Science KS4: Blended Learning Booklet

Stewards Academy

B6 Genetics

Name:

Form:

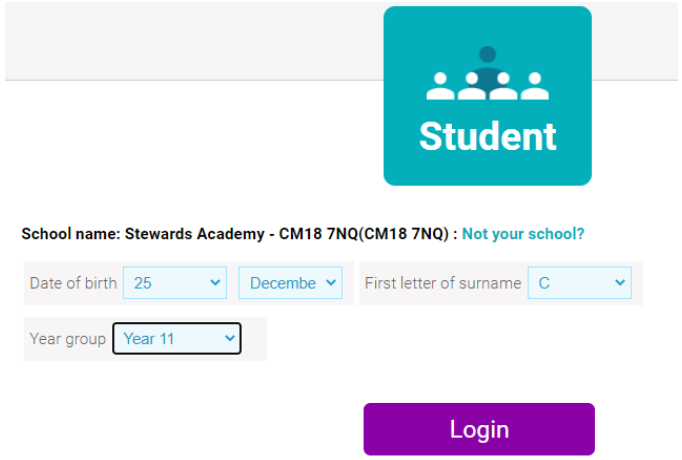
Aim to complete four lessons each week. Watch the videos and follow the four part lesson plan

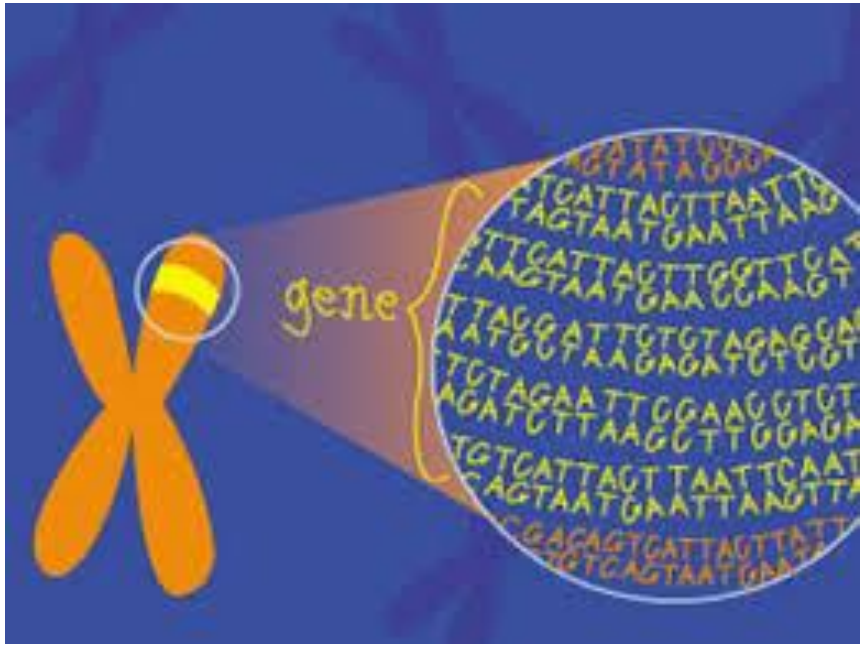
All video clips are online using the ClassCharts link. Upload all work onto ClassCharts for feedback.

The online textbook has all the key information and vocabulary to help you with this unit

To log on to the online textbook:

- https://connect.collins.co.uk/school/portal.aspx
- Type in “stewards” and select Stewards Academy
- Login using your date of birth, initial of your surname and your academic year





Contents

Contents

(T) = Triple scientists only

Big Picture – Year 10 Overview

Science

Unit Test

End of Year Exams

Nest Year

IR emission and absorption (T)

Colour, lenses, images and magnification (T)

The electro-magnetic spectrum

Sound waves and seismic waves (T)

Properties of waves

UNIT P6

Unit Test

Spectroscopy and other instrumental methods (T)

Tests for gases, *metals, hydroxides and anions (T)*

Pure substances and chroma-tography

Polymers and poly-merisation (T)

