

Question: 2.

Science



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Question: 2. Describe the scientific advances of the seventeenth and eighteenth centuries and their impact on society Mico University College

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Revolutions Lecturer: Ms. A Jackson Due Date: October 25, 2012 Essay Plan *

The introduction gives some brief information on the scientific revolution and then it zooms in to give information on what took place in the 17th and 18th

century * The body start with the 17th century scientific advances made by

the different natural philosophers/ scientist * The body continues with the

18th century advances * The impacts of these advances on the society

comes next * The conclusion/summary of all that was discussed follows The

scientific revolution was one of many inventors and innovations and one in

which many experiments were being done without the churches permission

and opinion. According to an article posted on www.indepthinfo.com which

states that " The scientific revolution was a period in history beginning in the late 1500s when scientific ideas began to be consciously put to use by

European society. It is generally thought to have begun with a book, On the

Revolution of the Heavenly Spheres by Nicolaus Copernicus in 1543. " This

book clearly defined or contradicts the belief of the Roman Catholic Church

that the earth was at the center of the universe. The knowledge of ideas was

basically spread by an innovation and invention called the printing press by

Johannes Gutenberg. This invention made the spread of scientific ideas easy

rather than when information/documents were being printed one at a time

with the human hand that was very expensive. Another important thing to

note about the scientific revolution was the development of the scientific

method. According to an article posted on www.indepthinfo.com, " The

scientific method was invented by Sir Francis Bacon. This method enabled all

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experiment to use a hypothesis. He criticized the Greek notion that deduction was sufficient to access all information needed. The scientific method began to be applied to all technical areas from astronomy to farming. These advances generally made life easier and understanding broader. " " The revolution in science began with persons such as Copernicus, Paracelsus, Vesalius, and others in the 16th century and reached full flower in the 17th century" (www. infoplease. com). The 17th century produced scientist/natural philosophers such as Isaac newton, René Descartes, Galileo, Francis Bacon, Simon Stevin, Johannes Kepler and many others. The 18th century brought about the likes of Jethro Tull, Eli Whitney, James Watt, Thomas Newcomen and John Kay. Most of these persons were influential in the Industrial Revolution. In this essay I will be elaborating on the scientific advances in the 17th and 18th century by these scientist/natural philosophers and the impact they and the impact they and the advances made on society. It is important to note that the 17th century includes the years from the 1601 to 1700. " During the 17th century major changes in philosophy and science took place. Before the 17th century began, science and scientists were not truly recognized. In fact, at first people like the 17th century genius Isaac Newton were called natural philosophers, since there was no concept of the word scientist for most of the 17th century"(www. inventors. about. com). According to James Watkins on www. hubpages. com " the 17th century saw the rise of those we now call scientists; they called themselves natural philosophers. These men caused a profound change in the culture, outlook, and lives of human beings. " " By the end of the 17th century, a scientific revolution had occurred and science had an established mathematical, mechanical, and empirical body of

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knowledge. " (www.inventors.about.com) The invention began around " 1608 when Hans Lippershey invented the first refracting telescope, followed by 1620 when the earliest human-powered submarine invented by Cornelius Drebbel. Then in 1624 William Oughtred invents a slide rule, 1625 Frenchmen, Jean-Baptiste Denys invents a method for blood transfusion and in 1629 Giovanni Branca invents a steam turbine. In 1636 W. Gascoigne invents the micrometer. 1642 Frenchmen, Blaise Pascal invents an adding machine. 1643 Evangelista Torricelli invents the barometer. 1650 Otto von Guericke invents an air pump. 1656 Christian Huygens invents a pendulum clock. Followed by 1663 when James Gregory invents the first reflecting telescope. 1668 Isaac Newton invents a reflecting telescope. 1670 Dom Pérignon invents Champagne. 1671 Gottfried Wilhelm Leibniz invents a calculating machine. 1674 Anton Van Leeuwenhoek was the first to see and describe bacteria with a microscope. 1675 Christian Huygens patents the pocket watch. 1676 Robert Hooke invents the universal joint. 1679 Denis Papin invents the pressure cooker and in 1698 Englishmen, Thomas Savery invents a steam pump. " (www.inventors.about.com). In addition to the 1600`s, the world book (2005) states that " modern physiology began in the early 1600`s with the work of William Harvey, an English physician. He performed careful experiments and use simple mathematics to show how blood circulates through the human body. In the mid 1600`s an English scientist named Robert Hooke pioneered in use of the microscope to study the fine structures of plants and animals and uncovered a new world of cells. Also in the mid 1600`s, Robert Boyle an Irish scientist, helped to establish the experimental method in chemistry. He introduced many new ways of identifying the chemical composition of substances. " (p. 198) This was just a <https://assignbuster.com/question-2/>

