the fish that contain these toxins can cause an increase in cancer, immune disorders, and birth defects.

iii. Marine animals

Sea turtles are affected by plastic pollution. Some species are consumers of jelly fish, but often mistake plastic bags for their natural prey. This plastic debris can kill the sea turtle by obstructing the esophagus. So too are whales; large amounts of plastics have been found in the stomachs of beached whales

Some of the tiniest bits of plastic are being consumed by small fish, in a part of the pelagic zone in the ocean called the *Mesopelagic zone*, which is 200 to 1000 metres below the ocean surface, and completely dark. Not much is known about these fish, other than that there are many of them. They hide in the darkness of the ocean, avoiding predators and then swimming to the ocean's surface at night to feed.[26] Plastics found in the stomachs of these fish were collected during *Malaspina's circumnavigation*, a research project that studies the impact of global change on the oceans. The most popular mesopelagic fish is the lantern fish. It resides in the central ocean gyres, a large system of rotating

ocean currents. Since lantern fish serve as a primary food source for the fish that consumers purchase, including tuna and swordfish, the plastics they ingest become part of the food chain. The lantern fish is one of the main bait fish in the ocean, and it eats large amounts of plastic fragments, which in turn will not make them nutritious enough for other fish to consume.

iv. Birds

Plastic pollution does not only affect animals that live solely in oceans. Seabirds are also greatly affected. In 2004, it was estimated that gulls in the North Sea had an average of thirty pieces of plastic in their stomachs.[29] Seabird's often mistake trash floating on the ocean's surface as prey. Their food sources often have already ingested plastic debris, thus transferring the plastic from prey to predator. Ingested trash can obstruct and physically damage a bird's digestive system, reducing its digestive ability and can lead to malnutrition, starvation, and death. Toxic chemicals called *polychlorinated biphenyls* (PCBs) also become concentrated on the surface of plastics at sea and are released after seabirds eat them. These chemicals can accumulate in body tissues and have serious lethal effects on a bird's reproductive ability, immune system, and hormone balance. Floating plastic debris can produce ulcers, infections and lead to death. Marine plastic pollution can even reach birds that have never been at the sea. Parents may accidentally feed their nestlings plastic, mistaking it for food. Seabird chicks are the most vulnerable to plastic ingestion since they can't regurgitate like the adult seabirds.

After the initial observation that many of the beaches in New Zealand had high concentrations of plastic pellets, further studies found that different species of prion ingest the plastic debris. Hungry prions mistook these pellets for food, and these particles were found intact within the birds' gizzards and proventriculi. Pecking marks similar to those made by northern fulmars in cuttlebones have been found in plastic debris, such as styrofoam, on the beaches on the Dutch coast, showing that this species of bird also mistakes plastic debris for food.
An estimate of 1.5 million Laysan albatrosses, which inhabit Midway Atoll, all have plastics in their digestive system. Midway Atoll is halfway between Asia and North America, and north of the Hawaiian archipelago. In this remote location, the plastic blockage has proven deadly to these birds. These seabirds choose red, pink, brown, and blue plastic pieces because of similarities to their natural food sources. As a result of plastic ingestion, the digestive tract can be blocked resulting in starvation. The windpipe can also be blocked, which results in suffocation. The debris can also accumulate in the animal's gut, and give them a false sense of fullness which would also result in starvation. On

the shore, thousands of birds corpses can be seen with plastic remaining where the stomach once was. The durability of the plastics is visible among the remains. In some instances, the plastic pills are still present while the bird's corpse has decayed.

Similar to humans, animals exposed to plasticizers can experience developmental defects. Specifically, sheep have been found to have lower birth weights when prenatally exposed to bisphenol A. Exposure to BPA can shorten the distance between the eyes of a tadpole. It can also stall development in frogs and can result in a decrease in body length. In different species of fish, exposure can stall egg hatching and result in a decrease in body weight, tail length, and body length.

v. Effects on humans

Due to the use of chemical additives during plastic production, plastics have potentially harmful effects that could prove to be carcinogenic or promote endocrine disruption. Some of the additives are used as phthalate plasticizers and brominated flame retardants. Through biomonitoring, chemicals in plastics, such as BPA and phthalates, have been identified in the human population. Humans can be exposed to these chemicals through the nose, mouth, or skin. Although the level of exposure varies depending on age and geography, most humans experience simultaneous exposure to many of these chemicals. Average levels of daily exposure are below the levels deemed to be unsafe, but more research needs to be done on the effects of low dose exposure on humans. A lot is unknown on how severely humans are physically affected by these chemicals. Some of the chemicals used in plastic production can cause dermatitis upon contact with human skin. In many plastics, these toxic chemicals are only used in trace amounts, but significant testing is often required to ensure that the toxic elements are contained within the plastic by inert material or polymer.

It can also affect humans in which it may create an eyesore that interferes with enjoyment of the natural environment**.**

Clinical significance

Due to the pervasiveness of plastic products, most of the human population is constantly exposed to the chemical components of plastics. 95% of adults in the United States have had detectable levels of BPA in their urine. Exposure to chemicals such as BPA have been correlated with disruptions in fertility, reproduction, sexual maturation, and other health effects. Specific phthalates have also resulted in similar biological effects.

Thyroid hormone axis

Bisphenol A affects gene expression related to the thyroid hormone axis, which affects biological functions such as metabolism and development. BPA can decrease thyroid hormone receptor (TR) activity by increasing TR transcriptional corepressor activity. This then decreases the level of thyroid hormone binding proteins that bind to triiodothyronine. By affecting the thyroid hormone axis, BPA exposure can lead to hypothyroidism.

Sex hormones

BPA can disrupt normal, physiological levels of sex hormones. It does this by binding to globulins that normally bind to sex hormones such as androgens and estrogens, leading to the disruption of the balance between the two. BPA can also affect the metabolism or the catabolism of sex hormones. It often acts as an anti androgen or as an estrogen, which can cause disruptions in gonadal development and sperm production.

Reduction efforts

Efforts to reduce the use of plastics and to promote plastic recycling have occurred. Some supermarkets charge their customers for plastic bags, and in some places more efficient reusable or biodegradable materials are being used in place of plastics. Some communities and businesses have put a ban on some commonly used plastic items, such as bottled water and plastic bags.

Biodegradable and degradable plastics

The use of biodegradable plastics has many advantages and disadvantages. Biodegradables are biopolymers that degrade in industrial composters. Biodegradables do not degrade as efficiently in domestic composters, and during this slower process, methane gas may be emitted. There are also other types of degradable materials that are not considered to be biopolymers, because they are oil-based, similar to other conventional plastics. These plastics are made to be more degradable through the use of different additives, which help them degrade when exposed to UV rays or other physical stressors yet, biodegradation-promoting additives for polymers have been shown not to significantly increase biodegradation. Although biodegradable and degradable plastics have helped reduce plastic pollution, there are some drawbacks. One issue concerning both types of plastics is that they do not break down very efficiently in natural environments. There,

degradable plastics that are oil-based may break down into smaller fractions, at which point they do not degrade further.

Incineration

Up to 60% of used plastic medical equipment is incinerated rather than deposited in a landfill as a precautionary measure to lessen the transmission of disease. This has allowed for a large decrease in the amount of plastic waste that stems from medical equipment. If plastic waste is not incinerated and disposed of properly, a harmful amount of toxins can be released and dispersed as a gas through air or as ash through air and waterways. Many studies have been done concerning the gaseous emissions that result from the incineration process

3.3 Environmental Effects on Plastic Chemicals

3.3.1 Adverse Health Effects of Plastics

In the process of production, chemicals are used. There is no doubt that chemicals have serious problems. For example, many chemical additives that give plastic products desirable performance properties have negative environmental and human health effects. These effects include:

- Direct toxicity, as in the cases of lead, cadmium, and mercury
- Carcinogens, as in the case of diethylhexyl phthalate (DEHP)

Endocrine disruption, which can lead to cancers, birth defects, immune system suppression and developmental problems in children

3.3.2 Chemical Migration from Plastic Packaging into Contents

People are exposed to these chemicals not only during manufacturing, but also by using plastic packages, because some chemicals migrate from the plastic packaging to the foods they contain. Examples of plastics contaminating food have been reported with most plastic types, including Styrene from polystyrene, plasticizers from PVC, antioxidants from polyethylene, and Acetaldehyde from PET.

Among the factors controlling migration are the chemical structure of the migrants and the nature of the packaged food. In studies cited in Food Additives and Contaminants, LDPE, HDPE, and polypropylene bottles released measurable levels of BHT, Chimassorb 81, Irganox PS 800, Irganix 1076, and Irganox 1010 into their contents of vegetable oil and ethanol. Evidence was also found that acetaldehyde migrated out of PET and into water.

3.4 Recommendations

Find alternatives to plastic products whenever possible. Some specific suggestions:

- Buy food in glass or metal containers; avoid polycarbonate drinking bottles with Bisphenol A
- Avoid heating food in plastic containers, or storing fatty foods in plastic containers or plastic wrap.
- Do not give young children plastic tethers or toys
- Use natural fiber clothing, bedding and furniture
- Avoid all PVC and Styrene products
- Buy food in glass or metal containers
- Avoid heating food in plastic containers, or storing fatty foods in plastic containers or plastic wrap.

4.0 CONCLUSION

This unit have explained environmental effects which emanates from plastic chemicals. We have also suggested ways of combating health issues which might emanates from the environment.

5.0 SUMMARY

We have discussed the effects of chemical plastics, textiles, wastes disposal and other materials on the environment. From this discussion, we can now set forth in the next unit to establish the chemical and radiochemical hazards in the environment.

6.0 TUTOR MARKED ASSIGNMENT

1. What are environmental issues? Suggest ways of correcting health problems from plastic production.
2. Explain the environmental impacts of textile production in modern society.

