AQA Biology: Additional content

SAMUEL WARD ACADEMY TRUST

Paper 1 Biology Topics

- Cells and organisation
  - Cell structure and transport
  - Cell division
  - Organisation and the digestive system
  - Organising animals and plants
- Disease and bioenergetics
  - Communicable diseases*
  - Preventing and treating disease*
  - Non-communicable diseases
  - Photosynthesis
  - Respiration

Paper 2 Biology Topics

- Biological response
  - The human nervous system*
  - Hormonal coordination*
  - Homeostasis in action (Biology Only Topic)*
- Ecology
  - Adaptations, interdependence and competition
  - Organising an ecosystem*
  - Biodiversity and ecosystems*
- Genetics and reproduction
  - Reproduction*
  - Variation and evolution*
  - Genetics and evolution*

*** Topics with extra content compared to Trilogy.**

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Key points to learn

Topic 5: Communicable diseases

1. Culture medium	Contains all the nutrients needed for microbes to grow
2. Sterilised	Any unwanted microbes have been killed
3. Inoculate	Introduce (add) microbes
4. Why incubate at 25°C?	Growing microbes at 25C reduces chances of growing ones that might harm humans
5. Area of a circle	$\text{Area} = \pi \text{ x } (\text{radius}^2)$ $A = \pi r^2$
6. Binary fission	One divides into two. How bacteria multiply.
7. Detecting plant disease	1. Stunted growth 2. Spots on leaves 3. Areas of rot 4. Unusual growths 5. Malformed stems or leaves 6. Discolouring 7. Pests
8. Identifying plant disease	1. Gardening manual or website 2. Take to a laboratory 3. Using testing kits containing monoclonal antibodies
9. Ion deficiency in plants	Nitrate deficiency causes stunted growth
	Magnesium deficiency causes chlorosis (lack of chlorophyll)

Key points to learn

10. Physical plant defences against microbes	1. Cellulose cell walls 2. Tough waxy cuticle on leaves 3. Layers of dead cells on stems (bark on trees) which falls of
11. Physical plant defences	1. Antibacterial chemicals 2. Poisons to deter herbivores
12. Mechanical plant defences	1. Thorns and hairs deter animals 2. Leaves which curl when touched 3. Mimicry to trick animals

Topic 6: Preventing and treating disease

13. Monoclonal antibodies	Specific to one binding site on one protein antigen so target a specific chemical or specific cells in body
14. Making monoclonal antibodies	1. Produced by stimulating mouse lymphocytes to make an antibody 2. Lymphocytes are combined with particular tumour cell to make a cell called a hybridoma cell 3. These hybridoma cells make the desired monoclonal antibody 4. Hybridoma cells are cloned to make lots of the antibody
15. Uses of monoclonal antibodies	1. In pregnancy tests 2. To measure hormone and chemical levels in blood and detect pathogens 3. In research to find specific molecules in cells/tissue by binding to them with a dye 4. To treat some diseases
16 Issues with monoclonal antibodies	They create more side effects than expected. As a result they are not used as often as first expected.

Biology Additional Content

Knowledge Organiser

Big picture (Biology Paper 1)

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Background

It's not just animals that get diseases. So how do they protect themselves? Also, once we've identified a pathogen, we may grow more so that we can work out how to cure it. How?

Maths skills

- You need to be able to express numbers using Standard form eg. 1.2×10^3 is 1200
- If 1 bacteria divides every 20mins you should be able to work out that there are 64 after 2hours. (2 hrs = 120 mins. There are six lots of 20mins in 120mins. So 1x2x2x2x2x2x2 i.e x2 six times.)

