WEEK 1 – 2

CHAPTER 1: HISTORICAL ANTECEDENTS OF SCIENCE AND TECHNOLOGY

LEARNING OBJECTIVES:

At the conclusion of this chapter, students should be able to:

1. Examine the development of science and technology throughout history;
2. Identify the significant technological advances of different historical times; and
3. Assess the importance of technology in the information age.

INTRODUCTION:

- **Science and technology have supplied humanity with several innovations and technologies that have had a significant impact on how people think, behave, and live throughout history.**
- This course examines these breakthroughs and their effects on society.
- The first chapter examines significant advancements in science and technology throughout history, while the second chapter examines key shifts in science that altered worldview because of intellectual revolutions.
- Lastly, Chapter 3 describes how Philippine culture views advances in science and technology, as well as the state-sponsored aims and efforts to accomplish them.

IN THE WORLD: ANCIENT AGES

→ The origin of the **English word "knowledge"** is the **Latin word** "**scientia**" which **meaning** "**science**."

→ Many people regard **science** to be a **systematized body of knowledge** due to the fact that it pushes people to seek answers to their questions about the events occurring in their environment.

→ **Everyone contributes to the study of science** since the **essence of science** is to **comprehend how the world functions**.

→ When people question about science, its origins and development over the span of human history are among the most frequently discussed issues.

→ **Both science and technology** are indebted to ancient civilizations for their contributions. In their search for alternate sources of sustenance, humans made scientific advances and discoveries that are now regarded as the underpinnings of many of the most important and valuable technologies in use today. Because people required access to clean water to survive, the **world's first civilizations formed along rivers**. The rivers provided water for crop irrigation, and their constant flooding increased the soil's fertility.

MESOPOTAMIA

→ Between **3300 and 750 B.C.**,

→ Mesopotamia **was home to the world's first civilizations** that have been discovered.

→ The territory corresponds roughly to the majority of modern-day **Turkey, Iraq, Iran**, and **Syria**, as well as **portions of Kuwait**.

→ **Ancient Greeks gave Mesopotamia** its name, which **means "between two rivers"** and refers to the region's location inside the Tigris-Euphrates River system.

→ Mesopotamia was **home to a variety of very successful early civilizations**, including the **Sumerian**, **Babylonian**, and **Assyrian cultures**.

SUMERIAN CIVILIZATION

→ **Iraq** was **home to the earliest known civilization in Mesopotamia**. It was **called Sumer**.

→ In ancient script, the **Sumerians called themselves and their land "the black-headed people"** and **"the land of the black-headed people,"** respectively.

→ They were famed for **constructing walled city-states**, and many of their inventions are still in use today.

→ **Cuneiform**, one of **the first writing systems**, is credited to the Sumerians circa 3000 BCE. It is distinguished by **writings pressed into wedge-shaped clay tablets**. Prior to the creation of the **Phoenician script**, this writing system was the **major means of communication for all neighboring cultures**.

→ The Sumerians advanced economically through trade. In addition to the Sumerian script, they **created a number system with two bases: 60 and 10**. It was beneficial to the operation of their business.

→ In addition, the **Sumerians invented SAILBOATS** that enabled them to trade with neighboring civilizations and travel by water. The **sails of the earliest sailboats were made of cloth**, while the **hulls were made of wooden planks**.

→ The **WHEEL** is recognized as just another of the Sumerians' **major achievements**.

→ The Sumerians are considered to have been **the first to employ wheels**, **first for pottery production** around 3500 BCE and later **for transportation in chariots** around 3000 BCE. Due to the need for long-distance communication with merchants from other civilizations, the people of this civilization developed a writing system.

→ **Due to the innovations of sailboats and the wheel**, Sumer was one of the **oldest commercial centers in history**, producing textiles, leather goods, and jewelry.

→ The **Sumerians are believed to have invented agricultural practices such as irrigation**. The construction of massive flood walls or levees to collect Tigris and Euphrates flooding demonstrates their inventiveness. They made holes in the levees to allow water to escape during the dry months of summer, so irrigating the land.

→ Additionally, they are **one of the earliest civilizations to use the plow to dig and break up hard soil in order to allow planting**.

- → Sumerians are **commonly regarded as the first astronomers in human history**. They studied the phases of the moon, the movements of the planets, and the motions of the stars. Using the phases of the moon as a guide, they were able to **develop a lunar calendar** that led to the establishment of 12 lunar months each year.

THE BABYLONIAN CULTURE

- → During the first two millennia of Mesopotamian history, **Babylon was the region's cultural epicenter.**
- → Common belief holds that the **name Babylon is derived from the Hebrew terms bav-il or bav-ilim**, which **mean "Gates of the Gods."** Its ruins can be found in the contemporary nation of Iraq.

- → **Numerous biblical references** to Babylon give a wealth of information about the city and its history, beginning with **Hammurabi around 2000 B.C**. and continuing until the **city's fall around 500 B.C**.
- → The entirety of the **Old Testament** contains scattered references to Babylonian people, government, religion, cultural practices, and military might.
- → The **city of Babylon is first referenced in Genesis 10**, which describes the family tree of Noah's three sons. According to this, **Ham**, **the son of Noah**, was the father of Cush, who was the father of Nimrod (Genesis 10:8-10). Nimrod was an imposing warrior who established a kingdom that included Babylon. Nimrod was the son of Cush, the son of Ham.

- → In **Genesis 11**, the **construction of the Tower of Babel** is described. The Babylonians **desired to construct a tower "with its summits in the heavens"** in order to enhance their dignity. God hindered the tower's construction by preventing the workers from communicating in their native tongues. **The tower was never built**, and the residents gradually dispersed to different corners of the globe, each speaking their own language.

- → The **biblical books of Isaiah, Jeremiah, Ezekiel, Daniel**, and **Revelations reference Babylon**. These ties motivated the mission of **German archaeologist Robert Koldewey to Babylon in 1899**, which he led. The excavation unearthed a portion of the old city's architecture.
- → The biblical story of the **Tower of Babel** and **Nebuchadnezzar's palaces** is believed to have been influenced by the **temple of Etemenanki**, which has been unearthed.

- → The **crew led by Koldewey** also **uncovered what they believe to be the Hanging Gardens of Babylon** in a basement, which consisted of fourteen enormous chambers with vaulted stone ceilings. Popular belief holds that **King Nebuchadnezzar II gifted the Gardens to his homesick spouse Amytis** as a token of his affection.

- → **According to historical sources**, the Gardens **comprised large terraces filled with trees, bushes, and floral plants**. It also had its own irrigation system that was connected to the Euphrates River to water the plants and trees.

- → The **Babylonians adopted the Sumerian number system**, and they are **credited with contributing to the formation of the number system** that served as the progenitor of other systems in use today.
- → **Cuneiform tablets** from **between 1800 and 1600 B.C.** have provided archaeologists with evidence of the various **mathematical applications utilized by the Babylonians** in daily life.
- → In addition to the **Pythagorean Theorem**, **fractions**, **square** and **cube formulas**, and other pertinent topics were etched on the tablets.

- → It is well-known that **Babylonian priests used observations of the sky**, specifically the **sun**, **moon,** and **stars**, **to compile astronomical data and make forecasts**, which they then recorded on clay tablets. In certain temples, it was possible to record the phases of Venus.
- → They **created a lunar calendar similar to that of the Sumerians** by **dividing the year into 12 months** with varied **numbers of days, alternating between 29 and 30 days per month**.
- → In addition to **water clocks and sundials**, the Babylonians devised **other timekeeping methods**.

Africa

- → Due to the fact that **Africans are successful in a wide range of industries**, including
  - **agriculture**,
  - **metallurgy**,
  - **engineering**,
  - **textile production**, and
  - **medicine**,
  - the **scientific and technological environment** in Africa is unusually diverse.

- → **Numerous African plant species**, including
  - **coffee,**
  - **palm oil,**
  - **sugarcane,**
  - **cotton,**
  - **African rice, and**
  - **sorghum,**

  have been exported for planting purposes to other parts of the globe.

- → In **addition to being used as sources of analgesics**,
    - **Antidotes** (for counteracting poisons),
    - **Anthelmintics** (dewormers), and
  - **Antimicrobials**, plants can also be employed for their aesthetic qualities.

- → For the **purposes of hunting and defense**, ancient African artisans **developed improvements in metallurgy and the fabrication of implements**.
- → **Local craftsmen produced this advancement**. This **collection of weaponry** includes a
  - **Bow** (also called a vurha or uta),
  - **Arrows** (also called matlhari or miseve),
  - **Knives** (also called banga or mukwanga), and
  - **Axes** (xihloka or demo).
  - People also **constructed holes lined with poison-tipped stakes (goji or hunza)** that were used to trap elephant-sized animals.

