



Unit 2

Mitosis  
Growth in animals  
Growth in plants  
Stem cells  
*The brain*  
*Brain and spinal cord problem*  
The nervous system  
*The eye*  
Neurotransmission speeds

Unit 3

*Sexual and asexual reproduction*  
Meiosis  
DNA  
DNA extraction  
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*Genetic variants and phenotypes*  
*Mendel*  
Alleles  
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*Multiple and missing alleles*  
Gene mutation  
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Unit 4

Evidence for human evolution  
Darwin's theory  
*Development of Darwin's theory*  
Classification  
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*Tissue culture*  
Genes in agriculture and medicine  
*GM and agriculture*  
*Fertilisers and biological control*

Unit 5

Health and disease  
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Cardiovascular disease  
Pathogens  
Spreading pathogens

*Virus life cycles*

*Plant defences*  
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Physical and chemical barriers  
The Immune system  
Antibiotics  
*Core practical- antibiotics*  
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**B1 (paper 1)**

**B2 (paper 2)**

Unit 1

Animal and plant cells  
Microscopes  
Core practical-Microscopes  
Specialised cells  
Inside bacteria  
Enzymes and nutrition  
*Food tests*  
*Core practical- testing food*  
Enzyme action  
Enzyme activity  
Core practical- enzymes  
Transporting substances  
Core practical- osmosis

**On both papers 1 and 2**

Unit 6

Photosynthesis  
Factors that affect photosynthesis  
Core practical  
Absorbing water and min. ions  
*Transpiration and translocation*  
*Plant adaptations*  
*Plant hormones*  
*Uses of plant hormones*

Unit 7

Hormones  
Hormonal control of metabolic rate  
The menstrual cycle  
Hormones and the menstrual cycle  
Control of blood glucose  
Type 2 diabetes  
*Thermoregulation*  
*Osmoregulation*  
*The Kidneys*

Unit 8

Efficient transport and exchange  
*Factors affecting diffusion*  
The circulatory system  
The heart  
Cellular respiration  
Core practical

Unit 9

Ecosystems  
*Energy transfer*  
Abiotic factors and communities  
Quadrats and transects  
*Biotic factors and communities*  
*Assessing pollution*  
Parasitism and mutualism  
Biodiversity and humans  
Preserving Biodiversity  
*Food security*  
The water cycle  
The carbon cycle  
The nitrogen cycle  
*Rates of decomposition*

Core questions and answers can be found on quizlet

Search for 'aylshamsience' or follow the links below

Unit number and title	Quizlet link
1 Central concepts in biology	<a href="https://quizlet.com/_44jd2l">https://quizlet.com/_44jd2l</a>
2 Cells and control	<a href="https://quizlet.com/_44jd7x">https://quizlet.com/_44jd7x</a>
3 Genetics	<a href="https://quizlet.com/_44jdcB">https://quizlet.com/_44jdcB</a>
4 Natural selection and genetic modification	<a href="https://quizlet.com/_44je44">https://quizlet.com/_44je44</a>
5 Health, disease and the development of medicines	<a href="https://quizlet.com/_44jj0y">https://quizlet.com/_44jj0y</a>
6 Plant structures and their functions	<a href="https://quizlet.com/_3ytkst">https://quizlet.com/_3ytkst</a>
7 Animal coordination, control and homeostasis	<a href="https://quizlet.com/_3ytqxf">https://quizlet.com/_3ytqxf</a>
8 Exchange and transport in animals	<a href="https://quizlet.com/_3ytst2">https://quizlet.com/_3ytst2</a>
9 Ecosystems and material cycles	<a href="https://quizlet.com/_44jcba">https://quizlet.com/_44jcba</a>



Learning the meaning of key words and using them in your answers is a big part of doing well in biology.

Use the key word pages to identify words you are unsure of, learn the meanings of and apply to new situations.

Trying to string key words together in summary paragraphs is a good way of checking your understanding of a concept

<p style="text-align: center;"><b>Topic 1 –Key concepts in Biology</b></p> <p style="text-align: center;"><b>Bold – Higher tier</b></p> <p style="text-align: center;">Grey – Separate biology only</p>	Understood	Learnt
<p>1.1 Explain how the sub-cellular structures of eukaryotic and prokaryotic cells are related to their functions, including:</p> <p>a animal cells – nucleus, cell membrane, mitochondria and ribosomes</p> <p>b plant cells – nucleus, cell membrane, cell wall, chloroplasts, mitochondria, vacuole and ribosomes</p> <p>c bacteria – chromosomal DNA, plasmid DNA, cell membrane, ribosomes and flagella</p>		
<p>1.2 Describe how specialised cells are adapted to their function, including:</p> <p>a sperm cells – acrosome, haploid nucleus, mitochondria and tail</p> <p>b egg cells – nutrients in the cytoplasm, haploid nucleus and changes in the cell membrane after fertilisation</p> <p>c ciliated epithelial cells</p>		
<p>1.3 Explain how changes in microscope technology, including electron microscopy, have enabled us to see cell structures with more clarity and detail than in the past and increased our understanding of the role of sub-cellular structures</p>		
<p>1.4 Demonstrate an understanding of number, size and scale, including the use of estimations and explain when they should be used</p>		
<p>1.5 Demonstrate an understanding of the relationship between quantitative units in relation to cells, including:</p> <p>a milli (10<sup>-3</sup>)</p> <p>b micro (10<sup>-6</sup>)</p> <p>c nano (10<sup>-9</sup>)</p> <p>d pico (10<sup>-12</sup>)</p> <p><b>e calculations with numbers written in standard form</b></p>		
<p>1.6 <i>Core Practical: Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations</i></p>		
<p>1.7 Explain the mechanism of enzyme action including the active site and enzyme specificity</p>		
<p>1.8 Explain how enzymes can be denatured due to changes in the shape of the active site</p>		
<p>1.9 Explain the effects of temperature, substrate concentration and pH on enzyme activity</p>		
<p>1.10 <i>Core Practical: Investigate the effect of pH on enzyme activity</i></p>		
<p>1.11 Demonstrate an understanding of rate calculations for enzyme activity</p>		
<p>1.12 Explain the importance of enzymes as biological catalysts in the synthesis of carbohydrates, proteins and lipids and their breakdown into sugars, amino acids and fatty acids and glycerol</p>		
<p>1.13B <i>Core Practical: Investigate the use of chemical reagents to identify starch, reducing sugars, proteins and fats</i></p>		
<p>1.14B Explain how the energy contained in food can be measured using calorimetry</p>		
<p>1.15 Explain how substances are transported into and out of cells, including by diffusion, osmosis and active transport</p>		

