SMITH'S WOOD ACADEMY

Home learning activities

Subject
Science
Year Group
Year 8
Unit of work / Knowledge organiser
Inheritance, Variation and Evolution - 2
Activities

- Complete the 'Knowledge Check' by clicking on the link below (Mr Tobi has also emailed this link out to you):

https://forms.office.com/Pages/ResponsePage.aspx?id=tWaUKrjGMEuM3bZvypd0-1JR5WsjuLFPvbjI4VXu0Y1URFNNUFJCTTU0TURIUUszNkNWRTc5Q09OQS4u

- Read through each of the Sections of the 'Knowledge Organiser' on 'Inheritance, Variation and Evolution'.
- Make careful and details notes on the Sections of the second page of the 'Knowledge Organiser', including writing out the 'genetic cross diagrams' in the boxes and the 'Key Words', written **in bold,** with their meanings.
- Describe, in your own words, what is meant by 'survival of the fittest', without looking at your earlier notes.
- Read the 'Key Revision Facts' sheet carefully.
- Describe, in your own words, the meaning of 'inherited variation' and give an example, without looking at the 'Key Revision Facts' sheet.
- Complete the 'Match and Draw', 'Extinction' and 'Predator/Prey Relationship' activities on the 'Test Yourself' pages using the 'Key Revision Facts' sheet to help you; the answers are provided at the end, but do not look at these until you have tried to complete the work yourself (**be strict with yourself here**).
- Complete the exam question on 'Adaption and Inheritance' using the 'Key Revision Facts' sheet to help you. Use the mark scheme (**once you have tried the question**) to mark your answers carefully.

Where do you complete the work?
In Study Books.

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What to do if you finish the work? (Extension activity)
• Make sure you have completed the previous work set on 'Inheritance, Variation and Evolution - 1' and then continue with all sections of the 'Mini Project' on 'Variation'.
These websites might help:
• BBC Bitesize -> Secondary -> KS3 -> Science -> Biology -> Inheritance and Genetics
If you are struggling with your work or if you have finished.
Please email your classroom teacher directly using the email list found in the Home Learning section of the website.

Year 8: Inheritance, Variation and Evolution

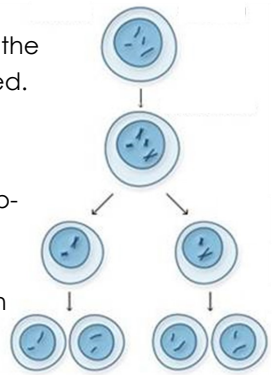
Sexual reproduction involves the **fusion** of two **gametes** (the sperm and the egg, or pollen and egg cells in plants). The mixing of **genetic information** leads to **variation** in the offspring.

Gametes are produced by **meiosis**:

The number of chromosomes in the nucleus is doubled.

The first division produces two diploid cells.

A second division produces four haploid cells.

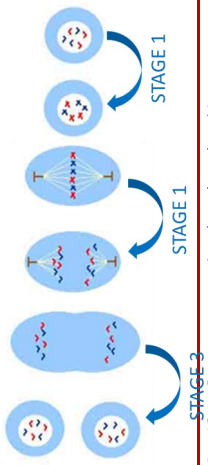


Asexual reproduction only involves one parent and there is no mixing of genetic information. This leads to **genetically identical** offspring called **clones**.

Asexual reproduction happens by **mitosis**:

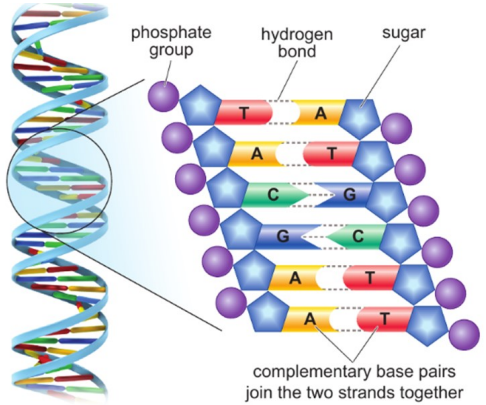
Mitosis happens in three stages:

1 - The parent cell replicates its DNA.
2—The chromosomes are pulled to either side of the cell.
3—The cell divides into two identical cells.



Within the **nuclei** of cells, there are **chromosomes** containing stored genetic information as **DNA**. Small sections of DNA on chromosomes are called **genes**. The full set of genetic information for an organism is called a **genome**.

Scientists have studied the whole human genome which will improve our understanding of inherited diseases.



