Learning Guides: sts-prelim

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Learning Guide: Cradles of Early Civilization_1_1.pdf

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Pages 1-9

Here is a simplified, easy-to-read learning guide based on the provided text, designed for study.

Learning Guide: General Concepts and Historical Events in Science, Technology, and Society

I. Cradles of Early Science

This section explores the significant scientific and technological advancements in ancient civilizations across different continents.

A. Development of Science in Mesoamerica

Mesoamerica covers Central America from Southern Mexico to the border of South America, a region rich in pre-European culture and knowledge.

1. Maya Civilization * **Duration:** Lasted approximately 2,000 years. * **Astronomy:** * Advanced understanding used in temples and religious structures for astronomical observation (e.g., Chichén Itzá pyramid aligned with equinoxes). * Knowledge of predicting eclipses. * Used astrological cycles for planting and harvesting. * **Time Measurement:** Developed two complex calendar systems for planning activities and religious rituals. * **Technology & Engineering:** * Methods for growing various crops. * Built elaborate cities with ordinary tools. * Sophisticated hydraulic systems with waterways for water supply. * Looms for weaving cloth. * Glittery paints from mica mineral. * Produced rubber products 3,000 years before Goodyear's patent. * **Writing:** One of the world's first civilizations to use a writing system (Mayan hieroglyphics). * **Mathematics:** * Skilled in mathematics. * Number system based on numeral 20. * Independently developed the concept of zero and positional value (before the Romans).

2. Inca Civilization * Made advanced scientific ideas despite being an old civilization. * **Key Developments:** * Roads paved with stones. * Stone buildings resistant to earthquakes and disasters. * Irrigation systems and water storage techniques for crops in diverse lands. * Calendar with 12 months for religious festivals and planting. * First suspension bridge. * **Quipu:** A system of knotted ropes used for record-keeping, interpreted by experts. * Inca textiles: Highly prized artistic achievements.

3. Aztec Civilization * Significant contributions to science, technology, and society. * **Key Contributions:** * **Mandatory Education:** Valued education, mandating it for all children regardless of social class, gender, or age (early form of universal education). * **Chocolates:** Developed chocolate in Mexico; used as currency by Mayans and tribute to gods by Aztecs. * **Antispasmodic Medication:** Used a type of medication to prevent muscle spasms and relax muscles, useful during surgery. * **Chinampa:** Agricultural farming technology dividing land into rectangular areas surrounded by canals. * **Aztec Calendar:** Enabled planning of activities, rituals, and planting seasons. * **Canoe:** Invention of a light, narrow boat for water travel.

B. Development of Science in Asia

Asia, the biggest continent, was home to many influential ancient civilizations.

1. India * **Metallurgy:** Known for manufacturing iron and metallurgical works; Indian steel was highly regarded in the Roman Empire. * **Medicine:** * **Ayurveda:** Traditional medicine system originating before 2500 BC, still practiced today. * Discovered medicinal properties of plants. * Ancient texts like the *Susruta Samhita* describe surgical and medical procedures. * **Astronomy:** * Developed theories on the configuration of the universe, spherical self-supporting Earth. * Concept of a 360-day year with 12 equal 30-day parts. * *Siddhanta Shiromani* (12th century) covered planetary motions, eclipses, conjunctions, and more. * **Mathematics:** * Indus Valley Civilization: Earliest mathematical knowledge, standardized length measurement (Mohenjo-daro ruler). * **Aryabhata (476-550 AD):** Introduced trigonometric functions, tables, techniques, and algebra algorithms. * **Brahmagupta (628 AD):** Suggested gravity as a force of attraction, explained zero as a placeholder and decimal digit, and refined the Hindu-Arabic numeral system (now universal). * **Madhava of Sangamagrama:** Considered the founder of mathematical analysis.

2. China * Major contributions in medicine, astronomy, science, mathematics, arts, philosophy, and music. Influenced neighboring countries. * **Traditional Medicine:** Centuries of experience and discovery of plant/animal properties (e.g., acupuncture). * **Technology & Inventions:** * **The Four Great Inventions:** Compass, papermaking, gunpowder, printing tools (reached the West late in the Middle Ages). * Other tools: Iron-plough,

wheelbarrow, propeller. * Designed different models of bridges. * Invented the first seismological detector. * Developed a dry dock facility. * **Astronomy:** * Detailed records of supernovas, lunar and solar eclipses, and comets. * Observed heavenly bodies to understand weather changes and seasons. * Used lunar calendars. * **Seismology:** Prepared for natural calamities due to their understanding. * **Limitation:** Cultural factors (religious and philosophical framework) may have prevented Chinese achievements from developing into modern science by hindering the acceptance of "laws of nature."

C. Middle East Countries (Golden Age of Islam)

- **Period:** 7th to 13th century (Muslim scholarship).
- **Factors for Intellectual Growth:** Common Arabic language, access to Greek texts from the Byzantine Empire, proximity to India.
- **Scientific Method:** Muslim scientists valued experiments over plain-thought experiments (unlike the Greeks), leading to the development of the scientific method and an empirical approach.
- **Key Scientists & Contributions:**
    - **Ibn al-Haytham:** Regarded as the "Father of Optics" for his empirical proof of the intromission theory of light.
    - **Muhammad ibn Musa al-Khwarizmi:** Gave his name to the concept of the **algorithm**; **algebra** is derived from "al-jabr," the title of one of his publications.
    - **Arabic Numeral System:** Originally from India, but Muslim mathematicians refined it with additions like decimal point notation.
    - **Jabir ibn Hayyan:** Considered the "Father of Chemistry."
    - **Ibn Sina:** Pioneered experimental medicine and was the first physician to conduct clinical trials.
        - **Notable Works:** *The Book of Healing* and *The Canon of Medicine* (standard medical texts until the 17th century).
        - **Contributions:** Discovered the contagious nature of infectious diseases, introduced clinical pharmacology.
- **Decline:** Began in the 11th-13th century due to Mongol conquests, which destroyed libraries, observatories, and learning institutions.

D. Development of Science in Africa

Science emerged in Africa long before European colonization, with early civilizations being knowledge producers.

1. Ancient Egyptian Civilization * Significant advances in astronomy, mathematics, and medicine. * **Geometry:** Developed out of necessity to preserve farmlands along the Nile River. Used to build rectilinear structures and post-and-lintel architecture (e.g., pyramids, early dams). * **Alchemy:** Egypt was a center of alchemy, the medieval forerunner of chemistry. * **Medicine:** Studied human anatomy and pharmacology; applied examination, diagnosis, treatment, and prognosis (parallels the empirical scientific method). * **Astronomy:** Used three types of calendars: lunar, solar, and stellar (or combinations).

2. Metallurgy * North Africa and the Nile Valley imported iron technology from the Near East, benefiting from developments during the Bronze and Iron Ages. * Invented metal tools for homes, agriculture, and architecture.

3. Mathematics * **Lebombo Bone:** Dated 35,000 BCE, considered the oldest known mathematical artifact. May have been a tool for multiplication, division, simple calculations, or a six-month lunar calendar. * **Ancient Egyptians:** Proficient in four fundamental mathematical operations, algebra, and geometry. * **Islamic Regions in Africa (Medieval Period):** Benefited from advanced mathematical learning, including algebra, geometry, and trigonometry.

II. The Scientific Revolution

The Scientific Revolution was a "golden age" in science history, marking its birth as a discipline and field of inquiry.

- **Key Features:**
    - Development of the **scientific method**.
    - Generation of innovative, useful, and sometimes controversial scientific ideas and discoveries.
    - Shift from "thought experiments" to **data-driven and experiment-based ideas**.
    - Inspired human creativity and critical thinking.

- **Essential Contributors:**
    - **Nicolaus Copernicus:** Developed the **heliocentric model** of the universe, placing the Sun at the center with planets orbiting it at unvarying rates. This logically positioned the planets in sequence.
    - **Charles Darwin:** Made significant contributions to evolutionary biology and philosophy of science. His **theory of evolution by natural selection** remains influential.
    - **Sigmund Freud:** Developed **psychoanalysis**, a method for understanding human behavior, especially neurological conditions.

III. Overall Impact of Science on Ancient Civilizations

- Science developed globally: Asia, Europe, Mesoamerica, Africa.
- Ancient peoples invented tools for daily life, discovered medicines, observed heavenly bodies, built structures, and developed mathematics.
- Science provided the means for civilizations to survive, understand the natural and physical world, and develop technologies for everyday tasks.

Think About These Questions (for self-study):

- How did society shape science, and how did science shape society?
- How do social and human issues influence science?
- How do the political and cultural landscapes of a society affect the development of scientific culture, activities, and literacy?
- Considering the current state of our society, do you think science literacy among people has contributed to the growth of our economy?
- How can science influence government policies?

Learning Guide: Lesson 1 Intellectual Revolution_1_1.pdf

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Pages 1-20

Here is a simplified, easy-to-read learning guide based on the provided text:

LEARNING GUIDE: INTELLECTUAL REVOLUTIONS THAT DEFINED SOCIETY

1. Introduction to Science & Society

- **Goal:** Understand how Science and Technology transform society.
- **Core Idea:** Science has always been deeply connected with human society. It's as old as the world itself, with no single identifiable start point.