1.16 Core Practical: Investigate osmosis in potatoes		
1.17 Calculate percentage gain and loss of mass in osmosis		

### CB1: Key Concepts in Biology - Core Questions

	Question	Answer
1	What is the function of the nucleus in cells?	Contains DNA
2	What is the function of the cell membrane?	To control which substances <u>enter and exit</u> the cell.
3	What is the function of the mitochondria in cells?	Releases energy. Where aerobic <u>respiration</u> occurs.
4	What is the function of the ribosome in cells?	Making proteins.
5	Name three structures that you might find inside a plant cell but <i>not</i> inside an animal cell.	Cell wall, vacuole, chloroplast.
6	What is the function of the chlorophyll in cells?	Traps light energy to be used in photosynthesis.
7	What is the function of the vacuole in plants?	Stores cell sap.
8	What is the function of the cell wall in plants?	Contains cellulose to provide support.
9	Prokaryotic cells (e.g. bacteria) differ from eukaryotic cells (e.g. animal) in what way?	Prokaryotic cells <u>don't have a nucleus</u> (they have chromosomal and plasmid DNA instead )
10	What are the small loops of DNA in bacteria called?	Plasmid DNA
11	In what way are sperm and eggs cells similar to each other but different to body cells?	Haploid nucleus. They contain half as many chromosomes as body cells.
12	List four ways that sperm cells are adapted for their function.	They have an <u>acrosome</u> , <u>haploid</u> nucleus, many <u>mitochondria</u> and a <u>tail</u>
13	List three ways that egg cells are adapted for their function.	They hold <u>nutrients in their cytoplasm</u> , have a <u>haploid</u> nucleus and <u>changes occur in the cell membrane</u> after fertilisation
14	How are the cells that line the small intestine specialised for their function of absorbing food?	They have many tiny folds called <u>microvilli</u> that give them a <u>large surface area</u> .
15	How have developments in microscope technology helped us understand more about cells?	A <u>higher magnification</u> using <u>electron microscopes</u> has allowed us to <u>see more detail</u> including more sub-cellular structures.
16	What is 30 $\mu\text{m}$ in mm?	0.03 mm (be ready for other examples)
<b>17 H</b>	<b>What is 1150000 m in standard form?</b>	<b><math>1.15 \times 10^6 \text{ m}</math> (be ready for other examples)</b>
18	How do you calculate the total magnification of a microscope?	<u>Eyepiece</u> lens magnification x <u>objective</u> lens magnification
19	How do you calculate the actual length of a magnified image?	Actual length = magnified length $\div$ magnification
20	Which stain is used when viewing plant cells?	Iodine
21	Why might a scientist add methyl blue to an animal cell sample before viewing it under a microscope?	It is a <u>stain</u> that makes objects in the slide <u>more visible</u> .
22	What is an enzyme?	A <u>biological catalyst</u> made of <u>protein</u>
23	List three cellular reactions that enzymes catalyse	Respiration, photosynthesis, digestion, protein synthesis and DNA replication.
24	Which enzyme breaks down protein? Name the product formed.	Protease breaks down protein into amino acids

25	Which enzyme breaks down fat? Name the product formed.	Lipase breaks down fat into fatty acids and glycerol
26	Which enzyme breaks down carbohydrate? Name the product formed.	Carbohydrases such as amylase break down carbohydrates into sugars.
27	What is the uniquely shaped 'pocket' on the outside of an enzyme called?	The active site
28	What do we call substances that fit into the active site for enzymes to work on?	Substrates
29	Which model do we use to explain how enzymes work?	Lock and key model
30	State three conditions that might affect the rate at which an enzyme works.	Temperature, pH and substrate concentration
31	Which two conditions could affect the shape of an enzyme's active site?	Temperature and pH
32	What is a denatured enzyme?	An enzyme that has an <u>active site</u> which has <u>changed shape</u> and no longer allows the substrate to fit.
33B	Describe how to test for starch in food.	<u>Iodine test.</u> Add iodine, the colour changes from yellow-orange <u>to blue-black if starch is present.</u>
34B	Describe how to test for reducing sugars in food.	<u>Benedict's test.</u> Mix a food solution with equal parts Benedict's solution and heat. A green, <u>orange or red precipitate forms</u> if sugars are present.
35B	Describe how to test for proteins.	<u>Biuret test.</u> Mix a food solution with potassium hydroxide and two drops of copper sulfate solution, the <u>colour changes to purple</u> if protein is present.
36B	Describe how to test for fats and oils (lipids)	<u>Ethanol emulsion test.</u> Mix food with <u>ethanol and shake.</u> Pour some of that mixture into <u>water and shake.</u> <u>Cloudy layer</u> at the top forms if fats are present.
37B	Name and describe the process that you can use to measure the amount of energy in food.	<u>Calorimetry.</u> Burn food under a container of water, <u>record the temperature rise of the water.</u>
38	Define diffusion	Substances moving from <u>high to low concentration</u> (down a concentration gradient).
39	Define osmosis	The overall movement of solute molecules in a solution across a <u>partially permeable membrane</u> from a <u>dilute solution to a more concentrated one.</u>
40	Define active transport.	The movement of substances from an area of <u>low concentration into an area of higher concentration.</u> This requires <u>energy.</u>

## Key words for Unit 1

### CB1b Plant and animal cells

Word	Meaning
<b>aerobic respiration</b>	A type of respiration in which oxygen is used to release energy from substances, such as glucose.
<b>cell (surface) membrane</b>	The membrane that controls what goes into and out of a cell. It is often called the cell surface membrane because eukaryotic cells contain other structures with membranes.
<b>cell sap</b>	Liquid found in the permanent vacuole in a plant cell.
<b>cell wall</b>	A tough layer of material around some cells, which is used for protection and support. It is stiff and made of cellulose in plant cells. Bacteria have a flexible cell wall.
<b>chlorophyll</b>	The green substance found inside chloroplasts. It traps energy transferred by light.
<b>chloroplasts</b>	A green disc containing chlorophyll, found in plant cells. Where the plant makes glucose, using photosynthesis.
<b>chromosome</b>	A structure found in the nuclei of cells. Each chromosome contains one enormously long DNA molecule.
<b>cytoplasm</b>	The watery jelly inside a cell where the cell's activities take place.
<b>DNA</b>	A substance that contains genetic information. Short for deoxyribonucleic acid.
<b>eukaryotic</b>	A cell with a nucleus is eukaryotic. Organisms that have cells like this are also said to be eukaryotic.

