NATIONAL OPEN UNIVERSITY OF NIGERIA

ECE 231

Science in Early Years

Module 3

ECE 231 (Science in Early Years) Module 3

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Unit 1 European Renaissance and the Birth of Modern Science

1.0 Introduction

In the last unit, we discussed science in the Middle Ages. In the course of our discussion, you saw how formal attempt to understand science started gradually and by the mid-13th century, a lot of people had started embracing science. In this unit, we shall continue with how science became fully embraced by the society. This started in Italy in 14th century and got to its peak in the 16th century. The historians of science calls the period the age of re-birth of science otherwise called the "Renaissance."

2.0 Objectives

At the end of the unit, you should be able to:

- define the term Renaissance
- identify the factors that led to Renaissance
- explain the contribution of Renaissance to the development of modern science and technology.

3.0 Main Content

3.1 Meaning and Origin of Renaissance

The term "Renaissance" is a French word meaning "rebirth". It refers to historic era which is a cultural movement that encompasses a rebellion of learning based on intellectual transformation. Renaissance can be viewed as a bridge between the Middle Ages and the modern era. It was a cultural movement that affected European intellectual life. It began in Italy and spread gradually to Europe. Renaissance attempted to improve and perfect the way intellectuals of the Middle Ages approached religion. It also affected other intellectual inquiries such as literature, philosophy, arts, politics and science. Renaissance thinkers sought out learning from ancient texts typically written in Latin or Greek.

Renaissance was a period of revival in classical learning in Europe which was brought about partly by contact with other civilization, especially Islamic civilization in Spain and Palestine and partly by the development of urban centres with literate upper classes. The period was characterized mainly by the establishment of universities and a surge in scholastic learning. Some of the scholars of this period include St. Thomas Aquinas, a theologian and the experimentally – minded Roger Bacon.

Self-Assessment Exercise

Explain in your own words what you understand by the term "Renaissance."

3.2 Characteristics of Renaissance

The following are some of the events that characterized the Renaissance period.

1. Emphasis was laid on the study of ancient texts in its original form and appraisal was made on them through combination of reasoning and empirical science.
2. The development of highly realistic perspective in artistic technique. This can be seen in terms of painting and architecture.
3. It was a period of revival in classical learning in Europe which was brought about partly by contact with other civilization especially Islamic civilization in Spain and Palestine, and partly by the development of urban centres with literate upper classes.
4. Establishment of universities and a surge in scholastic learning and values.
5. Great intellectual excitement among scholars who were convinced that they were living in a new age which promised to be ever more glorious than the great days of Greece and Rome.
6. Greater ease of communication.
7. Invention of printing which makes publication easy.
8. Invention of gun powder to replace swords and shields used in the medieval periods. The gun powder helped in offence and defense against enemies.

Self-Assessment Exercise

Explain the "Great Intellectual Excitement" that occurred during Renaissance.

3.2 Contributions of Renaissance to the Development of Modern Science

The rebirth of learning led to the development of national languages. For instance, an Italian poet Dante, in his work "Divine Comedy" was written in Italian which was the language of the common people in Italy and could be understood by them. It was not written in Latin as it used to be in the medieval period.

Renaissance has exposed men to the spirit of inquiry and criticism and to further research which constitute some of the characteristics of modern science and technology.

It was during renaissance that meaningful study on medical science started. Men and animal bodies were dissected and previous theories about the human body were debunked.

The invention of printing has also ease publication of scholastic works. This has made it possible to have access to published works which in turn facilitated learning. The invention of gun powder also led to the establishment of national armies which helped to strengthen the position of the monarchies and the interest of the state. The Renaissance also manifested itself in the field of science.

Researches were made about the animal kingdom, plant structure and vegetable life. The new scientific knowledge required that scientist should use experiment in establishing any

new discovery. It was from this period that science, as we know it today, began to take proper shape.

There was the development of chemicals to supplement the use of herbal drugs in curing sickness. Distillation technique and practical apparatus used in experiments were improved.

Important contributions were made on the theory of diseases and treatments of different ailments were developed.

