Two questions essay examples

Science, Mathematics

The epigraph mentioned in the question has been taken from the journal The Medieval Church Encounters the Classical Tradition. This blame on medieval ages is most often credited to the Christian Churches for throwing away the minute sparks of science and other creative activities.

However, the conformation of the scholars to this fact has proved to be a major hindrance to the real understanding of the medieval ages. It cannot be denied that the middle ages were the times of political and social turmoil and saw a steep decline in the fields of learning and literacy. But, it is the failure to acknowledge the advances made in the field of science, philosophy, mathematics, medicine, architecture, among many others, which ceases to do the justice to the complex learning structure and the hierarchy of the medieval times. On the contrary, the small beginnings made in this period grew to bigger advancements in the future to come. This period saw the emergence of important scientific developments that laid the foundation of the modern science and technology. The scholars were eager to understand the ever – expanding world in which they reside and grow and this was done with all the scientific freedom, and with minimum or no interference from the church. The focus started to move away from the monopoly of the Church and the scholars, and various other things gained value (Ede and Cormack, p. 91 – 92).

With a revived learning, entered the trade and exchange of ideas among various cultures. Europeans carefully studied the translated Greek texts, specially, the works of Aristotle. The advancements in the field of science that followed were rooted heavily in the logic of Aristotle’s works. By the fourteenth century, the scholars completely disassociated themselves from

the Church and began to impart the knowledge, which they had gained, to the children. They made education accessible to all, which revived the common interest in the ancient texts. With the growing education, grew the number of scholars who wanted to question the current system and bring in the new systems of study. Their main intention was to rediscover the ancient Greek texts. However, with time the use of conceptual logic increased in their learning, and they ended up completely abandoning the mystical Greek texts. They moved away from theology as the basis of the nature's study. Although Aristotelian works ended up becoming completely obsolete with time, they did provide an all round study of the nature of the world, which included numerous subjects like politics, logic, philosophy, theology, and metaphysics. It held its ground until the stronger proofs for the otherwise were found. Hence, it would not be wrong to conclude that the studies that followed in the modern times were the refinements of the works of Aristotle in the middle ages.

This period also saw many new scientific inventions, out of which the most significant one was that of the movable type printing press by Johannes Gutenberg. By this time, Europe has also understood and mastered the art of production of paper, which furthered the popularity of the printing press. His work gained attention, because the characters used in the printing were the attempted replicas of the characters of the written script. The invention of a printing press was revolution of the time, because it brought in the culture of maintaining records in the form of books. The books began to be used by many scholars in order to preserve their knowledge, leading to an exploding demand. With increased books in the market, the education reached out to

the masses and literacy began to spread among the masses (Ede and Cormack, p. 94-96).

With improved literacy rates, there were many scholars who began translating the ancient works of other cultures to improve their learning. Arabs mastered the study of mathematics, with Islamic centers becoming the centers of mathematical scholarship. They began their learning by translating and studying the works of other cultures. One such translated text was an Indian script, named Siddhanta, which introduced the concept of zero for the first time. This introduction became the stepping-stone for various advancements in the field of mathematics. From this concept, Arab mathematicians took a step further towards developing the concepts of decimal places, algebra, and calculus. It became the language of philosophy, when the scholars began to believe that the world is best expressed in the form of numbers. When Aristotle’s views of astronomy began to be challenged and new theories were brought in by the philosophers to follow the suit, they insisted on using mathematical and measurement proofs for adding more weight to their theories.

While Islam’s contributions to modern science and mathematics were immense, the science and mathematics of the Islamic times saw a steep decline in the beginning of twelfth century. The change in the theological attitude of the Muslims can be attributed as the prime reason for the decline. While in the Golden Age of Islam, the scholars were willing to translate and assimilate the Greek philosophy within Islam, the later schools of Islamic thought believed that this was against the teachings of the Prophet.

With the advancement in mathematics came the new developments in the

fields of astronomy. The scientists now began to challenge the widely accepted cosmic model of Aristotle. It began with Copernicus stating that the earth was a heavenly object set in motion, and not stationary. This changed the whole idea of the universe and brought us one step closer to the picture of universe we have today. The errors in the Copernican theory were worked upon and corrected by the philosophers to follow. However, it was Sir Isaac Newton, who used mathematical models to explain the elliptical shape of the orbits, where the planets revolve around the sun, brought in the stamp of acceptance to the model.