- → These **scientific accomplishments date back at least 40,000 years at a minimum**. Compared to the achievements of other African nations, Egypt's other spectacular architecture and monuments receive excessive attention.

- → The Western world has a strong aversion to the African method of collecting scientific information, which is one of the reasons why the history of science in Africa, beyond ancient Egypt, is not widely recognized. It appears that Africans draw no distinction between scientific inquiry and spirituality, religion, and culture in their daily lives.
- → In addition to **their scientists serving as religious leaders**, the Africans did not rely simply on the logical or experimental method to acquire scientific knowledge.
- → Western science, on the other hand, **considers that scientific knowledge can only be achieved through a logical and experimental approach in the laboratory**. This mode of thought is based on the principles of intuition, observation, and trial-and-error experimentation.

- → Moreover, **Africa's lack of technological dominance diminished its scientific achievements**. **During the 1600s**, bigoted views did not help the issue. **In the 1600s**, the **scientific achievements of African slaves brought to Europe were not acknowledged**.
- → In addition, **African scientists did not sufficiently record their findings in writing** (in the Western meaning of the term), and any documentation that did exist was lost due to a lack of safeguarding.

Egyptian Antiquity

- → The **ancient Egyptian civilization**, **one of Africa's most illustrious, flourished in the fertile Nile Delta**. From its beginning in northern Africa, the **Nile** flows to the Mediterranean Sea. Because of the black, fertile soil along the Nile, **Egypt was referred to as Kemet**, or **"Dark Land."**
- → Egypt saw scant precipitation, although the Nile floods enabled the **production of wheat and flax**. The **creation of an irrigation canal** was one of this **culture's earliest scientific achievements**.

- → **Egyptians utilized and improved the plough for agricultural purposes**. The plow prepared the soil for the sowing of numerous crops. Moreover, **they invented the shadoof**, a pole with a bucket at the end that was used for irrigation.
- → **In addition to frankincense, myrrh, cinnamon pellets, and honey,** the Egyptians are **credited with the development of breath mints**.
- → **During the Old Kingdom of ancient Egypt (from 2613 B.C. to 2181 B.C.),** various impressive construction projects were completed. The **Great Sphinx of Giza**, a **20-meter-tall monolith of white limestone** showing a lion's body and a human head in repose, is one of the era's most recognizable symbols.

- → The **Egyptian aristocracy** was **burial within pyramids**. Egyptians believed that the soul continued to exist after death as an immortal creature. If a person is to be resurrected, his or her body must be kept so that the individual's spirit can recognize it after death. The **ancient Egyptians considered death as nothing more than a transfer into a new existence**. This culture practiced mummification so that the spirit might know the body after death.

- → **Djoser**, **pharaoh of the third dynasty of the ancient Kingdom**, built the first Step Pyramid near Saqqara using Imhotep's blueprints. The **colossal pyramids of Khufu, Khafre**, and **Menkaure** were completed **under the reign of Djoser**.
- → The Egyptians' favored medium for recording information was **papyrus**, a **paper-like substance** derived from the pith of the papyrus plant. **Mats, baskets, rafts**, and **ropes** were all made from the **abundant plant life in the Nile Delta**.
- → As evidenced by their **use of wigs and cosmetics**, **pictograms** and **hieroglyphs** demonstrate that Ancient Egypt was equally **imaginative in the realm of cosmetics**.

- → In addition to these innovations, the **Ancient Egyptians created medications to cure a range of ailments**.
  - **Imhotep** was a **physician who documented more than two hundred diseases** and their respective treatments in writing.

The Indus Valley Culture

- → The **Indus Valley civilization** existed in the region that is today **Pakistan and Northwest India**.
- → **During the Bronze Age**, it was the largest of the four urban societies that existed in Egypt, Mesopotamia, South Asia, and China.
- → It flourished in regions where the **Indus and Ghaggar-Hakra rivers meet**.
- → **One of the largest rivers in Asia**, the Ghaggar-Hakra flows across Northwest India and Eastern Pakistan.
- → In the 1920s, archaeologists **discovered the city of** Mohenjo-Daro, which was **constructed 4,600 years ago** and was part of the Indus Valley civilization. This significant discovery demonstrated that Mesopotamia, Babylon, and Egypt were not the only ancient human settlements.

- → The Indus Valley Civilization was distinct from others of its time because it **lacked enormous monuments**, **mummies buried in tombs**, **records of territorial wars or battles**, and **emperors**.
- → Even Nevertheless, the two towns discovered at Mohenjo-Daro on the lower **Indus and at Harappa** demonstrate that the civilization had a highly developed urban life, comparable to Sumer but superior to Ancient Egypt.
- → The **inhabitants of the Indus Valley** invented new techniques for working with metals **(bronze, tin, copper, and lead)** and producing objects by hand **(seal carving and carnelian products)**.
- → Their cities are renowned for their **well-organized, baked-brick residences** and groups of huge non-residential buildings, as well as their intricate drainage systems and water storage systems.

- → The inhabitants of this area also **created accurate methods for measuring and weighing items** for commerce, as well as a **method for writing between 250 and 500 characters**.
- → Also well-known are the Indus Valley civilization's agricultural practices. The local populace cultivated **barley**, **mustard**, **peas**, and even **cotton**. As pets, they also maintained dogs, cats, cattle, poultry, camels, and buffalo.

- → **Archaeologists and historians continue to debate why this civilization may have collapsed**. Some think it was due to the arrival of the Aryans, while others point to the river's drying up, which hindered farming.

Historic China

- → People claim that **ancient China was among the** oldest and longest-lasting civilizations **in the world**.
- → "China" is **derived from the Sanskrit word** "Cina," which is **derived from the Qin Dynasty's name**, pronounced "Chin."
- → The **Greeks and Romans referred to China as** Seres, which **means** "the land from where silk originates."
- → Ancient China has a long and illustrious history of scientific accomplishment.
- → Numerous scientific disciplines, including
  - **Engineering**,
  - **Mathematics**, and
  - **Astronomy**,

  owe a great deal to it.

- → China, as one of the few locations on Earth, was the first to record the supernova that produced the **Crab Nebula in 1054 BC**.

- → The abacus, **a counting device invented in China** between 1000 and 500 B.C., was another Chinese invention. In **addition to counting**, a number of calculations were performed using it.
- → The Chinese are credited with **inventing** acupuncture and **using** herbal medicine extensively. By putting a series of small metal needles into particular sites on the skin and underlying tissue, acupuncture reduces pain, cures sickness, and improves overall health.

- → During the Han Dynasty, numerous innovations were developed (206 BC-220 AD).
  - The invention of paper in China, **in 105 A.D.**, had a significant **impact on the country's historical records and literary output**.
  - In **960 A.D.**, when the first portable printing press was invented, it became possible to produce printed items on a global scale.

- → Porcelain is another well-known Chinese export. During the era in which porcelain was initially made, it was **highly prized across the globe**. The **material was used to create a wide range of things**, including
  - **vases**,
  - **plates**,
  - **cups,** and
  - **exquisite furniture**.

  It is **composed of an unique clay** that, when heated, crystallizes and solidifies to form a robust shell.

- → The majority of historians concur that silk manufacture began in China during the **Neolithic period**. The silkworms consume mulberry leaves before spinning their own cocoons in which to mature.
- → **During the Han Dynasty**, **silk manufacturing and cultivation reached a highly developed condition** known as sericulture.
- → A **global network of trade channels** known as the Silk Road was established as a result of the immense demand for silk.

- → A **group of Chinese Taoist alchemists** sought to manufacture an immortality potion by **combining sulfur, charcoal, and potassium nitrate** around the year 142 AD. This combination, which was eventually referred to as gunpowder, was initially **utilized in the fireworks industry**.

→ Later, it **was used in the Mongol Wars** of the 10th century and, paradoxically, during European colonial dominance over China in the 19th century.

The Aegean Sea's Civilization

→ After the so-called "Greek Dark Ages," the **time between 800 and 500 B.C. is commonly referred to as "Ancient Greece."**

→ **Hellas**, or **Ellada**, which **translates to "Greece,"** is an **alternative name for the Southeastern European** nation of Greece. It is **composed of a huge primary island and numerous smaller islands**.

→ **Markets and public gathering places proliferated** in the expanding number of villages in ancient Greece. The **oldest Greeks were heavily involved in commerce**.