In physics, Renaissance has also made some advances. The main works in physics covered terrestrial magnetism, optics and mechanics. Mathematics served all disciplines as it was used to give precision and quantitative results.

There was also the introduction of the Indian Arabic numerals including zero. Many mathematics books were written. Important discoveries were also made in the field of astronomy. For instance, it was proved that the sun was the center of the universe rather than the earth as it was believed in the medieval period.

Finally, the Renaissance has provided the gateway for the world to discover itself. Man began to sail away from his own country to discovering new lands which he had read about from the study of works left behind by early geographic of Greek and Arab origin. Instruments such as the compass, quadrant and sextant were used by sailors in an open sea.

Self-Assessment Exercise

What is the importance of printing in the rebirth of modern science?

4.0 Conclusion

It can be concluded that intellectual and scholastic learning flourished in centres like Oxford Cologne, Paris and Rome. Renaissance was a gradual movement and it provided a very important impetus to scientific thinking and knowledge. On the whole, it laid the foundations for modern science and technology.

5.0 Summary

In this unit, we have learnt about the meaning and characteristics of Renaissance. We have also learnt about the implications of Renaissance on the development of modern science and technology. In the next unit, we shall talk about the development of science in Europe in the 16th and 17th centuries.

6.0 Self-Assessment Exercise

1. List and explain the characteristics of Renaissance.
2. What are the implications of Renaissance on the development of science and technology?

7.0 References/Further Reading

Butterfield, H. (1965). *The Origin of Modern Science.* New York: Free Press.

Burhard, J. (1974). *The Civilisation of the Renaissance*. London: Penguin .

Kuhns, S.T. (1996). *The Structure of Scientific Revolutions*. Chicago: The University of Chicago Press.

Unit 2 Scientific Development in The 16th and 17th Centuries

1.0 Introduction

In the previous unit, we studied the meaning and origin of Renaissance. We also looked at the characteristics and implications of Renaissance on the development of modern science and technology. In this unit, we shall talk about how science was developed in Europe in the 16th and 17th centuries. We will also look at the factors that led to revolutionary upsurge in science in Europe in the 16th and 17th centuries. Finally, we shall look into some of the 16th and 17th century scientists and what they have discovered.

2.0 Objectives

At the end of this unit, you should be able to:

- describe the development of science in Europe in the 16th and 17th centuries
- discuss the factors that led to revolutionary upsurge in the Europe in the 16th and 17th centuries
- make a list of some of the scientists of the 16th and 17th centuries and what they are credited for.

3.0 Main Content

3.1 Beginning of Scientific Revolution in 16th and 17th Centuries

The scientific revolution which is also called Renaissance positively affected the rapid development of science in Europe in the 16th and 17th centuries. It provided the intellectual basis for modern western technology particularly in Europe. The period witnessed a drastic emergence of able-bodied men of science who can be regarded as genius. These men of science made new discoveries in almost all aspects of science and technology. Significant transformations were made in the field of astronomy, physics and mathematics. Also witnessed in these centuries was the use of scientific apparatus and instruments to carry out scientific investigations.

The change from just thinking and speculations about things to investigating them experimentally with special apparatus was one of the chief changes that gave rise to modern science. Today, most of the apparatus in a physics laboratory has been specially designed and made for scientific purposes. This was not the case in the early days of the scientific revolution.

During these centuries, it was possible and convenient to borrow scientific instruments from other walks of life although emphasis was laid on designing scientific instruments for specific purposes. It can be said that the 16th and 17th centuries witnessed the development of scientific instruments. This made it possible for industries to develop rapidly in the 16th century especially mining. Mining was a rapidly growing industry and mines were getting bigger and deeper.

It should also be noted that in the 16th and 17th centuries, scientific instruments were used on a large scale for the first time in history and this suddenly opened up vast new field of discovery. The development of instrument also played a major part in establishing the experimental method which is a major characteristic of modern science. Below are some of the factors that aided the rapid development of science in the 16th and 17th centuries.