7.0 REFERENCES/FURTHER READINGS

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UNIT 3 ENVIRONMENTAL EFFECTS OF TEXTILES, WASTES AND OTHER MATERIALS

CONTENTS

1.0 Introduction
2.0 Objectives
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    3.1 Textile Waste: Definition, Meaning And Types Textiles Waste
    3.2 Processes of Managing Textile Waste
    3.3 Textile Industry Overview
    3.4 Environmental Impacts of Textile Industries
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1.0 INTRODUCTION

Environment means surrounding external conditions influencing development or growth of people, animal or plants, living or working together conditions.

The aim of this unit is to give students an in-depth understanding of environmental effects of textiles and other materials. It is expected that the knowledge in this unit would equip students with the various concepts relating to environmental effects of chemical plastics, textiles and other materials and also provide broad guide on how to manage environmental impact of pollution. In this unit, our focus is on environmental issues with special attention on environmental effects on textiles, wastes and other materials.

2.0 OBJECTIVES

At the end of this course students should be able to:

- explain the effects of environmental hazards on various economic units
- suggest ways of salvaging health effects from environmental spillover.

3.0 MAIN CONTENTS

3.1 Textile Waste: Definition, Meaning and Types Textiles Waste

Textile waste is a material that is deemed unusable for its original purpose by the owner.

Textile waste can include fashion and textile industry waste, created during fibre, textile and clothing production, and consumer waste, created during consumer use and disposal.

Pre-consumer textile waste is waste generated in the fashion supply chain before the textile reached the consumer. Textile swatch waste is leftover textile samples. Cut-and-sew textile waste is textile scraps generated during garment manufacturing.

End-of-roll textile waste is factory surplus textile waste leftover on the textile rolls from garment manufacturing. Sampling yardage waste is factory surplus sample textiles that have been leftover from textile sample manufacturing. Damaged textile waste is unfinished textiles that have been damaged, for example colour or print defects. Finished clothing waste is unsold finished clothing waste that has not yet been worn. Clothing sample waste is part-finished or finished clothing samples from the design and production of clothing, which have not be worn by consumers.

Post-consumer textile waste is waste generated and collected after the consumer has used and disposed of it. Secondhand clothing waste popularly called **okrika or tokunbo in Nigeria** is clothing or fashion accessories that have been used and discarded by consumers.

Secondhand textile waste is any textile waste (such as home furnishings or any non-clothing waste) that have been used and discarded by consumers. Producing textiles is an environmentally damaging process. Textiles consume vast quantities of natural resources, like water, oil and land, they use toxic chemicals and generate large amounts of carbon dioxide. But it’s not just what we put into textile and fashion production – it is also what comes out during the production and consumer use processes.

Unfortunately, millions of tones of textiles are discarded every year. In Europe and America, it is estimated that 10 million tones of textiles are discarded every year. In China the total annual production of pre and post-consumer textile waste is estimated to be over 20 million tones. Not only does this textile waste pollute our environment and clog landfills around the world, but the precious resources that went into making these

textiles are wasted. The good news is that by reusing textile waste, designers can divert textile waste away from landfill and prolong the lifecycle of the textile material.

3.2 Processes of Managing Textile Waste

i. Contact factories and textile mills

Contact factories and textile mills as they may have an endless supply of surplus textiles. Target factories and textile mills that produce the specific type of material that you are looking for. If you get in contact with the right one at the right time, this could be a goldmine of high-end textile waste, sold at a fraction of the price due to possible irregular shapes, sizes and quantities.

ii. Visit trade fairs

Visit trade fairs to get a better understanding of what types of textiles are available and how to get hold of them. Speak to the exhibitors directly to see what they do with their textile waste. Start up conversations — you may get more than you can handle!

Depending on where you live, there are textile shops and markets selling end-of-roll textiles and samples. Regardless of where you live, contact textile shops and ask them if they have any samples available.

iii. Go online

Research, research, research! Dig online to discover where textile waste is going, who is selling it and who is buying it. Many companies and consumers sell samples, stock clothing, textiles and secondhand clothing online. Check ebay.com and taobao.com in your country.

Check out source4style.com to find more information about sourcing sustainable textiles and check out their selection of textile waste available for online purchase. Also check out ethical fashion forum. com for tips and tricks to sourcing sustainably.

iv. Reach out to your network

Reach out to other designers and ask for their waste. Beautiful waste can be found at your friend’s studio or even on the floor of your university design studio. Look around you and you might be surprised at what you can find.

v. Raid wardrobes

Look in your own, your friends' and your family´s wardrobes to see what is hanging around and not being used anymore. This textile supply may be varied, but on the up-side it may not cost you a dime! Go to secondhand stores and markets to find an endless supply of textiles. Be specific on what type and quality of textiles you are looking for. If you are looking for high quality and luxury textiles, then go to vintage and consignment stores. If you are looking for large quantities of secondhand jeans, then visit a charity shop or flee market.

vi. Go to secondhand stores and markets

Textile recyclers get an endless supply of textile waste in all shapes and sizes. Often high quality clothes are resold in charity shops and lower quality goods are sold to developing countries. Find out where the waste you want goes to and ask around at ways that you may access some of it. Contact the recycling companies to see if they are willing to sell you any of the clothing and textiles.

vii Get in touch with recyclers

Get in touch with brands to see what they are doing with their textile waste. They may have end-of- roll textiles and samples that are too small for them to mass produce, which they may be interested in passing on. Target the brands that are in your area and that have textiles that you like using. Be realistic and think of brands that might be open to selling or giving away their textile waste. Brands that have textiles with iconic patterns or logos will not usually be interested in this type of reuse by a third party.

viii Set up a clothing collection

'Take back' programs are becoming the hot topic in sustainable fashion. High-street brands, such as H&M, M&S, Esprit and Uniqlo, all have take back containers in-store around the world to encourage their customers to return unwanted clothes. Why not organise your own take back programme? Collect from your customers or organise a clothing collection in your community and work with what you get. Many people have overflowing wardrobes and they have no idea what to do with their unwanted clothes. Remember to let your potential clothes' donors know what you will do with their donated clothes and textiles**.**

3.3 Textile Industry Overview

Textile processing industry is characterized not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes. There is a long sequence of wet processing stages requiring inputs of water, chemical and energy and generating wastes at each stage. The other feature of this industry, which is a backbone of fashion garment, is large variation in demand of type, pattern and color combination of fabric resulting into significant fluctuation in waste generation volume and load. Textile processing generates many waste streams, including liquid, gaseous and solid wastes, some of which may be hazardous. The nature of the waste generated depends on the type of textile facility, the processes and technologies being operated, and the types of fibers and chemicals used. The textile industry is a significant contributor to many national economies, encompassing both small and large-scale operations worldwide.

The textile manufacturing process is characterized by the high consumption of resources like water, fuel and a variety of chemicals in a long process sequence that generates a significant amount of waste. The common practices of low process efficiency result in substantial wastage of resources and a severe damage to the environment. The main environmental problems associated with textile industry are typically those associated with water body pollution caused by the discharge of untreated effluents. Other environmental issues of equal importance are air emission, notably Volatile Organic Compounds (VOC)'s and excessive noise or odour as well as workspace safety.

3.4 Environmental Impacts of Textile Industries

- **Air pollution**

Most processes performed in textile mills produce atmospheric emissions. Gaseous emissions have been identified as the second greatest pollution problem (after effluent quality) for the textile industry. Speculation concerning the amounts and types of air pollutants emitted from textile operations has been widespread but, generally, air emission data for textile manufacturing operations are not readily available. Air pollution is the most difficult type of pollution to sample, test, and quantify in an audit. Air emissions can be classified according to the nature of their sources:

i. Point sources

- Boilers

- Ovens
- Storage tanks

ii. Diffusive

- Solvent-based
- Wastewater treatment
- Warehouses
- Spills

Textile mills usually generate nitrogen and sulphur oxides from boilers. Other significant sources of air emissions in textile operations include resin finishing and drying operations, printing, dyeing, fabric preparation, and wastewater treatment plants. Hydrocarbons are emitted from drying ovens and from mineral oils in high-temperature drying/curing. These processes can emit formaldehyde, acids, softeners, and other volatile compounds.

Residues from fibre preparation sometimes emit pollutants during heat setting processes. Carriers and solvents may be emitted during dyeing operations depending on the types of dyeing processes used and from wastewater treatment plant operations. Carriers used in batch dyeing of disperse dyes may lead to volatilisation of aqueous chemical emulsions during heat setting, drying, or curing stages. Acetic acid and formaldehyde are two major emissions of concern in textiles.

- **Water pollution**

The textile industry uses high volumes of water throughout its operations, from the washing of fibres to bleaching, dyeing and washing of finished products. The large volumes of wastewater generated also contain a wide variety of chemicals, used throughout processing. These can cause damage if not properly treated before being discharged into the environment. Of all the steps involved in textiles processing, wet processing creates the highest volume of wastewater. The aquatic toxicity of textile industry wastewater varies considerably among production facilities. The sources of aquatic toxicity can include salt, surfactants, ionic metals and their metal complexes, toxic organic chemicals, biocides and toxic anions. Most textile dyes have low aquatic toxicity. On the other hand, surfactants and related compounds, such as detergents, emulsifiers and dispersants are used in almost each textile process and can be an important contributor to effluent aquatic toxicity, BOD and foaming.

- **Solid waste pollution**

The primary residual wastes generated from the textile industry are non-hazardous. These include scraps of fabric and yarn, off-specification yarn and fabric and packaging waste. There are also wastes associated with the storage and production of yarns and textiles, such as chemical storage drums, cardboard reels for storing fabric and cones used to hold yarns for dyeing and knitting. Cutting room waste generates a high volume of fabric scraps, which can often be reduced by increasing fabric utilization efficiency in cutting and sewing.