Word	Meaning
<b>field of view</b>	The circle of light you see looking down a microscope.
<b>mitochondrion</b>	A sub-cellular structure (organelle) in the cytoplasm of eukaryotic cells, where aerobic respiration occurs. Plural is mitochondria.
<b>nucleus</b>	The 'control centre' of a eukaryotic cell.
<b>ribosome</b>	Tiny sub-cellular structure that makes proteins.
<b>scale bar</b>	A line drawn on a magnified image that shows a certain distance at that magnification.
<b>scientific paper</b>	An article written by scientists and published in a science magazine called a journal. It is like an investigation report but usually shows the results and conclusions drawn from many experiments.
<b>vacuole</b>	A storage space in cells. Plant cells have a large, permanent vacuole that helps to keep them rigid.

### CB1a Microscopes

Word	Meaning
<b>eyepiece lens</b>	The part of the microscope you look down.
<b>magnification</b>	How much bigger something appears compared with its actual size.
<b>objective lens</b>	The part of the microscope that is closest to the specimen.

Word	Meaning
<b>resolution</b>	Smallest change that can be measured by an instrument. For example, in a microscope it is the smallest distance between two points that can be seen as two points and not blurred into one point.
<b>stain</b>	A dye used to colour parts of a cell to make them easier to see.

### CB1c Specialised cells

Word	Meaning
<b>acrosome</b>	A small vacuole in the tip of the head of a sperm cell, which contains enzymes.
<b>adaptation</b>	The features that something has to enable it to do a certain function (job).
<b>adapted</b>	If something has adaptations for a certain function (job), it is said to be adapted to that function.
<b>ciliated epithelial cell</b>	A cell that lines certain tubes in the body and has cilia on its surface.
<b>cilium</b>	A small hair-like structure on the surface of some cells. Plural is cilia.
<b>digestion</b>	A process that breaks molecules into smaller, more soluble substances.
<b>diploid</b>	Describes a cell that has two sets of chromosomes.
<b>egg cell</b>	The female gamete (sex cell).

<b>embryo</b>	The tiny new life that grows by cell division from a fertilised egg cell (zygote).
<b>enzyme</b>	A substance that can speed up some processes in living things (e.g. breaking down molecules).
<b>epithelial cell</b>	A cell found on the surfaces of parts of the body.
<b>fertilisation</b>	Fusing of a male gamete with a female gamete.
<b>gamete</b>	A cell used for sexual reproduction.
<b>haploid</b>	Describes a cell that has one set of chromosomes.
<b>microvillus</b>	A fold on the surface of a villus cell. These folds increase the surface area so that digested food is absorbed more quickly. Plural is microvilli.
<b>oviduct</b>	A tube that carries egg cells from the ovaries to the uterus in females. Fertilisation happens here.
<b>specialised cell</b>	A cell that is adapted for a certain specific function (job).
<b>sperm cell</b>	The male gamete (sex cell).



### CB1d Inside bacteria

Word	Meaning
<b>chromosomal DNA</b>	DNA found in chromosomes but the term is often used to describe the large loop of DNA found in bacteria.
<b>DNA</b>	A substance that contains genetic information. Short for deoxyribonucleic acid.
<b>flagellum</b>	A tail-like structure that rotates, allowing a unicellular organism to move. Plural is flagella.
<b>index</b>	A small raised number after a unit or another number to show you how many times to multiply it by itself. For example, $10^3$ means multiply 10 together 3 times ( $10 \times 10 \times 10$ ).
<b>plasmid</b>	A small loop of DNA found in the cytoplasm of bacteria.
<b>plasmid DNA</b>	DNA found in plasmids.
<b>prokaryotic</b>	A cell with no nucleus is prokaryotic. Organisms such as bacteria, which have cells like this, are also said to be prokaryotic.
<b>standard form</b>	A very large or very small number written as a number between 1 and 10 multiplied by a power of 10. Example: $A \times 10^n$ where $A$ is between 1 and 10 and $n$ is the power of 10.

### CB1e Enzymes and nutrition

Word	Meaning
<b>biological catalyst</b>	A substance found in living organisms that speeds up reactions (an <u>enzyme</u> ).
<b>catalyst</b>	A substance that speeds up the rate of a reaction, without itself being used up.
<b>digest</b>	To break down large molecules into smaller subunits, particularly in the digestive system.
<b>monomer</b>	A small molecule that can join with other molecules like itself to form a polymer.
<b>polymer</b>	A substance made up of very long molecules containing repeating groups of atoms. (Formed by joining monomer molecules together.)
<b>product</b>	A substance formed in a reaction.
<b>substrate</b>	A substance that is changed during a reaction.
<b>synthesis</b>	To build a large molecule from smaller subunits.

### SB1f Testing foods

Word	Meaning
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<b>Benedict's solution</b>	A bright blue chemical reagent that turns orange or red when warmed with a solution of reducing sugars.
<b>biuret test</b>	A test that uses copper sulfate solution and potassium hydroxide solution to test for proteins. The blue of the copper sulfate solution turns purple in the presence of proteins.
<b>calorimeter</b>	Equipment used to measure the energy released from a substance by burning it.
<b>chemical reagent</b>	A substance or mixture used in chemical analysis or reactions.
<b>iodine solution</b>	A yellow-orange solution that turns black-blue when in contact with starch.
<b>Precipitate</b>	Insoluble substance formed when two soluble substances react together.
<b>reducing sugar</b>	A simple sugar, such as glucose or fructose, that reacts with (reduces) Benedict's solution and changes its colour.

