1. Renaissance in Europe and Development of Science

As the 'Mediaeval Period' in Europe was nearing its end, it saw advances in various fields of life. Europeans discovered unknown lands and there were movements of religious reformation. The foundations of the 'Modern Period' were laid in this period. Hence, this period is called 'Renaissance', which means rebirth.

In this period, the ancient Greek and Roman traditions of art, architecture, philosophy, etc. were revived. However, renaissance is not only the revival of ancient traditions. Renaissance also saw overall development in many fields and it proved to be the beginning of a new era.

1.1 European Crusades and its far-reaching consequences

Jerusalem and Bethlehem are the two cities, which are considered holy by the Jews, Christians and Muslims. These cities were under Islamic rule in the eleventh century. Several wars were fought by the Christians in Europe in the eleventh century to regain hold on these cities. These wars are known as 'Crusades'.

Supporting the Crusades : The common people in Europe were highly inspired by the idea of being part of the wars, which were fought for the cause of religion. Pope, the highest authority of the Catholic Church had announced that those who fought in a crusade would be forgiven of their sins and would immediately go to heaven. This led to spontaneous participation by common people in the crusades. Besides, the social, political circumstances in Europe were also among the causes for the beginning of these wars.

Roman emperors were trying to bring the regions of Syria and Asia Minor under their rule. Rich merchants in Venice and Genova, the two trading centres in Italy wanted to establish their trade in the Central Asian market places. Thus, the crusades were supported by the rulers and rich traders in their own interest.

The first crusade started in 1096 C.E., While giving a call for the second crusade, Pope Eugenius III sought help from the French King Louis VII and the German King Conrad III. Ultimately the crusaders were defeated by the Turks. In 1187 C.E. Saladin, the Sultan of Egypt defeated the crusaders by conquering Jerusalem. However, the crusades did not stop after that. In the course of time, totally nine crusades were launched. Despite the crusades, Jerusalem and the region around it remained under the control of Islamic rule.

Causes of the failure of the Crusaders : The failure of the Christian Crusaders can be attributed to the attitude of the Pope and the European rulers, who initiated the crusades mainly for their own vested interests. Besides, the other factors like common people losing faith, rift between the Pope and the European kings, dispute between the Pope and the German Emperor, non co-operation by the Emperor of Byzantium also caused the failure of crusades.

Consequences of the Crusades : Some historians feel that crusades led to the end of feudalism in Europe. People began to lose faith in Pope. The contact with the regions in Central Asia led to the increased trade and the new avenues were opened for the cities in Italy and Germany. It saw the rise of a new class of traders.

The European warfare went through many changes. European nations acquired expertise in building forts, managing the forts as military outposts, building bridges for moving the army from one place to another, destruction of the enemy's routes, etc. European kings levied new taxes which were directly added to the royal treasury.

Europeans were introduced to newer types of plants, fruits, perfumes, different styles of clothing, sugar, silk and cotton, textiles, spices, medicinal herbs and so on. During the prolonged times of crusades Europeans came into contact with the Arabs and got introduced to several new subjects. Europeans adopted many Arabic words used in alchemy, music and commerce.

1.2 Renaissance Period in Europe

The European renaissance began in the 14th century C.E. and reached its zenith in the 15th-16th century C.E. These three centuries proved to be foundational stage of a culture based on rationalism and science.

This period gave a new direction to human intellect, genius and way of life. People got more interested in unfolding the mysteries of the universe by adopting scientific approach. Many people began to write poetry, drama and fiction, a field that had remained untouched so far. Novel experiments were conducted in the field of science. In the pre-renaissance times the thought about the existence of the universe revolved around the concept of 'God'. Now, humans formed the centre of this thought. This way of thinking is called 'Humanism'.

The European rulers of the renaissance period encouraged adventurous seafarers to explore distant lands. They brought back information about the plants, fruits, flowers, trees, unknown species of animals, weaponry etc., from the distant lands they visited. In 1543 C.E. Nicolaus Copernicus told the world that the centre of our planetary system is the 'Sun' and not the 'Earth'. In 1609 Galileo prepared a more sophisticated telescope, which enabled further research in the field of astronomy. The theories propounded by Copernicus and Kepler could be supported by the empirical observations made possible by Galileo's telescope. This facilitated research in the field of physical sciences.