→ The **majority of the population's wealth** was derived from **marine trade**. **Fruits**, **vegetables**, **wines**, and **herbs** were among the things that were traded.

→ **Equally well-known** are **its political**, **artistic**, **philosophical**, and **scientific accomplishments**.

→ **Numerous outstanding scientists and intellectuals were fostered** due to the growing democratization of education.

→ The theories of these philosophers and scientists, combined with the countless discoveries of Ancient Greece, had a profound effect on the evolution of Western Civilization.

→ **Greek Philosophy** is without a doubt the **most well-known contribution the Greeks made to Western Civilization**.

→ **Ancient Greek philosophers** such as
- **Socrates,**
- **Plato**, and
- **Aristotle**

pondered the purpose of existence and the origins of the cosmos.

→ In a quest to comprehend the human condition and the workings of the universe, these philosophers and many who followed them **rejected the answers provided by religion, superstition, and myth.** Their brains were opened to new possibilities as logical thought overcame the unscientific common ideas society then subscribed to.

→ **In Ancient Greece**, **mathematical and scientific advancements emerged shortly thereafter**.

→ The **Pythagorean Theorem**, which was **devised by the Greek mathematician and philosopher Pythagoras**, is widely acknowledged as the **standard for calculating the area or volume of an object**. In addition, he believed that **"number"** is the **only really objective method to observe the world**.

→ **Thales of Miletus** acquired global fame as the **first Western philosopher and mathematician** when the solar eclipse on May 28, 585 BC unfolded exactly as he had foretold. He also **founded the Milesian School**, estimated the heights of the pyramids, and **described the location of Ursa Minor**.

→ **Hippocrates**, the **"Father of Western Medicine,"** made substantial contributions to the medical field by exploring the **effects of diet and lifestyle on disease**, as well as **wounded soldiers and the body's veins and arteries**. After his death, the **Hippocratic Oath** was created **as a promise** to adhere to moral and ethical principles in medical practice.

→ Ancient Greece had a **comparable surge in the development of engineering and mechanics**. The Greeks **developed water mills** to grind grain by harnessing the power of water. The **first water mills were built on Philo's revolutionary Perachora wheel design**. At this period, both Samos and Athens constructed aqueducts to better control their water supplies.

→ **Ctesibius devised the water clock**, or **clepsydra**. **Ctesibius' water clock tracked time using clay vessels and water drips**. In order to increase the volume, he also utilized bells designed to be struck by falling stones.

→ **During the First Punic War**, according to legend, **Archimedes of Syracuse invented the odometer**. The early iterations of the odometer were **used to measure the distance traveled by a vehicle**. Since then, advancements in transportation technology and the construction of roads have occurred.

During the Period of Ancient Rome

→ At the time **Augustus Caesar** came to the throne as the **first Emperor**, **ancient Rome** was a tranquil riverside town. It ultimately expanded and strengthened through trade.

→ **By adopting and refining Greek culture**, **Rome expanded its influence** across the **majority of**
- Europe,
- Britain,
- Western Asia,
- the Mediterranean, and
- North Africa.

→ **Despite the fact that many of the Romans' technological achievements were based on Greek concepts**, the Romans were proud of the fact that they had **produced technological advances that were lost throughout the Middle Ages**.

→ **Ancient Roman civil and military engineering led to the construction of infrastructure** like as
- **roads and bridges**,
- as well as **architectural marvels** such as
  - **arenas**,
  - **sculptures**, and
  - **pantheons**

→ **Galen**, a **physician from Pergamum (modern-day Turkey)**, was the **first to classify diseases according to their symptoms and provide treatments**. His writings on medicine were the gold standard for many years.

→ **Roman physicians utilized a range of surgical instruments**, including the:

- **Rectal Speculum**,
- **Bone Levers**, and
- **Cupping Vessels**, in their medical practice.

Typical materials were **lead**, **steel**, and **bronze**.

→ The **use of concrete**, which is **extremely durable** due to the incorporation of volcanic ash, **was a significant factor** in the **expansion of the Roman Empire**.

→ **Roman concrete** was **used to construct roads, houses, and aqueducts** that were submerged in water in numerous locations, demonstrating its versatility.

→ **Aqua Appia**, the **first Roman aqueduct**, was **built by Appius Claudius Caecus in 312 BC**. It **served as a precursor** to **Rome's modern sewage system**, **sanitary management**, and **public baths** by bringing water from a variety of sources into the city.

→ **The Colosseum**, the **largest amphitheater in the world**, and **the Pantheon**, a **former Roman temple**, are merely two **examples of the Romans' great architectural achievements**.

→ Both of these landmarks appear as good as new today.

→ The **military of ancient Rome was renowned** for its exceptional leadership and technological capabilities.

→ The **ballista** was a **Roman long-range artillery weapon** used to penetrate distant enemy lines. Ancient Greeks utilized burning projectiles to create Greek fire.

→ Numerous historians continue to argue as to what precipitated the fall of the Roman Empire. **Although the year of the fall (476 A.D.)** is agreed upon, the **causes are widely contested**.

- **Some historians have hypothesized** that the **eastern and western halves of the empire split away**, causing its demise.
- **Others believe that the empire fell due to internal and external decadence**. **Wars and plagues led to a population decline.**
- Furthermore, it is **asserted that the development of Christianity, political and economic difficulties, and barbarian invasions all contributed to the empire's demise**.
- However, **only the western half collapsed**, **ushering in the "Dark Ages," sometimes known as the "Middle Ages,"** and **signifying the end of classical civilization**.

Mesoamerica

→ **Mexico, Guatemala, Belize, Honduras**, and **El Salvador** comprise the cultural and historical region of Mesoamerica in North America.

→ The **Olmec culture** began in northeastern Mexico around 1200 B.C. and is the **earliest Mesoamerican civilization** known.

→ Prior to the arrival of the Spanish conquistadors in Mexico, various **early Mesoamerican civilizations**, including the

- **Maya**,
- **Aztec**, and
- **Inca**,

flourished from around 900 to 1500 A.D.

The Mesoamerican Civilization of the Maya

→ The **Maya** were **largely recognized as Mesoamerica's most highly advanced people**.

→ **Maya hieroglyphics**, **their writing system**, had **one thousand symbols**. They **constructed writing instruments from animal hair and feathers**.

→ These **codices**, which were **primarily written on tree bark**, were the **most important source for studying Maya history, religion, and science**.

→ The **majority of these publications** were **deemed occult by the Spanish**, who consequently burnt them.

→ **Numerous Maya stone monuments** contain **pictorial inscriptions (glyphs)** that have not been deciphered over the years.

→ The **Dresden Codex** is **remarkable** because it contains:

- **Maya astronomical tables**,
- **writings about the cosmos**, and
- **accurate predictions of solar eclipses**.

It is one of three books that have been discovered.

→ The **Maya established a number of observatories** in order to **study the night sky**.

→ **By understanding eclipses and other celestial phenomena,** the **Maya displayed their expertise** with **arithmetic and their capacity to conceive abstract concepts**.

→ The **Maya utilized the 365-day solar year** and the **260-day sacred year** due to their proficiency in astronomy and mathematics. These **two annual cycles comprised the calendar cycle**.

→ This culture also **established the "long count," a calendar based on counting cycles or sets of time**.

→ The **Maya calendar** uses a system **centered on the number 20 to record dates**.

→ The **Maya were a civilization** that made **tremendous advancements in construction, adornment, and even warfare. The Maya towns were highly developed**, with formidable structures such as enormous pyramids and temples made of limestone bricks.

→ The **Maya embellished their temples with mica**, **flora**, and **different minerals**.

→ With the **aid of hydraulic technology**, they **created complicated waterways** that aided their agricultural practices.

→ Using **looms**, they **wove exquisite fabrics with elaborate patterns**.

→ The **women sewed huipiles**, **which are colorful tunics**.

→ **Maya exploited rubber** to **create bookbindings, adhesives, and textiles** using the sap of rubber trees and morning glory plants.
→ There are **numerous hypotheses as to why the Maya city-states were perpetually at war with one another**, such as **competition for scarce resources and political authority**.
→ Objects unearthed during excavations indicate that the Maya utilized a broad variety of metals and mineral-based weapons, including ones fashioned from obsidian and chert.

Civilizations of the Aztecs and Incas

→ Both the Aztec and Inca empires **endured for two centuries before the Spanish conquest**.
→ **Tenochtitlan**, or **modern-day Mexico City**, was the **Aztecs' capital city**, where they **created artificial islands** known as **chinampas**, which contributed to its prosperity.