2. Defining Science

Science can be understood in several ways:

- **As an Idea:** It encompasses theories, systematic explanations, and observations about the natural and physical world.
- **As an Intellectual Activity:** It involves systematic observations and experiments to understand phenomena.
- **As a Body of Knowledge:** It is a subject or field of study dedicated to learning about the natural and physical world (e.g., school science).
- **As a Personal & Social Activity:** It represents human efforts and knowledge aimed at developing a better understanding of the world around us.

3. Early Examples of Scientific Practices

Science has a long history, as shown by ancient practices:

- **Trepanation:** An early form of brain surgery (making a hole in the skull), dating back 6,000 years in Cappadocia, Turkey.
- **Sustainable Agriculture:** Chinese farmers practiced raising fish in rice paddies over 1,000 years ago, benefiting both the environment and communities.
- **Mummification:** The process of preserving deceased humans.
    - **Egyptian Mummification:** Practiced because Egyptians believed the soul needed to find and recognize the body to live forever after death.

4. The Scientific Revolution

- **Definition:** A period of enlightenment (16th-18th century) in Europe where major developments in mathematics, physics, astronomy, biology, and chemistry fundamentally changed society's understanding of nature.
- **Impact:** It led to the emergence of modern science.
- **Why Europe?**
    - Invention of the printing machine, facilitating knowledge dissemination.
    - Flourishing intellectual activities in learning centers.
    - Growing number of scholars in various fields.

5. Pre-Scientific Revolution Context

Before the Scientific Revolution, explanations for phenomena often came from:

- **Philosophy:** Provided ideas and explanations.
- **Religion:** Used to rationalize the origin of life and natural phenomena.

6. Conflict with Traditional Views

- **Resistance:** Many early scientific ideas were not accepted by rulers and religious leaders.
- **Consequences:** Scientists often faced condemnation, and some were even sentenced to death by religious institutions.
- **Perseverance:** Despite resistance, scientists continued their pursuit of knowledge about the natural world.

7. Key Figures & Revolutionary Ideas

Nicolaus Copernicus (1473-1543)

- **Major Contribution:** Developed the **Copernican Model** (published 1543), which introduced **Heliocentrism**.
- **Heliocentrism:** An astronomical model that proposed:
  - The Sun is near the center of the Universe and is motionless.
  - Earth and other planets orbit the Sun in circular paths.
- **Challenged Previous Beliefs:** This model directly contradicted the dominant **Aristotle and Ptolemaic model** (geocentrism), which held for nearly 2,000 years and placed the Earth at the center of the Universe.
- **Reception:** The Copernican Model was banned and ignored by Rome in the 16th century, judged as heretical and unacceptable for Catholic teaching.

Pages 19-38

Here is a simplified, easy-to-read learning guide based on the provided text:

Learning Guide: Early Astronomy & Evolution

This guide covers key concepts in the shift from geocentric to heliocentric models and the foundational ideas leading to Darwin's theory of evolution.

Part 1: Early Astronomy & The Copernican Revolution

1. The Dominant Ancient Model (Ptolemaic/Aristotelian) * For nearly 2000 years, astronomy was dominated by the **Aristotle and Ptolemaic model**. * This model was **geocentric**, meaning it believed the Earth was the center of the universe.

2. Nicolaus Copernicus (1473-1543) * **Background:** Raised Roman Catholic, feared persecution for challenging established views. * **Interest:** Developed an early interest in astronomy and science. * **Key Idea:** Proposed a **heliocentric model** of the universe, where the Sun (Greek: *helios*) is at the center.

3. Copernicus's Heliocentric Model * **Publication:** His groundbreaking work, *On the Revolutions of the Heavenly Spheres*, was published in 1543, shortly after his death. * **Core Argument:** The Sun, not the Earth, is the center of the universe. * **Limitation:** Copernicus still adhered to the ancient belief in **uniform circular motion** for planetary orbits, even though he knew it wasn't perfectly accurate.

4. The Copernican Revolution * **Definition:** A gradual shift in understanding that the Earth is not the center of the universe. * **Impact:** It fundamentally changed the scientific **paradigm** (a set of scientific ideas and assumptions). * **Significance:** This revolution helped humanity realize we are part of the universe, but not necessarily its most important or central part.

Part 2: Charles Darwin & The Theory of Evolution

1. Charles Darwin (1809-1882) * **Role:** Known as "The Father of Evolution." * **Background:** Born in Shrewsbury, England. Studied Medicine and Theology. * **Profession:** Naturalist. * **Burial:** Westminster Abbey.

2. Darwin's Theory of Evolution * **Evolution:** Defined as **change over time**, the process by which modern organisms have descended from ancient organisms. * **Scientific Theory:** A well-supported, testable explanation of natural phenomena.

3. Key Ideas that Shaped Darwin's Thinking

- **James Hutton (1795) - Geological Change:**
  - Proposed Earth's surface changes slowly due to geological forces.
  - Suggested Earth is much older than previously thought (thousands vs. millions of years).
- **Charles Lyell - Principles of Geology:**
  - Argued that geological features are constantly being built up or eroded down.
  - Inspired Darwin to consider if life also changes over vast periods, just as the Earth does.
- **Lamarck's Theory of Evolution:**
  - Proposed ideas like:
    - **Tendency toward Perfection:** Organisms strive to become more complex (e.g., giraffes stretching necks).
    - **Use and Disuse:** Organs used more would develop; those not used would atrophy.
    - **Inheritance of Acquired Traits:** Traits acquired during an organism's lifetime could be passed to offspring.
  - *(Note: Lamarck's specific mechanisms were later disproven, but he established the idea of change over time.)*
- **Thomas Malthus (19th Century Economist) - Population Growth:**
  - Observed that populations grow faster than the food supply.
  - Predicted insufficient living space and food shortages if populations continued to grow unchecked.
  - Darwin applied this concept to animal populations, recognizing a struggle for existence.

- **Alfred Russel Wallace (1823-1913) - Natural Selection:**
    - A botanist who independently conceived of evolution by **natural selection** based on his fieldwork in Malaysia.
    - His essay summarizing his findings prompted Darwin to finally publish his own extensive research.

4. Darwin's Voyage and Publication * **Voyage of HMS Beagle:** Began February 12, 1831, sailing around the world. * **Findings:** His observations and collected evidence from this journey laid the foundation for his revolutionary hypothesis about how life changes over time. * **Publication:** Prompted by Wallace's essay, Darwin published his monumental work, *On the Origin of Species*.

Pages 37-56

Here is a simplified, easy-to-read learning guide based on the provided text:

Learning Guide: Darwin's Journey and the Theory of Evolution

1. The Spark: Publishing "On the Origin of Species"

- **Alfred Russel Wallace's Influence:** Wallace wrote an essay summarizing evolutionary change from his fieldwork in Malaysia.
- **Darwin's Motivation:** Wallace's work prompted Charles Darwin to publish his own long-developed findings.

2. The Voyage of H.M.S. Beagle

- **Dates:** February 12, 1831 – 1836 (a 5-year journey).
- **Ship:** H.M.S. Beagle.
- **Charles Darwin's Role:** Naturalist (he studied plants, animals, and collected fossils).

- **Destination:** A voyage around the world.
- **Key Finding:** Darwin gathered evidence that led him to propose a revolutionary hypothesis about how life changes over time.

3. Observations on the Galapagos Islands

- **Location:** The Galapagos Islands are 500 miles west of Ecuador in the Pacific Ocean, directly on the equator.
- **Significance:** Many of Darwin's crucial conclusions stemmed from his observations of wildlife here. (Note: "Galapagos" means "turtle").
- **Finches: A Key Observation:**
    - Darwin observed **13 different types of finches** on these islands.
    - All Galapagos finches resembled a bird he had seen on the South American continent.
    - **Key Difference:** The most distinct difference among finch species was their **beaks**, which were specifically adapted for the diets available on individual islands.
- **Darwin's Initial Thoughts:**
    - He questioned why, if birds were created for their specific environments, the Galapagos finches didn't resemble birds from similar environments (like Africa) instead of South America.
    - He hypothesized that some birds migrated from South America to the Galapagos and then **changed** over many years.

4. Returning Home: Developing the Hypothesis

- **Island Variations:** Darwin observed that characteristics of many plants and animals varied significantly among the different islands.
- **Core Hypothesis:** He proposed that separate species might have arisen from an original common ancestor.
- **Fossils:**
    - Darwin collected **fossils**, which are the preserved remains of ancient organisms.
    - He noticed that some fossils resembled organisms still alive, suggesting a connection between past and present life forms.

5. Darwin's Theory: Evolution by Natural Selection

After studying his findings, Darwin developed new concepts of change, leading to his groundbreaking theory.

