1. **Ages of sand-** Douglas Adams speech on ages of sand and 4 most revolutionary periods throughout science, and the development of Glass throughout time. 4 most crucial times, 1608 Telescope, 1678 Microscope,1961 Computer Chip, 9180 Fibre Optics
1. **Al-Dinawari-** He worked in Botany. He took Theophrastus' books and provides prescriptions how to use the plants as medicinal to cure diseases.
2. **Alhazen-** He first developed the scientific method
3. **Al-Jahiz-** He proposed the idea that animals were competing to survive due to lack of resources and to reproduce. And over time an advantage was developed and passed onto the offspring. This advantage is today known as Natural Selection.
4. **Aristotle**-most recognized for his hierarchical system trying to organization of the living world and organized the living world ranked by importance to the world the most important being MAN.
1. **Artificial Taxonomy-** Aristotle and Theophrastus were the first to use artificial taxonomy to organism the living world. Artificial Taxonomy is writing down the information of folk taxonomy and creating lists of living things and these lists have been passed onto many generation and translated into many languages. As the roman empire expanded these lists became very economically and medicinally important to the empire. The lists are compiled by looking at the detailed description of the object and classifying it.
2. **Avicenna-** Famous philosopher. Took what Hippocrates and add to it the medical knowledge or Islamic world and Indian subcontinent
3. **Binomen- a name with two parts** the first part is the genus group and the second Is the specific epiphet
4. **Binomial nomenclature-** Linnaeus created a system where every species is assigned a two part Latinised name. The first name consists of the genus--> a groups of species with similar characteristics and the second part of the name is the specific epithet.

5. **Biogeography-** A branch of biology that deals with the study of geographical distribution of plants and animals
6. **Chronological prediction-** A chronological prediction is one that guesses what will happen in the future. It does not need to be based on any facts.
7. **Classification-** An arrangement of organisms into hierarchical groups that reflect their relatedness
8. **Control-** When performing experiments is it important to maintain some sort of control. Whether it's controlling certain variables or
9. **Cuvier (Georges)-** Created the theory of Catastrophism. Seen by observing layers of fossils he proposed that each layer of fossils represented organisms that had existed in the past. And that abrupt changes between geological layers marked different shifts in ancient environments. Each layer of fossils represented remains of organisms that died in local catastrophes such as floods or asteroids. Then a somewhat different species recolonized and another catastrophe struck created another layer of fossils higher up.
10. **Deduction-** Reasoning that goes from general to specific The way theories and problems are studied in Physics and Chemistry is by using a deductive method. These theories are universal however, there can only be one right answer and if there is a problem it needs to be addressed immediately and the theory is invalid.
11. **Empirical observation**
12. **Essentialism-** Essentialism is the belief that every organism have a set of unique and unchanging characteristics that make them unique and their differences are accounted by having a certain "Essence". It was believed that god put the essence in every organism which made each organism unique and made them the way they are. This essence was passed onto future generations.
13. **Extinction-**The irreversible condition when a species has no living representatives in the wild. Extinction follows the death of the last surviving individual. Extinction may occur from

14. **Fact-** A theory or hypothesis can become a fact through multiple evidence through testing various hypotheses and when there is no longer any doubt. A fact is an observation that has been repeatedly confirmed and accepted as "true" However in science there is always a grain of doubt that must be considered.
15. **Folk Taxonomy-** Folk Taxonomy is the where the rules of categorisation and the rules are passed on orally from generation to generation. What is categorised and to what extent is determined by the culture of the people and their natural surroundings for example Eskimos having 30 terms for snow. Folk Taxonomy still exists today, anthropologists have identified many commonalities. Often the taxonomy has at most 4 levels where the highest group distinguishes between plants and animals. There are often 500 elements that must be memorised and this is often a limit to our cognitive skills to mentally keep track of all these elements.
1. **Great Chain of Being-** The great chain of being is a hierarchical system
1. **Harvey-** He is the father of physiology . He was the first to understand the flow of the heart and blood.
1. **Hierarchical system-** A Hierarchy system is a type of categorisation system where all the objects in the system are organised according to levels or a hierarchy system
2. **Hippocrates-** Hippocrates brought together many scientists. He wasn't a naturalist. He and those other scientists assembled together a written form every single practice of human biology at the time. This book he created is known as the Hippocratic Corpus. He is also known for Hippocratic Growth
1. **Historical narrative-** A narrative occurs when scientists make many observations or use experiments to formulate a prediction.
2. **Hypothesis-** In the general public it is believed that a hypothesis is a good guess. But in terms of a scientific definition a hypothesis is formulated from extensive research of literature or from observations of the natural world to explain a phenomenon. A hypothesis is a way to test whether an explanation is correct or not.