→ Similar to the Maya, the **Aztecs could predict astrological events and make astronomical observations**.
→ The agricultural and spiritual rituals of the Maya were centered on their calendar. In contrast to the Maya, **the Aztecs were able to preserve their writing in the form of codices** that describe facets of Aztec life as well as significant scientific discoveries. Famous is the **Aztec sun stone**, which **represents the Aztec sun god.**

→ The **Aztecs possessed highly developed social and cultural structures**, particularly in the **domains of knowledge and religion**.
→ They created a **pictographic writing system** known as **Nahuatl**, a **form of which is still extensively used today**.
→ The **Aztecs constructed enormous stone temples** for religious events and to store statues of their gods. In Mesoamerica, the Inca Empire or Inca Civilization was the dominating civilization

→ The **Inca were renowned for their technological innovation**. From the highest peaks to the lowest valleys, a complex network of roads was constructed. They **created irrigation canals and bridges** across bodies of water. The bulk of the structures they constructed are still standing since they were constructed to last and to look good at the same time.
→ **In addition to being expert doctors**, the **Inca performed amputations and trepanation on injured soldiers**.
→ **To supplement their food production**, they **produced**
- **tunics,**
- **long shirts**, and
- **elegant clothing**.

→ Their **armory included**
- flutes,
- drums,
- panpipes, and
- horns, among other musical instruments.

→ **Quechua**, the **official language of the Incas**, is still spoken by natives today.
→ In addition, they **formalized the Quipu System**, which **was used to record fiscal and demographic information,** as well as **dates and events for calendars** and other uses.

In the World: The Middle Ages

→ People during the Middle Ages **had a reputation for being** more **crass**, **profane**, and **backward in their sensibilities**.
→ Numerous scholars had preconceived assumptions regarding this time period, which led to this misconception. Despite the fact that many Roman ideas were lost during this period, the Middle Ages produced numerous valuable inventions and technological developments that have served as the foundation for modern advances.

Various Germanic tribes invaded the regions formerly ruled by the Roman Empire, bringing with them the Dark Ages or Middle Ages period of history. Academics now disapprove of the phrase "Dark Ages," which implies a time without innovation or advancement. The majority of historians concur that the fall of the Roman Empire ushered in the Middle Ages. Three assaults of Rome by Alaric I, king of the Visigoths (one of numerous Germanic tribes in Northern Europe), were instrumental in the empire's downfall. Magister Militum means "Master of the Soldiers" in Latin, and he was awarded this title. He changed his mind about conquering Constantinople after realizing that the Romans would not offer subsidies for his tribe. As a result, the Germanic invaders, including the Vandals, Gepids, Ostrogoths, and Visigoths, eventually overran Rome after the Western Roman Empire's emperor Valens's death.

According to numerous historians, the Middle Ages began in the sixth century and ended in the fifteenth. It consists of the prehistoric, medieval, and contemporary middle ages.

Imperial Byzantium

Only the eastern portion of the Roman Empire, centered in Byzantium, survived the empire's collapse. In the early 4th century, when Emperor Constantine acquired control of the city, he renamed it Constantinople (320-330). In order to comprehend what made the Byzantine Empire distinctive, the name was derived from this necessity. The Byzantine Empire reached its pinnacle under the reign of Emperor Justinian, who expelled the numerous Germanic tribes that had invaded it. Social, political, economic, and military reforms all originated during this period, which is traditionally regarded as the start of the second golden age of the Roman Empire.

Under Justinian, the final Byzantine emperor, the empire began to decline and lose its once-impressive reputation throughout antiquity. However, scientific and technological advancements continued. The Greek Fire and the Handheld Trebuchet are only two of this dynasty's renowned weapons. The cheiromangana, also known

as the Handheld Trebuchet, evolved from the counterweight trebuchet. In order to propel a projectile, the trebuchet's system includes a siege engine. During the Middle Ages, this weapon was well praised for its effectiveness in combat.
During the Middle Ages, a number of inventions were developed to increase agricultural output. Similar to a water mill, a tidal mill uses the flow of water to crush and grind grains. Regardless, its strength is derived from the ebb and flow of the tides. Northern Ireland is home to one of the earliest tide mills known to man.

Kingdom of Islam

During the Middle Ages, the Islamic Empire became one of the world's most powerful entities. This empire reached its height around the middle of the seventh century and lasted until the middle of the thirteenth century, according to estimates. During this period, the Islamic world produced a number of notable personalities who made substantial contributions to the fields of art, engineering, scholarship, poetry, philosophy, geography, and trade.

Islam has had a significant influence in the quest of scientific knowledge and technical growth in the region. The Koran, the Muslim holy book, supported the expansion of scientific knowledge by encouraging Muslims to seek insight and hunt for evidence of Allah in nature. By placing a higher emphasis than the Greeks on observation and experimentation, Muslim scientists were instrumental in the development of the modern scientific method. Experts in other fields made comparable contributions to the empire's level of knowledge. Believers put their faith into practice and carry out Allah's plan through studying a variety of disciplines. Astronomy, philosophy, chemistry, mathematics, medicine, and botany were just a few of the subjects that early Islamic teachings helped.

During the Middle Ages, paper production skills spread to numerous regions. Arabs advanced Chinese techniques by substituting starch for mulberry bark as the use of writing instruments such as pens and pencils became more prevalent than that of brushes. The House of Wisdom in Baghdad was built in the eighth century as a direct result of Arabic translations of Greek and Syrian texts. Scholars and scientists collaborated on research in subjects as diverse as alchemy, astronomy, medicine, philosophy, and optics at the Abbasid Caliphs' House of Wisdom. Here, Muslim intellectuals acknowledged the significance of knowledge dissemination by translating philosophical and scientific books into Arabic. One of the oldest works to be translated into Arabic was Ptolemy's Al-Magest, which gave a geocentric understanding of the world. By the 10th century, Baghdad had hundreds of bookshops, all of which required scribes and bookbinders to assemble volumes. Very little remains of the House of Baghdad prior to its destruction during the Siege of Baghdad in 1258 survives.

Also commencing in the eighth century was the Golden Age of Islamic Science, which lasted until the thirteenth century. A new generation of scholars and scientists rose to the challenge of broadening the bounds of knowledge. Ibn Al-Haytham, often known as Alhazen, conducted investigations in optics using the scientific method, paving the path for modern optics in medicine. He investigated the spectral separation of light and developed the Laws of Refraction. Western science owes a great deal to the concepts presented in his work, Book of Optics. He cemented his legacy as the "Father" of the contemporary optical industry. A physician and philosopher, Abu Ali al-Hussein Ibn Sina (Avicenna) penned al-Qanun fi al-Tibb. In addition to identifying tuberculosis and meningitis as contagious diseases, this medical encyclopedia also provided the first account of the anatomy of the human eye. Until the 18th century, the Latin version of the Canon functioned as the major reference for European physicians. Abu Oasim Khalaf ibn Abbas Al Zahrawi, better known as "Al Zahrawi," was recognized as the greatest surgeon of the Middle Ages. He was a physician, pharmacist, and surgeon for the duration of his life. Al Tasreef Liman 'Ajaz 'Aan Al-Taleef, or The Clearance of Medical Science for Those

Who Cannot Compile It, was compiled by him while he was the court physician in Arab Spain during its Golden Age. It was a collection of his half-century of medical school, residency, and practice experience diagnosing and treating a variety of diseases. It describes how to operate on a variety of body parts, including the ear, eye, and throat, as well as the necessary instruments and techniques.

In the 13th century, attacks by European Crusaders and Mongols heralded the beginning of the end for the Golden Age of the Islamic Empire. Due to the contributions of Muslim scientists, the West was able to make scientific and industrial advancements, giving Europe a military and economic superiority over the Islamic world.

Europe during the Dark Ages

In the eighth century, with the assistance of the English monk Alcuin of York, Charles the Great, often known as Charlemagne, built the Carolingian Empire, which gave rise to the Carolingian Renaissance. Throughout the empire's rule, literature, the arts, architecture, and other creative efforts flourished. As a result of Charlemagne's fostering of a scholastic renaissance, liturgical modifications and biblical exegesis flourished. Astronomy was important to his educational reform's scientific tenets, both as a practical skill and a theoretical study. After the fall of the Carolingian Empire, numerous scientific advancements are chronicled. The rise and collapse of a number of Germanic kingdoms in Western Europe and the Viking Age are significant turning points in the history of Europe (793-1006 AD). Even though they are generally associated with savage characteristics such as warriors, pillagers, and bad navigators, the Vikings deserve credit for a lot of technological advancements, particularly in the military and navigation domains. The Vikings utilized the axe in battle and in daily life. According to legend, the Dane Axe required two hands to wield well. Each member of the Viking army was required to carry a shield. The Vikings also devised a magnetic compass that could be used for marine navigation in conjunction with the Sun.