- **Evolution:**
  - **Definition:** Change in species over time.
  - Also known as **"Survival of the Fittest."**
- **Key Concepts within the Theory:**
  - **Natural Variation:** The natural differences that exist among individuals within a species.
  - **Artificial Selection:** A process where humans (instead of nature) select individuals with desirable variations for breeding, leading to changes in a species over generations (e.g., dog breeding).
  - **The Struggle for Existence:** Members of each species must compete for essential resources like food, shelter, and other necessities to survive.
  - **Survival of the Fittest:** Individuals within a species who possess characteristics (adaptations) that make them better suited or "fitter" for their environment are more likely to survive and reproduce.
  - **Natural Selection:** Over time, this process results in changes in the inherited characteristics of a population. These changes increase a species' **fitness** (its ability to survive and reproduce) in its specific environment.

6. Darwin's Enduring Contributions

- **Evidence for Evolution:** Darwin provided compelling evidence that species evolve over time.
- **Theory of Natural Selection:** In 1859, he proposed this theory to explain the mechanism of evolution (often summarized as "Survival of the Fittest").
- **Species Replacement:** He showed that ongoing change within species leads to new, more successful species replacing older, less successful ones.
- **Extinction:**
  - **Definition:** The permanent disappearance of a species.

- Darwin's work explained that less successful species become extinct, and fossil evidence supports the idea that modern species evolved from ancestral forms that are now extinct.

Pages 55-74

Here is a simplified, easy-to-read learning guide based on the provided text:

Learning Guide: Key Figures and Ancient Civilizations

I. Charles Darwin (1809-1882)

A. Key Contributions: * Provided evidence that species evolve over time. * Proposed the **Theory of Natural Selection** in 1859 to explain evolution, often summarized as "survival of the fittest." * Believed that changes within species lead to new species replacing older, less successful ones, which become extinct. * Fossil evidence supports that species evolved from extinct ancestral forms. * **Extinct:** Species that have permanently disappeared.

B. Key Life Milestones: * **1809:** Born in Shrewsbury, England. * **1831:** Graduated from Cambridge University; embarked on a five-year voyage aboard the HMS Beagle, including the Galapagos Islands. * **1836:** Returned from his voyage, established himself as a scientist in London. * **1838:** Recognized the importance of natural selection after reading Thomas Malthus. * **1858:** Joint presentation of Wallace-Darwin papers on natural selection to the Linnean Society. * **1859:** Published his seminal work, *On the Origin of Species*. * **1871:** Published *The Descent of Man, Selection in Relation to Sex*. * **1882:** Died; buried at Westminster Abbey, London.

II. Sigmund Freud (1856-1939)

A. Introduction: * An Austrian neurologist. * Considered the **father of psychoanalysis**. * One of the first psychologists to extensively study human motivation. * Lived in Vienna for 80 years, observing patients.

B. Psychoanalysis: * **Definition:** A scientific method for studying the human mind and neurotic illnesses. * **Core Idea:** Freud noticed patients' physical symptoms often had a mental basis, leading him to believe that many forces influencing behavior are **unconscious**. This formed the basis of his theory of personality. * **Development:** Developed his models over five decades, primarily through clinical studies of individual patients undergoing treatment.

C. Mental Illness and Motivation: * **Mental Illness:** Freud believed mental illness results from **nurture** (upbringing, environment), not **nature** (genetics, inherent traits). * **Motivation:** He questioned "What makes people do things?" His answer was **motivation**, driven by fundamental **needs** (e.g., food, shelter, clothing). * **Drives/Desires:** * Being deprived of a need creates a strong feeling called a **drive** or **desire**. * While animals respond instinctively, humans learn various ways to respond to these drives. * Human motivation explains the underlying reasons for people's behavior. * These drives, often unconscious (e.g., "will to live," "will to die"), can sometimes lead to irrational behavior.

D. The Human Mind: Id, Ego, and Superego Freud proposed that the human mind has three interconnected aspects that influence behavior:

1. **Id:**
    - **Nature:** Entirely unconscious.
    - **Function:** Seeks to bring immediate pleasure (**pleasure principle**).
    - **Characteristics:** Contains primitive parts of our personality, including aggressive and sexual drives.
2. **Ego:**
    - **Nature:** Primarily conscious (**Rational Self**), but with unconscious components.

- **Function:** Deals with reality. Decides what actions to take based on what is believed to be right and rational for positive outcomes.
- **Characteristics:** Acts as a mediator between the Id's desires, the Superego's morals, and external reality.

3. **Superego:**

   - **Nature:** Largely unconscious.
   - **Function:** Acts as our conscience. Reminds us of what we **should** do, based on internalized societal and parental standards of morality.
   - **Characteristics:** Develops from societal rules and moral teachings.

E. Conflict and the Iceberg Analogy: * The **Id** (instinctive drives) and the **Superego** (moral conscience) are in constant conflict. For example, your drive might tell you to do one thing, while society's rules (internalized by the Superego) tell you something else. * Freud compared the human mind to an **iceberg**: * **Tip above water (Consciousness):** Represents conscious awareness (mainly the Ego). * **Vast region below the surface (Unconscious):** Symbolizes the unconscious mind, where the Id and Superego reside entirely, and a significant part of the Ego also operates. * Only the Id is **totally unconscious**.

III. Development of Science in Mesoamerica

A. Mesoamerica Defined: * **Geographical Area:** Encompasses the entire region of Central America, stretching from Southern Mexico down to the border of South America. * **Major Civilizations:** The Maya, Aztec, and Inca civilizations flourished in this region.

B. Maya Architecture: * The Maya were renowned builders, constructing impressive structures for various purposes: * **Temples and Palaces:** Towering structures that dominated their cities. * **Religious Centers:** Priests performed religious ceremonies and sacrifices atop the temples, with people gathering in the plazas below. * **Other Structures:** Included ceremonial platforms, pyramids, observatories (indicating advanced astronomical knowledge), and ball courts.

Pages 73-92

Here's a simplified learning guide based on the provided text:

Learning Guide: Ancient Mesoamerican Civilizations (Maya, Inca, Aztec)

I. Maya Civilization

The Maya were known for their advancements in science, technology, and learning.

A. Astronomy & Timekeeping * **Understanding Celestial Bodies:** Deep knowledge of stars and planets. * **Eclipse Prediction:** Able to predict eclipses. * **Astrology & Agriculture:** Used astrological cycles for planning planting and harvesting. * **Calendar System:** Developed a sophisticated calendar for measuring time.

B. Technology * **Hydraulics:** Built advanced hydraulic systems. * **Crop Growing:** Invented technologies for cultivating crops. * **Paints:** Devised glittery paints using mica, a mineral. * **Weaving:** Constructed looms for weaving cloth.

C. Advances in Learning * **Writing System:** Created a complex system of **hieroglyphics** (picture-based writing). * **Numerals:** Developed their own set of numerals. * **Calendar:** Created a highly accurate **365-day calendar**.

D. Ancient Innovations * **Rubber:** Perfected the use of rubber 3000 years ago, long before modern patents.

E. Decline of the Maya * **City Abandonment:** Many major Maya cities were abandoned around 900 A.D. * **Unknown Cause:** Archaeologists are unsure why the civilization declined. * **Leading Theory:** A severe drought around 900 A.D. may have led to widespread starvation and migration.

II. Inca Civilization

The Inca were master engineers, innovators, and organizers.

A. Scientific & Engineering Innovations * **Stonework:** * Constructed stone temples without using mortar. * Stones were cut and fitted so precisely that a knife could not fit between them. * **Suspension Bridges:** Credited with inventing the first suspension bridge. * **Irrigation Systems:** Developed sophisticated irrigation and water storage techniques to grow crops in various types of land. * **Textiles:** Known for their high-quality Inca textiles.

B. Information Management: Quipu * **Definition:** A system of knotted cords used to store vast amounts of information crucial to their culture and civilization. * **Structure:** Typically had a main string (about two feet long) with other strings knotted to it. * **Counting System:** Used a base-ten (decimal) system for recording data. * **Communication:** Allowed messages and data to be carried across the empire by Inca runners.

C. Timekeeping: Calendar * **Structure:** Divided into 12 months. * **Month Divisions:** Each month was divided into 3 weeks. * **Week Length:** Each week had 10 days. * **Religious Significance:** Each calendar month hosted a different religious festival.

D. Medical Advances * **Skull Surgery:** Successfully performed complex skull surgery. * **Anesthesia:** Used medicines to make patients unconscious during surgical procedures.

III. Aztec Civilization

The Aztecs were a dominant power in central Mexico, known for their societal and scientific contributions.

A. Location * Lived in the **Valley of Mexico** in central Mexico.

B. Key Scientific Contributions * **Education:** Established mandatory education for their citizens. * **Chocolates:** Developed and popularized the use of chocolate. * **Antispasmodic Medication:** Created medicines to relieve muscle spasms. * **Chinampa:** Developed **chinampas** (floating gardens) for agriculture in lakes. * **Aztec Calendar:** Created their own

advanced calendar system. * **Canoe:** Credited with the invention of the canoe for water travel.