1. **Ibn al_Baitar-** He expanded on Theophrastus' work and created a pharmaceutical catalogue of medicinal plants. This catalogue was used in the 18th and 19th century.
1. **Induction-** Reasoning that goes from more specific to general. This type of reasoning is used in Biology and there is no way to be able to study every single organism to make these conclusions so multiple theories are accepted and the theories are not universal.
   Example: After observing many cats you come up with the conclusion that all cats purr.
1. **Industrial melanism**
2. **Lamarck (Jean-Baptiste)**
3. **Law-** A law is a descriptive explanation about a phenomenon in the world. A theory can become a law if it has been proven universally. In biology many theories cannot be laws because they have only been proven on earth they have not been proven on other planets
4. **Leclerc (George-Louis - Buffon)-** George Louis Leclerc questioned that if every species was made to be perfect why did vestigial features exist? Features that were no longer used. From this he explained that some species were made by nature some by time. These features must have had a function in the previous ancestors.
5. **Linnaean taxonomy-** There are 6 categories family would be added in later. Linnaeus organised his organisms by how they looked and their physical description there was no
1. **Linnaeus (Carolus)**HE is known as the modern father of Taxonomy. He was known for two major contributions. His binomial nomenclature where the first part is
1. **Logical prediction-** Science uses logical predictions to state what is expected to happen to one variable if another variable changes. A logical prediction explains how you will demonstrate that your hypothesis is true. Logical prediction is used more frequently with deductive reasoning but it can also be used with inductive as well.

2. **Mechanical Taxonomy-** Taxonomy where organisms are organised by non biological characteristics**.**
3. **Linnaeus Taxonomy**

1. **Middle ages-** There are three significant eras of the middle ages. The early, middle and late. In the early middle ages rome has just crashed from the invasion of the goths and during this time the Golden Ages in the islamic world begins to flourish. The middle ages Rome becomes strong again and begins to build commerce, transportation massive communication and gain knowledge again, and creating a culture in which is rich in knowledge. This was the Scientific Revolution and there were major advancements in the physical sciences however 1600 years and natural sciences are still at the point where they believe the earth was created on Oct 23 4004 BCE and every organism was put by god and had an essence. The late middle ages

1. **Natural sciences**- A branch of science that deals with physical world ie. Geology, chemistry, Biology
2. **Null hypothesis-** A null hypothesis is often coupled with a hypothesis. It is a prediction of what will occur if the hypothesis is incorrect.
3. **Organicists-**They have the combined view of life that life was based on laws of physics and chemistry but that due to genetics living things are more than simply a sum of its parts. For example many amino acids can form a long string of amino acids that does not have a function but when this string is folded it can be folded to have many different and specific functions.
4. **Physical sciences-** Study of inanimate natural objects. Physical Sciences often use deduction techniques to create theories and laws. These laws are however universal Ex. Physics and Chemistry.
5. **Physicalists-**believe that all living things except for humans work like little machines and can be reduced into parts to explain how the machine works as a whole.
6. **Primary reference**
   Authors directly involved in the work

-Contains all references used to build concepts
Ie: Articles

1. **Proximate causes-**
   -"Physical science" - like physics
   -Looks at the immediate cause
   -Problems involving proximate causes have mechanical, predictable outcomes
   -Deals with the phenotype, morphology, and behaviour --> as well as genes in action as they express the phenotype
   -Answers the question "HOW": what ois the phenotype, what are the genes doing?
   -Predictable answer
   -General procures theories and laws through experiments
   -Based on treatment and effect (ie: medicine, biochemistry, etc)
1. **Sampling error-**Sampling error occurs when only a small sample is observed instead of the whole population or not enough samples are made. This will often lead to inaccurate results.
1. **Scala naturae-** The Scala Naturae was created by Aristotle. He tried to organise and categorise all the organisms on the world based on their complexity and importance to the living world. In the Scala Naturae god is placed on the top and it was believed that god created man kind and made sure the world functioned properly. They believed that all organisms had an essence that made them the way they were and that all organisms were placed on the earth by god were unchanging and god put an essence in each organism that made them the way they were.
1. **Secondary reference-**
1. **Special creation-** Special Creation is an origin of how life began. It states that god put everyone and everything on earth on October 23 4004 BCE. They also believed the organisms don’t change over time and the reason why the organisms were unique was because of having a certain essence which made them the way the are.

1. **Taxon (taxa)-** A taxonomic group from any rank such as species, class or family (organisms within these categories all fit in a group called a taxon)
2. **Taxonomy**- a classification system of organism into an ordered system that indicates natural relationships  Rules used to classify things.
3. **Tertiary reference-**

1. **Theophrastrus-** His work was exclusively in Botany. He studied plants and created a catalogue of plants made into 10 books 9 that are still relevant today divided into medicinal purposes of plants and non medicinal. His categorisation and organisation of books was so relevant his system of dividing plants is still relevant today. He is known as the ancient father of taxonomy.

1. **Theory-** An explanation or model that explains events in the natural world and makes predictions on how they will occur. A Theory is based on many observations and has been backed up by many hypotheses under different circumstances and conditions  that have proven the theory to be true. A scientific theory must be based on facts.
2. **Ultimate causes-** The ultimate cause is not always directly related to the scenario but it is known to be the "real" cause

1. **Van Leeuwenhoek-** Van Leeuwenhooek built the first microscope to be able to see small objects. He would put the specimen on a glass bead and look through the microscope on the other side. Unfortunately when he died he also took the knowledge of how to make the glass beads with him. It wasn't until 1961 someone was able to figure out how to make a microscope. He introduced the idea that there were many micro smaller organisms that we could not see. This was accepted by the church however because it fit into the concept of essentialism, and that there were simply more organisms than orginally believed.
2. **Vesalius**- Founder of Modern Astronomy

1. **Vitalists.-** believe that there is something special about the living world than the inanimate world, thy have a vital force known as

an essence but it could not be described in a manner to satisfy the physicalists. But we now know that this vital force as genetics