Europe began to recover from the continuous conflicts with Muslims and Vikings in the Early Middle Ages throughout the High Middle Ages. Later, the Crusades inflamed an already simmering animosity between Christians and Muslims. The Latin Church sanctioned the Crusades as a means of preventing the spread of Islam across Europe. At the beginning of the eleventh century, the intensity of these Holy Wars intensified. In 1095, at the Council of Clermont, Pope Urban II of the Latin Church in Western Europe emphasized the need of liberating Palestine and Jerusalem from Muslim domination. Europeans initiated the First Crusade against Muslims in 1096. Beginning with the Crusades, the foundation for future advances in weaponry was created. During the Crusades, European soldiers on foot utilized spears and sharpened versions of traditional weaponry such as swords and daggers. Knights also rode into battle armed with long lances and a horse. The crossbow was a significant development in First Crusade weaponry and was largely regarded as a vital weapon. From the 11th century to the start of the 13th century, it was a widely spoken language.

The revived confidence brought forth by the success of the First Crusade contributed to the continent's economic expansion. As a result of developments in agricultural technology and techniques, such as the three-field system, the standard of living of many Europeans rose. The three-field system, as its name suggests, divides a single piece of land into three portions, each of which is utilized to cultivate a separate seasonal crop. Improvements in agricultural practices also contributed to the increase and diversification of the continent's food supply. The result was a huge expansion in Europe's urban population.

Early in the 12th century, when Latin students from Western Europe rediscovered the writings of important Greek philosophers, science and literature were profoundly transformed. Middle Ages scholars frequently traveled to Western Europe, especially Spain and Italy, in pursuit of Greek works to translate into Latin. Rediscovery of ancient Greek philosophy was made possible by the translation of these writings. Throughout the Middle Ages, Physics and Metaphysics, two of Aristotle's treatises, saw a rebirth in popularity. William of Moerbeke (12th century) and Averroes (1126-1198) are two of the most well-known interpretations of Aristotle's works (1215-1286).

Also during this time, the work of astronomer Claudius Ptolemy, Geography, was translated into Latin; it was this book that inspired Christopher Columbus to discover the New World. Thanks to Latin translations, mathematical works of Euclid and Archimedes were also rediscovered. Numerous texts, such as Archimedes' Works and the Latin translation of Euclid's Elements of Geometry, made their original Greek versions accessible to a larger audience of scholars. Early European colleges taught from translations of ancient Greek philosophers' works. During the High Middle Ages, the first medieval colleges established in the early 13th century; they were popularly known as Studium Generale. These universities offered students the opportunity to learn from professionals in the arts, medicine, law, and other relevant subjects. The number of medieval universities in Europe grew according to the demand for higher education. Many of the philosophies and practices of the Studium Generale can be observed in the numerous European institutions that are still in operation today.

Universities in the Middle Ages allowed scholars from Europe and the Islamic world to connect and share information. Christian scholasticism, a school of critical thought that tried to reconcile religious theology and scientific truth, has its roots in the combination of two concepts. The Franciscans, founded in 1209 by St. Francis of Assisi, and the Dominicans, founded in 1215 by St. Dominic, were the two principal monastic institutions responsible for spreading scholasticism education throughout Europe. Numerous renowned 13th-century intellectuals belonged to the Franciscan or Dominican order. Included among them were Albertus Magnus, Robert Grosseteste, and Roger Bacon. The scientific method, a cornerstone of modern science, was devised in part during the High Middle Ages by the friar-scholar Roger Bacon. In his 800-page book Opus Majus, Bacon detailed the phases of scientific enquiry, which included (a) observation, (b) hypothesis creation, and (c) experimentation. In addition to this approach to scientific accomplishments, he emphasized the significance of independent verification for all scientific procedures. He worked diligently to document his methodology in order to demonstrate to other scientists the value of adopting a methodical approach to the study of science. His systematic depiction of scientific inquiry set the foundation for the contemporary scientific method.

By the end of the High Middle Ages, two non-scientific disciplines, alchemy and astrology, had gained popularity as medieval scholars delved deeper into the numerous fields of science and technology.

Alchemy, an ancient school of natural science, traditionally sought to turn ordinary metals such as lead or copper into more expensive metals such as gold. It is enigmatic because it is founded on a spiritual worldview that considers metals as living beings with legendary powers, rather than as inanimate objects employed for material creation. Astrology, on the other hand, relates the location of the sky and celestial bodies to human dwellings and the physical world. According to contemporary standards for scientific investigation and technological advancement, these two fields are no longer scientific. Although the variables that governed them were intended to explain the mysteries of nature, medieval thinkers linked them to scientific inquiry.

The 14th century heralded the beginning of the Late Middle Ages, a period of tremendous intellectual growth. During this time period, the University of Paris and Oxford University in particular realized their full potential. During the 17th and 18th centuries, the majority of this body of knowledge was generated at these universities. In addition, they promoted the use of mathematics to examine the physics of motion. Nicholas Oresme, a mathematician, proved the theorem on uniform acceleration, often known as the theorem on average speed. Constant velocity travels the same distance in the same amount of time as acceleration. John Buridan, another mathematician, established a theorem that described how a body in motion maintains its motion due to an inherent and natural quality of the body, which he termed impetus. Inventions of the Late Middle Ages included the precursors to modern eyeglasses, windmills, magnets (which led to the production of the first compasses), and spinning wheels. Medieval scholars' concern with chemistry and astronomy led to the creation of astrolabes and clocks. Historians cite constant scientific effort throughout this time period as a defining aspect of the scientific revolution of the 16th century. Also, from the beginning of the Renaissance to the end of the eighteenth century, it contributed to the accumulation of human knowledge.

IN THE WORLD : MODERN AGES

Renaissance

The transition from the Middle Ages to the modern age occurred dramatically during the Renaissance, which lasted from the 14th to the 17th centuries. The French translation of "rebirth" is "renaissance." This term alluded to the renewed interest in the arts and sciences among ancient Greeks and Romans. This period is characterized by maritime expeditions, new discoveries, innovations, and scholarly discussions.

This period is notable for the usage and innovation of printing, which enabled the dissemination of knowledge throughout the Western world. Johannes Gutenberg's invention of the printing press in the 1440s was a game-changer in the spread of mass communication. Gutenberg, a renowned goldsmith of his time, constructed the first portable printing press using his metalworking skills. Individual type heads (letters) that were cast, molded, and affixed to moving, rectangular stalks were utilized in the first machine. The ink would then be transferred onto a sheet of clamped paper using a screw press after the letters were arranged to make words and phrases within a predetermined region. Initially, the printing press was utilized to distribute copies of sacred texts. After the invention of the printing press, more individuals were able to access information. Gutenberg's Presses for Printing During the Renaissance, a handful of pioneering authors and painters produced significant literary and creative advances. Notable Renaissance authors and artists include Dante, Petrarch, Leonardo da Vinci, Michelangelo, and Raphael. The Divine Comedy, Dante's magnum achievement, gave him the title "Father of Italian Poetry." Francesco Petrarca, commonly known as Petrarch, was considered "The Father of Humanism" due to his rediscovery of ancient Greek and Roman works. The artist, sculptor, and scientist is famous for the Mona Lisa, the Vitruvian Man, and The Last Supper. Michelangelo is famous for his work on the ceiling of the Sistine Chapel, which depicts episodes from the Book of Genesis. Raphael, an Italian painter and architect, exemplified the orderly arrangement of elements and purity of form that can be observed in his works such as The School of Athens and The Sistine Madonna.

The Scientific Revolution, a series of events that ushered in the era now known as modern science, signaled the beginning of important technological and scientific advancements throughout this period. During this time, many of the most renowned scientists in the West arose, and their work is still studied and cited today. Among them are Nicolaus Copernicus, whose heliocentric theory challenged the common belief that the Earth is the center of the universe; Galileo Galilei, an Italian astronomer who proved that Copernicus was correct; and Sir Isaac Newton, whose mathematical description of the motion of the Earth and other celestial bodies around the Sun eliminated any remaining doubts about heliocentrism. The increase of scientific knowledge cleared the ground for additional industrialization and transportation advancements. The mass production of goods, the substitution of animals and humans with machines, and the introduction of new types of technology all contributed to the emergence of fuel consumption in this era. Coal was utilized to generate heat and power, which were then utilized to transform raw materials into finished products. Since the Middle Ages, coal has been mined as a source of residential heating fuel in England and other regions of Northern Europe.