Pages 91-110

Here is a simplified, easy-to-read learning guide based on the provided text:

Ancient Civilizations: Science & Contributions (Pages 91-110)

This guide summarizes key scientific and technological contributions from the Aztecs, ancient India, and ancient China.

I. Aztec Science and Contributions

The Aztec civilization made significant advancements in various fields:

- **Mandatory Education:** Education was a societal priority.
- **Chocolates:** Aztecs were among the first to cultivate cacao and consume chocolate.
- **Antispasmodic Medication:** Developed medicines to relieve muscle spasms.
- **Chinampa:** Innovative agricultural technique involving floating gardens built on lake beds, greatly increasing food production.
- **Aztec Calendar:** A complex calendar system.
- **Invention of the Canoe:** Developed canoes for transportation on water.

The Aztec Calendar

- **Appearance:** Often depicted as a large stone disk, featuring the sun god in its center.
- **Purpose:** Used to predict or forecast future events.

- **Cycles:** Operates on a 260-day cycle.
- **Comparison to Modern Calendar:**
    - **Similarities:** Both track days and have cyclical patterns.
    - **Differences:**
        - Aztec calendar has 260-day cycles; modern calendar has 365 days/year.
        - Aztec calendar used for predictions; modern calendar primarily tracks days/months.
    - **Influence:** The Aztec calendar has influenced the common calendars we use today.

II. Development of Science in Asia

Ancient civilizations in India and China made profound contributions to science and technology.

A. India

Key rivers were crucial to the development of Indian civilization.

1. Traditional Medicine:

- **Ayurveda:** An ancient system of traditional medicine, practiced before 2500 BC and still used today as an alternative medicine.
- **Hatha Yoga:** A system of physical postures and breathing techniques for health and well-being.

2. Key Scientists & Contributions (Gupta Era):

- **Varahamihira:** Contributions to trigonometry, optics, arithmetic, and calculation of equinoxes.
- **Aryabhatta (476-550 AD):**
    - Approximated the value of Pi (π).
    - Developed the decimal system, including the concept of zero (0).
    - Advanced algebra.
    - Proposed heliocentrism (Earth revolves around the Sun).
    - Provided explanations for lunar and solar eclipses.
- **Sushruta:** Known as the "Father of Modern Surgery," author of the *Susruta Samhita* (a foundational text on surgery).

- **Brahmagupta:** First to systematically use zero (0) and suggested gravity as a force of attraction.
- **Madhava:** Considered the founder of mathematical analysis.

3. Other Indian Contributions:

- **Invention of Pottery:** Early development of pottery techniques.
- **Discovery of Cotton:** Cultivation and use of cotton for textiles.
- **Modern Metallurgy:** Advanced metalworking techniques.

4. Indus Valley Civilization:

- **Standardized Measurement:** Developed standardized units for measuring length.
- **Mohenjodaro Ruler:** Designed a precise ruler.

B. China

China is an ancient civilization with substantial contributions that significantly influenced neighboring countries (e.g., Korea, Japan, Vietnam).

1. Areas of Contribution:

- Medicine
- Astronomy
- Science
- Mathematics
- Arts
- Philosophy
- Music

2. Key Inventions & Technologies:

- **Inventions:**
    - Compass
    - Papermaking
    - Gunpowder
    - Printing tools
    - Iron plough
    - Wheelbarrow
    - Propeller

- **Architecture & Engineering:**
  - Developed and designed sophisticated bridges.
  - Invented the first seismological detector (to detect earthquakes).
  - Developed dry dock facilities for shipbuilding and repair.
- **Agriculture & Industry:**
  - Evidence of early farming communities.
  - Domesticated animals for food and clothing.
  - Worked with metals to fabricate tools and farm implements.
  - Developed the idea and method of producing silk.

3. Medicine:

- **Acupuncture:** An ancient therapeutic technique involving the insertion of thin needles into the body.

4. Astronomy:

- Maintained detailed records of celestial phenomena:
  - Supernovas (exploding stars).
  - Lunar and solar eclipses.
  - Comets.
  - Other heavenly bodies.

5. Dynastic Contributions:

- **Shang Dynasty (First Chinese Dynasty):**
  - Developed bronze containers and vessels.
  - Produced silk for clothing.
  - Established a system of writing.
- **Chou Dynasty:**
  - Improved farming methods, leading to increased rice and crop production.
  - Systematically studied and recorded solar eclipses.
  - Mapped major stars in the heavens.

Pages 109-128

Here is a simplified, easy-to-read learning guide extracted from the provided text, focusing on essential information for studying.

Learning Guide: Ancient Science & Civilization

I. Ancient Chinese Dynasties: Scientific & Cultural Contributions

A. Shang Dynasty (First Chinese Dynasty) * **Innovations:** * Developed bronze containers/vessels. * Produced silk for clothing. * Established a system of writing.

B. Chou Dynasty * **Agriculture:** Improved farming, leading to increased rice and crop production. * **Astronomy:** * Studied and recorded eclipses of the sun. * Mapped major stars.

C. Ch'in Dynasty * **Name Origin:** The name "China" is derived from "Ch'in." * **Territory:** Established the country's territorial boundaries. * **Emperor Shih Huang Ti:** * Instituted harsh governance. * Abolished feudal privileges. * Ordered the burning of many books (including the legacy of the Shang dynasty). * Initiated the construction of the Great Wall of China.

D. Han Dynasty * **Medicine:** Discovered healing drugs and herbs from plants and animals. * **Inventions:** * Developed the "earthquake weather clock," now known as the **seismograph**. * Pioneered the technology of **paper making**. * Invented the **printing press**.

E. Sung Dynasty * **Navigation:** Constructed bigger boats/ships capable of long-distance high seas travel.

F. T'ang Dynasty * **Inventions:** * Invented and developed **gunpowder**. * Recognized **coal as fuel**.

II. Middle East: Pioneers in Science

A. Astronomy & General Science * Recorded supernovae, lunar/solar eclipses, and comets.

B. Key Scientists & Their Contributions

- **Ibn al-Haytham:**
  - Known as the **"Father of Optics."**
- **Muhammad Ibn Musa Al-Khwarizmi:**
  - Developed **Algebra** and **Algorithm**.
  - Introduced decimal point notation to Arabic numerals.
- **Jabir Ibn Hayyan:**
  - Known as the **"Father of Chemistry."**
- **Ibn Sina:**
  - Pioneered the science of **experimental medicine**.
  - Introduced **quarantine** to limit disease spread.
  - Introduced **clinical pharmacology**.
  - Authored influential books: "The Book of Healing" and "The Canon of Medicine."

III. Development of Science in Africa

A. Main Areas of Scientific Development: * Astronomy * Mathematics * Medicine * Alchemy

B. The Lebombo Bone * **Location:** Found in Swaziland, Africa. * **Significance:** Oldest known calendar, dated to 35,000 years ago. * **Description:** A baboon fibia with 29 well-defined notches. * **Believed Use:** Thought to be a lunar calendar device (29-30 day cycle).

IV. Egyptian Civilization: The Gift of the Nile

A. Geography & Foundation * **Location:** Northeastern Africa. * **Nile River:** Crucial for supporting agricultural activities and the civilization itself, providing necessary water as it flows from Central Africa to the Mediterranean.

B. Architectural & Engineering Feats * **Pyramids:** * Massive stone structures, still a mystery how they were built with Stone Age tools. * No ancient illustrations explicitly show the construction methods. * Multiple theories exist, but the exact method remains unsolved.

C. Key Innovations & Practices * **Timekeeping:** * **Sundial:** Used to tell time by the sun's shadow. * **Waterclock:** Used to measure time by regulating the flow of water. * **Health & Afterlife:** * **Mummification:** A process of preserving bodies for the afterlife. * **Calendar:** * Devised the first **365-day calendar**, divided into 12 months of 30 days each.

Learning Guide: Lesson 2 ST Nation Building_1_1.pdf

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This is a simplified learning guide created from the original PDF. Use this for studying instead of reading the lengthy original text.

Pages 1-20

Here is a simplified, easy-to-read learning guide on the historical background of Science and Technology in the Philippines, derived from the provided text.

Learning Guide: Historical Background of Science and Technology in the Philippines

This guide outlines the evolution of science and technology (S&T) in the Philippines, from ancient times to modern government initiatives.

I. Pre-Spanish Era (Early Filipino Civilization)

- **Indigenous Knowledge System:** Early inhabitants possessed their own culture, traditions, belief systems, and knowledge.
- **Society & Governance:**
  - Livelihood included farming, hunting, and trading.
  - A council of elders assisted the Datu (chief) in governance.
  - Writing system: **Baybayin**.
  - Civilization developed through religion, arts, and literature.
  - Believed in gods and goddesses, influencing traditions.
- **Science in Daily Life:**
  - **Agriculture:** Methods for planting, animal care, food production, and preparing soil.
  - **Astronomy:** Observing heavenly bodies to predict seasons.
  - **Medicine:** Utilized plants for medicinal purposes.
- **Technology & Tools:**
  - Used for constructing houses and irrigation systems.
  - Tools for: planting, hunting, cooking, fishing, combat.
  - Developed means for land and water transportation.
  - Crafted musical instruments.
- **Metal Age Influence:** Archeological findings confirm the significant impact of the Metal Age on early Filipino lives.