Galileo's Telescope

The inventions of gunpowder and printing respectively brought about fundamental changes in the techniques of warfare and dissemination of knowledge. The first printing press in Germany was started in 1440 by Johannes Gutenberg. The first printing press in Italy started in 1451. The invention of printing has been an outstanding gift of the renaissance period. New avenues opened to extend varied information and knowledge to common people. A number of modern universities came into existence in Europe in the 18th century. The syllabi in these universities included subjects like : the Epics - 'Illiad' and 'Odyssey' written by Homer, Greek drama, speeches of great orators, literature, painting, sculpture, ethics,

political science and history, etc. As a result of this people began to think freely.

It so happened...!

Galileo (1564-1642 C.E.) : Galileo established the rational method of empirical observation and forming a theory on the basis of those observations. Hence, Galileo is known as the 'Father of the Empirical Science'. He proved that the speed of objects of different weight falling down is equal by carrying out actual demonstrations from the heights of the tower of Pisa in Italy. Thus, Aristotle's view that heavy objects will fall down faster than lighter objects, was disproved. With Galileo's modified telescope he could trigger a revolution. He was successful in enhancing the power of his telescope many times more than the existing telescopes. It benefitted the seafarers to a great extent. It became easier for them to locate lands while sailing in the oceans. With his telescope he could discover four major satellites of the planet Jupiter. Galileo also invalidated with evidence, Aristotle's opinion that the Moon is self-luminous and has smooth surface. He proved that there are mountains and valleys on the moon and the light emitted from it is actually the reflected rays of the sun. He had also calculated the time the sun takes to complete one cycle around itself, as 27 days. It is said that Galileo was the first scientist to observe the spots on the sun.

At this point, it may be noted that Varahmihir, an Indian scholar, is said to have mentioned the sunspots (*Tamas Kilakas*) in his treatise 'Brihatsamhita', (circa 6th century C.E.).

Try to do this.

Collect information about how the early European universities worked.

Catholic Church : In the pre-renaissance period the 'Catholic Church' not only controlled the religious life of people but also controlled the individual life of people. It exploited of common people by issuing mandates for payments of fees. It also put restrictions on free thinking and its circulation. Anyone who dared to interpret Bible differently from the conventional interpretation propagated by the Catholic Church, was sentenced to death. The humanist philosophy of the renaissance was instrumental in making a ground for resistance against the overpowering Catholic Church.

Modern Science : Scientists began their search for reality by strictly using the scientific method, which emphasises on empirical experience. This very approach led to the onset of modern age of science. Learning mathematics, science and arts gained importance during renaissance, for example the works of Leonardo da Vinci.

Arts : During renaissance the scientific approach influenced the field of arts as well. In this period alchemy began to separate from its mystical roots and later transformed into the scientific discipline of 'Chemistry'. The advancement of chemistry expanded the knowledge of the sources of metals and elements. A significant change was introduced in the field of paintings. Oil paints and also boards painted by using oil paints were made. The scientific method of observation of nature made it possible to paint the natural scenes with minute details. With the same method, detailed diagrams of the human body and its internal organs could be drawn. The work of Leonardo da

Vinci and Michelangelo is quite significant in this regard.

1.3 Development of Science

It is said that the European natural scientists of the 17th century laid the foundations of modern science. The scientists of the 17th century put emphasis on the following things : to prove that scientific principles established by empirical experiments remain true despite time and space; to convert the emergent scientific rules into scientific formulae; to create a new scientific parlance and so on. These efforts helped the progress of science.

Institutions devoted to the cause of science : In Europe some organisations were established for research in science. These organisations published scientific journals, which included research articles written by scientists, correspondence between them, as also clearing doubts and exchanging thoughts. Among them 'Academy of the Lynx Eyed' or 'Lincean Academy' in Rome, 'Academy for experiment' in Florence, 'Royal Society for Improving Natural Knowledge' in London, 'French Academy of Sciences' in France were of prime importance.