Waves

I will be able to describe characteristics of waves that can be measured. **I will** be able to measure reflection and refraction of waves and explain why they occur. **I will** be able to place visible light withing the electromagnetic spectrum. ***I will** be able to sound waves can reveal structures (T). **I will** be able to explain how lenses work (T)*

Hydrocarbons & Chemical analysis

I will be able to describe the properties of hydrocarbons. ***I will** be able to describe the properties of alkenes, alcohols, carboxylic acids and polymers (T).* **I will** be able to use techniques to produce and identify a pure substance. ***I will** be able to identify positive and negative ions and evaluate different analysis techniques (T).*

Meiosis and reproduction

Genetics and gene disorders

The work of Gregor Mendel (T)

Unit Test

UNIT C7 & C8

Crude oil, hydrocarbons and fractional distillation

Combustion and cracking of alkanes

Alkenes, alcohols and carboxylic acids (T)

DNA structure and protein production (T)

Genetics

I will be able to explain how we inherit our characteristics as a result of our genes which are made of DNA. **I will** be able to explain how the DNA is replicated and packaged in a specialised way to form the sex cells. ***I will** be able to describe the work by Gregor Mendel around plant genetics*

I will be able to explain how forces affect motion and how an understanding of these forces can make driving safer. ***I will** be able to explain the effects of forces on levers and in creating pressure (T).* I will be able to explain the effects of forces applied to springs.

Forces

DNA, genes and the human genome

UNIT B6

Unit Test

Forces and energy in springs

Moments, levers and pressure (T)

Momentum and road safety

Mass and Weight

Forces, speed and acceleration

UNIT P5

Energy Changes & Reaction Rates

I will be able to describe, explain and represent energy changes in chemical reactions and link them to bond energies and the particle theory. ***I will** be able to explain how dells produce a voltage and how fuel cells work (T).* **I will** be able to measure and calculate the rate of a reaction and describe factors that can affect rate. ***I will** be able to apply Le Chatelier's principle to reactions in equilibrium (T).*

Unit Test

Exo and endo thermic reactions

Reaction profiles

Cells, batteries and fuels cells (T)

Measuring rates of reaction

Factors affecting rates of reaction

Catalysts and collision theory

Reversible reactions and energy changes

Factors affecting equilibrium

UNIT C5 & C6

I will be able to explain how conditions in the body, processes and organ systems are coordinated and controlled. **I will** be able to describe how hormones control sexual development and human reproduction, *as well as how hormones enable plants to respond to stimuli (T)*

Homeostasis

Unit Test

Plant hormones (T)

Human reproduction and IVF

The endocrine system and the kidneys (T)

The nervous system *and the eye (T)*

Homeostasis

UNIT B5

Unit Test

Nuclear fission and fusion (T)

Hazards and uses of radiation

I will be able to reconise an atomic isotope and explain how one isotope can turn into another through three different forms of radioactive decay. **I will** be able to represent radioactive decay using a nuclear equation.

Atomic structure

Titration (T)

Electrolysis

Oxidation and reduction)

Unit Test

UNIT P4

Atomic structure

Radioactive decay

Nuclear equations

Neutralisation

Chemical changes

I will be able to describe why some metals are more reactive than others, **I will** be able to describe how neutralization occurs and how salts are formed. **I will** be able to explain how some metals are extracted by electrolysis rather than oxidation

I will be able to describe how lifestyle choices can affect the risk of catching a non-communicable disease. **I will** be able to explain how communicable diseases are spread and how we can control their spread. ***I will** be able to describe how plants are affected by and protected from disease causing organisms (T).*

Health

Metal reactivity

UNIT C4

Unit Test

Plant diseases & defenses (T)

Protecting the body

Malaria

Pathogens

Health and disease

UNIT B4

Year 10

ZOOM IN...

MY LEARNING JOURNEY:

Subject: Genetics Year: 10 Unit: B6

AIMS

Students will learn about the human genome and how the genome is used to learn more about disease and human migration patterns. Students will investigate the structure of DNA and how genes code for proteins. Students will also learn about how cells divide by meiosis to form gametes. Finally, students will learn key genetic terms and how to interpret genetic cross diagrams in the form of Punnett squares.