brief synopsis on some of the inventions that took place during the 17th century. Another natural and well known philosopher of this time was Galileo Galilei. His invention began with “ the thermometer, then the telescope which he decided to invent based on a Dutchman`s idea and also his experiments with gravity and inertia. ” According to world history, “ Galileo`s experiment demonstrated that objects of different weights fell at the same time. Galileo proved the Greek philosopher Aristotle`s theory of motion wrong. He did this by dropping a ten-pound weight and a one-pound weight from the top of the Pisa Tower. ” (p 522) Another account of Galileo`s invention was by Fiero, Gloria, K. (2006),. According to Fiero, Gloria, K. (2006), “ Galileo perfected the telescope invented by the Dutch lens-maker that literally revealed new worlds. Through its lens, one could identify the craters of the moon, the rings of Saturn and the moons of Jupiter. ” He further went on to say that “ Galileo`s efforts aroused opposition from the Church and after a long and unpleasant trial he was confined to reside under house arrest where he died nine years later. ” (p 302) Essential to the scientific revolution was the scientific method/empirical method introduced by Francis Bacon. According to Fiero, Gloria, K. (2006), “ essential to the scientific revolution was the advancement of the empirical method- a process of inquiry that depends on direct observation of nature and experimentation. Natural phenomena provide evidence from which one may draw general conclusions, following a process known as inductive reasoning. With this new process, he sought to eliminate the errors in reasoning derived from blind adherence to traditional sources and religious beliefs. ” (p 302) Another natural philosopher of this era was René Descartes. According to James Watkins on [www. hubpages. com](http://www.hubpages.com), “ René Descartes revolutionized <https://assignbuster.com/question-2/>

philosophy and is called 'the father of philosophy'. He also revolutionized mathematics and invented the analytical geometry which is still evident in graphs and charts of today. Rene Descartes stated that the physical world was made up of invisible particles in motion. He believed that all knowledge could be unified through mathematics. Rene Descartes reasoned that God is perfect and infinite. Therefore, the finite, imperfect mind of man could not have dreamed Him up out of thin air. God created man and endowed him with both matter and mind, which are the distinct constituents of reality. " Also according to World Book (2005), " he proposed that mathematics was the model all other sciences should follow. He believed that mathematics yielded absolutely certain conclusions because the mathematics started with simple, self-evident truths and then used logic to move, step by step, to other truths. " (p 198) He unlike Bacon used deductive reasoning and it was said that he died from pneumonia. The next natural philosopher/scientist that made a significant impact in this era was Simon Stevin. According to James Watkins on [www. hubpages. com](http://www.hubpages.com), " He published Table of Interest Rates in 1582, which may seem common to us but to people in his time interest rates were mysterious and understood only by bankers, who kept them secret and guarded them as valuable property. But, the greatest invention of Simon Stevin was the metric system, which introduced the word " decimal" into our language in 1608. Simon Stevin demonstrated in his booklet *The Tenth* how his system would simplify math for merchants and their customers; for bankers and their borrowers. He suggested the decimal system be used for all weights and measures and coinage, as well as divisions of time and degrees of the arc of a circle. Stevin showed the advantage of using decimals for surveying, measuring cloth and wine casks,