1.4 Scientific inventions in various fields

Various instruments like compass, telescope, thermometer and barometer were invented in this period. Microscopes invented in this period made it easier to observe various types of micro-organisms. Robert Boyle, an alchemist is known for discovering that the absolute pressure and the volume of a gas are inversely proportional. This created interest in further research on gases like hydrogen, nitrogen and oxygen. The research in physics was more focused on various aspects of 'heat' and 'sound'. In zoology a methodology known as 'Taxonomy' was developed to classify animals. The research by Benjamin Franklin was very important as it threw light on various aspects of lightening and electricity. He coined many technical terms, which are used in the electrical science even today.

Textile Industry : Weaving of woollen cloth was a very old cottage industry in England. In the year 1738 John Kay made and patented 'flying shuttle'. It increased the speed of weaving. The next advanced stage was 'spinning jenny', a spinning frame with multiple spindles, made by James Hargreaves in England. One could work eight spindles simultaneously on this frame and it reduced the amount of labour and time of production. In the year 1769 Richard Arkwright made a more advanced spinning frame, which mechanised the process of spinning. It could produce yarns much faster with better twisting and strength. Samuel Crompton invented a more modified spinning machine in 1779 C.E., named as 'spinning mule'. With this machine the speed of producing cloth increased two hundred times. In 1785 C.E. Edmund Cartwright invented power loom. In the year 1793 a machine called 'cotton gin' was introduced. This machine was useful in removing cotton seeds from cotton fibers with a much greater speed.

Metallurgy : England had a number of iron mines but it was necessary to advance the technique of smelting in order to acquire pure iron from it. Gradually the fuel for iron furnaces was replaced from wood to coal. It facilitated creation of furnaces that could attain much higher temperature resulting into increased production of iron. Later, special machines were made to keep the furnaces burning at a set temperature and to maintain its aeration. In 1865 the process of producing steel from molten iron was invented and the nature of iron industry underwent major transformation. At about the same

time, a method was developed to pour the molten metal into casts for making iron bars (for example, rails).

Use of Machines : Once a machine proved effective for one industry, people tried to test its usefulness for other industries too. These attempts resulted into inventions of newer machines. In 1783 Thomas Bell made a machine for cylinder or roller printing on fabric. By 1809 a machine came in use for sticking together the heels and soles of a shoe. Tailoring machines were made. James Watt invented steam engine. In the beginning, this engine was only used to transport coal and iron ore out of the mines. Later, steam powered machinery came to be used in textile industry.

In course of time steam powered ploughs, harvesters, grass cutting machines were made. These machines could complete agricultural operations in very short time. In America Robert Fulton, an engineer successfully sailed the steamboat, which was named, 'Clermont'. The first attempt of using steam engine for road transport was done by George Stephenson. A steam engine for railway was also produced. This railway engine could successfully cut the distance between Liverpool to Manchester. Later railway services were expanded through Europe. It shortened the time of travel within Europe.

1.5 Geographic Discoveries and Explorers

Marco Polo : The Italian traveller, Marco Polo, introduced China and other Asian countries to Europe. He stayed in China in the royal court of Kubalai Khan. There he studied Mongolian and Chinese languages.

Ibn Batuta : Ibn Batuta was a scholar and famous mediaeval traveller. Ibn Batuta visited India, Maldives, Sumatra, China, Spain, Sardinia, East and West Africa for various reasons.

Henry the Navigator : He was the prince of Portugal in the 15th century. He encouraged people to go on expeditions and search for lands, which were not known till then. These expeditions resulted into the discovery of 'Madeira' and 'Azores', two archipelagos near Africa. These two are autonomous regions of Portugal. The Portuguese began to transport African people to Portugal and sell them as slaves. African gold was also brought back to Portugal by these people.

Bartholomew Dias : Dias began his expedition on the orders of the King of Portugal, John II. He reached the southern tip of Africa, which he named as 'Cape of Storms,. Later, the name was changed to 'Cape of Good Hope'. He was the first seafarer to circumnavigate the African continent.

Christopher Columbus : In the year 1453 Istanbul (Constantinople), the capital city of the Eastern Roman (Byzantine) Empire was conquered by the Ottoman army. Thereafter it became the capital of the Ottoman Empire. Now the eastern sea route was closed for Europeans. It had become necessary for them to search for an alternative route to reach Asia. With the support of the King Ferdinand and Queen Isabel of Spain, Christopher Columbus, an Italian explorer set sail in the search of India. He was certain that by sailing westwards, he would find India, as the earth is round. Instead of reaching India, he reached the islands near America.