#### CB1g Enzyme action

Word	Meaning
<b>active site</b>	The space in an enzyme where the substrate fits during an enzyme-catalysed reaction.
<b>denatured</b>	A denatured enzyme is one where the shape of the active site has changed so much that its substrate no longer fits and the reaction can no longer happen.

<b>lock-and-key model</b>	Model that describes the way an enzyme catalyses a reaction when the substrate fits within the active site of the enzyme.
<b>specific</b>	Where an enzyme only reacts with one kind of substrate.

#### CB1h Enzyme activity

Word	Meaning
<b>optimum pH</b>	The pH at which an enzyme-catalysed reaction works fastest.
<b>optimum temperature</b>	The temperature at which an enzyme-catalysed reaction works fastest.

#### CB1i Transporting substances

Word	Meaning
<b>active transport</b>	The movement of particles across a cell membrane from a region of lower concentration to a region of higher concentration ( <i>against</i> the concentration gradient). The process requires energy.
<b>diffusion</b>	When particles spread and mix with each other without anything moving them. Diffusion into and out of cells occurs for particles that are small enough to pass through the cell surface membrane.
<b>concentration</b>	The amount of a solute dissolved in a certain volume of solvent. Measured in units such as g/cm <sup>3</sup> .

<b>concentration gradient</b>	The difference between two concentrations. There will be an overall movement of particles <i>down</i> a concentration gradient, from higher concentration to lower concentration.
<b>osmosis</b>	The overall movement of solvent molecules in a solution across a partially permeable membrane, from a dilute solution to a more concentrated one.
<b>passive</b>	A process that does not require energy is passive. A passive process is the opposite of an active process (which requires energy).
<b>semi-permeable</b>	Describes something that will allow certain particles to pass through it but not others. Another term for 'partially permeable'.
<b>solute</b>	The solid that has dissolved in a liquid to make a solution.
<b>solvent</b>	The liquid in which a substance dissolves to make a solution.



<b>Topic 2 – Cells and Control</b>			
<b>Bold – Higher tier</b>			
Grey – Separate biology only		D	L
2.1 Describe mitosis as part of the cell cycle, including the stages interphase, prophase, metaphase, anaphase and telophase and cytokinesis			
2.2 Describe the importance of mitosis in growth, repair and asexual reproduction			
2.3 Describe the division of a cell by mitosis as the production of two daughter cells, each with identical sets of chromosomes in the nucleus to the parent cell, and that this results in the formation of two genetically identical diploid body cells			
2.4 Describe cancer as the result of changes in cells that lead to uncontrolled cell division			
2.5 Describe growth in organisms, including: a) cell division and differentiation in animals b) cell division, elongation and differentiation in plants			
2.6 Explain the importance of cell differentiation in the development of specialised cells			
2.7 Demonstrate an understanding of the use of percentiles charts to monitor growth			
2.8 Describe the function of embryonic stem cells, stem cells in animals and meristems in plants			
2.9 Discuss the potential benefits and risks associated with the use of stem cells in medicine			
2.10B Describe the structures and functions of the brain including the cerebellum, cerebral hemispheres and medulla oblongata			
<b>2.11B Explain how the difficulties of accessing brain tissue inside the skull can be overcome by using CT scanning and PET scanning to investigate brain function</b>			
<b>2.12B Explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system, including spinal injuries and brain tumours</b>			
2.13 Explain the structure and function of sensory receptors, sensory neurones, relay neurones in the CNS, motor neurones and synapses in the transmission of electrical impulses, including the axon, dendron, myelin sheath and the role of neurotransmitters			
2.14 Explain the structure and function of a reflex arc including sensory, relay and motor neurones			
2.15B Explain the structure and function of the eye as a sensory receptor including the role of: a) the cornea and lens b) the iris c) rod and cone cells in the retina			
2.16B Describe defects of the eye including cataracts, longsightedness, short-sightedness and colour blindness			
2.17B Explain how cataracts, long-sightedness and short-sightedness can be corrected			

## CB2: Cells and Control Core Knowledge

	Question	Answer
1	What are the stages of mitosis?	Interphase, prophase, metaphase, anaphase, telophase and cytokinesis
2	Why do cells do mitosis?	Growth, repair and asexual reproduction
3	Describe mitosis	The production of <u>two diploid</u> daughter cells, <u>genetically identical</u> to each other and the parent cell.
4	What is cancer?	<u>Uncontrolled mitosis</u> . Rapid cell division can cause <u>tumours</u> that can damage the body.
5	How is growth different in plants and animals?	In animals, cells <u>divide</u> then <u>differentiate</u> . In plants they <u>divide, elongate then differentiate</u> .
6	What is growth?	Growth is an increase in size as a result of an <u>increase in number or size of cells</u> .
7	What process leads to the creation of specialised cells?	Differentiation
8	How are percentile charts used to monitor growth?	Mass and length/height of babies are <u>checked on a graph</u> to compare to others the <u>same age</u> . Babies should remain on or around the same percentile line as they grow.
9	How can percentage change be calculated?	$(\text{Final value} - \text{initial value}) / \text{initial value} \times 100$
10	What are stem cells?	Cells that <u>divide repeatedly</u> over a long period of time to produce <u>cells that can differentiate</u> .
11	What are plant stem cells called?	meristems
12	What is the difference between adult and embryonic stem cells?	<u>Embryonic</u> stem cells can differentiate to <u>produce any kind of cell</u> . Adult stem cells <u>usually only produce specialised cells of one tissue type</u> .
13	List two benefits associated with the use of stem cells in medicine	Benefits- can <u>treat different diseases</u> caused by damaged cells. Can be used to <u>test new drugs</u> and treatments on.
14	List two risks associated with the use of stem cells in medicine	Risks- if stem cells continue to divide this could cause <u>cancer</u> . Also if stem cells from one person are placed in another they could be killed by the immune system and be ' <u>rejected</u> '.
15B	In the brain- what is the role of the cerebellum?	Controls balance and posture. Also timing and fine control of muscle activity- smoothing out movements.
16B	In the brain- what is the role of the cerebral hemispheres?	Used for senses, language, memory, behaviour and consciousness.
17B	In the brain- what is the role of the medulla oblongata?	Controls heart rate, breathing and responsible for reflexes such as vomiting, sneezing and swallowing.
18B	<b>How can CT and PET scanning be used to access brain tissue inside the skull?</b>	<b>These can investigate brain function by: CT scanning shows structures using an X-Ray moving in a circle around the skull. PET scanning shows brain activity through the uptake of radioactive glucose by active cells.</b>