II. Spanish Colonial Era

- **Introduction of Formal S&T:** The Spanish brought their culture, practices, and formal education.
  - Established schools for both boys and girls.
  - Introduced new subjects and disciplines.

- **Focus of Learning:**
  - **Science:** Focused on understanding the human body, plants, animals, and heavenly bodies.
  - **Technology:** Centered on using and developing household tools.
- **Galleon Trade (1565-1815):**
  - Contributed to additional technology and development.
  - Facilitated the exchange of ideas, crops, tools, cultural practices, and Western technologies.
- **Halt in S&T Growth:** Despite being developed in the region, the growth of science was slowed by:
  - Superstitious beliefs among the populace.
  - Dominance of Catholic doctrines and practices.

III. American Colonial Era

- **Significant S&T Development:** Americans had a greater impact on S&T advancement in the Philippines.
- **Key Improvements:**
  - Established a **public education system**.
  - Improved engineering works (e.g., infrastructure).
  - Enhanced public health conditions.
  - Improved transportation and communication systems.
- **Medical Research:** Conducted extensive research to control tropical diseases like Malaria, Cholera, and Tuberculosis.

IV. Post-Colonial Era (World War II & Beyond)

- **World War II Impact:**
  - Severely destabilized the country's development.
  - Limited resources and capacity for rebuilding after widespread destruction.
- **Post-War Focus:** The newly established republic concentrated on using its limited resources to enhance its scientific and technological capabilities.

- **Overseas Development Allocations (ODA):** Funding from other countries played a crucial role in improving the Philippines' scientific productivity and technological capability.

V. Influences on S&T Development in the Philippines

- **Internal Influences:**
  - **Survival:** Basic needs driving innovation.
  - **Culture:** Traditional practices and indigenous knowledge.
  - **Economic Activities:** Agriculture, trade, and industry.
- **External Influences:**
  - **Foreign Colonizers:** Spanish and American rule.
  - **Trades with Foreign Countries:** E.g., Galleon Trade.
  - **International Economic Demands:** Global market needs and trends.

VI. Government Policies on Science and Technology

- **Goal:** The Philippine government actively implements programs, projects, and policies to boost the nation's S&T capacity.
- **Key Initiatives:**
  - Programs and projects are geared towards advancing S&T.
  - Recognition and support for Filipino scientists.
- **DOST and NRCP Collaboration:**
  - The **Department of Science and Technology (DOST)** seeks expertise from the **National Research Council of the Philippines (NRCP)**.
  - **NRCP Recommendations:** Advised policies and programs aimed at enhancing the Philippines' competitiveness within the ASEAN region.

Pages 19-38

Here is a simplified, easy-to-read learning guide based on the provided text:

Philippines Science and Technology: A Learning Guide

This guide summarizes key government initiatives, research areas, and notable Filipino scientists in the field of Science and Technology.

I. Government Initiatives & Policy Frameworks

A. Enhancing S&T Competitiveness

- The Philippine government implements programs and policies to boost Science and Technology (S&T).
- The **Department of Science and Technology (DOST)** sought expertise from the **National Research Council of the Philippines (NRCP)**.
- **NRCP's Recommendation:** Policies and programs to improve the Philippines' competitiveness in the ASEAN region.

B. NRCP Policy Clusters & Key Recommendations

The NRCP clustered its recommendations into four areas:

1. **Social Sciences, Humanities, Education, International Policies and Governance**
    - Integrate ASEAN awareness in education.
    - Emphasize teaching in mother tongue.
    - Develop infrastructure and ICT broadband.
    - Ensure local food security.

2. **Physics, Engineering and Industrial Research, Earth and Space Sciences, and Mathematics**
    - Emphasize degrees, licenses, and employment opportunities in these fields.
    - Provide grants for peer monitoring.
    - Review **RA 9184 (Government Procurement Reform Act)**.
    - Utilize PhilGEPS (Philippine Government Electronic Procurement System).
    - Harness S&T as a driver of development.
3. **Medical, Chemical, and Pharmaceutical Sciences**
    - Ensure drug manufacturing firms comply with ASEAN-harmonized standards.
    - Create an educational council for standardization in these fields.
    - Empower food and drug agencies.
    - Allocate 2% of the GDP to research.
    - Legislate support for Human Genome Projects.
4. **Biological Sciences, Agriculture, and Forestry**
    - Protect and conserve biodiversity through full implementation of existing laws.
    - Promote the use of biosafety and standard models.
    - Promote indigenous knowledge systems and indigenous people’s conservation efforts.
    - Formulate common food and safety standards.

C. The Human Genome Project (HGP)

- **What it was:** An international, 13-year effort (1990-2003).
- **Primary Goals:**
    - Discover all human genes.
    - Make genes accessible for biological study.
    - Determine the complete sequence of DNA bases in the human genome.
- **Specific Goals:**
    - Identify approximately 20,500 genes in human DNA.
    - Sequence the 3 billion chemical base pairs of human DNA.

- Store this information in databases.
- Improve tools for data analysis.
- Transfer related technologies to the private sector.
- Address ethical, legal, and social issues (ELSI).

II. Existing DOST Programs & Educational Initiatives

A. DOST Programs

The DOST supports various programs: * Funding for basic research and patents. * Scholarship grants. * Philippine Science High School System. * Science and Technology Parks. * **Balik Scientist Program:** Encourages Filipino scientists living abroad to return and contribute to national development. * Establishment of the National Science Complex and National Engineering Complex in UP Diliman.

B. Philippine American Academy of Science and Engineering (PAASE) Capacity-Building Programs

PAASE identified several programs: * National centers of excellence. * Manpower and institutional development programs. * Regional centers supporting specific industries. * Science and technology business centers. * Strengthening of science education.

C. Education-Related Science Programs

- Special Science Classes.
- K to 12 Education Program.
- Philippine-California Advanced Research Institutes (PICARI) Project.

III. Emerging S&T Research & Project Areas

The Philippines is focusing on research and projects in these critical areas:

1. **Alternative and Safe Energy**
    - **Solar energy:** Electricity from the sun.
    - **Wind energy:** Electrical energy from the wind.
    - **Biomass electricity:** Plant-derived energy to substitute gasoline.
    - **Hydroelectric and Ocean energy:** Energies sourced from water.
    - **Geothermal energy:** Utilization of steam from the ground for heating or electricity.
2. **Harnessing Mineral Resources**
    - Focus on potentially valuable minerals with prospects for economic extraction.
    - *Examples:* Fuel/crude oil, gold, silver, platinum.
3. **Finding Cures for Various Diseases and Illnesses.**
4. **Climate Change and Global Warming.**
5. **Increasing Food Production.**
6. **Preservation of Natural Resources.**
7. **Coping with Natural Disasters and Calamities.**
8. **Infrastructure Development.**

IV. Factors Influencing S&T Policy Development

The development of S&T policies, programs, and projects in the Philippines is shaped by: * **National Goals** * **International Treaties** * **Legal Frameworks** * **Social Needs, Issues, and Problems**

V. Famous Filipinos in Science

- **Ramon Cabanos Barba**
    - **Contribution:** Outstanding research on tissue culture in Philippine mangoes; invented techniques to promote crop flowering using potassium nitrate spray.

    - **Recognition:** Proclaimed National Scientist of the Philippines in June 2014.
- **Josefino Cacas Comiso**
    - **Contribution:** Works on observing the characteristics of Antarctica using satellite images.
- **Jose Bejar Cruz Jr.**
    - **Contribution:** Internationally known in electrical engineering; made major contributions to the theory and practice of automatic control.
    - **Recognition:** Elected officer of the Institute of Electrical and Electronic Engineering (IEEE).
- **Lourdes Jansuy Cruz**
    - **Contribution:** Notable for research on sea snail venom; contributed to the development of conotoxins as tools for examining human brain activity.

Pages 37-56

Here is a simplified, easy-to-read learning guide based on the provided text:

Filipino Scientists & Their Contributions: A Learning Guide

This guide summarizes the key achievements and contributions of prominent Filipino scientists, making it easier to study and understand their impact.

I. Pioneers in Agriculture & Biotechnology

1. Ramon Cabanos Barba * **Field:** Horticulture (Tissue Culture) * **Key Contributions:** * Pioneering research on tissue culture in Philippine mangoes. * Invented techniques to promote crop flowering using potassium nitrate spray. * **Recognition:** Proclaimed a National Scientist of the Philippines (June 2014).

2. Rafael D. Guerrero III * **Field:** Aquaculture & Environmental Science * **Key Contributions:** * Known as the "Father of Tilapia Sex-Reversal." * Extensive research on tilapia culture. * Invented vermicomposting (using worms to create compost).

3. Lilian F. Patena * **Field:** Plant Biotechnology * **Key Contributions:** * Developed tissue culture for garlic production. * Discovered seedless breeds of lime and grapefruit. * Discovered micropropagation, strengthening the plantain industry. * Inventor of leaf-bud cutting in cassava cultivation.