The blast furnace, a type of metallurgical furnace used to produce industrial metals, was invented in the 15th century, along with the widespread use of iron and steel. In the furnace, iron is melted and poured into molds, where it is utilized to create various items. Steel and iron were used to create knives, tools, swords, armor, chains, and anchors. As glass was seen as a crucial component in the manufacture of high-quality items, the glass industry also prospered. Cotton, silk, figured fabrics, and tapestries are just a few examples of the high-quality textiles created during the textile industry's heyday. Textile production techniques existed since the Middle Ages, but the industry modernized them. Agriculture would be more profitable if fewer resources were invested. Sheep farming grew widespread because it helped feed a growing population with less labor than other agricultural practices. Instead of sickles, scythes were utilized to harvest crops and grass, and oxen replaced horses in the transportation and distribution of goods. People began using animal manure as fertilizer to raise crop yields, which led to the practice of mixed farming, which optimized land use and increased meat and grain production. Significant advancements in navigation and exploration fostered the expansion of knowledge and commerce. Christopher Columbus, an Italian explorer and navigator, was among the Europeans who traveled to Africa and Asia. The use of ships and mines was widespread across Italy. Thanks to developments in civil engineering, buildings and other structures can now be defended. During this time, inland transportation by canals also began, albeit at a slower rate than sea trade in the early modern period.

The invention of masts, sails, and sternpost rudders are but a handful of the numerous improvements that have facilitated sea travel. As shipbuilding expanded in Europe, particularly Italy, merchant vessels like as Henry Vill's Great Harry became ubiquitous. For journeys and navigation, instruments such as the compass, quadrant, and forestaff were developed for use by mariners. The mining sector first employed wheeled carts and wooden tracks, which eventually led to the development of railroads.

Industrial Revolution

The Industrial Revolution, the movement from rural to urban and industrial life, began in the 18th century. With the emergence of modern machinery and factory infrastructure during this time, mass production became feasible. Some believe that Arnold Toynbee coined the term "Industrial Revolution." At the heart of this transition, he contends, is the "substitution of competition for the medieval regulations that once guided the production and distribution of wealth" (1884).

England's industrialisation is frequently recognized as the first of its sort. The large working class and plenty of natural resources in England were two of the numerous factors that contributed to the country's rapid industrialization. These helped England to increase its economic output by employing equipment, resulting in economic expansion. As the economy transitioned from agricultural to industry, English employees were able to adapt to its changing demands. During the 18th century, France, which at the time possessed comparable political, military, and economic power to England, was also at the forefront of industrialization. From its birthplace in England, the industrial revolution quickly spread to the rest of Europe and North America.

To meet the needs of this era, it was required to develop new energy sources, technical improvements, and agricultural techniques. As new machinery was developed for the efficient production of goods, it became vital to locate readily available energy sources such as coal and fuel. Utilizing scientific techniques in crop rotation and animal breeding resulted in a significant increase in agricultural output. Later, the factory system was implemented to increase output and yields. The machines and infrastructures of the 18th and 19th centuries owe a great deal to the iron and steel industries' advancements. Toberman Bergman, a Swedish metallurgist, did not discover carbon's essential role in steel until 1750. Despite this, steel wasn't produced commercially until several years after its discovery. Henry Bessemer and William Kelly's contributions improved steel production techniques.

Kelly experimented with numerous strategies to produce steel with less charcoal. Cast iron is weaker than steel created using Bessemer's patented method. Unfortunately, disagreements arose on who had the superior method. Later, Robert Mushet, a Welsh metallurgist, discovered an iron alloy containing carbon and manganese in addition to the generated iron. The carbon content is boosted to the quantity essential for steel manufacture with the inclusion of these two components.

In the Textile Business

The Industrial Revolution marked a turning point in the textile industry. John Kay's 1733 invention of a flying shuttle significantly enhanced yarn production. In 1764, James Hargreaves invented the spinning jenny. Additionally referred to as the Saxon Wheel. It is a gadget capable of concurrently spinning numerous spindles.

Richard Arkwright created the water frame, a textile machine that was moved by water rather than by hand, several years later. In 1769, a machine for the spinning of many threads was invented. Samuel Crompton created the spinning mule, a mix of the spinning jenny and water frame, in 1779.

Edmund Cartwright devised the power loom for spinning and weaving in 1787 in an attempt to increase cotton production on English estates. Eli Whitney's invention of the cotton gin in 1793 considerably increased the amount of clean cotton that could be used to produce textiles. Cabinet Power loom maker Thomas Saint did not apply for a patent for a mechanized sewing machine until 1790, while French tailor Barthelemy Thimonnier did not invent the chain stitch machine until 1829.

Commerce in the Transport Industry

Thomas Newcomen's invention of the steam engine was a key innovation of the period. His principal purpose was to develop a water-controlling engine for Cornwall's mines. Denis Papin, the creator of the pressure cooker, lent his principle to Newcomen. Newcomen and John Calley invented a piston-based engine that was simultaneously more efficient and energy-hungry. The boiler's steam would ascend a vertical cylinder. The steam shook a massive crossbeam attached to a pump, which in turn drove the machine. If steam water were to enter the pump, a partial vacuum would be generated, allowing the pressure to again draw the piston downward. In 1765, James Watt invented and patented the steam engine that generated power effectively. He created a prototype that would prevent his machine from repeatedly heating and cooling. Consequently, fire engines required less steam and gasoline to operate. Matthew Boulton, an industrialist, became interested in Watt's invention and eventually forged a business alliance with him. The development of the steam engine proceeded throughout the Industrial Revolution because it was essential to the operation of ships and railroads. In the decades after the turn of the nineteenth century, steam engines were placed in river boats and later used to propel vehicles on land. The invention of the steam engine altered the means by which commodities and people might be moved. It was also essential in facilitating the widespread adoption of rail travel. Richard Trevithick invented the first locomotive, also known as a train engine or rail transportation vehicle. The New Castle was its designated name. Nonetheless, the heavy object caused the rails to weaken and give way. In Northumberland, England, the locomotive created by George Stephenson, the "Father of Railways," was used to transport coal. Stephenson and his brother Robert considered ways to improve locomotives after observing the success of the Blucher. The

Locomotion No. 1 was designed in 1825 and has a top speed of 12 miles per hour. Stephenson built the Rocket, a locomotive capable of 30 miles per hour, for the Liverpool & Manchester Railway. After locomotives were perfected in the 1840s, railroad construction in the United States and Europe exploded. Transportation enhancements on land created the way for maritime innovation, which in turn facilitated easier travel to and commerce with a greater number of countries. Robert Fulton constructed the North River Steamboat (later dubbed Clerinont) in 1807 utilizing the steam engine created by Boulton and Watt.

As a result, the economic and political outlooks of many nations altered substantially as a result of the technological advancements of the time. The economic upheavals caused by industrialization divided the population into two distinct classes: capitalists and labourers. The industrial capitalists' and businessmen's lobbying activities resulted in the introduction of legislation and policies that would protect their companies, so increasing their earnings. The factory owners, store owners, and bankers all fared exceptionally well. However, for financial gain, capitalists exploited the working class. Although industrialization brought about advancement, it came at the expense of the working class, who experienced hardships like as working long hours for low pay. During the peak of the Industrial Revolution, the average worker worked 14–16 hour days, six days a week, in order to meet production demands. Many skilled individuals lost their jobs as a result of the increased efficiency of robots. Frequently, rapid urbanization occurs without corresponding infrastructure investments in clean water, safe housing, or well-planned community development. The rapid spread of disease was accelerated by a lack of cleanliness and medical care. Life expectancy in cities is significantly lower than in rural areas. These changes in technology-driven industrial civilizations provided the ground for the development of political doctrines such as liberalism, socialism, constitutionalism, and individualism.

Technology and Science in the Eighteenth and Nineteenth Centuries

Numerous significant discoveries and advancements were produced throughout the 18th and 19th centuries, the height of scientific progress. Charles-Augustin de Coulomb made substantial contributions to physics around the turn of the 18th century when he published a series of studies on electrodynamics that led to the development of Coulomb's Law. In 1774, Joseph Priestley discovered oxygen by collecting colorless gas from heated mercury. Antoine Lavoisier, a French chemist, was ultimately responsible for naming this colorless gas oxygen.