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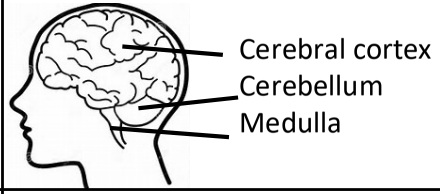
Key points to learn

Topic B10 The nervous system

Brain	Made of billions of interconnected neurons that control complex behaviour
	
Cerebral cortex	Concerned with consciousness, intelligence, memory and language
Cerebellum	Concerned with coordinating muscular activity and balance
Medulla	Concerned with unconscious activity such as heartbeat, movement of gut and breathing
Mapping the brain	Scientists study patients with brain damage, by electrically stimulating different areas and using MRI scanning
Treating brain damage	Is difficult due to the complexity and delicacy of the brain
Eye	Sense organ containing receptors that are sensitive to light intensity and colour
Iris	Coloured region of muscle that controls size of pupil
Pupil	Hole which can be adjusted to let more or less light in to eye
Retina	Contains light sensitive cells that convert light into electric impulses

Key points to learn

Cornea	Transparent covering at front of eye which allows light through
Lens	Refracts light so that it focusses on retina at back of eye
Ciliary muscles	Relax and contract to change shape of lens allowing the eye to focus on far or near objects
Optic nerve	Carries electrical signals to brain

Topic B16: Organising an ecosystem

1. Decomposition	Describes the decay of biological material so that it can be recycled in an ecosystem
	The rate of decomposition depends on: 1. Temperature – too low or too hot might slow it down as enzymes in decomposers are denatured 2. Moisture levels – most decomposers grow faster in moist conditions 3. Availability of oxygen – most decomposers respire aerobically so need oxygen
2. Compost	Decayed waste used as a natural fertilizer
3. Methane gas	• Produced by anaerobic decay of waste • Fuel for biomass generators

Biology Additional Content Knowledge Organiser

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Background

Your brain controls everything from walking to your thoughts and feelings. It works hard your whole life. Consuming about 20% of the body's oxygen. It could even power a 25W light bulb when you are asleep and supposed to be resting.

Without decomposers, life on Earth would come to an end. Not only would the planet fill with waste but we would also run out of the material needed to make new organisms. They might not seem that important, but they really are!

Key points to learn

Topic B11: Hormonal coordination

1. Plant hormones	• Used to coordinate and control growth and respond to light and gravity • Auxins and gibberellins are types of plant hormones
2. Auxins	Type of plant hormone
	Used as: • Weed killers • Rooting powders • Promoting growth in tissue culture
3. Phototropism	Plants respond to light due to auxins causing unequal growth rates in plant shoots 
4. Geotropism or Gravitropism	Plants respond to gravity due to auxins causing unequal growth rates in plant roots
5. Gibberellins	• A type of plant hormone • Important in initiating seed germination
	Used to: • End seed dormancy • Promote flowering • Increases fruit size
6. Ethene	A chemical that controls cell division and ripening of fruit
	Used to control ripening of fruit during storage and transport

Key points to learn

Topic B13: Variation and evolution

7. Clone	An individual that has been made asexually and is genetically identical to the parent
	Plants and animals can be cloned
8. Cloning plants	1. Tissue culture: • Using small groups of cells from one plant to grow identical new plants • Used to preserve rare plants or commercially in nurseries
	2. Cuttings: • Old technique. Cut a piece of a plant off, then regrow as new plant • Used by gardeners
9. Cloning animals	1. Embryo transplants: • Splitting apart cells from developing embryo then transplanting into host mothers
	2. Adult cell cloning: • Nucleus removed from unfertilised egg cell • Nucleus from adult body cell inserted into empty egg cell • Electric shock stimulates egg cell to divide to form embryo • When embryo has developed into a ball of cells it is inserted into womb of adult female

Biology Additional Content Knowledge Organiser

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Background

In 1996, Dolly the sheep was the first mammal to be cloned from an adult sheep. She died in 2003 after living a normal life. Her legacy lives on as cloning of plants and animals continues to intrigue human-kind.

Some apples can be over a year old before they make their way onto supermarket shelves. How can we manipulate plants to this extent? This topic considers some of the methods.