DEVELOPING COURAGE

- **C** That variation can enable a species to survive environmental challenge
- **O** investigate evolution in action (AMR)
- **U** See how Scientists work together to find evidence for evolution
- **R** Learn the proceedure for genetic modification
- **A** what genetic modification can bring to the world (positive/negative)
- **G** Be mindful of the that some peoples may not believe in evolution
- **E** Debating the ethics surrounding GMOs

UP NEXT

Variation & Evolution

- Variation
- Evoluion
- Natural selection
- Anti-microbial resisitance
- Selective breeding
- Genetic engineering
- Cloning
- Extinction

CAREERS

- Environmental Biologist
- Genetic Engineer
- Population Biologist

PREVIOUS LEARNING

Pupils will have some knowledge of our cells contain our genetic information in the form of chromosomes. That in multicellular organisms, cells have to divide and that this is a process called mitosis. Finally, that our characteristics are inherited, and that sexual reproduction leads to similarities and variation between individuals.

WHAT WE KNOW/ REMEMBER

- .....
- .....
- .....
- .....
- .....

RECOMMENDED READING

1. Genetics: DNA, Genes, and Chromosomes by Mason Anders,
2. Genetics: Heredity by Mason Anders,
3. My DNA Diary: Cystic Fibrosis (Genetics for Kids) by Lisa Mullan,
4. The Human Genome Project (History Just Before You Were Born) by Janey Levy.

PERSONAL OBJECTIVES

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Lesson 1 B6. 1- DNA and genes.

Connection

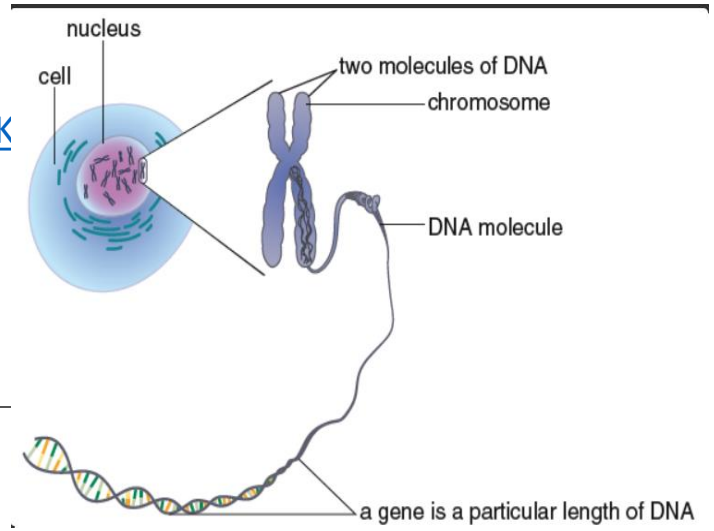
Have a look at the topic overview and the B6 zoom in.

Populate what you know and your personal objectives.

Activation

LI: describe the structure of DNA and describe a gene as a small section of DNA that codes for a protein.

1. Make a note of the title and the LI.
2. Copy keywords: gene, genome, chromosome.
3. https://www.youtube.com/watch?v=IePMXxQ-K
4. Read the text on pages 238-239.
5. Copy figure 6.2 on page 238.
6. https://www.youtube.com/watch?v=wv1TQXBQ6wQ



Demonstration

Attempt questions 1-8
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

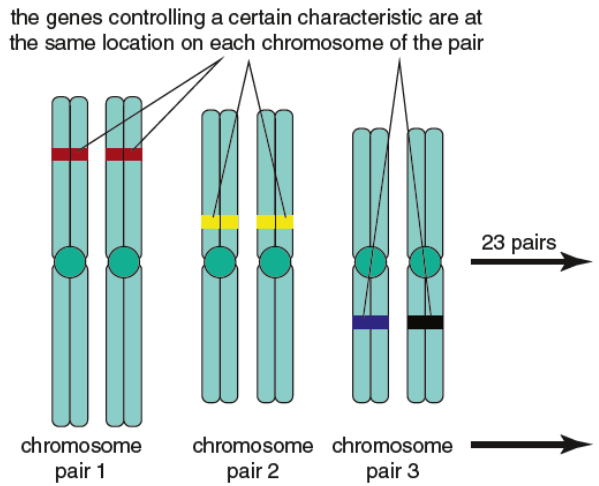
Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the B6 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher



Answers: B6.1 – DNA and genes

Connection

1 NA
2 NA
3 NA

Demonstration

1 DNA is a double helix shape.
2 DNA is a polymer of two strands that looks like a twisted ladder.
3 DNA/deoxyribonucleic acid
4 A short section of DNA that codes for the production of a particular protein
5 At the same position on each of the pair
6 Two (one on each chromosome of the pair)
7 Nucleus, mitochondrion
8 Can give antibiotic resistance
9 Genes exist on chromosomes and chromosomes make up DNA.

Lesson 2 B6. 2- The human genome

Connection

1. Where a gene can be found?
2. What is a genome?
3. Which cell part contains DNA?

Activation

LI: describe a gene as a small section of DNA that codes for a protein and explain the importance of understanding the human genome.

1. Make a note of the title and the LI.

Copy keywords: gene expression, gene therapy, genome, genomics, genome editing

2. Read the text on pages 240-241
3. https://www.youtube.com/watch?v=g4vfFCee_Ho
4. Copy figure 6.6 on page 240

Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
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Blue questions to GCSE Level 6
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Consolidation

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Extension

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Answers: B6.2 – The human genome

Connection

1. Gene can be found on chromosome.
2. The **genome** of an organism is the entire genetic material of that organism.
3. Mitochondrias.

Demonstration

1 Increase understanding of how genes are involved in a disease and other conditions/change when they become defective; so develop effective treatments, or correct defective gene/allele.
2 Cystic fibrosis (or any other)
3 Recommend better preventative medicine; improve treatment of disease by identifying targets.
Identify reasons for effective and ineffective medicines or side effects for specific people/personalised medicine.
4 Around 1.5%
5 Genes for making the cell function as a muscle cell, e.g. for synthesis of muscle filaments, enzymes of respiration, etc., are switched on; others, e.g. genes for digestive enzymes, etc., etc., are switched off.
6 Arguments for yes it was worth the money might include the medical and therapeutical benefits of knowing the genetic code such as testing for genetic diseases. We also understand more about how genes can be switched on or off (gene expression).
Arguments for no might include money could have been better spent on other medical research or treatment. Only a small percentage of the genome was found to code for protein.

Lesson 3 B6. 3- Tracing human migration.

Connection

1. Why HGP was so important?
2. What are the benefits of understanding human genome?
3. How many genes are coding for proteins?

Activation

LI: explain the importance of understanding the human genome and discuss the use of the human genome in understanding human migration patterns.

1. Make a note of the title and the LI.
2. Copy keywords: genome, genomic, migration pattern, Y-chromosome.
https://www.youtube.com/watch?v=vC92N5lndjE
3. Read the text on pages 242-243.

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

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Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: B6.3 – Tracing human migration

Connection

1. It helped scientists to understand more about human diseases.
2. Doctors may be able to recommend better preventative medicine, identify the targets of drugs more effectively, tailor healthcare to the individual.
3. There are 20 000-25 000 genes that code for proteins (it is 1.5% of the human genome).

Demonstration

1 Too much information to analyse; too costly to analyse it all; better to focus on regions known to show most variation.

2 The Y-chromosome; DNA found in mitochondria.
The cytoplasm of the fertilised egg, from our mothers, contained mitochondria. All our other cells are produced from this first cell (fertilised egg or zygote). The mitochondria are replicated before each cell divides. (The mitochondria from the sperm do not survive.)

3 Better to obtain analyses by sampling across all populations. If populations were left out, incorrect conclusions would be drawn.