4. Pedro B. Escuro * **Field:** Plant Breeding * **Key Contributions:** * Made significant contributions to rice breeding as a plant breeder. * **Recognition:** Received Presidential Plaque of Merit (1967) and Rizal Pro Patria award for contributions to rice breeding and genetics.

II. Medical Innovators & Health Researchers

1. Lourdes Jansuy Cruz * **Field:** Biochemistry * **Key Contributions:** * Notable for research on seasnail venom. * Contributed to the development of conotoxins as tools for examining human brain activity.

2. Fabian Millar Dayrit * **Field:** Herbal Medicine & Chemistry * **Key Contributions:** * Research on herbal medicine. * Studies on quality characteristics, physico-chemical parameters, and volatile organic compounds in virgin coconut oil.

3. Enrique M. Ostrea Jr. * **Field:** Neonatology (Newborn care) * **Key Contributions:** * Invented meconium drugs testing. * **Recognition:** Renowned Filipino-American neonatologist.

4. Dr. Abelardo Aguilar * **Field:** Medicine (Pharmacology) * **Key Contributions:** * Helped discover the antibiotic erythromycin (proprietary names: Ilotycin, Ilosone) in 1952.

5. Fe Del Mundo * **Field:** Pediatrics * **Key Contributions:** * Made extensive studies on childhood diseases. * Founder of the 1st pediatric hospital in the Philippines. * Invented the bamboo incubator for premature infants. * **Recognition:** National Scientist.

6. Ramon Gustilo * **Field:** Orthopedic Surgery * **Key Contributions:** * Invented various hip replacement systems for hip joints (e.g., Exodus). * Designed replacement systems for knees (e.g., Genesis).

7. Geminiano T. De Ocampo * **Field:** Ophthalmology * **Key Contributions:** * Introduced corneal transplantation in the Philippines. * Designed a corneal dissector. * Established the De Ocampo Eye Hospital.

8. Jose Rodriguez * **Field:** Leprology (Study of Leprosy) * **Key Contributions:** * Devoted 53 years to leprosy control in the Philippines. * Proposed a leprosy control program. * Authored many scientific articles on leprosy (Hansen's Disease).

III. Engineers & Technology Developers

1. Jose Bejar Cruz Jr. * **Field:** Electrical Engineering * **Key Contributions:** * Made major contributions to the theory and practice of automatic control. * **Recognition:** Elected officer of the Institute of Electrical and Electronic Engineering (IEEE).

2. Gregory L. Tangonan * **Field:** Communications Technology * **Key Contributions:** * Invented all-optical switching modules. * Invented the analog antenna. * Developed methods for sending messages using Fiber Optics and Digitalization for deployment.

3. Ramon Ilejay Castillo * **Field:** Electrical Engineering * **Key Contributions:** * Founder of Innovatronix. * Invented: Power on delay mechanism, Lantern blinker, Portable lamp dimmer, Dancing light and three-channel lamp cluster.

IV. Marine & Environmental Scientists

1. Josefino Cacas Comiso * **Field:** Oceanography / Satellite Remote Sensing * **Key Contributions:** * Works on observing the characteristics of Antarctica using satellite images.

2. Edgardo Gomez * **Field:** Marine Science * **Key Contributions:** * Pioneering assessment of damage on coral reefs. * First to introduce the

breeding of giant clams. * **Recognition:** Conferred the rank of National Scientist of the Philippines (2014).

3. Angel Alcala * **Field:** Marine Science * **Key Contributions:** * The first scientist to develop a project to create artificial coral reefs in 1977. * Authored over 60 scientific papers on marine issues.

V. Physicists, Astronomers & Chemists

1. Caesar A. Saloma * **Field:** Physics (Photonics and Signal Processing) * **Key Contributions:** * Recognized for contributions to photonics and signal processing. * **Recognition:** Internationally renowned physicist and professor at UP National Institute of Physics.

2. William Padolina * **Field:** Chemistry * **Key Contributions:** * As President of the National Academy of Science and Technology (NAST), oversaw IRRI's coordination of the golden rice network and development of beta-carotene-rich rice varieties. * **Recognition:** Chemist and President of NAST-Philippines.

3. Casimiro Del Rosario * **Field:** Physics, Meteorology, and Astronomy * **Key Contributions:** * Work on soft x-rays requiring high vacuum photography. * Studies on the effects of radioactive radiation on Euglena. * **Recognition:** Received the Presidential award for research and achievement in physics, meteorology, and astronomy.

VI. Other Notable Scientists

1. Mari-Jo P. Ruiz * **Field:** Mathematics (Graph Theory) * **Key Contributions:** * Outstanding educator and graph theorist.

2. Magdalena C. Cantoria * **Field:** Pharmacy and Botany (Pharmacognosy) * **Key Contributions:** * Focused research on the morphology, physiology, and biochemistry of drug plants. * Authored "Pharmacognosy in Action."

3. Carmen L. Intengan * **Field:** Nutrition * **Key Contributions:** * Contributed significantly to the advancement of nutrition in the country. *

Improved the Filipino diet. * **Recognition:** Director of the Food and Nutrition Research Institute (1974-1980).

4. Alfredo V. Lagmay * **Field:** Psychology * **Key Contributions:** * Pursued studies related to experimental analysis of behavior, behavior modification, relaxation, and hypnosis. * **Recognition:** National Scientist of the Philippines.

5. Eduardo A. Quisumbing * **Field:** Botany (Plant Taxonomy, Orchidology) * **Key Contributions:** * Known as the "Father of Orchidology." * Pioneer in the study of Philippine Medicinal Plants. * Authored "Medicinal Plants in the Philippines." * Undertook restoration of the Herbarium.

6. Francisco Quisumbing * **Field:** Chemistry/Invention * **Key Contributions:** * Invented the Quink ink, an indelible ink used in Parker Pens and as a commercial stamp.

Pages 55-74

Here is a simplified, easy-to-read learning guide based on the provided text (Pages 55-74), designed for study.

Learning Guide: Notable Scientists and Contributions

I. Filipino Scientists and Their Innovations

- **Francisco Quisumbing**
  - **Inventions:** Quink ink (used in Parker Pens), Indelible ink (Parker commercial stamp).
- **Jose Rodriguez**
  - **Field:** Leprologist and Researcher (focused on Leprosy/Hansen's Disease).

    - **Contribution:** Devoted 53 years to leprosy control in the Philippines; proposed a national control program; authored many scientific articles on leprosy.
- **Eduardo San Juan**
    - **Field:** NASA Engineer.
    - **Contribution:** Designed the moon buggy used by Apollo astronauts.
    - **Education:** Graduated from Mapua Institute of Technology.
- **Carmen C. Velasquez**
    - **Field:** Biologist, specialist in Fish Parasitology (study of parasites in fish).
    - **Contribution:** Discovered 32 new species and a new genus of digenetic nematodes from Philippine food fish, birds, and mammals. Her work was published and cited internationally.
- **Gregorio T. Velasquez**
    - **Field:** Pioneer in Philippine Phycology (study of algae).
    - **Contribution:** Conducted intensive studies of blue-green algae (myxophyceae) for over 30 years.

II. History and Nature of Science: The Scientific Enterprise

- Science and technology involve diverse types of work.
- They engage individuals of all backgrounds, genders, and nationalities.

III. Influential International Scientists and Their Discoveries

- **Sir Isaac Newton** (England: 1643-1727)
    - **Key Contributions:**
        - Formulated the **Three Universal Laws of Motion**.
        - Described the **Gravitational Force**.
    - **Newton's Laws of Motion:**
        1. **Law of Inertia:** An object at rest tends to stay at rest, and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
        2. **Law of Acceleration:** The acceleration of an object is directly proportional to the net force acting on it and inversely

proportional to its mass (F=ma). The acceleration is in the same direction as the net force.
    3. **Law of Action and Reaction:** For every action, there is an equal and opposite reaction.
- **Antony van Leeuwenhoek** (Netherlands: 1632-1723)
    - **Title:** "Father of Microbiology."
    - **Key Contributions:**
        - Significantly improved the **microscope**.
        - First person to describe **single-celled organisms**.
        - Created over 400 microscopes.
- **Louis Pasteur** (France: 1822-1895)
    - **Key Contributions:**
        - Developed **Pasteurization** (process to prevent milk and wine from souring).
        - Solved mysteries of diseases like rabies, anthrax, chicken cholera, and silkworm diseases.
        - Contributed to the development of the **first vaccines**.
- **Rachel Carson** (USA: 1907-1964)
    - **Title:** "Mother of the modern environmental movement."
    - **Key Work:** Authored "Silent Spring," a book that advocated for chemical testing and raised concerns about the indiscriminate use of pesticides.
- **James Hutton** (Scotland: 1726-1797)
    - **Title:** "Father of Modern Geology."
    - **Key Contribution:** Pioneered the scientific study of the Earth's surface and geological processes.
- **Albert Einstein** (Germany: 1879-1955)
    - **Key Contribution:** Developed the **Theory of Relativity** (famous equation $E=mc^2$).
    - **Awards:** Awarded the Nobel Prize in Physics in 1921.
- **Georges Cuvier** (France: 1769-1832)
    - **Title:** "Father of Paleontology."
    - **Key Contributions:**
        - Compared living animals with fossils.
        - Established **extinction** as a scientific fact.
- **Ivan Pavlov** (Russia: 1849-1936)
    - **Awards:** Nobel Prize in Physiology or Medicine in 1904.