Key points to learn

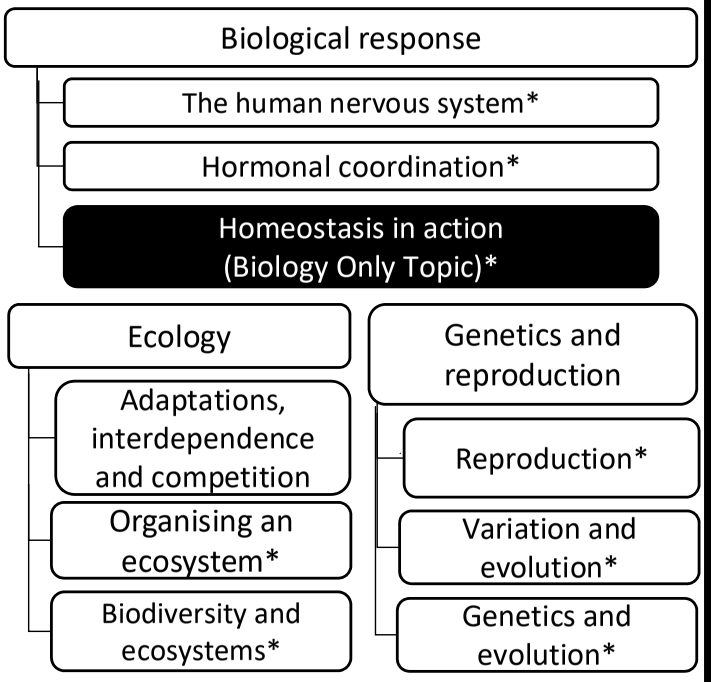
1. Thermo-regulatory centre	• Monitors and controls body temperature • Located in the brain • Monitors blood temperature and receives messages from skin
2. Temperature receptors	Can be found in the thermoregulatory system and the skin
3. Response to high temperature	• Blood vessels dilate (known as vasodilation) • Sweat is produced from sweat glans • Energy transferred from skin to environment
4. Response to low temperature	• Blood vessels constrict (known as vasoconstriction) • Sweating stops • Skeletal muscles contract (shiver)
5. Losing excess water	Via the lungs during exhalation From skin in sweat Removed via the kidneys in urine
6. Sweat	Mixture of water, ions and urea
7. Urine	Mixture of water, ions and urea
8. Osmosis	Diffusion of water through partially permeable membrane (surface that only lets small particles through). Moves from dilute solution → more concentrated solution

Key points to learn

9. Kidneys	Produce urine by filtration of blood and selective reabsorption of useful substances such as glucose, some ions and water
10. Losing excess amino acids	• Proteins in the diet result in excess amino acids • The liver deaminates amino aids into toxic ammonia • Ammonia then converted into urea
11. Liver	Removes excess amino acids by deaminating into ammonia then converting to urea
12. Deaminate	To remove an amino group from a molecule
13. ADH	Hormone that increases the permeability of kidney tubules. Used to control water reabsorption in kidneys Controlled by negative feedback
14. Treating kidney failure	1. Kidney transplant 2. Regular kidney dialysis
15. Kidney dialysis	A person is attached to a machine that restores concentration of dissolved substances in blood to normal
16. Kidney transplant	Healthy kidney from donor replaces damaged one. Tissue types in donor and recipient are matched and drugs are used to avoid rejection

Biology Additional Content Knowledge Organiser

Big picture (Biology Paper 2)



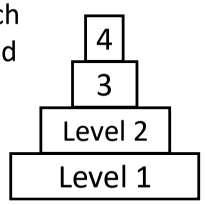
Background

Our bodies are dynamic places where the balance of substances and thermal energy are constantly changing. This topic considers how those crucial balances are maintained.

Additional information

Our bodies normally have two kidneys (a bean shaped organ) but can cope with only one. Each day they filter over 100litres of blood!

Key points to learn

1. Environmental changes that affect distribution of species	Include changes in: 1. Temperature 2. Availability of water 3. Composition of atmospheric gases
	May be seasonal, geographic or caused by human interaction
2. Trophic levels	Indicate the position of an organism within a food chain. 1. Pants and algae – producers 2. Herbivores – primary consumers 3. Carnivores that eat herbivores – secondary consumers 4. Carnivores that eat other carnivores – tertiary consumers
3. Apex predators	Carnivores with no predators
4. Decomposers	• Break down dead plants and animals by secreting enzymes into the environment • Small soluble food molecules then diffuse into microorganism
5. Biomass	Mass of biological material in an organism
6. Pyramids of biomass	• Show the amount of biomass in each level of a food chain • Trophic level 1 is at the bottom • Only approximately 10% of biomass from each level is transferred to level above 