3.5 Environmental Effects on Wastes Disposals

The old saying out of sight, out of mind definitely does not apply when it comes to getting rid of personal waste. For many people, though, sending old items including electronics made with potentially harmful metals to the garbage bin is done without thought for what impact the trash will have on the environment. Garbage, though unseen, can have real impacts on the environment when it is not properly disposed of.

Chemicals contaminating soil

When waste ends up at the landfill, chemicals in the trash can leech out into the soil, contaminating it. This will hurt plants, along with animals and even humans who come into contact with the soil. Once polluted, contaminated soil can be very hard to clean, and will likely have to be dug up to clear the area.

Surface water

Chemicals don’t just run from garbage into the soil. They can also reach nearby surface water, such as rivers and lakes. This will change the levels of chemicals in the water for the worse. The result? The ecosystems such as fish habitats in the water get hurt, as do any creatures that drink from the water source. Not good.

Air pollution

Garbage can create air pollution due to gasses and chemicals evaporating from the waste. This air pollution can occur in open-air dumps, where a lot of our waste and electronic trash goes, and through incinerators used at garbage disposal sites. The air pollution from incineration can be so bad, in fact, that it can even release toxic substances that can contribute to acid rain.

Other garbage will release methane as it wastes away, and methane is one of the greenhouse gases that contribute to global warming – and can also be ignited to cause an explosion.

Remember, much of our stuff these days is made with chemicals. These chemicals don't just disappear when they end up in the dump – they will continue to exist and cause environmental problems for a long time.

4.0 CONCLUSION

This unit have explained environmental effects which emanates from textiles, wastes disposal and other toxic materials. The unit have also suggested ways of combating health issues which might emanates from the environment.

5.0 SUMMARY

We have discussed the effects of textiles, wastes disposal and other materials on the environment. From this discussion, we can now set forth in the next unit to establish the chemical and radiochemical hazards in the environment.

6.0 TUTOR MARKED ASSIGNMENT

1. Explain the environmental impacts of textile production in modern society.
2. Discuss the importance of the study of environmental effects.
3. Discuss the various effects of chemical and textiles pollution.

7.0 REFERENCES AND FURTHER READING

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"https://en.wikipedia.org/w/index.php?title=Philosophy_of_environment&oldid=736461399"

UNIT 4 CHEMICAL AND RADIOCHEMICAL HAZARDS

CONTENTS

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2.0 Objectives
3.0 Main Contents
    3.1 Types of hazards
    3.2 Routes of Exposure
    3.3 Symbols
    3.4 First Aid
    3.5 Cardiovascular Disease
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

A chemical hazard is a type of occupational hazard caused by exposure to chemicals in the workplace. Exposure to chemicals in the workplace can cause acute or long-term detrimental health effects. There are many types of hazardous chemicals, including neurotoxins, immune agents, dermatologic agents, carcinogens, reproductive toxins, systemic toxins, asthmagens, pneumoconiotic agents, and sensitizers. These hazards can cause physical and/or health risks. Depending on chemical, the hazards involved may be varied, thus it is important to know and apply the PPE especially during the lab. Long-term exposure to chemicals such as silica dust, engine exhausts, tobacco smoke, and/or lead (among others) have been shown to increase risk of heart disease, stroke, and high blood pressure.

2.0 OBJECTIVES

At the end of this course students should be able to:

- explain the types of hazards chemicals created
- identify the routes of exposure of chemical hazards
- understand and explain the symbols of chemical hazards
- explain ways of treating chemical hazards.

3.0 MAIN CONTENTS

3.1 Types of Hazards

i. liquids such as acids, solvents especially if they do not have a label
ii. vapors and fumes
iii. flammable materials

Chemicals can change the physical state depending on temperature or pressure. Thus is it important to identify the health risks as these states can determine the potential route the chemical will take. For example, gas state chemicals will be inhaled or liquid state chemicals can be absorbed by the skin.

3.2 Routes of Exposure

- ingestion
- inhalation from fumes
- poisoning
- explosion

3.3 Symbols

Hazard pictographs are a type of labeling system that alerts individuals efficiently at a quick glance if there are hazardous chemicals present. The symbols help identify if the chemicals that are going to be in use may potentially cause physical harm or hard to the environment. The symbols are distinctive as they are shaped like a diamond with red borders. These signs can be divided into:

- Explosive (exploding bomb)
- Flammable (flame)
- Oxidizing (flame above a circle)
- Corrosive (corrosion of table and hand)
- Acute Toxicity (skull and crossbones)
- Hazardous to environment (dead tree and fish)
- Health Hazard/ Hazardous to the ozone layer (Exclamation mark
- Serious Health Hazard (Cross on a human silhouette)
- Gas Under Pressure (Gas cylinder).

3.4 First Aid

In case of emergency, it is recommended to understand the first aid procedures in order to minimize any damages. The different types of chemicals will cause a variety of damages but the majority of sources

recommend that it is best to rinse any contacted skin or eye with water for at least 15 – 20 minutes. Currently, there is insufficient evidence of how long the rinsing should be done as the degree of impacts will vary for substances such as corrosive chemicals. However, the recommended flush time is as follows:

- 5 minutes - non to mild irritants
- 15 – 20 minutes - moderate to severe irritants and chemical that cause acute toxicity
- 30 minutes - most corrosives
- 60 minutes - strong alkalis such as sodium, potassium or calcium hydroxide immediately flush the affected area. Additionally, transporting the affected person to a health care facility is important depending on the victim's condition. In the case that the victim needs to be transported before the recommended flush time, then flushing should be done during the transportation process. It is to note that some chemical manufacturers may state the specific type of cleansing agent that is recommended

3.5 Cardiovascular Disease

A 2017 SBU report found evidence that workplace exposure to silica dust, engine exhaust or welding fumes is associated with heart disease. Associations also exist for exposure to arsenic, benzopyrenes, lead, dynamite, carbon disulphide, carbon monoxide, metalworking fluids and occupational exposure to tobacco smoke. Working with the electrolytic production of aluminium or the production of paper when the sulphate pulping process is used is associated with heart disease. An association was also found between heart disease and exposure to compounds which are no longer permitted in certain work environments, such as phenoxy acids containing TCDD (dioxin) or asbestos.

Workplace exposure to silica dust or asbestos is also associated with pulmonary heart disease. There is evidence that workplace exposure to lead, carbon disulphide, phenoxyacids containing TCDD, as well as working in an environment where aluminium is being electrolytically produced, is associated with stroke.

4.0 CONCLUSION

This unit has identify the following:

i. types of chemical hazards
ii. routes of exposure of chemical hazards
iii. symbols of chemical hazards and
iv. ways of treating chemical hazards.

5.0 SUMMARY

We have discussed chemical hazards, types, routes of exposure, symbols and ways of treating chemical hazards. From this discussion, we can now proceed to explain the various areas of science and technology application.

6.0 TUTOR MARKED ASSIGNMENT

1. What do you understand by chemical hazard?
2. Outline and explain the route of exposure and symbols of chemical hazards.

7.0 REFERENCES/FURTHER READING

^ *"Chapter 8 - Chemical Hazards". sp.ehs.cornell.edu. Retrieved 2017-06-28.*

UNIT 5 INTRODUCTION TO THE VARIOUS AREAS OF SCIENCE AND TECHNOLOGY

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
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    3.2 "Classical" view of science and technology
    3.3 Demise of the "classical" view
    3.4 Birth of "Scientism"
    3.5 "Technological progressivism"
    3.6 What makes something social?
4.0 Conclusion
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6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

This unit will introduce you to the field known as Science and Technology Studies. Science and Technology Studies is an interdisciplinary field that examines how science and technology shape societies, cultures, and the environment and how social, cultural, and environmental factors shape the development of science and technology. In this unit, there is need for us to explain some basic definitions of what we will be studying. Science investigates the physical world, including human beings and the material they are made of. Technology entails making materials used by society, and in the production and dissemination of science. Society embraces the sum total of our interactions as humans, including the interactions that we engage in to figure things out and to make things. It should be clear that all of these are deeply interconnected.

2.0 OBJECTIVES

At the end of this course students should be able to:

- idefine Science and Technology
- define key terms necessary for understanding the field of define Science and Technology
- identify and define the major subfields or approaches to the field of define Science and Technology
- define the nature of science and technology according to several key philosophical perspectives

- explain developments in science and technology in terms of their interactions with social, cultural, environmental, and other issues.

3.0 MAIN CONTENT

3.1 Interaction of Science, Technology and Society

In this unit we will explore the interaction of science, technology and society, especially in the recent past (20th & 21st centuries). We will develop a critical stance between science and technology. A critical stance is the deliberate creation of distance between us and the object we study. In order to be critical we must step back and ask broad questions. Science claims to produce knowledge about the world. What is the nature of this knowledge? Is it absolutely certain? Are there other kinds of knowledge? And so on Technology claims to improve our lives. Who is us? What does it mean to have a better life? What's to be gained and what's to be lost.

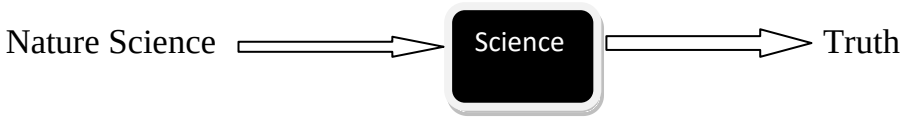
When we study science and technology we can take an internal or an external perspective.

An internal perspective starts with the principles and assumptions that scientists and engineers themselves work with and then uses these to try to explain their activities. The development of an internal perspective requires mastering the details of the science in question, takes years of hard work to acquire and involves nonverbal assumptions and practices picked up in this process. We usually rely on experts for an internal perspective.