DNA double helix

DNA is a **polymer** (a repeating pattern of molecules) made up of two strands. It has:
- a **double helix** structure
- sugar-phosphate backbones
- **complementary base pairs** held together by **hydrogen bonding**

DNA contains four different bases: **adenine**, **thymine**, **cytosine** and **guanine**. These are always found in complementary pairs: **A-T, C-G**.

Most of the **characteristics** of an individual are determined by more than one gene interacting. However, some characteristics are controlled by a single gene. Examples of these are fur colour in mice and red-green colour blindness in humans.

Different forms of a specific gene are called **alleles**. An individual inherits one allele from each parent so it will have two alleles for each characteristic.

The **genotype** is the combination of two alleles that an individual has for a particular characteristic. The **phenotype** is the expressed characteristic as a result of this combination of alleles (i.e. the displayed physical trait).

When an individual has two of the same alleles for a specific characteristic it is **homozygous**. If it has two different alleles it is **heterozygous**.

Dominant alleles are always given capital letters and will always be expressed in the phenotype if an individual has this allele. **Recessive alleles** are given small letters and will only be expressed in the phenotype if the individual is homozygous for this allele.

Example:
The allele for black fur on a mouse is given the capital letter **B** because it is **dominant**. The allele for brown fur on a mouse is given the small letter **b** because it is recessive.

The possible genotypes are therefore:
BB: Homozygous for the dominant allele, so the phenotype would be black fur.
Bb: Homozygous for the recessive allele, so the phenotype would be brown fur.
Bb: Heterozygous, so the phenotype would be black fur.

Genetic cross diagrams can be used to show the possible genotypes that an **offspring** could have from two known parents:

This genetic cross diagram shows that there is a 50% chance of the offspring being homozygous for the dominant allele, and 50% chance of the offspring being heterozygous. This means there is a 100% chance of the offspring having black fur.

Mother's alleles \ Father's alleles	**B**	**B**
B	BB	BB
b	Bb	Bb

Year 8: Inheritance, Variation and Evolution

Some diseases, such as cystic fibrosis, are **inherited**. The allele for having cystic fibrosis is recessive (**c**). The allele for not having the disease is dominant (**C**).

The genetic cross diagram below shows how two parents who do not suffer from cystic fibrosis can produce an offspring who has the **phenotype** of having cystic fibrosis:

Mother's alleles \ Father's alleles	C	c
C	CC	Cc
c	Cc	cc

The probability of two parents having a boy or a girl can also be determined using a genetic cross diagram. One of the pairs of **chromosomes** in the nuclei of body cells determines sex:
Males have the genotype **XY**.
Females have the genotype **XX.**

Mother \ Father	X	Y
X	XX	XY
X	XX	XY

This genetic cross diagram shows that the probability of having a boy (or girl) is always 50%.

There is **variation** in all **species**; there are differences between the characteristics of individuals.

Genetic variation is due to inherited genes. **Environmental variation** is caused by the conditions that organisms have developed in.

A **species** is defined as a group of organisms in which two individuals can produce fertile **offspring**.

A lion and tiger can be crossed to produce a liger. Lions and tigers are different species because ligers are infertile.

Charles Darwin came up with the theory of **evolution** by **natural selection** which can be explained in four stages:

Variation: There is genetic variation within all species.
Competition: Individuals within a species compete for food, space and mating partners.
Survival of the fittest: Only those individuals who are best adapted to their environment will survive.
Passing on genes: The individuals who survive reproduce together and their successful traits are passed on through their genetic information.

Over many generations, this leads to the formation of new species. All species have evolved from simple life forms that first developed more than three billion years ago.

Selective breeding is sometimes known as **artificial selection**.

For thousands of years humans have been selectively breeding plants and animals to have desired genetic characteristics. Two individuals of a species who have the desired characteristics are bred together and, over many generations, the offspring also display that characteristic.

Plants can be selectively bred for:
- disease resistance in food crops
- large or unusual flowers

Animals can be selectively bred for:
- ability to produce more food or milk
- calm temperaments

Inbreeding is when close relatives within a species are bred together and can cause them to display inherited defects.

Genetic engineering is a process where scientists can modify the genome of an organism to give a desired characteristic. This is done by inserting a gene from another organism.

Advantages:
- Plants or crops can be engineered to be resistant to diseases and herbicides, or to produce increased yields (**GM crops**).
- Bacteria can be engineered to produce insulin for treating diabetes.

Disadvantages:
- Concerns over the effect of GM crops on wild flowers and insects.
- Some people are concerned about the effects of GM foods on their health.