Self-Assessment Exercise

State the major achievement of the 16th and 17th centuries

3.2 Factors that Led to the Revolutionary Upsurge in Science in the 16th and 17th Centuries

- Quick cultural, political and economic changes taking place and the receptive of new ideas by the society.
- Formation of societies and organizations to promote, publicize and encourage science. Examples of such society include the English Royal Society and French Academy of Science.
- Emergence of able and devoted men of science. Examples of such men include Tycho Brahe, Robert Boyle, Galileo Galilee, Johanes Kepler etc.
- Use of well-formulated problems and the pursuit of answers to such problems.
- Use of improved experimental instruments such as telescope microscope, etc.
- Marriage of mathematics with science which made precision in science possible.
- Free communication among scientists. This includes healthy rivalry and argument among scientist without bitterness and confrontation.
- Invention of printing which makes communication possible.

Self-Assessment Exercise

Mention any two scientific societies formed in the 16th and 17th centuries.

3.3 Some of the 16th and17th Century Scientist and Their Achievements

Tycho Brahe

He developed precision instruments in form of sextant and quadrants which he used in observing the heavenly bodies. He used these instruments to disprove Aristotle's view about comets that comets were celestial objects and not metrological phenomenon that were capable of causing disease and epidemics as postulated by Aristotle.

Johannes Kepler

He confirms the Copernican theory by showing that the planet mars rotates round the sun. He was also able to prove that the ratio between the time taken by each planet to complete one orbit (rotation) and its distance from the sun is the same for all the planets.

Galileo Galilei

He was regarded as the founder of the science of dynamics. He was the first to establish the law of falling bodies. He showed that there was no measurable difference between the rates of fall of objects in a vacuum. He also showed that the acceleration of falling bodies is always the same throughout the fall.

Isaac Newton

He discovered the law of gravity and postulated laws of motion. According to him, every planet, at every moment, has acceleration towards the sun which varies inversely with the square of the distance from the sun.

William Harvey

He came up with a satisfactory explanation of circulatory system in the human body.

Albert Einstein

He discovered the quantum nature of light and provided a description of molecular motion. He also introduced the special theory of relativity.

Nicolas Copernicus

He propounded heliocentric theory which states that the sun is in the centre of the universe and that every other planet revolves round the sun.

Marie Curie

She discovered radioactivity and she was the first woman to win Nobel Prize.

Archimedes

He is known for applying science to everyday life. He developed practical inventions such as levers and screws.

William Gilbert

He discovered the nature of electricity and Magnetism.

Blaise Pascal

He invented the first mechanical adding machine and formulated one of the basic theorems of projective geometry.

Other scientist that also contributed to the scientific revolution during the 16th and 17th century includes Rene Descartes, Napier John to mention but a few.

Self-Assessment Exercise

1. Who discovered the Law of Gravity?

2. Name the first woman to Nobel Prize in Science.

4.0 Conclusion

In conclusion, it should be noted that during this period, different nations all over the world began to invest in science. This led to the establishment of scientific academies, and by the formation of scientific societies which sponsored the publication of important discoveries made by members and distribution of such copies to similar groups throughout Europe and other areas.

5.0 Summary

In this unit, you have learnt about scientific revelation in Europe in the 16th and 17th centuries. You have also learnt about the factors that led to revolutionary upsurge in science in the centuries in question. You have also seen some of the scientists of those centuries and their achievements. In the next unit, you will see how the scientific revolution of the 16th and 17th centuries has led to Industrial revolution in the 18th century in Britain.

6.0 Self-Assessment Exercise

1. Briefly describe the nature of scientific revolution in the 16th and17th centuries.
2. What are the factors that led to the revolutionary upsurge in science in the 16th and 17th centuries in Europe?

7.0 References/Further Reading

Hoover, R.K. (1984). *The Elements of Social Scientific Thinking* New York: St Martins.

Harre, Rom (1983). *Great Scientific Experiments.* England: Oxford University Press.

Kuhn Thomas (1996). *The Structure of Scientific revolution*. Chicago University Press.