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for the work of astronomers and mint masters. He went so far as to recommend soldiers be grouped in 10s, 100s, 1000s, and so on. Simon Stevin wanted to make mathematics the Latin of the scientific community, so that, like Latin, it would overleap vernacular barriers. Simon Stevin put forth a convincing case that his system would universalize measurements worldwide, facilitate trade, and provide a common method of calculation and measurement for science. " Johannes Kepler according to Fiero, Gloria, K. (2006), " provided detailed records of planetary movements that clearly substantiated the heliocentric theory. Kepler`s study of the magnetic forces emitted by the sun also indicate that the planets moved not in circles but in elliptical paths. This new physics described a universe in motion, a universe that was incompatible with the Aristotelian concept of a fixed and unchanging cosmos. " (p 302) According to [www. sunysofolk. com](http://www.sunysofolk.com), " he got his meticulous observation from Tycho Brahe on his death bed and he improvised on this to create the theory involving the elliptical orbits of the planets around the sun. His theory also clarified the difficulties in Copernican theory. " According to James Watkins on [www. hubpages. com](http://www.hubpages.com), " Johannes Kepler believed that the world was created by a Creator who used geometry to establish order and harmony, and that this harmony could be explained through musical terms. He wrote that he revealed God's geometrical plan for the universe. " And last but not least was Isaac Newton, According to [www. infoplease. com](http://www.infoplease.com), " he was the greatest figure of the scientific revolution. He was a fellow of the Royal Society of England. To earlier discoveries in mechanics and astronomy he added many of his own and combined them in a single system for describing the workings of the universe; the system is based on the concept of gravitation and uses a new branch of mathematics,

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the calculus, which he invented for that purpose. Newton also discovered that white light can be separated into a spectrum of colors, and he theorized that light is composed of tiny particles, or corpuscles, whose behavior can be described by the laws of mechanics. " Also according to Perry, M., etal (2007), " Newton invented the reflecting telescope in 1668. Newton published his masterpiece ' Philosophiae Naturalis Principia Mathematica" in 1687. It set out his theory of gravity and his laws of motion. Newton realised that there is a universal force (gravity) that attracts all objects in the universe to each other. His theory of gravity explained the movements of the planets. In 1704 Newton also published a book on light called Opticks. Newton showed that white light is made up of several colours. " The 18th century was a period of remarkable scientific breakthroughs. This began with the scientific advances of the 16th and 17th centuries, when people began to reject unproven theories and superstition in favor of careful observation, and carried out experiments to test ideas. The 18th century held in the two major developments that occurred as a result of the scientific revolution which were: the age of reason/enlightenment and the industrial revolution. " The industrial revolution had advances such as the Machine Drill for planting seeds invented by Jethro Tull, Cotton Gin invented by Eli Whitney, Marine Chronometer, invented by John Harrison, improved Steam Engines invented by James Watt and Thomas Newcomen, Three-color Printing, invented by Jacob Cristoph Le Blon, Flying Shuttle Loom, invented by John Kay driven by water power in most cases. " (www. darwing. com). Scientific advances in the 18th century during the age of enlightenment include, " Natural philosophy, as espoused by Newton and Descartes, began to spread, built upon the idea that mathematics was the new universal language.

Aristotelian thought became replaced by better and more accurate observations, as scientists tried to explain phenomena rather than devise complex theories and try to fit the findings to those. In medicine, the old idea of humors was gone and physicians began to develop ways of looking at the body and physiology in functional ways rather than try to apply theories, aided by the discovery of the microscope. Alchemy had lost most of its mystical and occult symbolism, and the alchemists became chemists and physicists. The influence of astrology declined, due to the twin attack by Newtonian physics and the invention of the telescope, and it became astronomy, taking on a much more pragmatic role in trying to explain the universe. This new approach to knowledge fueled the Industrial Revolution as geologists and engineers began to find coal and metal ores and provide the machines for mass production. " (www. explorable. com) According to world book encyclopedia (2005), " one of the major achievements of the 1700`s was the creation of modern chemistry. Scientists developed techniques necessary for isolating and studying gases in its pure forms. They discovered many chemical substances, including: chlorine hydrogen and carbon dioxide. Oxygen was discovered by the Swedish chemist Carl Scheele in the early 1770`s and independently by the English chemist Joseph Priestley in 1774. By 1777, Antoine Lavoisier of France had discovered the nature of combustion. He also developed the law of the conservation of matter. " The encyclopedia further went on to state that, " major advances in biology also occurred in the 1700`s. a Swedish naturalist and botanist named Carlos Linnaeus devised a systematic method of naming plants and animals in the mid-1700`s. Two French naturalists, Comte de Buffon and Georges Cuvier, made great advances in the study of fossil and of comparative anatomy and <https://assignbuster.com/question-2/>