An external perspective uses a different set of assumptions and attempts to analyze the context in which experts live and work, as well as what they say. We may be interested in their behaviours, goals, rhetoric, etc. We try to analyze the activities of technical experts, without any appeal to the special status of their expertise.

3.2 "Classical" View of Science and Technology

According to the classical view, science is a formal activity that creates knowledge by direct interaction with nature. Science has some kind of special method that allows different scientists to produce the same kind of knowledge whatever their social and political context might be. The scientists perform the same experiments in the same way, and agree upon and reject the same hypotheses, and also come to consensus on the truths of the natural world. The black box below better explain the classical view.



3.3 Demise of the "Classical" View

The classical view began to fall apart in the process of 20th century investigations of scientific activity. Philosophers were unable to formalize the “black box.” There appears to be no single “scientific method.” When historians began to explore past scientific activities more closely, they found there was no such thing as “pure science,” removed from social and political interactions and assumptions. When sociologists began to open the black box of contemporary scientific activity, they found that the inside was thoroughly social and political. Then, why do most people still hold the naive view?

3.4 Birth of "Scientism"

Scientism goes back at least as far as the Scientific Revolution (c. 1550–1700) and originates in the claim that there is a sharp divide between “facts” and “values.”. According to this view, when we do science, we set aside values and study only facts.

The authority of science rests on its claim to be “value free” and hence “objective.” Scientism promotes the idea that all of society’s problems can be solved by experts who are specially trained to unearth the facts of the matter. Scientism, and the scientistic movement, make the claim that science is for the benefit of all of humanity.

3.5 "Technological progressivism"

Technological progressivism has its roots in the European Enlightenment (c. 1700–1800), when progress became a synonym for good and technology came to be seen as a fundamental tool in progressive projects.

Good = Progress
Progress = Technology

Technological progressivism assumes that technological change is inherently good and sees it as self-propagating, moving by the internal constraints of technology itself. For example, we view new technologies as progressive and older ones as old fashioned and use this as a reason for changing technologies. We advocate the adoption of new technologies with little reflection on their social impact or the broader question of whether or not we want those impacts. In the classical view of the relationship between science and technology, science leads the way by creating knowledge from nature and technology follows by

applying this knowledge to the creation of new things. In this class, we will investigate the complex interaction between science and technology and the social environments in which they are produced, and which they, in turn, produce.

We can call the sum total of scientific and technological activities technoscience. Technoscience is the combined total of scientific and technological ideas and activities in their social, political and economic realities. Nobody has any doubt that modern society is techno scientific. Modern nation-states and the global economy, itself, could not function if they were not based on technoscience. Every aspect of our lives are permeated by the products of technoscience. It is impossible to understand modern society, without studying the effects of technoscience.

3.6 What makes Something Social?

Society is the result of people, and institutions, interacting with one another. It is a sort of epiphenomena of these individuals. Society in turn shapes the people and institutions that form it.

Most people experience society *as* though it *were an* external force acting upon them. The "effects" of society operate through the vague mechanism of social norms. Norms "tell" us what we should and should not do, what we should and should not think. But they are not rational – or rather, their rationality is not universal. Norms produce the values that we use in interacting with others. They produce many of our core ideas – such as ideas of the place of class, the role gender, the meaning of race, the function of justice, the importance of objectivity, the criterion of truth, the significance of evidence, etc.

4.0 CONCLUSION

This unit have shown that science and technology constitute critical fundamentals of societal development. Science produced knowledge and technology improve the living condition of man. Scientific and technological outcomes are combinations factors ranging from social, economic and political interplay.

5.0 SUMMARY

We have discussed desirability of science and technology in development. Chemical hazards, types, routes of exposure, symbols and ways of treating chemical hazards. From this discussion, we can now proceed to explain the elements of environmental studies

6.0 TUTOR MARKED ASSIGNMENT

Explain the relationship between science, technology and society.

7.0 REFERENCES/FURTHER READING

"CHAPTER 2 SCIENCE AND TECHNOLOGY IN MODERN SOCIETY." National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. 1993. *Science, Technology, and the Federal Government: National Goals for a New Era*. Washington, DC: The National Academies Press. doi: 10.17226/9481.

MODULE 3

Unit 1 Elements of Environmental Studies
Unit 2 Business Development and Evolution of Natural Endowment
Unit 3 Nature and Resources
Unit 4 Meaning and Value of Resources
Unit 5 Natural Resources Scarcity and Indicators of Scarcity

UNIT 1 ELEMENTS OF ENVIRONMENTAL STUDIES

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
  3.1 Scope of Environment
  3.2 Elements of Environment
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

In this unit we shall discuss the element of environment studies as a multi-disciplinary science because it comprise of many branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc. It also embraces the science of physical phenomena in the environment.

2.0 OBJECTIVES

At the end of this course students should be able to:

- understand and explain the meaning and types of environment
- explain the scope and elements of environment.

3.0 MAIN CONTENT

3.1 Meaning and Types of Environment

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living

organisms. There are three types of environment which influences the personality of an individual. These include:

i. Physical Environment
ii. Social and Cultural Environment, and
iii. Psychological Environment.

Physical environment refers to geographical climate and weather or physical conditions that affects individual lives. The human races are greatly influenced by the climate.

Social environment explains an individual's social, economic and political condition wherein he lives. The moral, cultural and emotional forces influence the life and nature of individual behaviour.

Every individual has his own psychological environment, in which he lives. The psychological environment enables us to understand the personality of an individual. Both the person and his goal form psychological environment.

3.2 Scope of Environment

The environment consists of four segments as under:

i. Atmosphere

The atmosphere implies the protective blanket of gases, surrounding the earth:

(*a*) It sustains life on the earth.
(*b*) It saves it from the hostile environment of outer space.
(*c*) It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.
(*d*) It transmits only here ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio waves. (0.14 to 40 m) while filtering out tissue-damaging ultraviolate waves below about 300 nm.

The atmosphere is composed of nitrogen and oxygen. Besides, argon, carbon dioxide,
and trace gases.

ii. Hydrosphere

The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water.

(*i*) Nature 97% of the earth's water supply is in the oceans,
(*ii*) About 2% of the water resources is locked in the polar icecaps and glaciers.
(*iii*) Only about 1% is available as fresh surface water-rivers, lakes streams, and ground water fit to be used for human consumption and other uses.

iii. Lithosphere

Lithosphere is the outer mantle of the solid earth. It consists of minerals occurring in the earth's crusts and the soil *e.g.* minerals, organic matter, air and water.

iv. Biosphere

Biosphere indicates the realm of living organisms and their interactions with environment, viz atmosphere, hydrosphere and lithosphere.

3.3 Elements of Environment

Environment is constituted by the interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively. These elements may be explained as under:

i. Physical elements

Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals.

They determine the variable character of the human habitat, its opportunities as well as limitations.

ii. Biological elements

Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

iii. Cultural elements

Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu.

4.0 CONCLUSION

This unit has explained the meaning, types, scope and elements of environment. The units have also established that the environment describes in totality the external forces, influences and conditions, which affect the life, nature, behavior and growth of living organisms.

5.0 SUMMARY

This unit have discussed environmental studies and how it affects the living conditions of various organisms.

6.0 Tutor Marked Assignment

Describe the importance of environment studies.

7.0 REFERENCES/FURTHER READING

Retrieved from "https://en.wikipedia.org/w/index.php?title=Philosophy_of_environment&oldid=736461399"

UNIT 2 BUSINESS DEVELOPMENT AND EVOLUTION OF NATURAL ENDOWMENT

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main Content
    3.1 Classification of Energy
    3.2 Animate Energy
    3.3 In Animate Energy
    3.4 Types of Energy
    3.5 Land and Its Embodiment
    3.6 Cultivability of Land
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

Though nature has blessed mankind with a number of natural resources, the two most important natural endowments are energy and land. These two resources may be termed as the basic natural resources because upon these alone rests the creation of all other resources available to mankind. This unit will attempts to explain the importance and opportunities derivable from the resources of energy and land.

2.0 OBJECTIVES

At the end of this Units student must be able to:

- understand the classification of energy
- understand the drawback of animate energy and the superiority of inanimate energy over animate energy.
- explain the various dimensions of land

3.0 MAIN CONTENT

3.1 Classification of Energy

All energy available to man can be classified *as animate or inanimate energy.* Animate energy forms are those which function through living organism such as plants, bacteria, animals, molds, fungi, etc., inanimate energy forms are those which are derived from non-living matins, especially the fossil-coal, oils, gas-and from falling water.

3.2 Animate Energy

Animate energy is generated through food and feed. It can be either biotic or muscular energy. Biotic energy is the energy that is associated with the process of life and growth. It is used for maintaining life and body. Meanwhile energy muscular is the energy, which is applied by an animal or man for useful work, such as pulling a can or lifting a weight. The bulk of food or feed intake is used in generating biotic energy, and only a fraction is available for macular energy. Therefore, the capacity to work is much limited in the case of animate energy.

Drawbacks of animate energy

Animate energy suffers from certain drawbacks as compared to inanimate energy. They can be enumerated as follows:

(1) Animate energy is spread out in limited quantities among units of men and animal. It is depressed and not concentrated which means low per capita return.

(2) Animate energy is more costly, considering its productivity. Expenditure is necessary on the maintenance of men and animals even when they are not working. According to an estimate, on the whole, animate energy probably costs thirty to hundred times as much as mineral energy, and human energy from three hundred to a thousand times as much.

(3) Animate energy has to use mostly organic matter, vegetable or animal substances as its working materials. It can use only a limited amount of inorganic matter as it is difficult to work deeply found minerals.