    - **Key Contribution:** Discovered **classical conditioning** through his experiments with dogs ("Pavlov's Dog").
- **Hipparchus** (Ancient Turkey: 190 BC - 120 BC)
    - **Title:** "Greatest ancient astronomical observer."
    - **Key Inventions/Contributions:**
        - Invented **Trigonometry**.
        - Created the **first catalogue of stars**.
        - Introduced concepts of **longitude and magnitude** for stars, and the linear division of a 360-degree circle.
- **Alexander Graham Bell** (Scotland: 1847-1922)
    - **Key Invention:** The **telephone**.
    - **Other Contributions:** Founding member of the National Geographic Society; worked on hydrofoils and aeronautics.
- **Archimedes** (Ancient Syracuse/Greece: 287 BC - 212 BC)
    - **Title:** "Greatest Mathematician of his age."
    - **Key Inventions/Discoveries:**
        - The **pulley**.
        - The **Archimedean screw** (pumping device).
        - Principles of **Hydrostatics**.
        - Leverage principles.
- **Friedrich Mohs** (Germany: 1773-1839)
    - **Key Contribution:** Developed the **Mohs Scale of Mineral Hardness**, which ranks minerals from 1 (Talc) to 10 (Diamond).
- **Robert Hooke** (England: 1635-1703)
    - **Title:** "Father of Microscopy."
    - **Key Contributions:**
        - First scientist to study and record **cells**.
        - Invented the **iris diaphragm** in cameras.
        - Invented the **universal joint** (used in motor vehicles).
        - Invented the **balance wheel** in watches.
- **Jane Goodall** (England: 1934-Present)
    - **Field:** Anthropologist, Conservationist, Primatologist.
    - **Key Contribution:** Renowned for her extensive studies of **Chimpanzees** in the wild.

Pages 73-92

Here is a simplified, easy-to-read learning guide based on the provided text:

Learning Guide: Pioneers in Science & Innovation

This guide provides concise information about key figures in various scientific and inventive fields, focusing on their essential contributions and notable facts.

1. Robert Hooke (1635-1703)

- **Nationality:** English
- **Known as:** Father of Microscopy
- **Key Contributions:**
  - First to study and record biological "cells."
  - Invented the iris diaphragm (for cameras).
  - Invented the universal joint (used in motor vehicles).
  - Invented the balance wheel (for watches).

2. Jane Goodall (1934-Present)

- **Nationality:** English
- **Profession:** Anthropologist, Conservationist, Primatologist
- **Key Contribution:** Pioneering studies of chimpanzees in their natural habitat.

3. Sir Norman Lockyer (1848-1931)

- **Nationality:** English
- **Achievements:**
  - Discovered meteors, novas (exploding stars), and comets.
  - Awarded the Gold Medal of the Global Astronomical Society in 1898.

4. Jacques Cousteau (1910-1997)

- **Nationality:** French

- **Profession:** Oceanographic Technician, Filmmaker
- **Key Contributions:**
    - Created "The Undersea World of Jacques Cousteau" TV series.
    - Conducted expeditions using his ship, the *Calypso*.
    - Raised public awareness about ocean pollution, over-exploitation of marine resources, and coastal development.
    - Served in the French Navy during WWII.

5. T. Theodore Fujita (1920-1998)

- **Nationality:** Japanese
- **Key Contributions:**
    - Developed the **Fujita Scale** (F-scale): A system to classify tornado intensity based on damage and estimated wind speed.
    - Revolutionized the understanding of severe thunderstorms, tornadoes, hurricanes, and typhoons.
    - Discovered **downbursts** and **microbursts** (localized strong downdrafts of air from thunderstorms).

6. Edmond Halley (1656-1742)

- **Nationality:** English
- **Key Contributions:**
    - Discovered the proper motion of fixed stars.
    - Studied the orbital movements of the moon and comets, famously predicting the return of "Halley's Comet."

7. Charles F. Richter (1900-1985)

- **Nationality:** American
- **Key Contribution:** Developed the **Richter Magnitude Scale** to measure and compare the size of earthquakes.

8. Alfred Adler

- **Nationality:** Australian Psychiatrist
- **Education:** Graduated from the University of Vienna Medical School (1895).
- **Associations:** Associated with Sigmund Freud.

- **Key Contributions:**
  - Established the first child-guidance clinic in Vienna (1921).
  - Developed the **Theory of Individual Psychology**.
  - Introduced the term "**Inferiority Complex**."

9. André-Marie Ampère

- **Nationality:** French
- **Profession:** Physicist and Mathematician
- **Career Highlights:**
  - Taught mathematics, chemistry, and languages in Lyons (1796).
  - Became a Professor of Physics and Chemistry (1801).
- **Key Contribution:** Discovered the relationship between electricity and magnetism.

10. Henri Becquerel

- **Nationality:** French
- **Profession:** Physicist
- **Education:** Educated at École Polytechnique.
- **Key Contributions:**
  - Discovered the **radioactivity of Uranium**.
  - This discovery was the first scientific clue leading to nuclear physics and, later, the atomic bomb.
  - Shared the 1903 Nobel Prize in Physics with Pierre and Marie Curie.

11. Louis Blériot

- **Nationality:** French (implied)
- **Key Contributions:**
  - Invented **monoplanes** (airplanes with a single wing).
  - First person to successfully fly an airplane across the English Channel.

12. Louis Braille

- **Nationality:** French (implied)
- **Background:**
  - Blind since the age of three.

    - Attended a school for the blind in Paris at age 10.
    - Built upon existing systems, like Charles Barbier's 12-dot system.
- **Key Contribution:** Devised the **Braille system** in 1824, a tactile reading and writing system for the blind using a 6-dot cell.

13. Marie Curie

- **Nationality:** Polish/French (implied)
- **Profession:** Chemist and Physicist
- **Key Contributions:**
    - Discovered the elements **radium** and **polonium**.
    - Awarded the Nobel Prize in Physics (1903, shared) and the Nobel Prize in Chemistry (1911).

14. John Dalton

- **Nationality:** English (implied)
- **Profession:** Chemist and Physicist
- **Career Highlights:** Mathematics and physics teacher in Manchester (late 1700s).
- **Key Contribution:** Advanced the **atomic theory** in 1805, proposing that all matter is composed of small, indivisible particles called atoms.

15. Rudolf Diesel

- **Nationality:** German (implied)
- **Key Contribution:** Invented the **Diesel Engine**.

16. Thomas Edison

- **Nationality:** American (implied)
- **Key Contributions:**
    - Obtained his first patent at age 21 for an electric vote counter (for the US House of Representatives).
    - Holds a record of 1,093 patents.
    - Notable inventions include: the motion picture projector, the phonograph, and the incandescent electric light bulb.

17. Alexander Fleming (1881-1955)

- **Key Contribution:** Discovered **Penicillin** in 1928, marking the beginning of the antibiotic era.

18. Benjamin Franklin

- **Nationality:** American (implied)
- **Profession:** Scientist, Inventor, Philosopher, Musician, Economist, Printer
- **Key Contributions:**
  - Invented many things, including the **lightning rod**.
  - First person to identify lightning as an electrical discharge (1752).

19. Galileo Galilei

- **Nationality:** Italian (implied)
- **Key Contributions:**
  - First person to observe the moon through a telescope (a refracting telescope).
  - Conducted pioneering work on **free fall** and laws of motion.

Pages 91-100

Learning Guide: Key Figures and Discoveries (Pages 91-100)

This guide summarizes essential information about various scientists, inventors, and their significant contributions.

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1. Benjamin Franklin

- **Roles:** Scientist, inventor, philosopher, musician, economist, printer.
- **Key Invention:** Lightning rod.
- **Scientific Contribution:** In 1752, he was the first to identify lightning as an electrical discharge.

2. Galileo Galilei

- **Astronomy:** The first person to observe the moon through a telescope.
- **Telescope Type:** His telescope was a refracting telescope.
- **Physics:** Conducted important work on free fall.

3. Joseph Lister

- **Medicine (Inflammation):** In 1857, he authored "An Essay on the Early Stages of Inflammation."
- **Antiseptic Surgery:** In 1867, he published "On the Antiseptic Principle in the Practice of Surgery," which significantly reduced surgical diseases by introducing antiseptic methods.

4. Dmitri Mendeleev

- **Chemistry:** In 1869, he worked on "Principles on Chemistry."
- **Major Achievement:** Developed the Periodic Table of elements.

5. J.J. Thompson

- **(1856-1946)**
- **Discovery:** Discovered the electron in 1897.