4 By 2015, data from 1000 populations and 130 countries has been sampled. This involved data from 700 000 people.

5 Genomic data could find its way into the hands of medical or pharmaceutical companies.

6 Analysis was carried out of regions of DNA that did not code for proteins and had no known function.

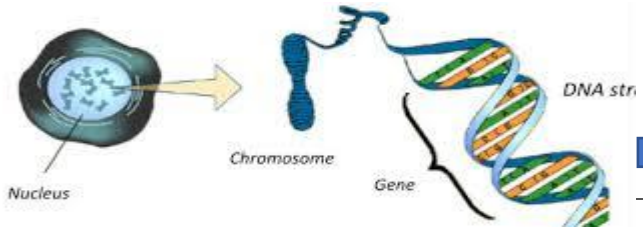
7 Understanding disease, single gene disorders, tracing migration.

8 Accept any plausible answer, such as change in climate or natural disaster.

Lesson 4 B6. 4- The structure of DNA. (T)

Connection

1. What is The Genographic Project?
2. State what sources of DNA were analysed in phase 1 of the human Genographic process?
3. From which regions DNA was selected?



Consolidation

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Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Activation

•**LI:** describe the structure of DNA as repeating nucleotide units and identify the four bases in DNA The structure of DNA Biology

1. Make a note of the title and the LI.
2. Copy keywords: **base, complementary, double helix, genetic code, nucleotide, polymer.**

https://www.youtube.com/watch?v=35FwmiPE9tI
https://www.youtube.com/watch?v=wdhL-T6tQco

4. Read the text on pages 244-245.
5. Copy figure 6.13 on page 245

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
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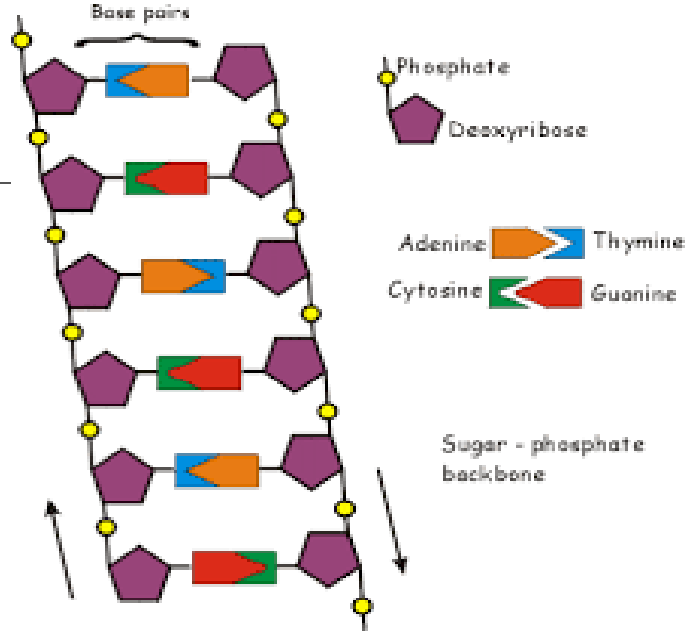


Answers: B6.4 – The structure of DNA.(T)

Connection

1. The project were DNA samples from local human population & samples from volunteers from the public.
2. In phase 1 – focussed on analysing data from Y-chromosomes.
3. Regions of DNA that did not code for proteins and that had no known function.

Demonstration

1 Double helix.

2 Like a twisted ladder.

3 A, T, C and G.

4 4 – because there are 4 different bases.

5 Diagram to show A paired with T and C paired with G.

6 By the sequence of bases in a gene.

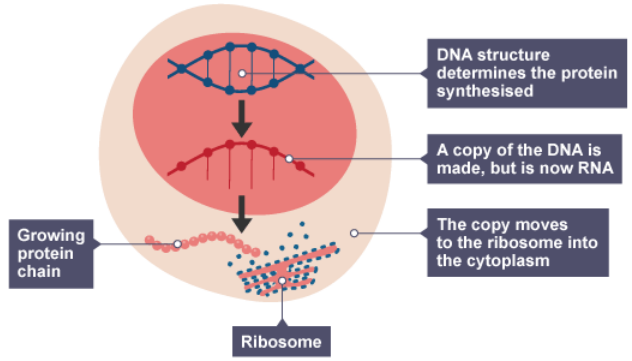
Lesson 5 B6. 5- Proteins (T)

Connection

1. What is the shape of DNA molecule ?
2. What DNA is made of?
3. Name the 4 bases and how they pair up?

Activation

LI: describe how proteins are synthesised according to the DNA template of a gene and explain that the genetic code of a gene specifies the protein to be made.