Evidence for Darwin's theory of evolution by natural selection:

Understanding of inheritance:
It has been shown that characteristics are passed to offspring through genes. Darwin did not have knowledge of genes or DNA at the time but he did suggest that character traits were passed down from parents to their offspring.

Fossils:
Fossils are the preserved traces or remains of organisms that lived thousands or millions of years ago. We can learn how organisms have changed over time by examining fossils.

Species of plants or animals are considered to be **extinct** when there are no remaining living individuals of that species.

Species may become extinct due to **natural disasters**, new **predators** or diseases, or changes to their **environmental conditions**.

Bacteria can evolve very rapidly due to reproducing at a fast rate.

Some bacteria are evolving to become **resistant** to **antibiotics**, which is concerning for human health.

MRSA is an example of a bacterial strain that is resistant to antibiotics.

Adaptation and Inheritance **Key Revision Facts**

- The camel is adapted to desert conditions. It has: big feet to prevent sinking into the sand; sandy coloured fur for camouflage; double eyelashes; low need to urinate or sweat; and shaggy fur.
- The polar bear is adapted for arctic conditions. It has: thick white fur, a layer of fat for insulation, and large feet.
- Animals compete for: food, water, a home and a mate.
- Plants compete for: water, light and space.
- The predator/prey relationship is closely linked. If the number of prey increases, so does the number of predators.
- Inherited variation is passed on to the next generation in the parents' genes, for example eye colour, hair colour or type of ear lobes.
- Environmental variation is caused and influenced by an organism's surroundings, for example, scars, dyed hair, or piercings.
- Continuous variation can take any value within a range, for example height or weight.
- Discontinuous variation has a limited range, for example blood group or ability to roll the tongue.
- Characteristics are inherited from our parents; half of the genes from the mother and the other half from the father.
- Natural selection is the way species evolve. If the organism has the genes that will help it survive, it will pass on these genes to the next generation.
- Factors that may lead to extinction are: disease, new predators or competitors, destruction of habitats, or changes to the environment.

Adaption and Inheritance **Test Yourself**

Match and Draw: Polar Bear

White fur	To prevent sinking in to the snow
Layer of fat below skin	Camouflage
Large feet	Insulation
Sharp claws	To help catch and tear apart prey

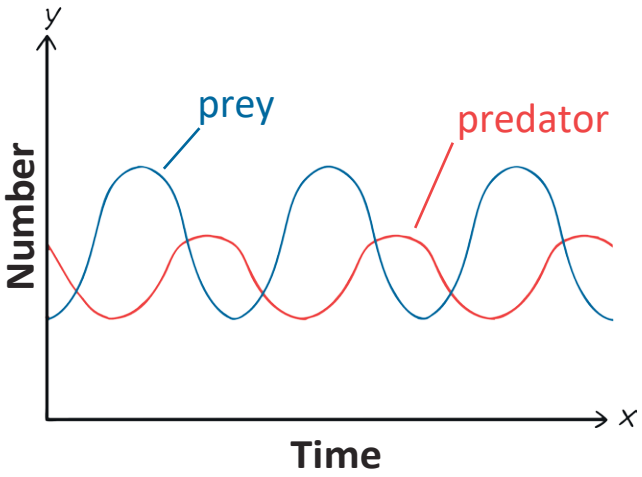
Extinction

What evidence is there that dinosaurs existed?

Dinosaurs are extinct. What does extinction mean?

Name 3 factors that may lead to extinction:

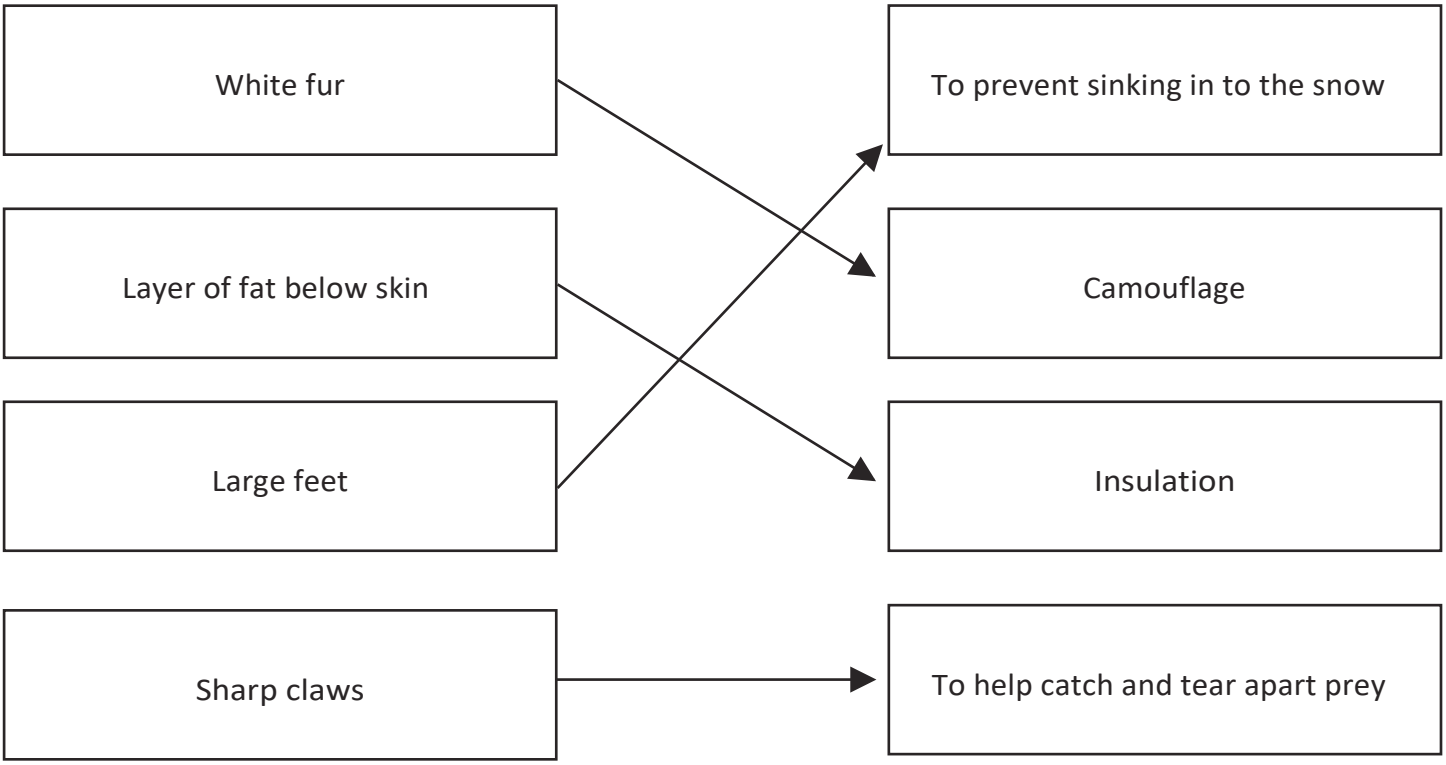
Predator/Prey Relationship



Use the information shown in the graph to write a conclusion about the predator/prey relationship.

Adaption and Inheritance **Test Yourself - Answers**

Match and Draw: Polar Bear



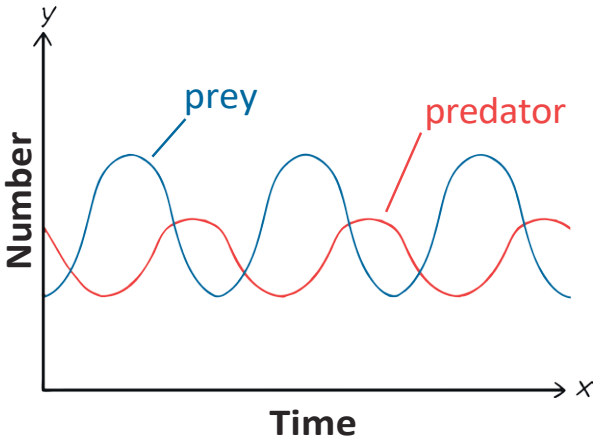
Extinction

What evidence is there that dinosaurs existed? **Fossils and bones**

Dinosaurs are extinct. What does extinction mean? **No more exist on the planet**

Name 3 factors that may lead to extinction: **Disease, predators, climate change**