(4) Animate energy keeps man more as a beast of burden engaged in physical work giving him little chance for higher activities and aspirations. Man can as the thinker, the inventor or the discoverer, the dreamer and the aspirer achieve more if his energy is diverted to resourceful ventures. But animate energy given little scope for this

(5) The use of animate limits the speed with which work can be done. The work performed with the help of animate energy is much slower as compared with the work that can be done with the help of animate effect, it influence cost and thereby effectiveness of operation, for example, if we assume that the building of an Egyptian pyramid required the work of 50,000 slaves for 20 years, while a skyscraper of a comparable size can be built by 500 labourers in 6 months, we get the ratio 400 to 1. This means that if man needs as up to 400 times as much food to generate the manpower that built the pyramid as his tool to fed the workers who built the skyscraper.

(6) Limited speed also results in an inefficient system of transportation and communication in a vegetable civilization depending entirely upon animate energy. This inefficiency relates to the road, the vehicles and the motive power. Roads are poorly built, vehicles are heavy and made of wood, and mostly of heavy iron and the animals supply the motive power. The food or feed consumption necessary to yield the necessary energy, required to transport heavy and bulky goods in wooden vehicle drawn by animals over poorly built roads, is so large that only short distances can be negotiated. Similarly, water transport, though to some extent free from the limitation of animate energy, is confined only to rivers, bays and coastal waters, and can affect only small portions of an area of existing international trade.

In addition, The use of animate energy results in an agricultural economy or a vegetable civilization. In such an economy, land means wealth. Feudalism is the typical form of social control in which property holding in the form of landed rights wields social status and economic as well as political power. The landlord usurps any surplus produce by men. People, therefore, live at subsistence level, capital are negligible and the labour remains ineffective and inefficient. Hence, low productivity per capita. Not being able to produce and spare that which could raise his effectiveness, he is caught in a 'vicious circle' of underdevelopment. As there is no surplus, there is little trade and specialization.

In a vegetable civilization, due to ineffective production methods, entire families-men, women and children have to keep busy from morning till night during the working season to raise the necessities of life. There is no time for study or schooling. As a result, labour lacks ambition and adopts a defeatist attitude. He becomes superstitious and pessimistic. He tries to seek contentment simply by not wanting, by stifling his wants and desires.

3.3 Inanimate Energy

Inanimate energy, as already stated, is the energy derived from non-living matter, especially the fossil fuel-coal, oil, gas- and from falling water. In fact, the history of economic development is the history of man's ability to control more and more of inanimate energy. The mechanical and industrial revolutions would have been impossible but for the availability of inanimate energy.

Superiority of inanimate energy over animate energy

Inanimate energy is superior energy in a number of ways:

1. **Available in more compact form:** In inanimate energy resources like coal, petroleum, gas and waterpower, power or energy are available in more compact form. A modern powerhouse can generate more energy than all men and animal of nation.
2. **Less costly:** Inanimate energy or mineral is much cheaper as compared with animal or human energy. The cost of maintaining a machine is much less than the cost of maintaining men and animals, chief sources of animate energy. Machines can be worked round the clock, with-the help of inanimate energy, whereas men and animals remain idle for far longer periods than when they are busy. Thus, the overheads in the case of animate energy, cost, further increases in the case of animate energy as men and animals have to be fed and sheltered even when they are not working. The mechanical slaves let along on cheaper food and require less attention than either men or animals.
3. **Inanimate energy resources are net products:** Coals, the most important source of inanimate energy, enjoys an inherent advantage over hay, a source of animate energy, in that it is raised and transported with coals itself, and thus may be said to raise and move itself. Thus, the coal available for energy production over and above transportation is still a net product. But a tonne of hays, moved by an ox, is not a net product because the ox that draws it must eat, while the coal that generates the steam to pull the train does not.
4. **Large-scale production becomes possible:** It is so because the use of inanimate energy, tremendously increases the speed with which work can be done. Also because in the case of inanimate energy, the use of metals is necessary, it provides for greater accuracy with which parts can be machined, and thus for interchangeability of parts. This is not so in the case of animate energy where wood forms the chief raw material and thus for lack of precision, production remains at a small scale.
5. **Improvement in the means of transportation and communication: The** use of inanimate energy has made transportation cheap, swift and efficient on land, by water and in the air, and modern means of transportation and communication have completely changed the basis of civilization. World has become a small place. Increased mobility provides for better understanding of the other's point of view and has led to mankind. Mechanical mobility has greatly increased the range of civilization. The cultivation of the Great Steppes would have been impossible but for the modem means of transportation the railroad and the steamship.
6. **Increases trade and specialization:** The use of mechanical energy results in greater mobility of both agricultural and

industrial products and thus widens their market. This increases trade and leads to specialization and thus broadens the resources basis of mobilized or market economy.

7. **Provides more leisure: The increased speed of work results in more leisure** at the disposal of man. Man is raised from the status of an animal. He gets sufficient time for higher activities and aspirations. He can act as the thinker, the inventor, the discoverer, the dreamer and as the aspirer. In fact, he gets a chance of showing his superior qualities only when inanimate energy is used.

3.4 Energy and Business Development

Nature of Energy: Energy is the name given to the ability or capacity to do work. Energy Provides the power to progress. Most of the energy on the earth comes from the sun through its rays. The sun's rays are essential in the growth and ripening of plants that provides food for man and feed for animals. Animal and human beings to operate their bodies use energy found in food. Energies from the sun are also stored in coal. Wood and oil, which are burnt by man to produce energy for him and produces other energy that man can use for productive purposes, are essential energy sources.

3.5 Types of Energy

All energy available to man can be classified as animate or inanimate energy. Animate energy as already mentioned above, are those energy which function through living organism such are those which are derived from non-living matters especially fossil, fuels, coal oil, natural gas and from failing waters.

From the early stages, man tried to use wind as an inanimate source of energy. He utilized the force of wind for sailing boats and later on for moving machines in case of windmill. Afterwards, the Romans also discovered water wheel. Then running water was made to provide energy for lifting waters and grinding cereal. Wind and water provided inanimate energy up to about 1750.

The development of steam engines by James Watts in 1776 was a real landmark in the use of inanimate energy. Thus with steam engine man started an unending age of invention and technical development. Many new sources of energy have been developed since that day and man falling waters is used to drive turbines connected to generators, electric energy is provided for hundreds of purposes. Burning fuels in which case it's called thermal electricity when it is generated from falling waters can also generate electricity. It is called hydroelectricity. The

energy thus released provides power for homes, factories, agriculture and transportation purposes. It must be noted that coal is not a direct source of energy but merely it is fuel, which is burnt to produce stream power or electric power. Coal is an induce source of energy or power. On the other hand moving wind, falling waters provides energy or power directly.

The Chief source of energy are summed up to be thus

(a) human power
(b) animal power
(c) wind power
(d) fossils fuel and
(e) falling

The Chief fossils fuels that are utilized to provide energy are:

(a) wood
(b) coal
(c) oil and
(d) natural gas.
(f) nuclear energy
(g) solar energy
(h) tidal energy
(i) geothermal energy.

At present, coal, oil and natural gas are the most important indirect source of inanimate energy while falling water is the most important direct source for inanimate energy. These indirect sources of energy viz... coal, oil and natural gas are exhaustible sources and once used up cannot be replaced or renewed (unless through discovered of new coal mines or oil wells) they are *'fund resources"* on the other hand, falling water, wind power solar energy tidal and geothermal e.g. water can be used over and over again. The force of water, which yields hydroelectric power, is permanent.

A new source of energy —nuclear energy-has come to fore. After World War Two the world has been talking about atomic energy and its application for peaceful purposes. But difficulties in its wide application are that the world reserves of uranium which is the basic material for atomic energy, are quiet low, and secondly, generation is quiet costly.

3.6 Land in it Embodiment

Land in it embodiment can be analyzed as follows:

(a) **Two Dimensional and Three Dimensional Land:** Before the advent of the machine age, natural resources were identified with land. In the pre-industrial era man's efforts to utilize nature were almost entirely confined to the surface of the earth and, therefore, the word 'land' was identical with the surface of the. Earth. It was a **two-dimensional concept.** Its most useful manifestation was soil, crop bearing and animal supporting soil. Agriculture was, therefore, the principal occupation of the people. Animal rearing and fishing confined mainly to rivers, lakes and coastal waters were other human engagements. Only minerals found on the surface were exploited to a limited extent. Thus man's control over natural resources was adequately indicated by the land area under his control. Feudalism was the typical form of social control .in which property holding in the form of landed rights wielded economic and political power. So far, land and in turn natural resources were fixed.

(b) **The Three Dimensional Perceptive:** With the coming of the 'machine age' and with the increased use of inanimate energy, man's activities no longer remained confined to the surface of the earth. He pushed his frontiers both downwards and upwards. He began to harness and utilize minerals lying in the deeper strata of the earth. He began to extract minerals-both fossil fuels and metals from the subsurface and thus pushed his frontiers downwards. He also pushed his frontiers upwards by obtaining nitrogen from air, by making increased use of solar energy, by discovering radioactivity and by harnessing hydel power. Thus, land ceased to be identical with surface, with a thin layer of soil, it assumed a **three dimensional form.** Its close identification with agriculture and animal husbandry ended. Minerals, especially coal, petroleum, iron, copper and similar energy and machine resources have gained disproportionately greater importance in relation to the area exploited, and as such the units of surface area have lost in value as dependable measure of the natural endowment. The word 'land' is now used in the sense of totality of nature. In this sense, it is highly dynamic. It never stands still. It changes in response to changing human attitudes, increased knowledge and ever-changing culture.

3.7 Cultivability of Land

In spite of the fact that the word 'land' is no longer identified with merely the surface of the earth and that land has assumed a three-dimensional form, the importance of land for raising agricultural crops, particularly food crops, is still very great. World population is increasing at an alarming rate, and with an ever-increasing population, the problems of providing food for the sustenance of a greatly increased human family is becoming more and more serious.