Lavoisier also described how carbon-containing compounds interacted with oxygen to produce carbon dioxide and water. Immediately after publishing his results on the Law of Conservation of Mass, he was dubbed "Father of Modern Chemistry." John Dalton's 1803 Atomic Theory is premised on the notion that all matter is composed of infinitesimally small particles called atoms. This concept broadened the possibilities of physics.

In 1820, when Hans Christian Oersted discovered that electrical current generates magnetic fields, he accomplished an important scientific breakthrough. In 1821, Michael Faraday will use this discovery to construct the first primitive electric motor.

Almost immediately thereafter, in 1831, Faraday published two volumes of electrical literature and conducted experiments on electromagnetic induction.

In his theory of electromagnetic radiation, James Clerk Maxwell proposed that light, magnetism, and electricity are all manifestations of the same phenomena. In his 1865 essay, A Dynamical Theory of Electromagnetic Field, Maxwell demonstrates that electric and magnetic fields propagate through space like waves at the speed of light. In 1873, he-l published A Treatise on Electricity and Magnetism, his electromagnetic treatise.

In 1874, George Johnstone Stoney introduced the hypothesis that electrons possess fundamental electrical quantities. William Crookes discovered cathode rays in 1879 utilizing Heinrich Geissler's vacuum tube. Eugen Goldstein collected protons from a tube of hydrogen gas and published their discovery some years later.

Near the close of the nineteenth century, gamma rays, electrons, and radioactive elements were discovered. William Roentgen accidentally discovered X-rays in 1895 while examining cathode rays. J. J. Thomson discovered the electron in 1897 by placing Crookes' tube in a magnetic field, where the cathode rays were negatively charged, leading him to the conclusion that all atoms possess a negative charge. Henri Becquerel discovered radioactivity, and Marie and Pierre Curie subsequently explained it. Marie Curie did not discover radioactive materials such as radium, polonium, and uranium until the late 19th and early 20th centuries.

Not until the second half of the nineteenth century did telegraph and radio communication become widespread. Alexander Graham Bell patented the telephone in 1876 after successfully discovering an electrical current-based method of instantaneous communication. Other innovators who contributed to the creation of the telegraph include Elisha Gray, Philip Reis, and Thomas Edison.

The "Father of Taxonomy," Carolus Linnaeus, invented the binomial nomenclature to describe living things. Linnaeus is well known for his works Species Plantarum (1753) and Systema Nature (1758), in which he documented every known species of plant at the time. Linnaeus devised a multi-tiered classification system and attributed similarities between animal and plant species to God's design rather than to evolutionary relationships. His binomial method

of naming organisms is still employed today, and he described more than 4,000 species of plants and animals.
James Hutton, a Scottish geologist, proposed in 1759 that progressive mechanisms on Earth explain variations in fossils. Georges Cuvier was a pioneer in the study of fossils. In 1813, he proposed the Theory of Catastrophism, which hypothesized that extinctions must have occurred often throughout Earth's history. He based his theory on the knowledge he gathered from excavating and researching fossils from various rock levels. Charles Lyell proposed the theory of uniformitarianism in 1830, which asserts that the same geological processes are at work today as they were in the past. In the nineteenth century, attempts to explain the vast diversity of species on Earth were met with considerable debate and ambiguity. In 1809, French biologist Jean-Baptiste de Lamarck proposed the Theory of Acquired Characteristics through Use and Disuse, often known as the Inheritance of Acquired Characteristics. It postulates that an organism can pass on to its progeny some of its acquired qualities, whether through use or disuse.

On the Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Species, published in 1859 by Charles Darwin, explains the diversity of life. It asserts that natural selection causes features to be passed down across generations. Darwin visited the South American coastlines from 1831 to 1836, collecting specimens of flora and wildlife for his research. In the same year, Alfred Wallace published his findings in On Tendency of Varieties to Depart Permanently from the Original Type.

Austrian monk Gregor Mendel, the "Father of Genetics," undertook research on pea plant breeding from 1856 until 1863. A few years after Darwin published The Origin of Species, he published his findings in a scholarly journal. Later, he developed an inheritance model that describes how parents pass on their genes to their offspring. However, a century after his death, his work was eventually recognized for its quality. Nonetheless, his findings supported the Theory of Evolution's use of natural selection to transmit traits.

The Growth of Science and Technology Throughout the 20th Century

The 20th century witnessed a plethora of scientific and technological developments that significantly enhanced the convenience and comfort of human life. Modern physics took a big leap forward with the invention of quantum theory in 1900 (whose creator was Max Planck) and the theory of relativity in 1905 (its creator was Albert Einstein). Einstein also elucidated the photoelectric effect, in which matter releases electrons in response to illumination.

Scientists were able to build semiconductors and atomic power as a result of Erwin Schrodinger's 1926 quantum mechanics equation. Schrodinger presented a partial gap equation for the wave functions of particles with limited, fixed modes, such as electrons, in his extension of quantum mechanics. Robert Goddard successfully launched a rocket from a farm near Auburn, Massachusetts, in the same year. James Chadwick discovered the neutron in an atomic nucleus years later. The science of genetics also made significant progress. In 1944, Oswald Avery discovered that DNA cells contain genetic information and chromosomes. Francis Crick and James Watson proposed the double helix concept in 1953 to represent the formation of double-stranded DNA. Thanks to medical research, there have been major advances in the identification and treatment of diseases. In 1928, Alexander Fleming discovered penicillin, which is effective against staphylococcus and streptococcus infections.

The world took note in 1945 when Howard Florey and Ernst Chain invented the first commercially viable antibiotic. In 1955, Niels Jerne elaborated on the process of anti-body formation, suggesting that the body already had antigen-combating antibodies. Jonas Salk created the first polio vaccine in 1952, whereas Albert Sabin created the first oral polio vaccine in 1961. Smallpox was proclaimed eradicated by the World Health Organization (WHO) just before the turn of the millennium.

The discovery of the human immunodeficiency virus (HIV) in 1983 by Luc Montagnier and Robert Gallo boosted public understanding of the origins of AIDS and the significance of adopting preventative measures against the infection. Animal cloning was first successfully performed in the latter part of the 20th century, when a sheep named Dolly was cloned. In 1866, Gregor Mendel's pioneering work in genetics was a resounding success.

Additionally, transportation methods for both the land and the air were developed. In 1903, Orville and Wilbur Wright took off in the first airplane piloted by a human and powered by a human-powered engine. The introduction of the first vehicle to the public by Henry Ford in 1908 transformed land mobility. This resulted in a frenzy of innovation in the automobile business, led by a number of pioneering manufacturers.

In the middle of the 20th century, researchers were dissatisfied with earthly advancements and lobbied for space flight. The Soviet Union launched the world's first artificial satellite, Sputnik, in 1957 and launched the first manned space mission in 1961. A few years later, NASA was in charge of the Mercury and Apollo space missions. Apollo 11 successfully landed on the moon on July 20, 1969. These tremendous advancements in transportation made previously inaccessible regions of the globe accessible to people, goods, and services. As a result of these technical breakthroughs, there has been a significant shift in human lifestyle and worldview.

The Age of Information and the Development of the Computer

This new era of information was ushered in with the invention of advanced computers and the Internet. In addition to the typical emphasis on accumulating data, the age placed a priority on discovering novel applications for said data. After its introduction in 1812, Charles Babbage's early systems of calculation, which included the computer, had a significant impact on technological advancement. Following subsequent technological advancements, society shifted its focus to newly developing digital industries.

American mathematician Claude E. Shannon is responsible for a significant advancement in information technology. In the 1940s, while a researcher at Bell Laboratories, he developed his views on digital communication, after which he published A Mathematical Theory of Communication. Shannon proposed that information media, such as television, radio, and others, can be represented as a sequence of ones and zeros. As a result of his groundbreaking study, he is today recognized as the "Father of Information Theory," and his ideas have played a significant role in the development of numerous technologies that have come to characterize this period. Shannon and the American mathematician and scientist Warren Weaver developed the Shannon-Weaver Model of Communication. As the "mother of all models," it harmonized the various concepts in the rapidly expanding field of electronic communication.

In this design, the transmission of a message or series of messages commences at the information generator. The message, which might be a string of text, a sequence of sound frequencies, or a series of images, is transmitted by a transmitter. The transmitter processes the message and provides a meaningful signal for transmission over the channel. The channel is the way via which the intended receiver receives the message. Any communication transmitted between machines must first be decoded by a decoder, which translates binary code into a form that the receiving system can comprehend. However, it was soon determined that the Shannon-Weaver Model of Communication was unsatisfactory due to the lack of feedback from the receiver to the provider of the information. Due to this limitation, various forms of communication theory, such the transactional model and the interactive model, were created.

