Science Lesson 8
Instructions

1) Use Teaching note slides and knowledge organisers to revise science lesson
2) When you feel confident with the knowledge of this topic, complete the questions on this section in the Question Booklet ready to bring into school
3) For support, refer back to knowledge organiser and teaching notes

Inheritance, variation and evolution – Knowledge Organiser

AQA GCSE INHERITANCE VARIATION AND EVOLUTION PART 4

Charles Darwin	*Theory of evolution by natural selection.*	Individual organisms within a particular species show a wide range of variation for a characteristic.
		Individual most suited to the environment are more likely to breed successfully.
		Characteristics enable individuals to survive are then passed on to the next generation.

Developed since its proposal from information gathered by other scientists.

Did much pioneering work on speciation but more evidence over time has lead to our current understanding.

Allows biologists to understand the diversity of species on the planet.

Evidence from around the world, experimentation, geology, fossils, discussion with other scientists (Alfred Wallace) lead to:

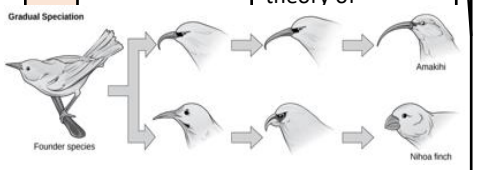
Theory of evolution (Biology only)

Charles Darwin 'On the Origin of the Species' (1859)	*Published the theory of evolution by natural selection*	Slowly accepted; challenged creation theory (God), insufficient evidence at time, mechanism of inheritance not yet known.

Other theories e.g. Lamarckism are based on the idea that changes occur in an organism during its lifetime which can be inherited. We now know that in the vast majority of cases this cannot occur.

Speciation (Biology only)

Alfred Wallace	*Independently proposed the theory of evolution by natural selection*	Published joint writings with Darwin in 1858.
		Worked worldwide gathering evidence.
		Best know for work on warning colouration in animals and his theory of



Speciation

Due to isolation of a population of a species e.g. species are split across far apart islands.

Environmental conditions differ for populations e.g. types of food available, habitat.

⇩

Individuals in each population most suited to their environments are more likely to breed successfully.

⇩

Over long periods of time each population will have greater differences in their genotype.

⇩

If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.

Classification of living organisms

The full human classification

Carl Linnaeus classified living things	*Kingdom*	Animalia
	Phylum	Chordata
	Class	Mammalia
	Order	Primates
	Family	Hominidae
	Genus	*Homo*
	Species	*sapiens*

Organisms are named by the binomial system of genus and species. Humans are *Homo sapiens*

Due to improvements in microscopes, and the understanding of biochemical processes, new models of classification were proposed.

Carl Woese

3 domain based on chemical analysis.

Archaea (primitive bacteria), true bacteria, eukaryota.

Evidence for evolution

Fossils and antibiotic resistance in bacteria provide evidence for evolution.

Antibiotic resistant bacteria	*Mutations produce antibiotic resistant strains which can spread*	Resistant strains are not killed.
		Strain survives and reproduces.
		People have no immunity to strain and treatment is ineffective.

Evolution is widely accepted. Evidence is now available as it has been shown that characteristics are passed on to offspring in genes.

Extinction

When no members of a species survive

Due to extreme geological events, disease, climate change, habitat destruction, hunting by humans.

Fossils tell scientists how much or how little different organisms have changed over time.

The understanding of genetics (biology only)

Gregor Mendel	*In the mid 19th century carried out breeding experiments on plants*	Inheritance of each characteristic is determined by units that are passed on to descendants unchanged.

Fossils

'remains' of ancient organisms which are found in rocks

Parts of organism that have not decayed as necessary conditions are absent.

Parts of the organism replaced by minerals as they decay.

Preserved traces of organisms such as footprints, burrows and rootlet traces.

Early forms of life were soft bodied and few traces are left behind and have been destroyed by geological activity, cannot be certain about how life began.

Led to gene theory being developed but not until long after Mendel died.

Further understanding of genetics

Improving technology allowed new observations.

Late 19th century: behaviour of chromosomes in cell division.

Early 20th century: chromosomes and Mendel's 'units' behave in similar ways. 'units' now called genes must be located on chromosomes.

Mid 20th century: structure of DNA determined. Mechanism of gene function worked out.

Inheritance, variation and evolution – Lesson Notes

Inheritance part 4 – Evidence for evolution

The **theory of evolution** by natural selection is **now widely accepted.**

Evidence for Darwin's theory is now **available** as it has been shown that characteristics are passed on to offspring in genes.