19B	What are the limitations in treating damage and disease in the brain and other parts of the nervous system including brain tumours and spinal injuries?	No adult stem cells can differentiate into neurones in the spinal cord. Wires can be used that give limited movement/feeling back. Tumours can be cut out or cells killed using radiotherapy or chemotherapy. All these methods can damage the brain. Chemotherapy may not work as the drugs do not always pass the blood-brain barrier
20	What is the Central Nervous System (CNS) made up of?	The brain and the spinal cord
21	Describe the structures and functions of the parts at each end of a neurone.	Dendrite- tiny branches that receive impulses from receptor cells Axon terminal- allows signal to be transmitted to the next cell
22	What is the function of the myelin sheath?	Insulator. Speeds up the signal.
23	What are neurotransmitters? Where are they released?	<u>Chemicals</u> that are released at an axon terminal and <u>diffuse across the synapse</u> (gap) between neurones to pass on a signal.
24	What are the steps in the reflex arc?	Stimulus>receptor>sensory neurone>relay neurone> motor neurone> effector> response.
25B	In the eye- what is the role of the cornea and lens?	<u>Cornea focuses light onto the retina</u> by refracting light rays and bringing them together. <u>Lens fine-tunes this focusing</u> and is controlled by ciliary muscles. Fat lens= near objects in focus, thinner lens= distant objects in focus.
26B	In the eye- what is the role of the iris?	The coloured part of the eye. <u>Contains muscles that controls the amount of light entering through the pupil</u> by allowing the pupil to constrict or dilate.
27B	In the eye- what is the role of the rods and cones in the retina?	Receptor cells at the back of the eye in the retina that are sensitive to light. <u>Cones detect the colour of light</u> - separate cones detect red, green or blue light. <u>Rods detect differences in light intensity</u> (brightness) and can work in lower light levels than cones. Both generate electrical impulses in sensory neurones which lead to the brain through the optic nerve.
28B	What causes cataracts and how is it treated?	<u>Protein builds up</u> in lens and makes it cloudy. Surgery to replace cloudy lens with plastic one.
29B	What causes long or short sightedness and how is it treated?	<u>Short sightedness caused by eyeball being too long</u> - image focussed before retina, corrected by diverging lens <u>Long sightedness caused by eyeball being too short</u> image focussed behind retina- converging lens used to correct it.
30B	What causes colour blindness and how is it treated?	Some cones do not work properly, so <u>people struggle to detect certain wavelengths of light and see colours correctly</u> . No treatment available.

## Unit 2 Cells and Control Key words

### SB2a Mitosis

Word	Meaning
<b>Anaphase</b>	The stage of mitosis in which the separated chromosomes move away from each other.
<b>asexual reproduction</b>	Producing new organisms from one parent only. These organisms are genetically identical to the parent.
<b>cancer cell</b>	Cell that divides uncontrollably.
<b>cell cycle</b>	A sequence of growth and division that happens in cells. It includes interphase and mitosis, and leads to the production of two daughter cells that are identical to the parent cell.
<b>Clone</b>	Offspring from asexual reproduction. All the cells in a clone are genetically identical to each other and to the parent's cells.
<b>Cytokinesis</b>	When the cytoplasm of the cell is separated as the cell membrane is pinched to divide the cell into two daughter cells.
<b>daughter cell</b>	New cell produced by cell division.
<b>Diploid</b>	A cell with two sets of chromosomes.
<b>DNA replication</b>	The copying of the DNA within a cell.
<b>Haploid</b>	A cell with one set of chromosomes.

<b>Interphase</b>	The stage when the cell prepares itself for the process of cell division, and DNA replication takes place. The cell also makes more of its sub-cellular structures.
<b>Metaphase</b>	The stage of mitosis when the chromosomes line up across the middle of the cell.
<b>mitosis</b>	The process of cells dividing to produce two daughter cells that are genetically identical to the parent.
<b>Multicellular</b>	An organism that is made of many cells.
<b>Prophase</b>	The stage of mitosis in which the nucleus starts to break down and spindle fibres appear.
<b>spindle fibre</b>	Filament formed in a cell during mitosis, which helps to separate chromosomes.
<b>Telophase</b>	The stage of mitosis in which the chromosomes arrive at opposite ends of the cell and the nucleus membrane reforms.
<b>Tumour</b>	Lump formed of cancer cells.

### SB2b Growth in animals

Word	Meaning
<b>Differentiation</b>	When a group of similar things, such as cells, become different in form from each other.
<b>Growth</b>	A permanent increase in the number or size of cells in an organism.



<b>Percentile</b>	A $\frac{1}{100}$ th division of a group. For example, 10 per cent of the data items are below the 10th percentile and 50 per cent are below the 50th percentile.
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## SB2c Growth in plants

Word	Meaning
<b>Differentiate</b>	To change into different types, for example when meristem cells differentiate into specialised cells such as xylem or root hair cells.
<b>Elongation</b>	When something gets longer (such as a cell in a plant root or shoot before it differentiates into a specialised cell).
<b>Meristem</b>	A small area of undifferentiated cells in a plant, such as near the shoot tips and root tips, where cells are dividing rapidly by mitosis.
<b>root hair cell</b>	Cell found on the surface of plant roots that has a large surface area to absorb water and dissolved mineral salts quickly from the soil.
<b>xylem cell</b>	Cell that joins with other xylem cells to form long, thick-walled vessels after they die. The vessels carry water and dissolved mineral salts through the plant.

## SB2d Stem cells

Word	Meaning
<b>adult stem cell</b>	Stem cell found in specialised tissue that can produce more of the specialised cells in that tissue for growth and repair.
<b>Cancer</b>	Disease caused by the uncontrolled division of stem cells in a part of the body.
<b>embryonic stem cell</b>	Stem cell from an early embryo that can produce specialised cells of many different types.