1. Make a note of the title and the LI.
2. Copy keywords: **amino acid, ribosome.**
3. https://www.youtube.com/watch?v=KJkZds_KupE

4. Read the text on pages 246-247
5. Copy figure 6.16a on page 246

Additional resources: https://www.bbc.co.uk/bitesize/guides/z3mbqhv/revision/6

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

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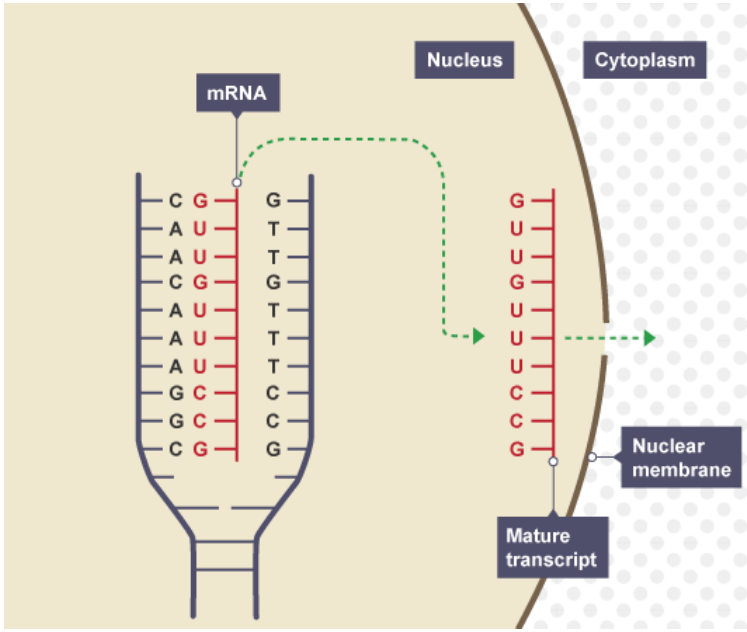
Purple questions to GCSE Level 9



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Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: B6.5 – Proteins (T)

Connection

1. Double helix.
2. DNA is a polymer made of repeating units of nucleotides.
3. Adenine (A) –Thymine (T)

   Cytosine (C) – Guanine (G)

Demonstration

1 antibody; collagen; enzyme; keratin; muscle protein/actin or myosin; some hormones, e.g. insulin.
2 20.

3 Three.

4 On a ribosome.

5 Attractive and repulsive forces between amino acids (and with the medium).

6 Intermolecular forces.

7 Flow diagram to show steps:
1. DNA unzips and bases act as template for messenger molecule
2. Messenger molecule leaves nucleus and attaches to ribosome
3. carrier proteins match amino acids to complementary base pairs
4. Peptide bonds form between amino acids
5. 5.A protein chain is formed as the messenger molecule moves along the ribosome

Lesson 6 -B6. 6 Mutations (T)