In the transactional paradigm, there is no one source of communication; rather, both the sender and the receiver exchange messages as communicators. Similar to the transactional model, the interactive approach is generally applied to the study of contemporary media such as the Internet. The Shannon-Weaver model's transmitter utilized pulse-code modulation (PCM), a binary and digital method for transmitting analog-type data. Although pulse code modulation (PCM) has been used for telegraph transmission since the early 1900s, British engineer Alec H. Reeves was the first to implement it for voice communication. In 1938 and 1939, he secured patents for his PCM device in France and Great Britain, respectively. As soon as Shannon joined Bell Laboratories, his invention was put into operation. Bell Laboratories built SIGSALY, a secret communication system, during World War II. The army awarded Bell Labs a contract for two systems in 1942. SIGSALY was given the titles Green Hornet, X System, Project X, and Ciphony I during its active years of 1943 to 1946. It was intended to be a secure form of communication by implementing a robust one-time pad (OTP) encryption. During World War II, it was notably used to shield Franklin D. Roosevelt and Winston Churchill's private conversations. By the conclusion of the war in 1946, much of the SIGSALY equipment had been decommissioned and the transmission logs had been destroyed.

Alan Turing, an English mathematician, initially presented his universal machine in 1936–1937. (UTM). Before the development of automated computing technology, humans nicknamed "computers" performed mathematical computations. Using a system of wheels and levers, the hypothetical machine described by Turing in his 1936 article On Computable Numbers with an Application to the Entscheidungs Problem could solve difficult mathematical equations and store enormous amounts of data more rapidly and correctly than humans. Turing is frequently referred to as the "Father of the Modern Computer" due to his work on the UTM, the first true "computing machine." In addition, German civil engineer and entrepreneur Konrad Zuse constructed the first programmable computer between 1936 and 1938. His Z3 electromechanical computer was the first fully working Turing-complete digital computer when it went live in 1941.

Around 1939, John V. Atanasoff and his PhD student Clifford Berry created the Atanasoff-Berry Computer. (ABC). This machine can solve a system of equations iteratively by determining the values of each variable. It was able to temporarily store binary data for subsequent processing on an electrostatic drum storage device with 1,600 capacitors partitioned by logic circuits. Although the machine's efficacy is controversial, its dynamic random-access memory (DRAM or RAM) storage technology has become the norm for the primary memory of modern computers.

In 1942, as a graduate student at MIT, Perry Crawford proposed utilizing a magnetic drum to store digital electrical information in his thesis titled Automatic Control by Arithmetic Operations. Project Goldberg was the codename for the 1950s computer breakthrough by Engineering Research Associates (ERA) that involved the construction of magnetic drums and disks using captured German Magnetophone components. The United States Navy used the magnetic drum memory device to crack codes; this approach was eventually adopted for use on computers at military academies in the United States and the United Kingdom. Eventually, ERA was acquired by Remington Rand, which went on to dominate the personal computer market in the early 1970s. Tommy Harold Flowers, an employee of the British Post Office, invented the first programmable electronic computer in 1943. He gave it the name Colossus. In comparison to the previous most complicated electronic gadget, its approximately 1,700 vacuum tubes represented a significant improvement. Due to its immense size, Flowers' machine was dubbed the Colossus. Flowers' addition of valves to the computer, which was generally believed to have rendered it unstable, actually made the machine more stable and played a crucial role in the decoding of German signals during World War 2.

In 1944, IBM, for instance, built the Harvard Mark 1, a general-purpose electromechanical computer designed by Howard Aiken that could compute and print mathematical tables. In June 1948, the first electrical digital computer with a stored program finished its first program, which sought to determine the greatest common factor of two numbers. In 1946, English engineers Frederic "Freddie" Calland Williams and Tom Kilburn cooperated to construct the Small-Scale Experimental Machine (SSEM), often known as the Manchester Baby computer. The machine and its corresponding software are now complete due to their combined efforts.

William Shockley's technical team was the first to mass-produce transistors for commercial usage. 1957 saw the founding of Fairchild Semiconductors by members of his team, who became known as the "traitorous eight." In a similar fashion, engineers from this company went on to found Advanced Micro Devices (AMD) and Intel Corporation, laying the framework for what is today known as Silicon Valley, a center for digital and technological R&D.

In 1948, IBM developed the 604 Electronic Calculating Punch, a computer capable of performing basic arithmetic computations hundreds of times faster than its predecessors. In December of 1957, utilizing the 604 model as a starting point, IBM created the 608 model, the first commercially available solid-state computer. It is generally accepted that American engineer Jack Kily invented and patented the first IC chip. He was an early pioneer in the science of miniaturizing and merging multiple electrical components, such as resistors, capacitors, and transistors, onto a single computer chip. The IC chip, a tiny electrical circuit, was invented in 1959. ICs are indispensable as the "brain" of modern technologies such as computers and mobile phones. In 200g, Kilby was awarded the Nobel Prize in Physics for his contributions to the integrated circuit.

In 1961, IBM released the 7030 Data Processing System, better known as the IBM Stretch computer. The first IBM supercomputer made entirely of transistors was a technological milestone. The Stretch computer was the first to utilise bytes, or 8-bit characters, despite its commercial failure. In the early 1970s, other companies also began building 8-bit processing devices. Both Intel and Fairchild were among the first companies to produce 8-bit microprocessors for commercial use. Because early computers had such a difficult time storing vast amounts of data, numerous storage strategies had to be developed. IBM's invention of floppy disks was the first mass-market data storage technology. Using this consistent and cost-effective method, instructions were loaded onto mainframes and local computer network hubs. IBM's 5.25" floppy disk and the 1977 arrival of the Apple II accelerated the widespread adoption of floppy disks.

As the successor to the floppy disk, the CD represents a significant advancement (CD). James Russell devised a system for recording digital data on optically transparent foil using a high-intensity halogen light source, which led to the development of the compact disc (CD). Russell's invention was granted a patent in 1970, and Sony and Philips licensed the patent in the 1980s. The compact disc (CD) was intended to replace vinyl as a recording medium due to its capacity to record and play back sounds without requiring physical contact between its components. Initially, a laser beam was used to scan a track of pits within the material of a compact disc. In the years that followed, this technology experienced a succession of improvements that led to its eventual public release.

Countries on both sides of the Cold War utilized computers to expedite intelligence gathering and sharing. In the United States, systems to address such procedures were built in collaboration between educational institutions and government bodies. This requirement was answered in 1969 when the Advanced Research Projects Agency Network, or ARPANET, was established. ARPANET was a packet-switching network, which meant that communications were divided into smaller bits, or "packets," before being transmitted to their appropriate destinations. When the intended receiver receives the message, it reassembles and can be read in its entirety. Before being shut down in 1990, ARPANET connected computer networks in the United States, Europe, and Australia for twenty years.
It was utilized by the Federal Reserve Board, the Department of Defense, the National Science Foundation, NASA, and the military of the United States. ARPANET was decommissioned in 1990 and replaced by the Internet. Simply explained, the Internet is a network of networks that connects networks from across the globe. Tim Berners-Lee, a British computer scientist working at the Conseil Européen de Recherche Nucléaire (CERN) in Geneva, Switzerland, created the World Wide Web (WWW) in 1989 so that people may share and access information globally. As a result of the World Wide Web, or "web," all of CERN's computers were linked to a single network, which allowed the flow of data quickly. Previously inaccessible info is now available from any internet-connected computer. In addition to the Uniform Resource Identifier/Uniform Resource Locator (URI/URL), the resource or address of a webpage, and the HyperText Transfer Protocol (HTTP), which defines how information is formatted and distributed across servers and browsers, Berners- Lee was able to establish a number of other ground-breaking concepts related to the World Wide Web in 1989. By the end of 1990, Berners-Lee had constructed the first web page editor, entitled WorldwideWeb.app. 1991 marked the beginning of public Internet access and engagement in the burgeoning online community. Internet Protocol (IP) addresses were designed so that each device connected to the internet could be identified uniquely. The IP address of a computer is a label that denotes its network location and identifies the host computer. To visit a website, users enter its Uniform Resource Locator (URL), such as "www.facebook.com," into a web browser; the protocols translate this URI into an IP address in the range 66.220.144.0 - 66.220.159.255.

The development of the internet and the various protocols and systems that make it function in the 1990s and beyond made possible revolutionary technological advancements still in use today. Such innovations include electronic mail (e-mail), instant messaging, video calling, blogs, online forums, social networks, and online shopping platforms. The Internet has enhanced the rate at which information can be transferred and stored.