Christopher Columbus

Amerigo Vespucci : Amerigo Vespucci an Italian explorer is supposed to have

gone on expedition on the orders of King of Spain in 1497. The land he found was named as 'Venezuela'. In his third expedition by following the river course, he could discover the delta region of the 'Amazon'. It is believed that America was named after Amerigo.

Vasco da Gama : In the year 1497, Vasco da Gama, the Portuguese seafarer set sail with a fleet of 4 ships and 170 sailors in the search of India. He reached the eastern coast of Africa and visited a few African ports like Mombasa and Malindi. At Malindi he met an Indian navigator and under his guidance Vasco da Gama landed at the Indian port of Calicut (Kozhikode) in 1498. He asked King Zamorin of Kozhikode for trading permission. After obtaining the permission he returned to Portugal. Thereafter he visited India twice. He became the first Viceroy of Goa and Kochi, after the Portuguese rule was established there. The trading between European countries and India was initiated through his efforts.

Vasco da Gama

You would like to know this :

The number of European colonies in the African continent increased because the continent had rich sources of diamonds, gold, copper as well as it was rich with fertile land, timber and forests. Later the Portuguese began to capture the Africans and sell them as slaves. Cheap human labour was the need of Europeans, which increased the demand for African slaves and helped to expand the slave trade.

Ferdinand Magellan : Ferdinand Magellan is known as the Spanish explorer who organised the first expedition, which proved to be the first attempt of circumnavigation of the earth. Unfortunately, when it had almost reached completion, Magellan was killed in Philippines. However his companions completed the circumnavigation. Charles I, the king of Spain had planned this expedition.

Samuel de Champlain : The French navigator and cartographer organised expeditions to North America. There he established French colonies. He established the city of 'Quebec' in Canada.

Abel Janszoon Tasman : Tasman was born in Holland. He contributed to the colonial rush for searching unknown lands by discovering New Zealand. In 1644 he surveyed the southwest coasts of New Guinea islands and discovered the region of Carpentaria in Queensland, a north-eastern state in Australia.

Captain James Cook : Captain James Cook of the British Royal Navy set his foot in New Zealand and Australia. He surveyed the islands in the Pacific Ocean and prepared accurate maps. He cut across 60,000 nautical miles during his journey of three years.

Louis Antony da Bougainvillea : He was a French seafarer. He reached Tahiti after crossing the Pacific Ocean. In 1771 he wrote a book, 'Voyages Around the World', which describes his journey to Tahiti. Using the information in this book, French missionaries reached Tahiti in the 19th century. They established a French colony in Tahiti. One of the islands and also a flowering climber 'Bougainvillea' is named after him.

Mungo Park : Mungo Park, a Scottish explorer is known for his expedition to Western Africa. In 1795, he traced the course of river 'Niger' as part of his expedition.

Do you know?

Alberuni (973-1049 C.E) : Alberuni visited India accompanying Sultan Mahmud of Ghazni. He tried to estimate the diameter of the earth. His method of determining the latitudes and longitudes was accurate. Considering his times, this was a very difficult task. He prepared a map of the earth indicating its round shape.

1.6 Industrial Revolution

'Industrial Revolution' indicates the transition from manual production to mechanised production. In the 18th and 19th centuries steam powered and water powered (Hydraulic) machines came into use for industrial production.

Industrial revolution could happen only in a capitalistic economy. In the capitalistic economy a new class of capitalists emerged, who were either owners of industrial establishments (factories) or could provide capital to such establishments. To produce commodities of common use with minimum possible production cost, to pay least possible wages in order to maintain maximum profit margins are, the characteristics of capitalistic economy.

Private ownership of the industrial establishments, manufacturer's right to manufacture and to fix the price of the manufactured goods, also to determine the profit margins, as also the right of the consumer to buy goods of his choice, are inbuilt norms of the capitalist economy.