did much to prepare the way for the scientific investigation of evolution. In 1776, the Scottish economist Adam Smith published "The Wealth of Nations", the earliest formulation of classical economics. The first systematic studies of electricity were conducted during the 1700's. In the late 1700's, two Italian scientists, Luigi Galvani and Alessandro Volta, made some of the first experiments with electric currents. " (p. p 199-200) According to www.daviddarlinginfo.com, " It would be more accurate, in fact, to say that these were not so much inventions as developments and improvements, since each of them was the result of experimental investigations made in the previous century. 1707 — Denis Papin, who had constructed a steam engine some decades earlier, now built a paddle-boat which he tried on the Fulda River, but the paddles were turned by man-power. In 1727, J. H. Schultze observed that silver nitrate, when exposed to the air, turned black due to the action of light. In 1769, Nicolas-Joseph Cugnot, of Lorraine, built a three-wheeled wagon propelled by a steam engine. This vehicle was so crude and so difficult to steer that it seemed to be of no practical use. In the last of the century Richard Trevithick, a Cornishman, designed and built a much more manageable and useful steam-propelled carriage, and so he is often spoken of as having made the first locomotive. In 1775 Jacques Perier for the first time moved a small boat by steam power on the Seine. From 1781-85, James Watt, working in Scotland, made very important improvements in the steam engine; he made use of the expansive property of steam, thereby increasing the efficiency of the engine. Used in industry, the steam engine became the principal factor in the Industrial Revolution of the next century. And by 1790 John Fitch, an American, was operating a commercial steamboat carrying 30 passengers. " In addition to all that was said before the article on www.

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localhistories. com said that, " During the 18th century chemistry made great advances. In 1751 Axel Cronstedt discovered nickel. In 1766 Henry Cavendish isolated hydrogen and studied its properties. (He also calculated the density of the Earth). In 1772 Daniel Rutherford discovered Nitrogen. In 1781 the astronomer William Herschel discovered the planet Uranus. In 1784 John Goodricke discovered variable stars. Meanwhile people began to investigate electricity. In 1746 Petrus van Musschenbroek invented a way of storing electricity called a Leiden Jar. In 1752 Benjamin Franklin proved that lightning is a form of electricity and then in 1800 Alessandro Volta invented the first battery. " The scientific advances of these two centuries impacted the society on way or another. According to Perry, M., etal (2007), " the scientific revolution was decisive in shaping the modern mentality; it shattered the medieval view of the world and replaced it with a wholly different view. " (p. 403). The advances of science impacted political ideas. According to Farah M., Karls A., (2001), " the advances in science led philosophers and other thinkers to believe that if systematic laws governed the workings of nature and the universe, it followed that political, economic and social relationships could also be understood through reasoned analysis. Scientific thought and method profoundly influenced political theory. Political philosophers believed in the idea of natural law, or a universal moral law that, like physical laws, could be understood by applying reason. " They further went on to state that " two English philosophers, Thomas Hobbes and John Locke grappled with their ideas of natural law and government during the 1600`s. Hobbes used the idea of natural law to argue that absolute monarchy was the best form of government. He believed that violence and disorder came naturally to human beings and that without an absolute

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government. He also believes that people should form a social contract, an agreement to give up their freedom and live obediently under a ruler. Locke also based his theories on natural law. Like Hobbes, he believed that government was based on a social contract and that it was necessary to establish order. However, he believed that people in a state of nature are reasonable and moral and have natural rights, or rights belonging to all humans by birth. These included the right to life liberty and property. " (p. p 521, 523) The advances in science not only impacted on political ideas but also on law. According to Farah M., Karls, A., (2001), " applying scientific or reasoned thought to the law helped to end unjust trials. Lawmakers placed less value on hearsay and on confessions made under torture in determining the guilt or innocence of suspected criminals. " The advances of science also affected religion. According to Farah M., Karls, A., (2001), " many Europeans also applied reason to religious belief. Members of the upper and middle classes increasingly turned away from traditional views and Europe became a more secular society. " In addition to the impacts on religion, According to Jackson, Spielvogel, J (2006), " for educated individuals, it established a dichotomy between scientific investigation and religious beliefs. As the scientific beliefs triumphed, it became almost inevitable that religious beliefs would suffer, leading to a growing secularization in European intellectual life-precisely what the church had hoped to combat by opposing Copernicanism. " (p. 467) Although science impacted religious beliefs, political ideas and laws; its major impact was on society. According to Perry M., etal (2007), " the critical factor in causing the historical phenomenon called the scientific revolution was the acceptance and use of the new science by educated elites. Without such acceptance, the science of Galileo, Kepler, Descartes,

