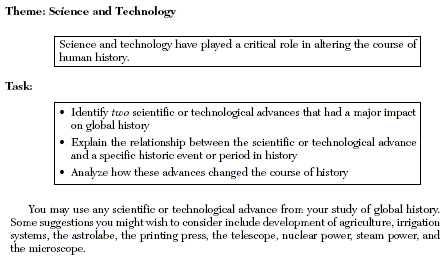
**Essay Five: Technological Innovation**

[](http://www.greececsd.org/files/filesystem/GHG_Thematic_Essays/GHG_Thematic_08.00.pdf)

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| **Introduction: Throughout the course of History Technological and scientific innovation have played important role in transforming human History. The Irrigation system invented by the Mesopotamians (Sumerians) resulted in the rise of civilization, printing press invented in Europe during the renaissance led to spread of knowledge, and the invention of spinning Jenny led the industrial revolution.** |

**Technological Innovation One: Irrigation system by the Sumerians**

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| **Historical background of the Innovation** | **Effects of the Irrigation system** |
| * The Mesopotamians or the Sumerians invented Irrigation system to adapt to their geography. * The Tigris and Euphrates rivers influenced the development of Ancient Mesopotamia. This area is also known as the Fertile Crescent, because this land had rich soil and abundant crops, it was able to sustain an early civilization. * The Tigris and Euphrates rivers flooded Mesopotamia at least once a year. As the floodwater receded, it left a thick bed of mud called silt. Farmers planted grain in this rich, new soil and irrigated the fields with river water. The results were large quantities of wheat and barley at harvest time. The surpluses from their harvests allowed villages to grow. * One problem Mesopotamians or Sumerians faced was drought and extreme flooding. * Over a long period of time, the people of Mesopotamia also known as Sumerians created solutions to deal with these problems.   + To provide water, they dug irrigation ditches that carried river water to their fields and allowed them to produce a surplus of crops.   + For defense, they built city walls with mud bricks.   + Sumerians traded their grain, cloth, and crafted tools with the peoples of the mountains and the desert. In exchange, they received raw materials such as stone, wood, and metal. * These activities required organization, cooperation, and leadership. Leaders were needed to plan the projects and supervise the digging. These projects also created a need for laws to settle disputes over how land and water would be distributed. These leaders and laws were the beginning of organized government, religion —and eventually of civilization. | * The invention of the irrigation in Mesopotamia affected the way they viewed the world. The unpredictable flooding and little rain led to frequent famine which convinced them to believe supernatural forces controlled the world. Therefore, idea of religion was formed. In Mesopotamia people looked to religion to answer questions about life. They believed that powerful Gods and Goddesses controlled all aspects of human life. They believed in many gods and their religion was polytheistic. The most prominent building in a Sumerian city was the temple dedicated to the chief god or goddess of the city. This temple was often built atop a massive stepped tower called a ziggurat. * With religion came the beginning of what we call social classes and government. Kings, landholders, and some priests made up the highest level in Sumerian society. Wealthy merchants ranked next. The vast majority of ordinary Sumerian people worked with their hands in fields and workshops. At the lowest level of Sumerian society were the slaves who worked as peasants. Social class affected the lives of both men and women. Sumerian women could work as merchants, farmers, or artisans. They could hold property in their own names. Women could also join the priesthood. Some upper-class women did learn to read and write, though Sumer’s written records mention few female scribes. * The invention of irrigation system further advanced the Mesopotamians society. They invented the wheel, the sail, and the plow and that they were among the first to use bronze. They were also the first to discover writing system named the cuneiform, mathematics, and geometry in order to erect city walls and buildings, plan irrigation systems, and survey flooded fields, Sumerians needed arithmetic and geometry. As a result, architectural innovations such as Arches, columns, ramps, and the pyramid shaped the design of the ziggurat and permanently influenced Mesopotamian civilization. |