At the same time, the scientific instruments were also being developed. These instruments opened up the gates to the new dimensions of the world, like navigation, timekeeping, surveying, etc. This phenomenon came to be known as Mechanical Philosophy. The tracing back of mechanical philosophy takes us to the ancient theories of atomism. The thinkers in the medieval times had asserted that the world was made up of small simple particles, which combine in different ways under different circumstances to create different forms of matter.

The increased knowledge and a bundle of hypothesis gave birth to a new phenomenon of experimentation. The first record of any scientific experiment in the history is of William Harvey’s experiments on a bandaged arm in the field of human anatomy, which can be found in his published works. He was also the first to demonstrate the functioning of a human heart and the circulation of the blood within the body (Thomas, p. 101). In this work, he demonstrated the pumping of the blood in the body of the animals and humans and the role of the heart. This theory of blood circulation paved

the way for the further advances in the medical field in the modern ages. With enough experimentation and data proofs recorded, he corrected on the heart function theory previously given by Galen and Vesalius, and better explained the human anatomy than the earlier theories.

Owing to all these factors of increased trade of goods and ideas among various nations, The spreading of literacy among the masses, easily available knowledge in the form of books and other published material, the middle ages also saw a rise of the first University. In these universities, the largely pursued subjects consisted of theology, arts, mathematics, literature, philosophy, science and medicine.

It is a commonly believed myth that there was no science during this period. On the contrary, the foundations of the modern science saw their seeds being sown in the medieval ages. Our system of writing, architecture, medicine, engineering and civil works, governance systems, democracy, legal systems, among many others have their roots in the medieval times. The advancements, which the Middle Ages witnessed, were the baby steps for the modern technological advancements to follow.

2. Cosmology is the study of the origin and evolution of the universe, and all the processes involved in it. History has seen numerous ancient cultures develop mythology based on cosmos. However, it was the period of ancient Greeks when the cosmology is believed to make a shift from being mythical to being scientific, leaving its recourse to the divine beings. It was only in sixteenth century when the abstract ideas began to take a shape to form a concrete study of cosmic science. Copernicus, by proposing the idea of a sun-centered universe laid the foundation of the way we understand the

universe today in sixteenth century. Prior to that, the study of science, nature and universe had been dominated by the metaphysical theories of Aristotle and Ptolemy.

During this time, the earth was believed to be perfectly round and the center of the universe. Nested around the earth were the crystal spheres, revolving around the earth every day. These spheres were also believed to be revolving around each other, creating a phenomenon of vibrations called the music of the spheres. The innermost sphere was the carrier of the moon, followed by the Mercury, the Venus and the Sun. Beyond the Sun laid Mars, Jupiter and Saturn. This model was a direct reflection of the culture of the medieval times in many ways, such as the hierarchy of the Church and the feudal systems.

However, from sixteenth century onwards, astronomy found a new direction with the appearance of Copernicus in the scene because Copernicus was a master in various fields of study. He is the astronomer, who is credited for the foundation of the field of modern astronomy. In his work published On the Revolutions of Heavenly Spheres, he introduced a huge transformation in the system developed by Ptolemy. Ptolemy believed the earth to be a stationary object lying in the center of the universe, around that the other planets and the sun revolved. Copernicus contradicted the Ptolemaic system by presenting a heliocentric model wherein the earth, along with other planets known at the time, revolved around the sun (Ede and Cormack, p. 135). However, his belief that God created the world in the perfect order made him assume the planets to be perfectly circular. His theory also hypothesized that other planets, along with revolving around the Sun,

revolved around the earth as well, inhibiting the motion in the form of epicycles (Heldon, 1995).

However, Copernicus was a firm believer in the Catholic Church, who realized that his theory was running against the earth-centered cosmology believed by the Christians. Hence, he did not publish his theories until his deathbed. Because of this, in spite of being revolutionary, his ideas could not reach the right audience and hence, failed to bring about any revolution, until taken up Galileo and Kepler several years later.