<b>meristem cell</b>	Stem cell found in a plant meristem.
<b>Rejection</b>	When the immune system attacks and kills cells and tissue that come from another person, such as blood (after transfusion) or stem cells.
<b>stem cell</b>	Unspecialised cell that continues to divide by mitosis to produce more stem cells and other cells that differentiate into specialised cells.

## SB2e The brain

Word	Meaning
<b>cerebellum</b>	Part of the brain that controls balance, posture and fine muscle movements.
<b>cerebral cortex</b>	The main part of the brain, which is used for most of our senses, language, memory, behaviour and consciousness.
<b>cerebral hemisphere</b>	One half of the cerebral cortex. (The cerebral cortex has two cerebral hemispheres.)
<b>medulla oblongata</b>	Part of the brain at the top of the spinal cord. It controls breathing and heart rate.
<b>nerve</b>	Large bundle of neurones (and blood vessels).
<b>neurone</b>	A cell that transmits electrical impulses in the nervous system.

## SB2f Brain and spinal cord problems

Word	Meaning
<b>blood-brain barrier</b>	Barrier that stops substances diffusing out of capillaries and into the brain. The barrier is mainly due to the cells of the capillary walls fitting together tightly.
<b>Chemotherapy</b>	The use of drugs to kill cancer cells.

Word	Meaning
<b>CT scan</b>	A scan in which multiple X-rays are taken of part of the body and put together by a computer. CT stands for computed tomography.
<b>gamma ray</b>	A high-frequency electromagnetic wave emitted from the nucleus of a radioactive atom. Gamma rays have the highest frequencies in the electromagnetic spectrum.
<b>PET scan</b>	A scan in which a radioactive marker is used to pinpoint certain areas in the body, such as very active cells. PET stands for positron emission tomography.
<b>Quadriplegia</b>	A condition in which both arms and both legs are paralysed.
<b>Radioactive</b>	A substance is radioactive if it emits ionising particles, or radiation.
<b>Radiotherapy</b>	The use of ionising radiation to treat diseases, such as to kill cancer cells.
<b>Tumour</b>	A lump formed of rapidly dividing cells.

## SB2g The nervous system

Word	Meaning
<b>axon</b>	The long extension of a neurone that carries an impulse away from the dendron or dendrites towards other neurones.
<b>axon terminal</b>	Small 'button' at the end of the branches that leave an axon.
<b>central nervous system</b>	The main part of the nervous system – the brain and spinal cord. Abbreviated to CNS.

Word	Meaning
<b>CNS</b>	Stands for central nervous system.
<b>Dendrite</b>	A fine extension from a neurone, which carries impulses towards the cell body.
<b>Dendron</b>	Large, long extension of a sensory neurone that carries impulses from dendrites towards the axon.
<b>Impulse</b>	Electrical signal transmitted along a neurone.
<b>myelin sheath</b>	Fatty covering around the axons of many neurones. It speeds up the transmission of impulses along their length and helps to insulate them from one another.
<b>nerve cell</b>	Another term for neurone.
<b>nervous system</b>	An organ system that contains the brain, spinal cord and nerves, and carries impulses around the body. This system helps us to sense and respond quickly to changes inside and outside our bodies.
<b>Neurone</b>	A cell that transmits electrical impulses in the nervous system.
<b>Neurotransmission</b>	Impulses passing from neurone to neurone.
<b>receptor cell</b>	Cell that receives a stimulus and converts it into an electrical impulse to be sent to the brain and/or spinal cord.
<b>Response</b>	Action that occurs due to a stimulus.
<b>sense organ</b>	Organ that contains receptor cells.

Word	Meaning
<b>sensory neurone</b>	Neurone that carries impulses from receptor cells, towards the central nervous system.
<b>spinal cord</b>	Large bundle of nerves, leading from the brain and down the back.
<b>stimulus</b>	Change in a factor (inside or outside the body) that is detected by receptors. Plural: stimuli.

## SB2h The eye

Word	Meaning
<b>Cataract</b>	Protein built up in the lens of the eye so that it becomes cloudy.
<b>ciliary muscle</b>	A muscle that relaxes or contracts to change the shape of the lens in the eye.
<b>colour blindness</b>	An eye defect in which someone cannot see the full range of colours.
<b>cone (cell)</b>	A cell in the retina that detects different colours of light.
<b>Constrict</b>	To make narrower.
<b>Cornea</b>	The transparent front part of the eye, which covers the iris and pupil.
<b>Dilate</b>	To make wider.
<b>Iris</b>	The coloured part of the eye. Muscles in it control the diameter of the pupil.
<b>lens (biology)</b>	Part of the eye that further converges light rays (which have been converged by the cornea) to focus them on the retina.

Word	Meaning
<b>long-sightedness</b>	An eye condition in which close objects appear blurred.
<b>optic nerve</b>	The nerve that takes impulses from the retina to the brain.
<b>Pupil</b>	The hole in the front of the eye through which light can pass.
<b>receptor cell</b>	Cells that detect stimuli, such as cells in the eye that detect changes in light.
<b>Retina</b>	The part at the back of the eye that changes energy transferred by light into nerve impulses. The retina contains rods and cones.
<b>rod (cell)</b>	A cell in the retina that detects low levels of light. It cannot detect different colours.
<b>short-sightedness</b>	An eye condition in which distant objects appear blurred.

## SB2i Neurotransmission speeds

Word	Meaning
<b>Effector</b>	Muscle or gland in the body that performs an action when an impulse from the nervous system is received.
<b>motor neurone</b>	Neurone that carries impulses to effectors.
<b>Neurotransmitter</b>	Substance that diffuses across the gap between two neurones at a synapse, and triggers an impulse to be generated in the neurone on the other side of the synapse.
<b>Reflex</b>	Response to a stimulus that does not require processing by the brain. The response is automatic. Also called a reflex action.

<b>Word</b>	<b>Meaning</b>
<b>reflex arc</b>	Neurone pathway consisting of a sensory neurone passing impulses to a motor neurone (often via a relay neurone), which allows reflexes to occur.
<b>relay neurone</b>	A short type of neurone, found in the spinal cord and brain. Relay neurones link with sensory, motor and other relay neurones.