Unit 3 Industrial Revolution and the Scientific Movement OF THE 18th and 19th Centuries

1.0 Introduction

In unit, we have seen how scientific revolution has led to the production of able-bodied men of science and the production of scientific instrument, tools and machines. In this unit, you will be exposed to how the scientific revolution of the 16th and 17th centuries has led to a boost in the production and use of machines in Britain and other European countries in the 18th century. There was widespread replacement of manual labour to the use of machines in factories. This is what is known as Industrial Revolution. In this unit, we shall see the factors that aided the Industrial Revolution and the impacts of the revolution on the society.

2.0 Objectives

At the end of this unit, you should be able to:

- describe the term Industrial Revolution
- enumerate the factors that led to Industrial Revolution in Britain
- explain the impact of the revolution on the society.

3.0 Main Content

3.1 Meaning and Origin of Industrial Revolution

Simply put, Industrial Revolution is the change from the use of hands in producing goods to the use of machine. In another word: It is the change from the cottage system of industry known in the medieval period to the factory system of industry. The revolution came about as a result of application of science for practical purposes. Several machines were invented in Britain and this helped Britain to become the birthplace of the Industrial Revolution. Goods that had traditionally been made in the home or in small workshops began to be manufactured in the factory.

Production of goods and technical efficiency grew dramatically, in part, through the systematic application of scientific and practical knowledge to the manufacturing process. The revolution began in Great Britain during the last half of the 18th century; it later spread to regions of Europe and to the United States of America in the subsequent centuries. The Industrial Revolution is called a "Revolution", because it changed the European society both significantly and rapidly. Europe metamorphosed from rural life to urban life and human labour was gradually replaced by mechanical labour.

Self-Assessment Exercise

Describe in your own words what you understand by Industrial Revolution.

3.2 Factors that Aided Industrial Revolution in Britain

The major factor that enabled Industrial Revolution in Britain was the invention of steam engine by Thomas Newcomer which was improved upon by James Watt. The steam engine was used to run factories, turn drills, drive ships and pull cars along a track. It was a cheaper and more dependable form of energy. The invention of steam engine led to the inventions that were made in the spinning and weaving industries.

Another factor that helped in making Britain the birthplace of the Industrial Revolution was the population. There was a geometric increase in population due to movement of people from rural areas to the cities as a result of improvements in agriculture. Introduction of machinery thus forced many rural dwellers off the land into the cities to work in the factories.

Also, the new factory owners were able to obtain necessary capital to operate their factories through short-term loans from banks with low interest rate. This served as encouragement for more people to establish factories.

There was also the availability of raw materials to feed the factories. These include coal, iron, ore, and wool from the home market, cotton from India and other agricultural and mineral resources from Africa.

In terms of transportation, Britain had some natural advantages. Since Britain is a relatively small country, no place in Britain is more than one hundred miles from the sea. Besides, there were many navigable rivers which made it possible to transport raw materials and finished goods by water to European markets and the whole world.

On the part of the British Government, there were no internal custom duties in Britain for the industries and duties on imported raw materials were very low. All these made manufactured goods to be cheaper and affordable.

Self-Assessment Exercise

How invention of steam engine did aided Industrial Revolution in Europe?

3.3 Impact and Limitations of Industrial Revolution

The revolution has affected all countries and states in the world today. From Great Britain, it has spread to other European countries and beyond; first to France and later to Germany, the United States of America and Japan. The revolution is now transforming other parts of Asia, Africa and Latin America.

The Industrial Revolution has brought changes in tools and weapons, transport and communications, mining, textiles, agriculture, social life to mention but a few.

The major significant achievement of the revolution was the mass production of cheap goods. This has increased the wealth of all Nations and it has improved the standard of living of the people. It has also improved health care system, agriculture, improved means of transport and communication and in short, man has achieved success in building a new society and civilization as a result of industrial revolution.

The Industrial Revolution also brought in the stratification of the British society into two classes. These are the factors owners also known as the capitalist and factory employees or workers who worked to get wages. The capitalist owned the means of production and determine the politics of the time. The workers merely sold their labour in order to survive.

Limitations of Industrial Revolution

One of the major limitations of Industrial Revolution is the exploitation of the lower class or the workers. Conflicts between the workers and the capitalists often lead to strike actions and lockouts.