Tycho Brahe, a court astronomer to Holy Roman Emperor, was the next to follow the suit and make a significantly recognized contribution to the field of astronomy. He developed various instruments to improve the accuracy of the astronomical observations (Ede and Cormack, 2012). Among many others, his major achievements included the witnessing the motion of a comet. His acute and fine observations of the positions of the planets paved the way for his student, Johannes Kepler’s redesigning and reconceptualization of the planets to be ellipses, rather than perfect circles, as drawn by Copernicus (Heldon, 1995). His observation of a comet was a great step forward for the scientific revolution and advancement.

In spite of all this, Tycho greatly adhered to the Ptolemaic explanation of the universe. He was apprehensive and had his own reservations about the Copenican model. He believed that the earth was a heavy body, and thus could not be in continuous motion. Assuming it to be stationary, he supposed that it must be the center of the space. Moreover, the advantages and the strengths of the heliocentric model of Copernicus did not become relevant until Kepler re-conceptualized the whole system in terms of the elliptical

revolutions, which allowed for the greater accuracy in predicting the positions of the planets in the universe.

Johannes Kepler was the one responsible for the realization and fulfillment of the Copernican model of the universe; however his achievements reached far beyond. He took the central feature of a stationary sun and revolving planets, and revisited the rest of the cosmic theory. He completely reworked the concept of universe, most of which is still accepted today (Ede and Cormack, 2012). Kepler, being a student of Tycho, owes a great deal of his work to him. The investigations and Tycho's unpublished notes of his studies laid the foundation of his widely accepted work on the planetary motion. Based on this fundamental data, he was able to boldly conclude that the earth, along with all the other planets known at the time, revolves around the sun, which is stationary, in an elliptical path, and not in perfect circles. Kepler's final overthrow to the Aristotelian metaphysics came in the form of celestial physics, where he aimed to explain the causes of the motion of celestial bodies. Aristotle believed that an object tends to move towards its natural resting place. Kepler countered this by introducing the concept of physical force as the cause of motion. He asserted that any object is without any force of its own, internal or external and that it is set in motion only from external forces. This theory paved the way for Newton's groundbreaking formulation of the law of gravity, which later came to be known as the universal force in nature (Heldon, 1995).

Despite all this advancement in the research for the model, the philosophers were apprehensive in accepting the theory. It went on to gain acceptance only after Newton introduced a mathematical model of the planetary motions

explaining the heavenly and the earthly movements within a single physical sun-centered system. Newton’s works on the mathematical representation of the elliptical orbits were considered to be a big breakthrough for the mathematical astronomy. It was in this work where for the first time, the concept of universal gravitation was introduced, and since then the world of astronomy and physics took a new turn. He used gravity to explain the motion of the whole universe, by using the mathematical models of the Galilean physics and the planetary models of Copernicus and Kepler (Ede and Cormack, 2012).

The medieval cosmos was finite, centered on a stationary earth. It was Galileo’s observations with the telescope, which provided the first convincing evidence of the wrongness of the Ptolemy and Aristotle’s model of the universe. The studies of Copernicus, Galileo, Tycho, Kepler and Newton toppled the whole hierarchy of the perceived universe in the medieval times, which always assumed that the human hierarchies are a representation of God’s cosmic design. Newtonian theory almost accurately predicted the planetary motions, which was asserted with the upcoming modern instruments that could measure the things in the space and prove the assertions, assumptions and the hypothesis made by the scientists.

Bibliography

Thomas, Charles C. Exercitatio Anatomica De Motu Cordis Et Sanguinis In Animalibus By William Harvey. I ed. United States, 1928. 100-103.

Ede, Andrew and Lesley B. Cormack. A History of Science in Society: From Philosophy to Unity. Toronto: Toronto University Press, 2012.

Heldon, Al Van. " Copernican System". The Galileo Project. 1995. Retrieved

from http://galileo. rice. edu/sci/theories/copernican_system. html

Heldon, Al Van. " Tycho Brahe (1546-1601)". The Galileo Project. 1995. Retrieved from http://galileo. rice. edu/sci/brahe. html

Heldon, Al Van. " Johannes Kepler (1571-1630)". The Galileo Project. 1995. Retrieved from http://galileo. rice. edu/sci/kepler. html