We require more and more food crops. But the supply of land area is fixed and, therefore, a proper assessment of cultivable land is of vital importance. In fact, how much land out of the total cultivable land is actually cultivated is determined by two sets of factors: (i) physical factors and (ii) cultural and human factors. Physical factors or natural factors determine the absolute or outer limits of cultivability, while the cultural or human factors determine the actual use within these absolute limits.

(a) **Physical Factors:** There are four physical factors, which generally determine the cultivability of land. They are: (i) temperature, (ii) moisture, (iii) topography and (iv) soils. These limiting factors are sometimes spoken of as the four physical frontiers of nature. These factors determine the cultivability of land in the general sense for any crop whatsoever, as also with reference to a particular crop. For example, Polar Regions are unsuited for cultivation because of their extremely cold climate; deserts are riot cultivable because of their soil-texture and aridity; and mountains are generally not cultivated because of their irregular topography and soil conditions. The influence of these factors in determining the cultivability of land for a particular crop may be clearly illustrated with the help of the following examples: Only one hectare in ten of the land of the world is physical available for wheat production. Adverse climate conditions prevent availability, about 18 million square kilometers, over one-third, is too hilly or rough for wheat cultivation, reduce by one-fifth the area climatically and topographically available, leaving only 9 million square kilometers physically suitable for wheat. Thus, physical limitations restrict the cultivable area for wheat to only 1/10th of the land surface. This 9 million square kilometers is the outer limit set by the physical factors for wheat cultivation. How much of it is actually used for wheat cultivation will be determined by cultural and human limitations.

(b) Cultural and Human Limitations: From the total 9 million square kilometers suitable for wheat cultivation in our example above the actual land utilized for wheat cultivation is approximately one million square kilometers or only about one hectare in nine of this available land is being utilized for wheat. This is the result of cultural or human limitations of cultivability. Cultural and human factors determine the actual land use within the outer prescribed by nature.

4.0 CONCLUSION

This unit explained in detail how energy can be classified and also state the various dimensions along which land can be classified. Its also explained the superiority between the two types of energy.

5.0 SUMMARY

Energy means capacity to do work, the greatest source of energy is the sun. It is of two type animate and inanimate. There is a direct relationship between energy consumption and Business development. A low level of energy consumption is an indication of underdevelopment. U.S.A., which is the most economical developed country in the world, is the largest consumer of energy in the world. In both United States of America and Western Europe, high-energy consumption is due to large-scale industrialization. The principal use of energy in underdeveloped economics is for eating, lighting and for transport. Over the past few years there has been a shift in the relative importance of various source's of energy .as compared to coal. Oil and natural gas have become more important as source of energy in recent years. Nigeria needs to develop energy urgently, beside petroleum she must open up her economy to more related industries so as to enjoyed improved standard of living.

6.0 TUTOR MARKED ASSIGNMENT

1. What are the differences between Inanimate and Animate Energy
2. What do you understand by Cultivability of Land?

7.0 REFERENCE/FURTHER READING

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UNIT 3 NATURE AND RESOURCES

CONTENTS

1.0 Introduction
2.0 Objective
3.0 Main Content
    3.1 Resource Resistance
    3.2 Constant Changing of Nature
    3.3 Distribution of Resources
    3.4 Flow and Fund Characteristics of Resources
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 References/Further Reading

1.0 INTRODUCTION

Nature refers to things and matters of this planet so far as they are unaffected by man. Nature forms the basis of all resources. Some of these resources are provided as such. For example, sunshine, water, air**,** etc., are available as resources for man by his ingenuity, skill alike. But most other things are available in the form of 'neutral stuff' and are converted into resources by man by his ingenuity, skill and hard work only. For example, coal is found in nature. But coal readily accessible and available for human use is rare. Without the aid of power-driven machinery, human inventions and man-made contraptions, most of the coal, lying in the deeper strata of the earth's crust, would have remained merely "neutral stuff'.

Similarly coal occurs in nature, but not coke or sulphate of ammonia, tar, dyes, aspirin, nylon, etc. Thus, through human ingenuity has coal become more useful and expands the available resources of mankind.

2.0 OBJECTIVE

At the end of this course student should be able to:

- define nature and the constant changing of nature
- understand how Resources is being distributed

3.0 MAIN CONTENT

3.1 Resource Resistance

Nature provides not only resources, but also resistances. Harmful things like barren and unproductive soil, typhoon, hurricane, floods, poisonous insects, and diseases are all natural resistances. These assist control of health care system harm others and hinder man imagination. These can increase or reduce the usefulness of the available resources. Thus, the totality of resources in a particular case is to be decided by taking both resources and resistance into account. According to Zimmermann, the extent of human satisfaction is a function of resources and resistance and not of resources alone. This position was explained as follows:

(i) If a society has sufficient resources to yield satisfaction u' its members to the extent of say, 10000 units; and at the same time it has resistances to yield dissatisfaction to the extent of, say, 5000 units, then the ultimate satisfaction of the society is to the extent of 5000 units only.

(ii) Similarly, if atomic energy can be used both for productive purpose, it is a resource, but to the extent it can be used for destruction, it is a resistance. Thus the extent to which atomic energy can add to human welfare or satisfaction depends on the combined effects of its use and misuses. However, this can lessen the impact of resistances and increase the usefulness of the resources. For examples, the river Ethiopia which was considered as river sorrow' two decade ago, has now been controlled and harnessed for a number of other benefits to the people of Nigeria for wood transport. Thus this concept call nature is not only a friend but a foe as well.

(iii) Nature is both bountiful and niggardly: Nature, no doubt, offers certain things freely to all. For example, air to breath, water to chink, a place to rest, friendly climate, or fertile soil is available to all alike. But such free gifts of nature are only few and can support only a small number of people. Other gifts of nature are freely available to all. To the uncivilized, they are limited in nature. Nature unknowingly offers them ever-increasing resources, which are deeply hidden and well guarded by obstacles, i.e. resistances. Only those, who are wise enough to overcome these resistances, can enrich themselves through hidden treasures of nature.

3.2 Constant Changing in the Concept of Nature

When thought of as the universe, nature may be considered constant. But when nature is viewed in terms of man, it becomes ever changing or dynamic. It is both expanding and contracting. It expands with the increase of human knowledge, improvements in technology and human skill. Nature unfolds her Mysteries to man, but no faster than he can learn, and improvement in acts. With every advance of knowledge not only some "neutral stuff" is being transformed into resources but also the same becomes far more useful than it used to be before, and this phantom resources', much large than the physical resources, become available to man.

To illustrate this point we can take an example. Coal is an important source of power. But the amount of coal required generating I kw- hour of electricity today is not the same as it was 50 year ago. Suppose in 1920, Canada had a cola reserve of 60,000 million tones that in 5pound of coal was necessary to generate. I kw-hour and that other uses- of coal ore equally inefficient that by 1970 the art of coal utilization advanced to the point where one pound of coal generate I kw. Hour and that other uses of coal similar advanced inefficiency and that during century, Canada used up 500 million such has enhanced fivefold we may say that in terms of functional capacity the original 60,000 million tones pile expanded to a phantom pile of 297 900 million tones (59,500 x 5). The physical loss is greatly over-compensated by the expansion of functional capacity.

3.3 Expansion Capability

As resources expand, they also contract as a result of exploitation. Minerals are used up and the natural process to replenish them is extremely slow.

Some resources are rendered useless by obsolescence. The development of large iron and steel plants rendered small iron-ore mines useless. Resources are also damaged by man beyond repair due to ignorance of the laws of ecology or due to reckless exploitation.

3.4 Distribution of Resources

Resources from nature are very unevenly distributed over the earth's surface. Various parts of the world differ in regard to climate, soil relief features, water bodies, natural vegetation, minerals wealth and other natural endowments. First-class fertile soil is found in only a few spots, and the so-called arable land makes up only 40 per cent of the land surface exclusive of the Polar Regions. The uneven distribution of

population and wide differences in the economic development and living standards of the people of various countries is the direct outcome of this uneven distribution of natural resources.

The uneven distribution relates both to the amount and frequency of resources. On the basis of frequency the nature of resources may be classified into four main parts:

(i) Resources, which are found everywhere or ubiquities, e.g. sunshine, or oxygen in the air.
(ii) Resources which are found in many places or commonalities e.g. arable land;
(iii) Resources which are found only in a few places or rarities e.g.; petroleum, and
(iv) Resources, which are found in one place only or iniquities e.g. cryolite. Frequency of occurrences of these resources is significant because production processes generally involve a combination of two or more types of materials. For example, for the production of steel, we require a particular combination of iron-ore, coal, limestone, manganese etc, now; individually each of these may be a commonality, though the workable combination of these materials may be a rarity. Similarly, mere physical presence of a resource does not automatically make it available. In a competitive price economy only the lowest cost resource-combination may be used. For example, though aluminum is very common, and in the absolute sense the known often is extremely limited, tin, rather than aluminum, is exploited because the cost of recovery, and market price make only rich deposits of aluminum available. Brazilian iron-ore is not profitably used for lack of cooking coal in the neighboring region.

Finally, rarity varies in its effects. Rarity of a vitally important material is of much greater concern than the rarity of dispensable luxury. Rarity of oil reserves is a matter of greater concern than the lack of silver and gold. Similarly, another aspect of rarity involves the relative ease with which common substances may be substituted for rare ones. Rarity of aluminum is particularly significant for aircraft industry, but not so in the case of kitchen utensil industry, for the former, it is a must because of its lightness and strength, but in the later case, it can be substituted by the other metals.