Other negative consequences of the revolution include pollution of both land, water and air which has led to loss of habitat for both plants and animals.

Drastic population growth following industrialization has contributed to the decline of natural habitats and resources.

Self-Assessment Exercise

What are the major limitations of Industrial Revolution?

What do you consider to be the major impact of Industrial Revolution?

4.0 Conclusion

While the Renaissance could be said to be theoretical in nature, the Industrial Revolution came about as a result of the application of science for useful practical purposes. The revolution started in the 18th century, rolled through the 19th century and exerted wider and greater effect extending year after year by much invention into the 21st century. Although the impact of the revolution will continue for as long as human society exist, but its effects have been of a mixed blessing to mankind.

5.0 Summary

In this unit, we have discussed the meaning of Industrial Revolution and the factors that aided it in Britain. We have also seen the positive and negative impacts of the Revolution. In the next unit, we shall discuss the major achievements of science in the 19th century.

6.0 Self-Assessment Exercise

1. Mention and explain the factors that aided Industrial Revolution in Great Britain.
2. Will you consider Industrial Revolution a blessing or a curse? Support your answer with relevant explanation and examples.

7.0 References/Further Reading

Hoover, R.K. (1984). *The Elements of Social Scientific Thinking.* New York: St Martins.

Harre Rom (1983). *Great Scientific Experiments* England: Oxford University press.

Burhard, J. (1974). *The Civilisation of the Renaissance*. London: Penguin Publishers.

Unit 4 Scientific Developments in the 19th Century

1.0 Introduction

In the last unit, we discussed the Industrial Revolution, factors that aided it and its impact on the society and on the development of modern science and technology. In this unit, we shall talk on major scientific developments in the 19th century.

2.0 Objectives

At the end of this unit, you should be able to:

- enumerate the major scientific achievements of the 19th century
- list some scientists of the 19th century and state what they are credited for.

3.0 Main Content

3.1 Background on Scientific Developments and Major Discoveries in the 19th Century

It should be noted that since the inception of Renaissance in the 16th century there were drastic developments in science and technology all over the world. The scientific revolutions of the 16th and 17th centuries were as a result of Renaissance.

The same thing happens to the Industrial Revolution of the 18th century in Britain. In the same vein, the 19th century appears as a golden age for science. This is because science at that time has spread to everywhere all over the world and so many inquiries and discoveries were made. These discoveries were made in the pure science, disciplines- such as physics, chemistry, biology, mathematics among others.

Mathematics and experiments were combined in physics. Controlled experiments in biology received a new lease of life. Many new universities were established and the old ones were reformed where research and teachings were encouraged. More scientific societies were formed, researches were published in journals and science became professionalized and recognized all over the world.

3.0 Major Discoveries in the Pure Sciences

Discoveries in Physics

Eminent 19th century physicists include Hans Christian Oersted, Michael Faraday, Herman Von Helmholtz and James Clerk Maxwell. These men, in their various ways, contributed to the theory of energy conversion and conservation working within the context of Newtonian theory. However, electromagnetic theory, towards the end of the 19th century, began to question the validity of Newtonian physics. Electric motors and generators were also discovered during this century. Radio and X-Ray waves were also discovered.

Self-Assessment Exercise

Mention two Physicists of the 19th century.

Discoveries in Chemistry

The 19th century chemistry built on the foundations of the chemical substance nomenclature founded by Lavoisier. Also elaborated was Dalton's atomic theory which states that all materials are made up of small indivisible and indestructible particles called atoms. Modern periodic table of element was developed by Dimitri Mendelee, a Russian.

Substances were also classified as elements and compounds. Discoveries were made on the properties of other unknown elements. As chemistry continues to make progress, chemists were able to uncover the true structure of organic substances. It was at this time that chemistry moved closer to unite with physics and achieved an increased power in industrial application. Other 19th century discoveries in chemistry include the world's first synthetic fertilizer. Thomas Edison devised the carbon – granule microphone which greatly improved the recently invented telephone.

Self-Assessment Exercise

State Dalton's atomic theory.