**Technological Innovation Two: Invention of Factory System**

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| **Historical Background of the Innovation** | **Effects of the Innovation** |
| * **Factory system** is a system of [manufacturing](http://www.britannica.com/EBchecked/topic/849534/manufacturing) that began in the 18th century and is based on the concentration of industry into specialized—and often large—establishments. The system arose in the course of the [Industrial Revolution](http://www.britannica.com/EBchecked/topic/287086/Industrial-Revolution). * The factory system replaced the [domestic system](http://www.britannica.com/EBchecked/topic/168578/domestic-system), in which individual workers used [hand tools](http://www.britannica.com/EBchecked/topic/254115/hand-tool) or simple machinery to fabricate goods in their own homes or in workshops attached to their homes. * The use of [waterpower](http://www.britannica.com/EBchecked/topic/637505/waterpower) and then the [steam engine](http://www.britannica.com/EBchecked/topic/564472/steam-engine) to mechanize processes such as cloth [weaving](http://www.britannica.com/EBchecked/topic/638448/weaving) in [England](http://www.britannica.com/EBchecked/topic/700965/England) in the second half of the 18th century marked the beginning of the factory system. * This system was enhanced by the introduction of interchangeable parts in the manufacture of [muskets](http://www.britannica.com/EBchecked/topic/399353/musket) and, subsequently, other types of goods. Prior to this, each part of a musket (or anything else assembled from multiple components) had been individually shaped by a workman to fit with the other parts. * In the new system, the musket parts were machined to such precise specifications that a part of any musket could be replaced by the same part from any other musket of the same design. This advance signaled the onset of [mass production](http://www.britannica.com/EBchecked/topic/368270/mass-production), in which standardized parts could be assembled by relatively unskilled workmen into complete finished products. * Under Factory system, work was organized to utilize power-driven machinery and produce goods on a large scale, had important social consequences. For example workers who had been independent craftsmen who owned their own tools and small businesses at home, and designated their own working hours could not compete with factories who manufactured goods in the factories where employer owned the tools and raw materials and set the hours and other conditions under which the workers labored. * The location of work also changed. Whereas many workers had inhabited rural areas under the domestic system, the factory system concentrated workers in cities and towns, because the new factories had to be located near waterpower and transportation (alongside waterways, roads, or railways). | The factory system gave birth of the industrial revolution and changed material production, wealth, labor patterns and population distribution. Although many rural areas remained farming communities during this time, the lives of people in cities changed drastically. The new industrial labor opportunities caused a population shift from the countryside to the cities. The new factory work led to a need for a strict system of factory discipline.   * The growth of cities led to horrible living conditions. The wealthy fared far better than the industrial workers because they could afford to live in the suburbs on the outskirts of the city. However, for most of the factory workers, cities were dirty, crowded places where epidemics frequently broke out. Overcrowded row homes created to house the workers and their families contributed to these conditions. Government reports of the time indicated people sleeping as many as six to one bed. The sanitary conditions in early industrial cities were filthy as well. Since the municipal governments did not concern themselves with cleanliness at the time, the cities did not have proper waste disposal systems, and people threw trash and sewage directly into the streets. The burning coal of the industrial factories coated cities in a layer of grime and polluted the air, and water supplies were polluted by waste. * The early factories were extremely unsafe. Imagine going to work without safety regulations and with no protections in place. If you were injured, you were not compensated. If you could not work anymore, you received nothing. It was a very real possibility that a person could become homeless from being out of work. * Also, imagine that there were no laws about how long you could work or how many consecutive days you could labor without time off. A person could work a shift of 12-16 hours. This same person could be asked to work this grueling shift six days per week. Many of these factories were also dusty, unventilated and sweltering hot in the summer. * Conditions in the coal mines were hazardous as well. Usually, men hunched in cramped tunnels that were only about three or four feet high, dug coal and placed it in carts. Then, small children or women would push the carts to the surface. Coal miners were faced with damp, cramped conditions, along with the danger of cave-ins and toxic gas. Many children who worked in the mines had long lasting health effects, such as lung disease and stunted growth. * The deplorable working conditions in early Industrial Europe led to a quest for change. Workers were among the earliest groups to band together in an effort to gain rights. Skilled workers of many crafts began to form trade unions. These organizations attempted to limit the number of people who could enter into their trade and negotiate for benefits from employers. These early trade unions were only concerned with better conditions for their own particular trade. Some unions organized strikes to achieve their goals. Ultimately, these early industrial unions paved the way for the labor unions more familiar today. |

**Technological Innovation Three: Printing Press**

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| **Historical Background of the Printing Press** | **Effects of the Printing press** |
| * There are many events in human history that are of great importance for the way we live today. **Johannes Gutenberg's** invention of the **'moveable type'** printing press is one of the most important. It is possible that without it there would have been no Renaissance, no Industrial Revolution, no Technological Revolution and no Democracy. In other words - no modern world! * Before the invention of printing press in Europe, most books were still copied out by hand in what was a painstaking and time-consuming labor. For this reason, very few books were made and those that were produced were extremely valuable objects that belonged either to the church or other powerful institutions. * Most people couldn't read - what would have been the point of learning? - and knowledge was largely limited to what a person saw, heard, and experienced in their own lifetime and in the church. .Gutenberg's invention of the printing press meant that books could be produced in greater numbers and more quickly and cheaply than ever before. This led to a huge social and Cultural Revolution. It was the internet of its day. | * The printing press had dramatic effects on European civilization.  Its immediate effect was that it spread information quickly and accurately.  This helped create a wider literate reading public.  However, its importance lay not just in how it spread information and opinions, but also in what sorts of information and opinions it was spreading. * First of all, more and more books of a secular ( nor religious and scientific) nature were printed, with especially profound results in science.  Scientists working on the same problem in different parts of Europe especially benefited, since they could print the results of their work and share it accurately with a large number of other scientists. * By the 1600's, this process would lead to the Scientific Revolution of the Enlightenment, which would radically alter how Europeans viewed the world and universe. * The Scientific Revolution began during the Renaissance. It rejected traditional authority and church teachings in favor of a new scientific method. Scientists observed nature, made hypotheses (educated guesses), and tested their hypotheses through experiments. Scientists during this time challenged the authority of the church. For example, Galileo and Copernicus argued that the sun was the center of the universe as oppose to the Catholic Church that argued that the earth is in the center of the universe. Sir Isaac Newton developed a theory to explain both the movements of planets and how objects fall on earth (the law of gravity). * The enlightenment ideas were also spread by the printing press. The Enlightenment or the Age of Reason refers to an important movement in Europe during the 18th century. Leading Enlightenment thinkers believed that by applying reason and scientific laws, people could better understand both nature and society. They also hoped to apply these principles to improve society. Enlightenment thinkers questioned the divine right of kings and the power of the Catholic Church. For example, Voltaire, an Enlightenment philosopher, encouraged religious toleration and intellectual freedom. Montesquieu argued for separation of powers in government as a check against tyranny. John Locke argued that all people should have natural rights and choose their government. An abusive government must be overthrown. * The printing press also allowed the protestant reformation. In 1517, Martin Luther posted his ninety-five theses calling for reforms in the Roman Catholic Church. Luther challenged the Pope’s right to sell indulgences or pardons from punishment for committing a sin, allowing a buyer to enter Heaven. Luther believed that only through personal faith alone could a person be saved and go to Heaven. Luther protested corruption in the Roman Catholic Church. As the Roman Catholic Church lost power in Europe. |