Key points to learn

7. Losses of biomass between trophic levels	1. Not all ingested material is absorbed, some is egested as faeces 2. Some absorbed material is lost as waste such as carbon dioxide and water in respiration and water and urea in urine 3. Large amounts of glucose are used in respiration
8. Food security	Means having enough food to feed a population
	Biological factors which threaten it: • Increasing birth rate • Changing diets • New pests and pathogens • Environmental changes • Cost of agricultural inputs • Conflicts
9. Making farming more efficient	By reducing energy transfer from animals to the environment. By: • Limiting their movement • Controlling the temperatures
	Some animals are fed high protein foods to increase growth
10. Sustaining fish stocks	• Ocean fish stocks are declining • Need have enough numbers to allow breeding to continue • Control of net size or use of fishing quotas can help
11. Use of biotechnology in food production	There are potential bio-tech solutions such as: • GM crops could provide more , or more nutritious food • Culturing microorganisms to be used as food eg Fusarium

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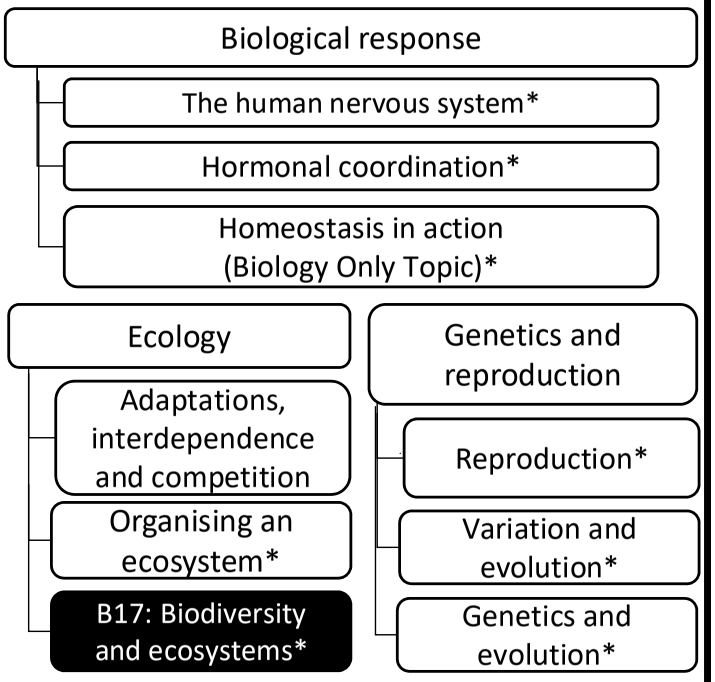
Big picture (Biology Paper 2)

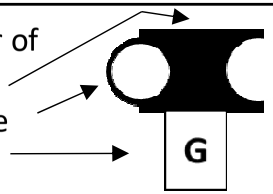


Background

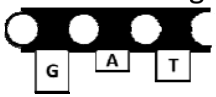
Of all the energy coming to Earth from the Sun only abut 1% of it is used by producers during photosynthesis. This might not seem much, but it is enough to sustain all life on Earth.

12. Artificially making human insulin	Genetically modified bacterium already produces insulin to treat people with diabetes

Key points to learn

1. Sexual reproduction	• Produces variation in offspring • If the environment changes variation gives a survival advantage by natural selection • Natural selection can be speeded up by humans in selective breeding
2. Asexual reproduction	• Only one parent needed • Identical offspring produced • Time and energy efficient as no need to find mate • Faster than sexual reproduction
3. Organisms that reproduce both sexually and asexually	1. Malarial parasites. Sexually in mosquito, asexually in human 2. Many fungi. Sexually to give variation but asexually through spores 3. Many plants. Sexually via seeds but asexually through runners (strawberry plants) or bulb division (daffodils)
4. Nucleotides	A monomer of a sugar, a phosphate and a base 
5. DNA Bases	• Four bases T, A, G, C • T links with A. G links with C

Key points to learn

6. DNA	• Is a polymer of repeating nucleotide monomers • Consists of alternating sugar and phosphate sections. • Attached to each sugar is a base 
7. Amino acid	• A sequence of three bases codes a particular amino acid • The order of bases controls the order in which amino acids are made to produce a particular protein
8. Protein synthesis	Process in which cells build proteins • DNA used to produce template for a protein • Template leaves nucleus and binds to surface of a ribosome • Carrier molecules bring specific amino acids to build protein • When protein is complete it folds up to forma unique shape to do its job (eg enzyme or hormone.
9. Mutations	• A change in DNA. They happen continuously • Most do not alter function of protein • Some code for an altered protein eg enzyme not fitting substrate