Discoveries in Biology

The study of microorganism became increasingly important in the 19th century. Louis Pasteur discovered that some microorganisms are involved in causing disease. He discovered immunization as a way of preventing disease. He also invented the process of pasteurization, to help prevent the spread of disease through milk and other food. Also in this century, Gregor Mendel, an Australian monk, laid the foundation of genetics-the study of heredity.

Charles Darwin postulated the theory of Evolution by natural selection. Theodore Schwann discovered the cellular structure of living organism.

Self-Assessment Exercise

What is the major achievement in Biology in the 19th century?

Discoveries in Earth Science and Astronomy

Attempt was made to determine the age of the Earth and this raised some controversies among the scientists. In Astronomy, with great improvement on optical instruments, it was possible for important discoveries to be made. In the Solar System, for instance, Asteroid, one of the many small or rocky planetoids that are members of the Solar System was discovered. Some planets were also discovered for example, Neptune was discovered by a German Astronomer Johann Galle.

Self-Assessment Exercise

Who discovered Neptune in the 19th Century?

3.3 Reasons Why Science Excelled in the 19th Century

Three major factors were responsible for the general praise for science in the 19th century.

- The ancient tradition of respect for learning as a contribution to civilization made science to be embraced in the 19th century.
- The fact that science can now be applied to industries which led to Industrial Revolution in Britain was an eye opener for investing in science.
- Conception of natural science as a weapon against religious dogma and popular superstition made science to be more recognized and embraced.

4.0 Conclusion

It can be deduced from the above discussion that with knowledge in all branches of science accumulating rapidly, scientist began to specialize in particular fields in the 19th century. It can then be concluded that from the 19th century onward, research began to uncover principles that unite the universe as a whole.

5.0 Summary

In this unit, we have discovered how and why science excelled in the 19th century. We have also seen how science became popular in various disciplines such as Physics, Chemistry, Biology and Astronomy. We have also discussed some scientists of the 19th century and their major achievements. In the next unit, which is the last unit for this course, we shall look into the major scientific achievements in the 20th and 21st centuries.

6.0 Self-Assessment Exercise

1. Discuss, with the aid of specific examples, the major scientific achievements in Biology, Chemistry, Physics and Astronomy in the 19th century.
2. What are the factors responsible for the acceptance and achievement of science in the 19th century?

7.0 References/Further Reading

Haire Rom (1983). *Great Scientific Experiments.* England: Oxford University press.

Burhard, J. (1974). *The Civilisation of the Renaissance*. London: Penguin Publishers.

Unit 5 Major Scientific Achievements of the 20th and 21st Centuries

1.0 Introduction

In the previous unit, you learnt about the major scientific achievements of the 19th century. You have also seen how science became popular and made discoveries in Biology, Physics, Chemistry and Astronomy. In this unit, we shall talk about the major scientific achievements of the 20th and 21st centuries. We shall also talk about science today.

2.0 Objectives

At the end of this unit, you should be able to:

- list and explain the major scientific achievements of the 20th century
- list and explain the major scientific achievements of the 21st century
- briefly explain nature of science today.

3.0 Main Content

3.1 Major Scientific Achievements of the 20th Century

The 20th century was a continuation of the development in the 19th century. Science became highly professionalized. Investigations were concentrated mainly on laboratory experiments with the use of scientific methods. This formed the basis of modern science.

The 20th century scientists achieved spectacular advances in the fields of genetics, medicine, social science, technology and physics.

Physics

Albert Einstein postulated the theory of Relativity to resolve certain theoretical and experimental anomalies. In Newtonian physics, Einstein also successfully used quanta to explain photoelectric effect, which is the release of electrons when metals are bombarded by light.

In the first half of the 20th century, scientists completely transformed the study of physics. Physics discovered the internal structures of the atom. It was discovered that mass could actually bend space and time. It was also found that the smallest known units of mass and energy behaved as waves and as particles.

Genetics

Gregor Mendel's work in genetics was revisited in the 20th century. Biologists are now convinced that genes are located in chromosomes, the thread-like structure that contains proteins and deoxyribonucleic acid (DNA). It was in this century that James Watson and

Francis Crick established the structured of DNA in 1953. British developmental biologist, Lewis Wolpert, was known for his pioneering work on the development of the embryo.