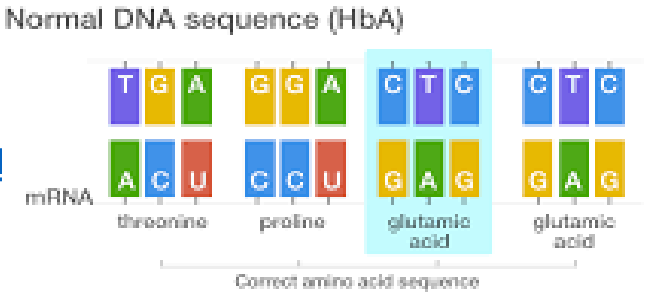
Connection

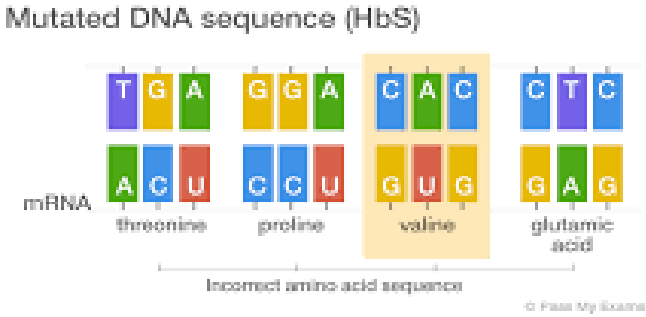
1. Give an example of protein.
2. What is a codon?
3. Recall stages of protein synthesis.

Activation

LI: describe the negative and, sometimes, positive effects of mutations and describe how mutations can affect protein function.

1. Make a note of the title and the LI.
2. Copy keywords: **gene mutation.**
3. https://www.youtube.com/watch?v=3jwDl7nYBPI
4. Read the text on pages 248-249





Demonstration

Attempt questions 1-6
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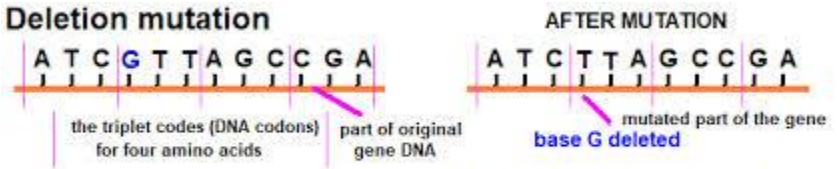
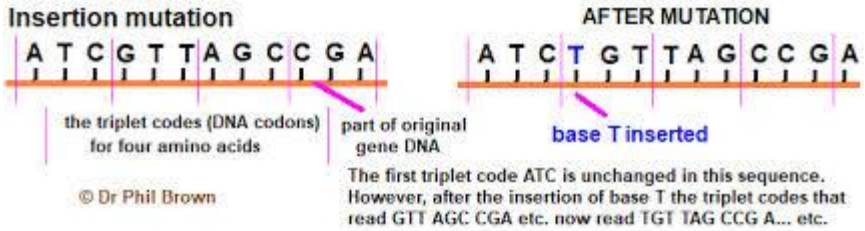
Challenge yourself to answer as many as you can.





Consolidation

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Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: B6.6 – Mutations (T)

Connection

1. Collagen, an enzyme, hormone.
2. We call every three bases a **codon.**
3. - Transcription

The two strands of the DNA helix are unzipped by breaking of the weak Hydrogen bonds between base pairs. This unwinding of the helix is caused by an enzyme (helicase enzyme).The enzyme RNA polymerase attaches to the DNA in a non-coding region just before the gene.The newly formed strand of mRNA is now ready to leave the nucleus and travel to the ribosome.

- Translation. The mRNA strand travels through the cytoplasm and attaches to the ribosome. The strand passes though the ribosome.

1.For every three mRNA bases the ribosome lines up one complementary molecule of tRNA. tRNA molecules transport specific amino acids to the ribosome which they leave behind shortly after lining up opposite the DNA. Because there are three mRNA bases for each tRNA molecule, we call this the **triplet code.**