<b>Word</b>	<b>Meaning</b>
<b>Synapse</b>	Point at which two neurones meet. There is a tiny gap between neurones at a synapse, which cannot transmit an electrical impulse.

<b>Topic 3 – Genetics</b>			
<b>Bold – Higher tier</b>			
Grey – Separate biology only		D	J
3.1B Explain some of the advantages and disadvantages of asexual reproduction, including the lack of need to find a mate, a rapid reproductive cycle, but no variation in the population			
3.2B Explain some of the advantages and disadvantages of sexual reproduction, including variation in the population, but the requirement to find a mate			
3.3 Explain the role of meiotic cell division, including the production of four daughter cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes The stages of meiosis are not required			
3.4 Describe DNA as a polymer made up of: a two strands coiled to form a double helix b strands linked by a series of complementary base pairs joined together by weak hydrogen bonds c nucleotides that consist of a sugar and phosphate group with one of the four different bases attached to the sugar			
3.5 Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein			
3.6 Explain how DNA can be extracted from fruit			
<b>3.7B Explain how the order of bases in a section of DNA decides the order of amino acids in the protein and that these fold to produce specifically shaped proteins such as enzymes</b>			
<b>3.8B Describe the stages of protein synthesis, including transcription and translation:</b> <b>a RNA polymerase binds to non-coding DNA located in front of a gene</b> <b>b RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene</b> <b>c the attachment of the mRNA to the ribosome</b> <b>d the coding by triplets of bases (codons) in the mRNA for specific amino acids</b> <b>e the transfer of amino acids to the ribosome by tRNA</b> <b>f the linking of amino acids to form polypeptides</b>			
<b>3.9B Describe how genetic variants in the non-coding DNA of a gene can affect phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced</b>			
<b>3.10B Describe how genetic variants in the coding DNA of a gene can affect phenotype by altering the sequence of amino acids and therefore the activity of the protein produced</b>			
3.11B Describe the work of Mendel in discovering the basis of genetics and recognise the difficulties of understanding inheritance before the mechanism was discovered			
3.12 Explain why there are differences in the inherited characteristics as a result of alleles			
3.13 Explain the terms: chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, gamete and zygote			
3.14 Explain monohybrid inheritance using genetic diagrams, Punnett squares and family pedigrees			
3.15 Describe how the sex of offspring is determined at fertilisation, using genetic diagrams			
3.16 Calculate and analyse outcomes (using probabilities, ratios and percentages) from monohybrid crosses and pedigree analysis for dominant and recessive traits			
3.17B Describe the inheritance of the ABO blood groups with reference to codominance and multiple alleles			
<b>3.18B Explain how sex-linked genetic disorders are inherited</b>			
3.19 State that most phenotypic features are the result of multiple genes rather than single gene inheritance			
3.20 Describe the causes of variation that influence phenotype, including: a genetic variation – different characteristics as a result of mutation and sexual reproduction b environmental variation – different characteristics caused by an organism’s environment (acquired characteristics)			
3.21 Discuss the outcomes of the Human Genome Project and its potential applications within medicine			
3.22 State that there is usually extensive genetic variation within a population of a species and that these arise through mutations			

3.23 State that most genetic mutations have no effect on the phenotype, some mutations have a small effect on the phenotype and, rarely, a single mutation will significantly affect the phenotype

### CB3 Genetics - Core Questions

	Question	Answer
1	State two advantages of asexual reproduction	No need to find a mate Quick to take advantage of resources
2	State a disadvantage of asexual reproduction	Almost no genetic variation- less adaptable to changes
3	State an advantage of sexual reproduction	Genetic variation for greater adaptability
4	State two disadvantage of sexual reproduction	Need to find a mate Desirable characteristics are not always passed on
5	What are gametes?	Haploid <u>sex cells</u> (e.g. eggs ,sperm, pollen)
6	Describe the products of meiosis	Cell division that produces <u>four haploid</u> daughter cells- <u>genetically different</u> to parent cell. These are gametes (sex cells).
8	What is a genome?	A <u>complete set of chromosomes/</u> full set of DNA
9	Describe the structure of DNA	<u>Two strands</u> in a <u>double helix</u> , joined together by <u>complementary bases</u> with <u>weak hydrogen bonds</u> between each other.
10	How do the bases form complimentary pairs in DNA?	<u>Cytosine- Guanine</u> (with 3 weak Hydrogen bonds) <u>Adenine- Thymine</u> (with 2 weak Hydrogen bonds)
11	What is a gene?	A section of DNA with the <u>instructions</u> for making a <u>single protein</u> .
12	When extracting DNA from fruit, what is the role of the detergent solution?	It breaks down the membranes around the cell and the nucleus.
13	When extracting DNA from fruit, what substance is used to precipitate DNA?	(ice-cold) ethanol
14B	How does DNA instruct the formation of proteins?	The <u>order of bases in DNA</u> decides the <u>order of amino acids in the protein</u> . These polypeptide chains then fold up to form specifically shaped proteins such as enzymes.
15B	What are the two stages of protein synthesis and where do they occur?	Transcription occurs in the nucleus Translation occurs in the ribosome
16B	Describe the six steps of protein synthesis	1- RNA polymerase binds to non-coding DNA located in front of a gene 2- RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene 3- attachment of the mRNA to the ribosome 4- coding by triplets of bases (codons) in the mRNA for specific amino acids 5- transfer of amino acids to the ribosome by tRNA 6- linking of amino acids using peptide bonds to form polypeptides proteins
17B	How can genetic variation in non-coding regions of DNA affect the phenotype of an organism?	RNA polymerase binds to non-coding regions of DNA. If these regions change then this <u>will alter the quantity of protein produced</u> .