Medical Science

The major achievement in this field was that a Dutch physician, Christian Eijkman, showed that diseases can are caused not only by microorganism but also by deficiency of certain substances, now called vitamins. Paul Ehrlich introduced the world's first bactericide, a chemical designed to kill specific kinds of bacteria without killing the patient's cells. Sir Alexander Fleming discovered penicillin in 1928.

By the mid-20th century, medical scientists had advanced in preventing, treating, and curing many diseases that have affected human being. Also, the diagnosis of disease has been modernized by the use of new imaging techniques. Improved drugs and development of new tools have made surgical operations easy and possible.

Social Sciences

Social sciences received a very great attention in the 20th century. An Australian physician, Sigmund Freud founded the practice of psychoanalysis, a name applied to a specific method of investigating, unconscious mental process. There were also dramatic discoveries in Anthropology.

Technology

Significant discoveries were made in Communications especially in the discovery of radio signal; television and transistor which is an electronic device used to control or amplify an electrical current. During the 1950s and early 1960s mini computers were developed using transistors.

By 1971, the first microprocessor, computer on a chip, was invented when combined with other specialized chips. Microprocessor became the central arithmetic and logic unit of a computer. During the early 1950s, public interest in space exploration developed. The Soviet Union launched the first Suputnik satellite in 1957. The first man landed on the moon on July 20, 1969.

3.2 Relevance of Science in the 21st Century

From the beginning of this course, you have seen how science has passed through revolutionary changes to the Dark Ages through the Medieval Ages up to the Modern age, which is the 21st century. From the previous units, it can be deduced that the development of science has led to revolutionary changes in thinking and behaviour. The continuous advancement of scientific knowledge greatly influenced our daily lives such that man can hardly survive without science. Science today has greatly influenced the present social, economic and political outlook of every society.

Science today is a continuation of Renaissance. This is because new innovations and discoveries in science are being made today through the use of a well-defined scientific method and the use of the process of science in carrying out investigations.

Modern science seems to carry out investigation on almost all aspect of nature. This is possible with the invention of more sophisticated scientific apparatus and evolution of dedicated men of science.

Another interesting feature of science today is the marriage of mathematics to science. The mathematical relationship between measured quantities, which seemed so exciting when first discovered, became exercises and examples in applied mathematics. Scientists working in industries use these facts to work out processes and give us new products, new varieties of plants and more useful breeds of animals for the benefit of mankind.

It is interesting today to note that the rapid development science has made cannot be over emphasized. No historical events of the past have influenced the world and the lives of men as has the rapid progress of science in the last century. While these material changes are taking place and producing profound effects on the minds of men, the advancement of knowledge is changing our philosophy.

No nation today can attain the first rank position without a most elaborate system where science is applied intensively to all problems of defense, industry, health, agriculture among others.

However, it is unfortunate that today, science which has so much increased the intellectual structure of man is now being used for unwholesome destruction of man and as a weapon of oppression by the super power countries. Modern methods of communication and transportation arising in particular from the scientific effects devoted to aircraft design and radio have made war between nations inevitably involving the whole world.

4.0 Conclusion

It can be concluded as a matter of facts that the rapid development that science and technology are making in the lives of mankind is so tremendous and fascinating that modern man may regret why they were born so soon. It should, however, be noted that the products of science and technology if not misused, are the greatest power that man can use in promoting international peace and understanding.

5.0 Summary

In this unit, you have learnt the scientific achievements of the 20th century as it affect the pure sciences such as physics, chemistry, biology, Earth sciences and astronomy. You have also learnt about the major characteristics of science today. It is hoped that the knowledge you have gained from this material will enable you to trace the development of science from early years till the present century.

6.0 Self-Assessment Exercise

1. Discuss briefly the Nature of Science in the 20th century.
2. Explain the major developments of science today.

7.0 References/Further Reading

Hoover, R.K. (1984). *The Elements of Social Scientific Thinking*. New York.

Burhard, J. (1974). *The Civilisation of the Renaissance.* London: Penguin Publishers.