6. Clyde Tombaugh

- **Profession:** Astronomical observer and Professor in Astronomy.
- **Discoveries:**
    - Discovered hundreds of asteroids.
    - Discovered Pluto (now classified as a dwarf planet).

7. Carl Zeiss

- **Invention:** Invented the apochromatic lens for microscopes.
- **Renown:** Famous for his high-quality optical instruments, including microscopes, telescopes, and field glasses.

8. Watson and Crick

- **Major Discovery:** Determined the structure of DNA (Deoxyribonucleic Acid).

9. Carolus Linnaeus

- **Title:** Known as "The Father of Taxonomy."

Learning Guide: Lesson 3 Science Education in the Philippines_1_1.pdf

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This is a simplified learning guide created from the original PDF. Use this for studying instead of reading the lengthy original text.

Pages 1-20

Here is a simplified, easy-to-read learning guide based on the provided text, designed for study purposes.

Science Education: A Learning Guide

1. The Core Goals of Science Education

Science education aims to achieve five fundamental objectives:

1. **Scientific Knowledge:** Develop a deep understanding of natural systems.

2. **Scientific Methods:** Foster the ability to understand and effectively use scientific inquiry methods.
3. **Societal Issues:** Equip citizens to make informed and responsible decisions regarding science-related social challenges.
4. **Career Awareness:** Inform students about various career paths available in the sciences.
5. **Personal Needs:** Contribute to personal development by helping individuals understand and fulfill their personal needs through scientific literacy.

2. Science Education in Basic Education

Science education at the basic level focuses on:

- **Learning:** Important concepts and facts relevant to daily life.
- **Skill Development:**
  - Process Skills (for daily activities)
  - Critical Thinking Skills
  - Life Skills
- **Attitude Cultivation:** Encouraging a positive attitude, particularly "The Love For Knowledge."
- **Future Impact:**
  - Builds a strong foundation for advanced science studies.
  - Prepares students to consider science-related careers.
  - Invests in developing a scientifically cultured and literate citizenry for the country.

3. Science Education in Tertiary Education

At the tertiary (higher education) level, science education aims to:

- **Focus:** Develop students' understanding and appreciation of scientific ideas and works.
- **Method:** Accomplished by offering basic science courses within the General Education curriculum.
- **Career Preparation:** Prepares individuals for professional roles such as:
  - Science Teachers
  - Scientists

    - Engineers
    - Other professionals in fields like: Engineering, Agriculture, Medicine, Health Sciences.

4. Case Study: Philippine Science High School (PSHS)

A. Overview and Identity

- **Type:** A specialized Public High School System.
- **Supervision:** Overseen by the Philippine Department of Science and Technology (DOST).
- **Status:** Recognized as the top science high school in the Philippines.
- **Campuses:** Operates with 16 campuses across the Philippines.
- **Curriculum:** Offers a total of 91 Science & Technology courses.

B. History and Mandate

- **Authored:** By Congressman Virgilio Afable.
- **Signed into Law:** In 1963 by President Diosdado Macapagal.
- **Founded:** In 1964.
- **Mandate:** To provide a free scholarship-based secondary course emphasizing science subjects, with the goal of preparing its students for science careers.

C. System Growth and Main Campus

- **Growth (1964-2014):** By 2012, the system had 11 campuses and around 3,800 scholars (known as 'Pisay' scholars), with additional campuses set to open in 2014. (Note: Current campus count is 16 as per later text.)
- **Main Campus Location:** Located in Agham Road, Diliman, Quezon City.

D. Achievements and Competitions

PSHS is renowned for its active participation and success in various national and international science, technology, and mathematics competitions, including:

- Metrobank-MTAP-DepEd Math Challenge

- MATHirang MATHibay
- Philippine Mathematics Olympiad
- Philippine Physics Olympiad
- Philippine Chemistry Olympiad
- Australian Mathematics Competition
- Australian Chemistry Quiz

Pages 19-38

Here is a simplified, easy-to-read learning guide based on the provided text:

Learning Guide: Philippine Educational Institutions

1. Philippine Science High School (PSHS) System

- **Overview:**
  - A specialized public high school system.
  - Supervised by the Philippine Department of Science and Technology (DOST).
  - Considered the top science high school in the Philippines.
- **Scope:**
  - Comprises 16 campuses nationwide.
  - Offers 91 Science & Technology courses.
- **Distinction:**
  - Known for active participation in national and international science, technology, and mathematics (STM) competitions.
  - **Examples of Competitions:**
    - Metrobank-MTAP-DepEd Math Challenge
    - MATHirang MATHibay
    - Philippine Mathematics, Physics, and Chemistry Olympiads

        - Australian Mathematics Competition
        - Australian Chemistry Quiz

1.1. PSHS - Central Visayas Campus (Cebu City)

- **Known as:** Sci-Hi
- **Location:** Salvador St., Labangon, Cebu City, Philippines.
- **Founded:** July 17, 1970.
- **Nationalized:** School year 1974-1975.
- **Concept:** Patterned after the objectives of the Philippine Science High School System and the Government's Science and Technological Education and Manpower Development Program.

1.2. PSHS - Mindanao Campus (Lanao del Norte)

- **Description:** The second Mindanao campus of the PSHS System.
- **Purpose:** Caters to scientifically and mathematically gifted high school students, especially those in Mindanao.
- **Location:** Nangka, Baloi, Lanao del Norte.
- **Established:** July 1, 1998.

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2. Special Science Elementary (SSES) Project

- **Basis:** Implemented in pursuance of DepEd Order No. 73 s. 2008 and DepEd Order No. 51 s. 2010.
- **Objective:** Identifies and supports elementary schools as "science elementary schools."
- **Aim:** To develop Filipino children equipped with scientific and technological knowledge, skills, and values.
- **Mission:**
    - Provide a learning environment for science-inclined children through a special curriculum that recognizes multiple intelligences.
    - Promote the development of lifelong learning skills.
    - Foster the holistic development of learners.

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3. Quezon City Regional Science High School

- **History:**
  - Established (date not specified in text).
  - Originally named Quezon City Science High School.
- **Vision:** To provide maximum opportunities for science-gifted students to develop a spirit of inquiry and creativity.
- **Support:** Well-supported by the local government unit and the Parent and Teacher Association (PTA).
- **Affiliation:** Under the Department of Education.

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4. Manila Science High School

- **Establishment:** October 1, 1963.
- **Location:**
  - **Previous:** Corner of Victoria-Muralla streets in Intramuros, Manila.
  - **Present:** Corner of Taft Avenue-P. Faura Streets.
- **Curriculum:**
  - Strong emphasis on Science and Mathematics.
  - Includes Humanities courses and other electives to encourage participation in extracurricular activities and holistic development.
- **Entrance Exam (MSAT - Manila Science High School Test):** Consists of five parts:
  1. Aptitude in Science
  2. Aptitude in Mathematics
  3. Problem-solving in Science
  4. Problem-solving in Math
  5. Proficiency in English

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5. Central Visayan Institute Foundation (CVIF)

- **Early History (Filipino-American High School):**
  - **1925:** American educator Mr. Fred Warner opened a secondary school in Duero.

    - Named "Filipino-American High School" due to its American and Filipino faculty.
    - **1928:** Provincial Governor Filomeno O. Caseñas took over management and transferred the school to his hometown, Jagna.
    - He later convinced his brother, Agustin O. Caseñas (Governor of Agusan), and sister, Maria Caseñas Pajo (managed Bohol Lyceum), to manage it.
    - **1929:** Formally incorporated to ensure its stability.
- **Name Changes:**
    - **1934-1935:** Renamed to Central Visayan Institute (CVI).
    - **July 2002:** With the approval of the CVI Board of Directors, the school was converted and renamed into the **Central Visayan Institute Foundation (CVIF)**.

Pages 37-43

Central Visayan Institute Foundation (CVIF) & Dynamic Learning Program (DLP) - Key Facts

I. Evolution of CVIF (Historical Overview)

- **Early Name:** Filipino-American High School
- **1934-1935:** The school's name was changed to **Central Visayan Institute (CVI)**.
- **July 2002:** The CVI was converted and renamed to **Central Visayan Institute Foundation (CVIF)**.

II. The Dynamic Learning Program (DLP)

- **Introduction:** Introduced in **2002**, the same year CVI became CVIF.
- **Impact:** It gained national attention, drawing hundreds of educators from across the country to observe and learn from the program.
- **What it is:**
    - The CVIF is the home of the DLP.

    - DLP is a combination (synthesis) of classical and modern teaching methods (pedagogical theories).
    - Its goal is to encourage the highest level of learning, creativity, and productivity in students.
- **Essential Features:**
    1. **Parallel Learning Groups (Modified Jigsaw Strategy):** A collaborative learning approach where students work in groups.
    2. **Activity-based Multi-Domain Learning:** Learning occurs through activities covering multiple subject areas.
    3. **In-school Comprehensive Student Portfolio:** Students maintain a detailed collection of their work.
    4. **Strategic Study and Rest Periods and Integrated Spiritual and Cultural Formation:** The program includes planned times for studying and resting, along with development in spiritual and cultural aspects.