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Background

Deoxyribonucleic acid (DNA) is a molecule that contains all the instructions to make and maintain a living organism.
In this topic you being to look at how this beautiful double helix object works

10. Gene control	The non-protein coding parts of DNA are used to switch genes on and off Mutations in these areas of DNA may affect genes

Key points to learn

1. Gregor Mendel	• Mid 19th Century • Experimented breeding plants • Observed that the inheritance of characteristics was determined by 'units' passed from parent to offspring
2. Chromosomes during cell division	Late 19th Century their behaviour during cell division was observed
3. Relating genes and chromosomes	• Early 20th Century • It was observed that chromosomes and Mendel's 'units' behaved in similar ways • Led to idea that 'units' (now called genes) were located on chromosomes
4. Structure of DNA	• Mid 20th Century the structure of DNA was determined and mechanism of gene function worked out • Led to gene theory being developed
5. Lamarck's theory of evolution	Early theory based on idea that changes that occur to an organism over its lifetime are inherited eg if a giraffe spends its life stretching for leaves, its offspring will be born with a long neck
	In the vast majority of cases this type of inheritance cannot occur

Key points to learn

6. Darwin's theory of evolution	Published in *'On the Origin of Species'* in1859 Used knowledge of fossils and geology.
	Proposed evolution through natural selection 1. Variation within a species 2. Individuals with characteristics most suited to environment survive and breed 3. These successful characteristics are passed on to next generation
	Only gradually accepted because: • Theory challenged idea that Go created all living things • Insufficient evidence at time to convince many • Inheritance and variation was not known about until 50years later
7. Alfred Russel Wallace	Also proposed theory of evolution by natural selection. Prompted Darwin to publish.
	Best known for work on warning colours in animals and theory of speciation
8. Speciation	New species arise as a result of: 1. Isolation – two populations of a species are separated 2. Natural selection operates differently only two populations 3. Populations become so different that they can no longer breed together - they are now different species.

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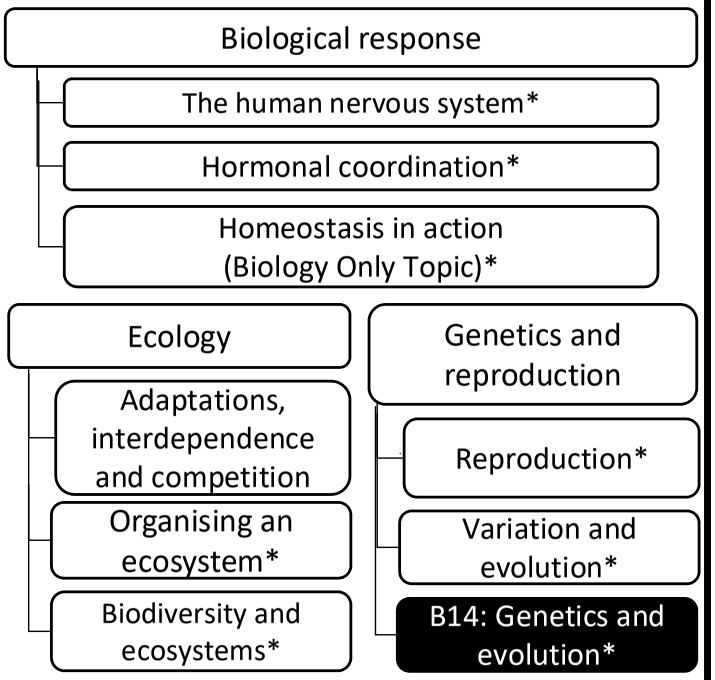

Background

Our understanding of genetics has come a long way since Gregor Mendel, the Austrian monk noticed that plant characteristics were passed from one generation to the next.
The mapping of the human genome and its three billion base pairs was completed in 2001 near Cambridge. The East of England remains at the forefront of genetic science across the World.