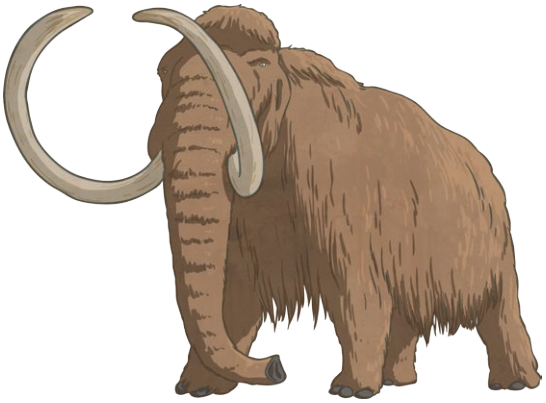
Predator/Prey Relationship

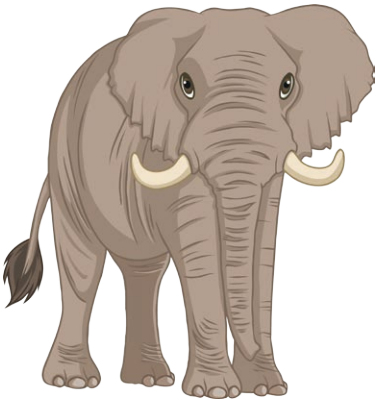


Use the information shown in the graph to write a conclusion about the predator/prey relationship. **The predator numbers are affected by the number of prey. When the prey numbers are high, the number of predators will start increasing. If numbers of prey fall, the number of predators falls too.**

Adaption and Inheritance
Exam Style Questions

1. Below are images of a mammoth and an elephant. The mammoth and elephant are believed to be closely related.



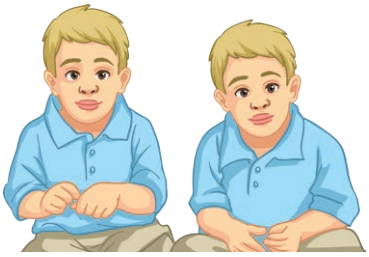


State 2 reasons why scientists would believe them to be closely related.

Mammoths are now extinct. What does extinct mean?

Name 3 factors that might lead to extinction

2. Jack and James are identical twins.

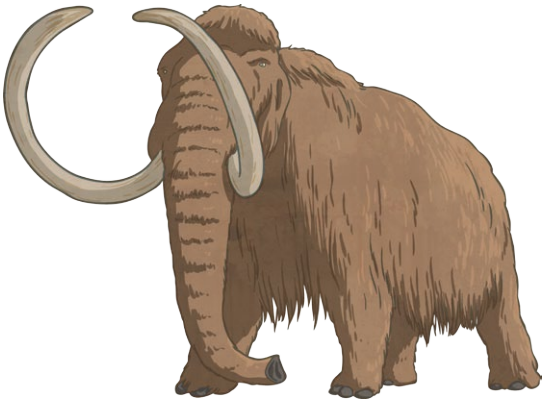


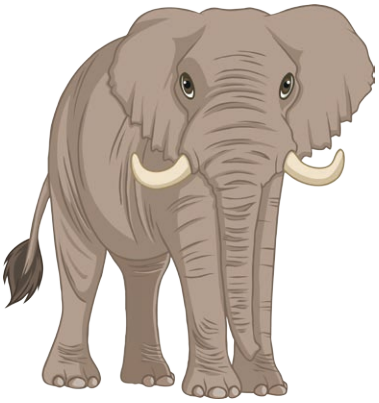
Explain why their hair colour is identical and yet there could be differences in their weight.

Adaption and Inheritance

Exam Style Questions – Answers

1. Below are images of a mammoth and an elephant. The mammoth and elephant are believed to be closely related.





State 2 reasons why scientists would believe them to be closely related.

Trunk

Tusks

Mammoths are now extinct .What does extinct mean?

There are no longer any more alive.

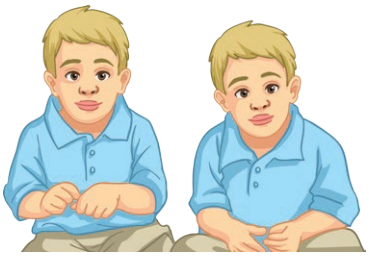
Name 3 factors that might lead to extinction

Disease

Predators

Change in climate

2. Jack and James are identical twins.



Explain why their hair colour is identical and yet there could be differences in their weight.

Natural hair colour is inherited, whereas weight can be affected by environmental factors.

Variation

Watch this video: https://www.youtube.com/watch?v=sNU30T2EmQ8

Task	Description
1	Create a family tree for your family looking at one inherited characteristic for example noting down the eye colours of each member next to their name.
2	Explain how sexual reproduction promotes variation.
3	Research the reasons why variation is beneficial within a species
4	Define the following key words (in terms of biology): variation, inherited, characteristics, classification, adaptations, habitat, species
5	Make a poster showing the different types of variation (inherited and environmental characteristics) with examples for each.
6	Choose two closely related species that live in two very different environments. Compare and contrast the variations between these species.
7	Research the classification system we use to classify living organisms today. Create a short project about its history and how the species are grouped. Evaluate this system of classification.
8	Make a game based on this topic that could be used as a revision activity for Year 8 pupils preparing for their assessment.