Darwin, Mendel, Wallace and many more scientists had their credibility questioned in their lifetimes. We can now see their work was **pioneering** and valuable.

Fossils now provide **proof** for **evolution** showing how organisms changed gradually over millions of years.

Our understanding of evolution has also been helped by the **study of antibiotic resistance in bacteria**. Bacteria multiply quickly in a short space of time. Advantageous mutations are rapidly spreading throughout the population of bacteria. We **can see evolution** through natural selection occur and are able to do research.

Inheritance part 4 – Fossils

Fossils are the ‘remains’ of ancient organisms from millions of years ago, which are found in rocks. Scientists can learn how much or how little organisms have changed over time. This is called the fossil record.

Fossils may be formed:

- From parts of organisms that have not yet decayed.
Usually because one or more of the conditions needed for decay is not present (oxygen, water or warmth).

- As preserved traces of organisms such as footprints, burrows and rootlet traces.

- When parts of the organism are replaced by minerals as they decay.

Inheritance part 4 – Fossils

The **fossil record** is **incomplete** for many reasons:

1. **Early life forms** were often **soft bodied** and so **few traces** remain.
2. Most organisms **do not** become **fossilised** as **conditions** are **rare**.
3. We are **still discovering fossils** which give us more information.
4. **Traces** are often **destroyed** by **geological activity** like earthquakes, volcanic eruptions, formation of mountain ranges and erosion.

This is why scientists can **never be certain** about **how life began** on Earth.

The **fossil record** of the **horse** gives us a good **idea** of how the modern horse has **evolved** from a much smaller, dog like animal.

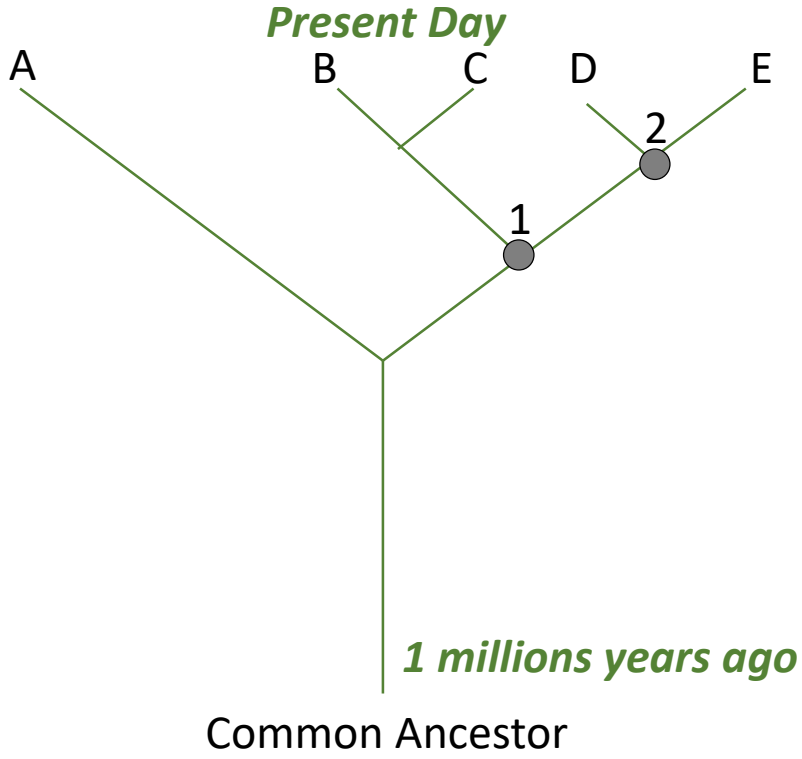
Inheritance part 4 – Fossils

Evolutionary tree diagrams are used to represent the **relationship between** various **species** based on the similarity and differences in their physical and genetic characteristics. The pattern of branching reflects how scientists think the species has evolved from a common ancestor**. Current classification data** is used for living organisms and **fossil data** for **extinct** organisms.

Species A – E all have the same common ancestor.

B and C, D and E share the same ancestor.

A is the present day species least closely related to all other species.



Species A and species 1 evolved from the common ancestor following speciation.

Species 1 was the ancestral species of species B,C and 2.

Species 2 gave rise to species D and E.

Inheritance, variation and evolution – Questions

Inheritance part 4 – QuestionIT

1. Name **two** pieces of evidence for Darwin's theory of evolution through natural selection which mean it is now largely accepted.
2. What are fossils?
3. How are fossils formed?
4. List two reasons why there are not many traces of early life on Earth.
5. What can be learned from studying fossils?
6. What does an evolutionary tree show?