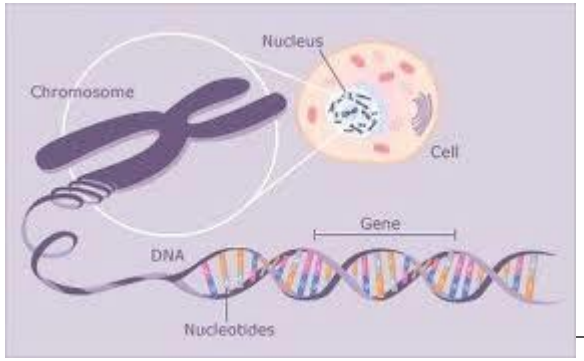
Demonstration

1 A change in an organism's DNA (these can be on a chromosome level or changes to the base sequence of the DNA).
2 If they bring about something that helps with the organism's survival, e.g. a melanic form, that improves camouflage.
3 Chromosome and gene.
4 The genetic code allows for some errors; when a protein may be changed, but is still able to carry out its function.
5 If an extra base is inserted; if a sequence of bases is copied and repeated; if one base is substituted with another; if bases are deleted.
6 Accept diagram showing how change in amino acid changes the intermolecular forces between the amino acids. Diagram should also show the enzyme shape is changed so the enzyme and substrate are no longer complementary.

Lesson 7 B6. 7- Meiosis.

Connection

1. Recall how many chromosomes in human cells.
2. Name male and female sex cells.
3. What is the difference between chromosome and DNA?



Activation

LI: explain how meiosis halves the number of chromosomes for gamete production and explain how fertilisation restores the chromosome number

1. Make a note of the title and the LI.
2. Copy keywords: gamete, genetic variation, meiosis, sex determination, X-chromosome, Y-chromosome.
3. https://www.youtube.com/watch?v=nMEyeKQClqI
https://www.youtube.com/watch?v=kGWNykqbxKY
4. Read the text on pages 250- 251.
5. Copy figure 6.21 An overview of meiosis.

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

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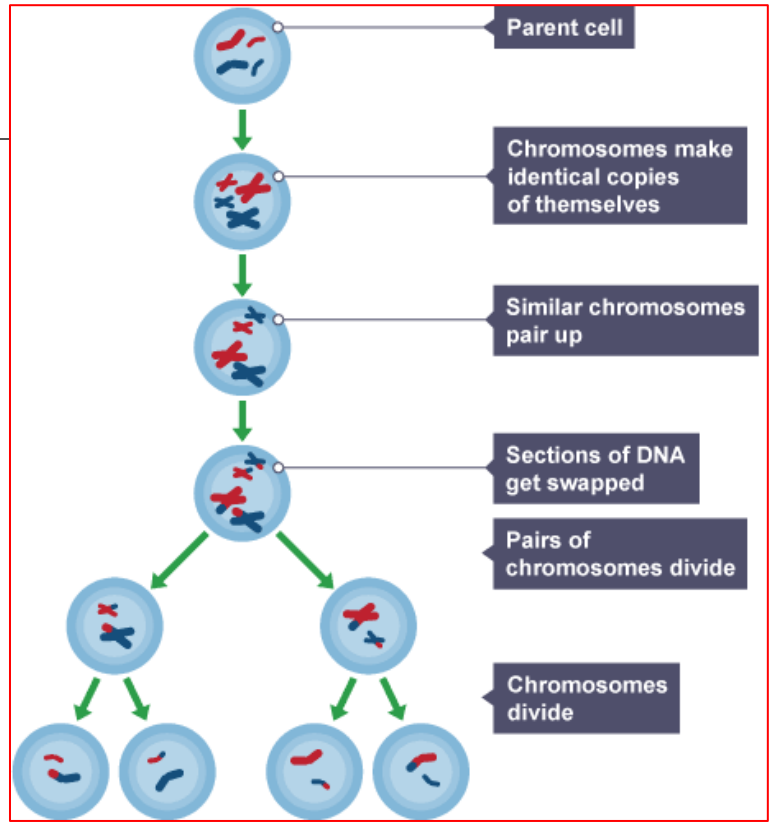

Answers: B6.7- Meiosis

Connection

1. 46 chromosomes.
2. Sperm cells in male and egg cells in female.
3. **DNA** is a double-stranded coiled polymer composed of deoxyribonucleotides while the **chromosome** is a thread like structure composed of **DNA** molecules tightly coiled.

Demonstration

1 Four.
2 Half the parent number/23 in humans.
3 One.
4 Two.
5 Each gamete is unique; the is some exchange of genetic material between chromosomes during meiosis (as [homologous] chromosomes pair up and the separate).
6 Fertilisation is random; some unknown environmental effect.