3. 5 Flow and Fund Characteristics of Resources

Natural resources may also be classified as flow and fund-resources. Flow resources are self renewable and their supplies continue

permanently, e.g. sunshine or hydel power. On the other hand, fund resources have only a fixed and limited stock and are not self-renewable. They exhaust though constant use. Coal, petroleum, iron-ore and other minerals are example of such fund resources. Fund resources may be further classified as *exhaustible fund resources* and *revolving fund resources.* Coal is an exhaustible fund resource because most of it is burnt and disappears from view. On the hand, iron-ore is revolving fund resource as it is not lost to use completely after its first use. Most iron is used in the form of steel or cast iron and used for making permanent fixtures like rails, bridges, machines, etc., and if protected against rust, it can be used for years, and even after that it can be scrapped and remelted and thus made available for further use. Thus, if a resource is capable of being reused, it is a revolving fund resource.

Similarly, flow resources, though capable of itself-renewal, may get silted or choked as a result of neckless exploitation or mismanagement. For example, when forest resources are properly managed, they can yield an endless stream of products, but when they are recklessly cut rare otherwise mismanaged, they get silted or choked. Thus conservation of such resources is imperative. The forests or the fisheries will continue to remain flow resources so long as their rate of exploitation does not exceed the rate of their annual increment.

4.0 CONCLUSION

This unit have explained the concept of Nature and how Resources form Nature are Unevenly distributed over the earth surface. Thought various part of the world differ in terms of resource. Classification of various natural resources were also discussed.

5.0 SUMMARY

we have discussed the conceptualization of nature and resources and the constant changing of the concepts as well as distribution of resources. We also explained the flow and fund characteristic of resources.

6.0 TUTOR MARKED ASSIGNMENT

1. Critically appraise man as resources of nature or man controller of resources.
2. Except man understand the diversity of nature, the survival of man is exhaustible elucidate.
3. Explain critically, the concept of resources and résistance.

7.0 REFERENCES/FURTHER READINGS

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UNIT 4 MEANING AND VALUE OF RESOURCES

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    3.2 Resource as a Dynamic Concept
    3.3 Classification of Resources
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1.0 INTRODUCTION

The word "resources" may be defined as "means of attaining given ends". These ends may be the satisfaction of individual wants or the attainment of social objectives. *Thus anything useful or anything having the attribute of utility may be term as resources.* Food, clothing, property or capital are, therefore, resources only because they are useful and satisfy human wants. But resources include many more things. They include not only material things like land, forests, coal, machinery, etc., but also intangible things like good health, knowledge, freedom, social harmony, technological capacity etc, because all these things have the attribute of utility. Similarly, water, air, sunshine, etc are all resources of a kind.

2.0 OBJECTIVE

At the end of this units student must be able to

- discuss resources as a dynamic concept
- explain the functional concept of resources
- distinguished the conceptual clarification between resource creation and resource destruction

3.0 MAIN CONTENT

3.1 The Functional Concept of Resources

Resource is something that has been described as functional. According to Zimmermann, "the word `resource' does not refer to a thing nor a substance, but to a function which a thing or substance may perform or

to given operation of attaining a given end such as satisfying a want.' Thus a factor is resource so long as it satisfies some human wants. It ceases to be resources, when it ceases to be used for the satisfaction of human wants and here it will be referred to as neutral stuff. For example, an iron ore mine is a resource because its ore resources serve as useful material for iron and steel industry, but, suppose, if with the expansion of the iron and steel industry, this is either favourably nor unfavourably. The 'neutral stuffs' of the pre-historic era have become resources with the increase of human knowledge about their existence and usefulness; consequently basic changes are in the nature of which:

(a) Rock led to granite stores
(h) Sand led to glass ware
(c) Sun led to solar energy etc.
(d) Wasted animal now becomes mechanical sets.

It is obvious therefore that knowledge is truly the mother of resources, that is, through knowledge man is able to solve the mysteries of nature and convert the 'neutral stuff of yesterday into resources of today. According to Wesley C. Mitchell, knowledge is the greatest of all human resources. It is the greatest because it gives birth to other resources.

Coal, petroleum and iron-ore did not serve as resources to a pre-historic man, though these things existed in this time as well and existed even abundantly. At the time when man knew nothing about these things and their usefulness. Then these things were mere 'neutral stuffs'.

Similarly, the aboriginal inhabitants of the USA lived in the poverty-stricken environment because they lacked the knowledge about the treasures that Nature had placed at their disposal. They remained satisfied with hunting and rudimentary and primitive type of agriculture to supply their basic requirements. But the European settlers who went later had the knowledge about the usefulness of various minerals. They were able to convert the large neutral stuffs into resources by extracting them from beneath the earth's surface and utilizing them for their well-being. Thus, so long as man knew nothing about their usefulness, they remained neutral stuffs and became resources sooner as the knowledge of their usefulness became more pronounced.

3.2 Resource as a Dynamic Concept

Resource is not something static. It is dynamic and increases in response to increased knowledge, improved arts and expanding science. For example:

(a) Aborigines adapted themselves to their natural surroundings. For them, almost all the resources were available on the surface of the earth. They could do nothing more than exploiting these variable resources. Hunting animal tearing and fishing confined mainly to rivers, bays and coastal waters were their chief engagements and supplied them with their basic requirements. But modem men, with help of their knowledge and intelligence, not only exploit what nature has provided them with but also improve upon them and make them more useful. They find uses of the things already known and discover new things. Thus resources are dynamic in response to increased knowledge improved arts and expanding science and culture.

(b) Resources also change in response to changing individual wants and social objectives. Resources have been defined as the means of attaining given ends i.e individual wants and social objective& Means take their meaning from the ends, which they serve. As ends change, means must change also. Thus resources must reflect every change in the purpose of the appraiser. Social objectives in times of war are different from those in time of peace. Changed or expanding wants also created new resources. For example, the development of aircraft industry necessitated the discovery of some material, which was light as well as strong, and thus aluminum was found out. Thus resources creation is a continuous process and resources change with every change in human civilization.

3.3 Classification of Resources

Resources may broadly be classified as: (a) material and; (b) non-material resources. Tangible things like coal, petroleum, iron-ore, copper, etc., are material resources. Similarly, intangible things like health, knowledge, freedom, social harmony, etc., are non-material resources. Both types of resources play an important role in the economic development of man. Both material and non-material resources may further be divided into three classes each. They may be classified as:

(i) Individual resources,
(ii) National resources, and
(iii) World resources.

(i) Individual or Personal Resources: These include one's material; possessions like land, property, cash, and his personal qualities like good health, good character, skill and knowledge, etc. National Resources: These are the sum total of all individual

resources owned by the citizens of a nation and also the resources collectively owned by the nation, such as public parks, roads, bridges, state railways, nation material resources, waterpower resources, good climate and soil, useful rivers and mountains, forest resources, high standard of national character, efficient and stable government and all other things which are beneficial to the nation.

(ii) **World Resources:** These are the sum total of all the resources owned by the different nations individually and collectively. They include all material and non-material things of the world leading to co-operation, human knowledge and all things which are beneficial to the mankind in general.

(iii) **World Resources:** In addition resources are basis of the economic property of various nations. Moreso that different countries are at different levels of economic development primarily because of their resources. For example it is evident that the United States of America and the West European countries are economically prosperous because they posses vast resources-natural, human or cultural. On the other hand, in most parts of Africa and Asia, though nature has been quite benevolent, people, due to their lack of knowledge and initiative, have been unable to turn the huge mass of neutral stuff into resources. The vast forest resources, mineral wealth, water-power potential, etc., still lie unutilized and are, therefore, not used in the service of man, wherever man has become conscious of resources and has begun to exploit them in a planned and rational manner, he has achieved high levels of economic prosperity. On the other hand, in places where he still lacks resources-consciousness and thus exploits them recklessly, he has not been able to rise above the status of an animal. He is subjected to his natural surroundings. He works according to the dictates of nature. He toils hard, but gets little reward of this work. He is only able to subsist. A resources conscious man is always trying to find new uses of various things and thus to increase the fund of his resources. As resources are something functional, a better and more efficient utilization of things results in the expansion of the total fund of resources. For example A tonne of coal today is worth 7 tonnes of coals 70 years back because man, by his ingenuity, has been able to find better ways of utilizing coal and to reduce wastage to the minimum. No doubt, people .have always been resource-conscious. They have always tried to own land, gain access to water and control over certain minerals. But it was individual resources—consciousness and astern individual, man is shortsighted. He is selfish and looks for immediate gain.

This left to himself; he is likely to exploit the national resources recklessly to gain temporary personal advantage. This may deny the society the long-term benefit of the resources provided by nature. Therefore, the society has to take care of the basic resources like oil, water, oil, forests, etc. And to so plan them that these resources provide a lasting benefit to the society at large. Hence, there is the need for social resource-consciousness.