In England the atmosphere was suitable for industrial revolution. Large amounts of iron ore and coal were available. The damp climate of England was suitable for producing cotton yarn. With these favourable conditions, textile industry flourished in England. At that time England had established its colonies in many countries. So, England could easily obtain large quantities of essential raw material at cheap rates from the colonies. England could also export the processed goods to the colonies and sell it there with large profit margins using their naval facilities. The profits earned in the colonies made large amounts of capital available to the British merchants. Availability of cheap labour made it possible for them to maintain optimum level of costs. These factors giving boost to economy prepared favourable ground for the onset of industrial revolution in England. Industrial revolution, however, affected India adversely. It set the decline of Indian cottage industry. The textile industry in India almost came to a halt. The administrative policies of the East India Company were made to benefit the British than the Indians. Railways made it possible to transport European goods to rural areas for sell. It turned into monetary exploitation of the Indians.

Find it out.

Make a list of the European countries where the Industrial Revolution spread in its first stage.

1.7 Economic Nationalism

Rise of 'Economic Nationalism' was an outcome of industrial revolution. Arresting the economic growth of rival nations along with fervently pursuing the economic growth of one's own nation became vary important. It became important to devise ways to put economic restrictions on the rival country. Measures such as prohibiting the import-export transactions of other countries, levying heavy tolls on their goods, establishing colonies mainly in the Asian and African countries, if need be, fighting battles with the natives of the colonies were part of economic nationalism.

The chain of surplus production was the effect of industrial revolution and in turn the economy based on surplus production supported economic nationalism and also imperialism. It began the vicious circle of continuously capturing new marketplaces, searching for sources of cheap supply of raw material, to maintain an unbroken chain of supply of raw material, to attract more and more investors, to safeguard their investments and so on. It resulted into the exploitation of colonies.

Extreme nationalism, industrialisation, concepts of racial superiority, aggressive colonial policies supported further growth of imperialism. The result was the immense expanse of the European empires nations like England, France, Belgium, Germany, etc. In the next lesson we shall learn more about European colonialism.

Exercise

Q.1 (A) Choose the correct alternative and rewrite the statement.

1. In 1440 ..... started printing press.
   (a) James Watt (b) Gutenberg
   (c) Aristotle (d) Homer
2. In 1609 ..... made a modified telescope.
   (a) John Key (b) Copernicus
   (c) Galileo (d) Kepler
3. ..... was the first explorer to circumnavigate the African continent.
   (a) Henry the Navigator (b) Marco Polo
   (c) Bartholomew Dias (d) Columbus

(B) Find the incorrect pair from group 'B', and write the corrected ones.

	Group 'A'	Group 'B'
1.	John Kay	flying shuttle
2.	Samuel Crompton	cotton gin
3.	Edmund Cartwright	power loom
4.	James Watt	steam engine

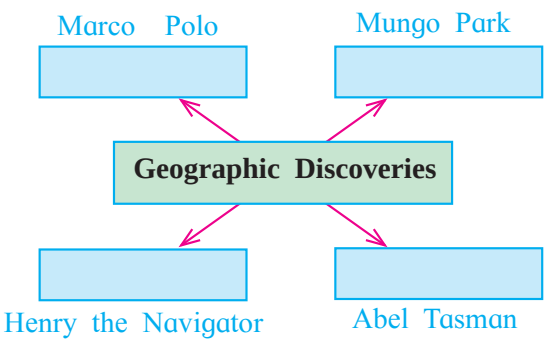
Q.2 Write the names of historical places/ persons/events.

1. Father of the empirical science –
2. Scientist who told the world that the centre of our planetary system is the 'Sun' and not the 'Earth' –
3. The treatise written by Varahmihir –

Project

Collect detailed information about the voyages of Bartholomew Dias and Vasco da Gama and read it out to the class.

Q.3 Complete the concept map.



Q.4 Write short Notes.

1. European Crusades
2. Metallurgy in Europe

Q.5 Explain the following statements with reason.

1. The European renaissance is supposed to have reached its zenith in the 15th-16th centuries.
2. The Industrial Revolution first began in England.

Q.6 State your opinion.

1. The European natural scientists of the 17th century laid the foundations of modern science.
2. The economy based on surplus production supported economic nationalism and also imperialism.

Q.7 Answer the following questions in detail.

1. Explain the causes and effects of European crusades.
2. Give detailed information of the development of science and scientific inventions during the renaissance period.