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Boyle and Newton would have remained the specialized knowledge of the few- or worse still, a suspect, even heretical approach to nature. " (p. 402) In addition, Jackson, Spielvogel, J (2006), " it has been argued that the literate mercantile and propertied elites of Europe were attracted to the new science because it offered new ways to exploit resources for profit. Some of the early scientists made it easier for these groups to accept the new ideas by showing how they could be applied directly to specific industrial and technological needs. This made science part of the high culture of Europe`s wealthy elites at a time when that culture was being increasingly separated from the popular culture of the lower classes" (p. 466) According to Perry M., etal (2007), " Access to the printing press in Europe was also critical to the acceptance of the new mechanical understanding of nature. Descartes understood this fact when he left France, after the condemnation of Galileo, and published and lived in the Netherlands. Persecution and censorship meant that the new science made far less of an impact in Catholic than in Protestant Europe. " (p. 402) Also the scientific advances helped with the introduction of scientific societies and universities. According to Perry M., etal (2007), " equally important, the science offered the dream of power to both governments and promoters of industry. In the seventeenth century, this dream enticed monarchs and statesmen to give their patronage to scientific academies and projects. The achievements of the new science were quickly institutionalized in academies dominated either by the state, as in France, or by the landed and commercial elite, as in England. " (p. 402) According to an article posted on www.indepthinfo.com, " universities had been around for a long time. The University of Bologna was founded in 1088. These institutions were vital in helping to develop curious minds. Kings also

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saw the value of encouraging scientists by creating scientific societies, where great minds could meet and discuss ideas, research, and new developments. These acted as think tanks that could develop useful ideas. The Royal Society in Great Britain founded in 1662 is probably the most famous. Both Sir Isaac Newton (The father of modern physics and inventor of calculus) and Robert Boyle (the father of modern chemistry) were early members. " It was said that this society became centers for the dissemination of science at a time when many universities were being controlled by clergy. Also Farah M., Karls, A., (2001), states that, " in 1666 Louis XIV of France supported the founding of the French Academy of Science. These societies provided financial support to scientist and published scientific books and journals. " (p. 521) In addition to the support that these societies gave this was how Newton's book was published. According to Perry M., etal (2007), " the new mechanical learning- not widely communicated by Newton`s Principia, which was far too technical for most people, but rather passed on as mechanical information in handbooks and lectures- began to be applied mechanics that improved the steam engine and utilized it in coal mining and water engineering stemmed from Newtonian lectures and books, which proliferated in Britain during the 1700`s. " also " elites and mildly prosperous families brought microscopes and globes into their homes. Owning these objects caused the status to rise, even if no-one in the family became an engineer or doctor. " (p. 402) According to an article posted on www.indepthinfo.com, " the Scientific Revolution would make Europeans the most powerful peoples in the world. It made individuals much more productive by creating machines that could do drudgerous labor and utilize multiple sources of power from wind and water

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to coal and steam. More people could be fed, clothed, and housed with less manpower. More wealth could be created in less time for more people. Innovations in military machines and tactics made Europeans a force to be reckoned with. New methods of trade and commerce made trade with other nations more advantageous, spreading even more knowledge. Scientists found that the rewards of scientific research were great on an individual, national, and world-wide level. The Scientific Revolution would spawn the Industrial Revolution. " According to Spielvogel J., (1999), " the scientific revolution was a major turning point in modern civilization, in the scientific revolution; the Western worldview overthrew the medieval worldview and arrived at a new conception of the universe. " (p. 73) During these two centuries many natural philosophers/scientist became known for their famous invention and innovations. People such as Galileo, Stevin, Drebbel, Bacon, Descartes, Brahe, Kepler, Newton and many others of the seventeenth century and Tull, Whitney, Newcomen, Watt, Harrison and many others. their inventions bringing in different ideas such as the scientific method, oxygen, microscopes, telescopes, different views on the universe and many other inventions. The 18th century also brought in things like the steam engine, flying shuttle, machines that were useful in the industrial revolution as well as many advances in medicine and mathematics. It also brought about the age of enlightenment/reason. It also had many different scientific societies and academies springing up all over Europe. The scientific revolution also ultimately weakened traditional Christianity as god`s role in a mechanical universe was not clear. It influenced political ideas on government as seen by Hobbes and Locke as well as law. It revolutionized Europe with using natural law to reason out things. It also changed the

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economic status of Europe during that period. Reference Page Books
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