3. 4 Resource Creation and Resource Destruction

Resources are not, they become; they are not static, but mainly a dynamic process, it expand and contract in response to human wants and human actions, resources are created through the interaction of natural, human and cultural factors. This point can be illustrated with the help of a few examples.

a) Tea shrubs grew wildly in the hills of Assam in India, but one knew much about their importance and economic potentialities till the year 1804 when **Lord William Bentick** recorded minutes discovery on the urging possibility of the great advantage that would result to India, from commercial point of view, from developing the tea plantations on a commercial basis in the country. As a result an experiment was made in 1834 with the help of Chinese seed. In 1837, a few tea makers and artisans were also introduced from China. And in course of time, as well known, India became the largest producer and exporter of tea in the world. This tea plant which grew wildly and remain `neutral stuff' for centuries became important resources as a result of the introduction of British capital and enterprise. Today tea is an important beverage in most parts of Europe and Asia. Its consumption in the U.S.A., Africa and Latin America is also increasing. Big and large tea plantations have been established in various monsoon lands' giving employment to millions of natives and earning valuable foreign exchange for the producing countries.

b) Similarly, rubber from the Amazon basin, though known to people in Western hemisphere for centuries, could be used to satisfy essential human wants only after **Charles** Goodyear discovered vulcanization in 1830. This discovery of Charles Goodyear not only belped to convert the "neutral stuff" in the wilds of Amazon basin into rubber re'sour'ces of Brazil, but also opened up new producing area and gave useful rubber resources to Malaysia and Indonesia; and Nigeria, which developed number fields with the help of foreign capital and enterprise.

c) The iron-ore deposits of Minas Gerais in Brazil provide another example of resources creation. These resources have been known for a long time. But in the absence of local coking coal supplies and inaccessibility of the inland deposits, they could not be used for the development of an iron and steel industry in the country. But when the U.S aid in the form of capital mechanical equipment and technical know-how *was* made valuable to Brazil, Brazil could also develop an iron and steel industry. Thus the iron-ore of Brazil could be converted from "neutral stuff' into resource only as a result of:

(i) International co-operations.
(ii) helpful attitude and policy of the government,
(iii) expansion of the market for the Brazilian-made steel products both domestic as well as foreign,
(iv) able and willing labour,
(v) improved sanitation making the fever-ridden valley to the Port of Victoria livable, and
(vi) modem technology.

Hence, "resourceship stems from the purposeful I interaction of natural and human primed and kept going by demand based on availability for use. Possibility of Resource Destruction: There is another side of the story. Just as resources are created by modem science and technology backed by wants and needs, they can also be destroyed and reconverted into 'neutral stuff with technological advancement, changes and needs. With the expansion of iron and steel industry, many small iron-ore tins bases, that were previously producing small quantities of iron-ore may be abandoned and turned into `neutral stuff', as it is comparatively more closely to work them rather than working big, mines. Similarly, the plantation rubber of Malaysia and Indonesia ousted the wild rubber of Brazil from the world market, because of its cost advantage.

The development of synthesis rubber with the application of modem science and technology *has* similarly affected the rubber industry of South-East Asia but with little effect on Nigeria rubber field. Hence resource creation and destruction is a continuing process and resources expand and contract in response to human want and human actions.

4.0 CONCLUSION

This unit has explained the functional concept of resources and how dynamic the concept is. Its also established the classification of resources and how resources is created and distributed.

5.0 SUMMARY

In summary, we say that resources are the basis of both security and opulence; they are the foundations of power and wealth. In times of war as well as peace, they affect man's destiny alike. Only live happily in peace. While the physical universe may be constant, resources as means of attaining given ends are ever changing. They are in constant flux, changing reflections of changing capacity and needs.

6.0 TUTOR MARKED ASSIGNMENT

1. Resources is a dynamic concept "Elucidate?
2. Explain fully the functional aspect of resource with the help of a few examples?

7.0 REFERENCES/FURTHER READING

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UNITS 5 NATURAL RESOURCE SCARCITY AND INDICATORS OF SCARCITY

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1.0 INTRODUCTION

This unit is concern about increasing scarcity of resource which may exist in two forms, absolute scarcity and relative scarcity. a distinction Should be made between the two forms scarcity.

2.0 Objectives

At the end of this unit student must be able to:

- understand the how resource is being conservated
- understand the various methods of conservation
- explain Recycling conceptually

3.0 MAIN CONTENT

3.1 Resource Scarcity

Absolute scarcity exists where insufficient physical quantifies of the resource are available to meet the demand for it, i.e., supply of the resource is insufficient to meet the demand. Relative scarcity, on the other hind exists when the physical quantities of the resource are sufficient to meet the demand, but problem arise over quality of supplies; poorer grades of the resource may be available to meet the demand, but cost of extraction will be higher. There are three important indicators of resource scarcity:

1. A rising marginal resource extraction cost.
2. Marginal exploration and discovery costs.
3. Real market price indicators.

However, many economists add an optimistic note on resource scarcity saying that technological advances will open up possibilities for exploring and discovering now deposits. In addition markets will *react* to the rising price/cost signal by. encouraging substitution, new ways of using resources, recycling and efficient use of resources.

Perdu DasCupta (1993) examines various substitution possibilities, that will certainly postpone if not prevent resource exhaustibility. They are:

1. Development of new materials such as synthetic fibres.
2. Technological developments which increase productivity of extraction purposes.
3. Technological advancements like aerial photograph that make exploration Activities easier and cheaper.
4. Technological advancements that will promote efficient use of resources.
5. Improvements in recycling technology.
6. Substitution of low grade resource reserves for high grade deposits that are getting exhausted.

3.2 Conservation of Resources

If our future generations should inherit a rich resource base, we must conserve our resources. What specifically is conservation? There are many popular definitions of resource conservation. One of the early well-known conservationist, Gifford Pinchot, defined conservation as "use of natural resources for the greatest good of the greatest number for the longest time". To him conservation implies both development and protection of resources. A more meaningful and precise definition of resource conservation simply means consuming less virgin natural resources than we otherwise would. More broadly, conservation can be defined as the process of prolonging the useful life of resources, either by preserving or by reusing and recycling. However, "If present trend continue, the world in 2020 will be more crowded, more polluted, less stable ecologically, more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources and environment are clearly visible ahead".

There is no doubt that the rapidly growing world population is straining the earth's carrying capacity today. We are not only running out of non-renewable resources but are also faced with the destruction of renewable resources system's capacity to regenerate. Over fishing has extensively damaged many oceanic fisheries.

3.3 Method of Conservation

Several methods/strategies have been suggested by conservationists, lent of which are being followed in an attempt to conserve resources. The first line of defense towards protecting our resources is waste reduction. Resource conservation basically means reduction of the amount of solid waste that are generated besides reduction of overall resource consumption and utilisation of recovered resources. Waste reduction is advocated as a principal means of conserving resources because a reduction in wastes implies more economical and efficient use of resources. Waste reduction can be achieved by redesigning industrial processes and by locating plants in such a way that the residues of one plant, can whenever and wherever possible *be* effectively used as raw materials by another industry. Waste reduction reduces environmental impacts and energy demands besides conserving natural resources. Further it provides a check on the ever increasing costs of waste management Waste reduction can be achieved through several ways among which area as follows:

1. Increasing the durability of products
2. utilising material substitution
3. Recycling and
4. Marketability of industrial wastes.

Increasing the durability of products means designing products for longer use and designing them for easy and economical repair or manufacture. The replacement of unbreakable containers in the place of brittle/breakable containers is an example. Increasing the durability of the product otherwise called as 'product life extension' does not merely mean making it tougher or stronger. It involves designing problem and marketing problem, as pointed out by a Canadian research team: "the design problem is to ensure that replacement of worn parts is simple: the marketing problem is to make parts available". It further pointed out that if products are not durable, they should be repairable and durability meant "either better materials or easily replaceable parts or both". Increase in durability will reduce wastes generated and promote preservation of our natural resources. The process of material substitution as a mean of conserving resources depends on technology. The transistor for example, requires one millionth of the materials needed to make the vacuum tube it replaces. Similarly commercial satellites, solid state electronics, microfilm facilities have reduced material requirements in communications industry. Aluminum is being extensively substituted for tin, particularly in the production of metal cans and containers. Similarly plastics are being used for insulation and anti-corrosive purposes where lead and zinc were originally used.

Substitution that would make possible more efficient energy we, will promote conservation of eaten. Some have even suggested substitution of labour or capital for energy.

However, material substitutions possibilities are also limited by attain conditions. It is possible that all raw-materials including the substitutable materials will be depleted at the same time. Secondly, substitution may involve time lags. The time required for effective substitution is a crucial factor. Equally important is the interval required for diffusion of the substitute technology in all processes of the industry. It has been reported by an international review of this question that the total time required for effective substitution has been of the order of 25 to 30 years when diffusion time is included. Besides time factors, side effects of substitute materials in the form of more pollution also may pose problems. Aluminum smelters, for example, may involve more pollution than tin which they replace. Thus while material substitution is an effective technique for resource conservation, it is limited by pollution impacts, time lag, and by the conservation, ability to manage the substitution process.

3.4 Recycling

Recycling is the most popular method practiced today for conserving resources. Recycling simply means extending the life of a resource. It is the re-use of a given input or output. For example, from the effluents of distilleries manufacturing alcohol, methane is separated by a chemical process which is then recycled in the production process as fuel for boiler. The residual liquid of the effluent after separation of methane, contains nitrogen, phosphate and potassium and is canalized in cane fields and has resulted in considerable increases in cane yield. Empirical evidence suggests that recovering and re-using industrial wastes is both technically feasible and economically attractive. A profit seeking company, however, will recycle a product only when its cost is lower than the use of the virgin material and this cost differential should be neither transitory nor cyclical. There are social costs and benefits associated with recycling, which private firms may not consider. The benefits of recycling essentially arise from the extension in the life of the recycled resource, the reduced pollution impact and the reduced demand for land for dumping. However, recycling is not a costless exercise. Hence, optimal level of recycling is said to be at the point at which extra costs of recycling outweighs extra benefits.

4.0 CONCLUSION

This unit have explained the concept of Natural Resources and indication of scarcity. Its also state clearly the concept of conservation of resources and the various methods of conservation.

5.0 SUMMARY

We have discussed natural resources scarcity and its indication. We also discussed conservation of resources and the various methods of conservation. The concept of recycling was also discussed

6.0 TUTOR MARKED ASSIGNMENT

1. What do you understand by conservation of resources
2. What are the methods of conservation of resources

7.0 REFERENCE/FURTHER READING

Karpagam, M (2010) Environmental Economics Sterling Publisher Ltd, New Delhi.