18B	How can genetic variation in coding DNA of a gene affect the phenotype of an organism?	This alters the <u>sequence of bases</u> which means different mRNAs will bind to the DNA. This will <u>alter the sequence of amino acids in the protein and therefore the activity of the protein produced.</u>									
19B	What did Mendel do?	Developed <u>rules</u> that described the <u>inheritance pattern of different characteristics</u> of pea plants. He did this by cross pollinating plants with different characteristics and observing their offspring.									
20B	What did Mendel conclude from his experiments?	That inherited 'factors' control the variation of characteristics, these factors (now called alleles) <u>exist in different versions that do not change.</u>									
21B	What are Mendel's three laws of inheritance?	<ol style="list-style-type: none"> <li>1. Each gamete (sex cell) only receives one 'factor' for a characteristic</li> <li>2. The version of a factor the gamete receives is random</li> <li>3. Some versions of a factor are more powerful than others and always have an effect in the offspring</li> </ol>									
22B	Why did people have difficulty understanding inheritance before the mechanism (chromosomes) was discovered?	Scientists could not see how <u>few factors could control so many variations.</u> In addition, they argued that if the factors could not change then the species could not evolve.									
23	What are alleles?	Different versions of the same gene									
24	What is an organisms genotype?	The combination of alleles an organism has for a characteristic (e.g. Bb).									
25	What is a phenotype?	What an organism looks like (as a result of its genotype)									
26	How do alleles result in differences in the characteristics inherited by an individual?	Inheriting different combinations of alleles result in different characteristics being 'expressed'.									
27	Describe the genotype BB	Homozygous dominant (be prepared for other examples)									
28	State the sex chromosomes contained within a male and a female body cell.	Male = xy. Female = xx.									
29	Draw a punnett square to show that the chance conceiving a girl is 50%	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>X</td> <td>X</td> </tr> <tr> <td>X</td> <td>XX</td> <td>XX</td> </tr> <tr> <td>Y</td> <td>XY</td> <td>XY</td> </tr> </table>		X	X	X	XX	XX	Y	XY	XY
	X	X									
X	XX	XX									
Y	XY	XY									
30	Define mutation.	A change in a gene that results in a new allele.									
31	When does mutation usually occur?	During cell division.									
32	How often will a mutation lead to a change in the phenotype of an organism? Why?	Very rarely. Most characteristics are the result of more than one gene.									
33B	Describe the inheritance of the ABO blood groups with reference to codominance and multiple alleles	Everyone's blood is one of four types A,B. AB or O. There are three alleles that code for these four types. I <sup>A</sup> , I <sup>B</sup> , and I <sup>O</sup> . I <sup>O</sup> is recessive to both other alleles but I <sup>A</sup> , I <sup>B</sup> show codominance. This means if you have both I <sup>A</sup> and I <sup>B</sup> you show the effect of both alleles in your phenotype.									

34B	Explain how sex-linked genetic disorders are inherited	Disorders that show a different pattern of inheritance in men and women are sex-linked. This happens because men inherit an X and a Y chromosome and women inherit XX. This means women often have less chance of inheriting a mutated gene on the X chromosome because they have a 'back up copy'.
35	What is the human genome project?	A project to map all 3.3 billion complementary bases in a full set of 46 human chromosomes.
36	State two ways that information about a person's genome could be useful in medicine?	1. Identifying their risk of developing certain diseases. 2. Identifying which medicines will work best for them.
37	What causes genetic variation?	Sexual reproduction and mutation
38	What defines data for discontinuous variation?	The data can only take a limited set of values (e.g. colour, sex)
39	What do we call variation where the data collected can be any value in a range?	Continuous variation
40	What name do we give the bell-shaped curve that continuous data for variation often forms?	A normal distribution



## Key words- Unit 3 Genetics

### SB3a Sexual and asexual reproduction

Word	Meaning
<b>asexual reproduction</b>	Producing new organisms from one parent only. These organisms are genetically identical to the parent.
<b>Clone</b>	All the cells in a clone are genetically identical to each other and to the parent's cells.
<b>Fertilisation</b>	Fusing of a male gamete with a female gamete.
<b>Invertebrate</b>	An animal without bones, such as an insect or worm.
<b>mitosis</b>	The process of diploid cells dividing to produce two diploid daughter cells that are genetically identical to the parent.
<b>sexual reproduction</b>	Reproduction that needs a male and a female parent.
<b>Variation</b>	Differences in the characteristics of organisms.
<b>Vertebrate</b>	Animal with bones, such as a human.

### SB3b Meiosis

Word	Meaning
<b>chromosome</b>	A structure found in the nuclei of cells. Each chromosome contains one enormously long DNA molecule packed up with proteins.
<b>daughter cell</b>	A cell produced by another cell that has divided.

<b>diploid</b>	A cell or nucleus that has two sets of chromosomes. In humans, almost all cells except the sperm and egg cells are diploid.
<b>DNA</b>	Deoxyribonucleic acid. A polymer made of sugar and phosphate groups joined to bases. One molecule of DNA is found in each chromosome.
<b>egg cell</b>	The female gamete in humans.
<b>Fertilisation</b>	Fusing of a male gamete with a female gamete.
<b>Gamete</b>	A haploid cell used for sexual reproduction.
<b>gene</b>	Section of the long strand of DNA found in a chromosome, which often contains instructions for a protein.
<b>Genome</b>	All the DNA in an organism. Each body cell contains a copy of the genome.
<b>Haploid</b>	A cell or nucleus that has one set of chromosomes. Gametes are haploid.
<b>Meiosis</b>	A form of cell division in which one parent cell produces four haploid daughter cells.
<b>Mitosis</b>	A form of cell division in which one parent cell produces two diploid daughter cells.
<b>Polymer</b>	A molecule made out of a chain of repeating similar units (called monomers).
<b>Replicate</b>	When DNA replicates it makes a copy of itself.
<b>sperm cell</b>	The male gamete in humans.
<b>zygote</b>	Another term for 'fertilised egg cell'.

## SB3c DNA

Word	Meaning
<b>Adenine</b>	One of four bases found in DNA. Often written as A.
<b>base (in DNA)</b>	Four substances that help make up DNA, often shown by the letters A, C, G and T. Pairs of bases form 'links' between two 'spines' formed of phosphate groups and a type of sugar.
<b>chromosome</b>	A structure found in the nuclei of cells. Each chromosome contains one enormously long DNA molecule packed up with proteins.
<b>complementary base pair</b>	Two DNA bases that fit into each other and link by hydrogen bonds. There are two types of complementary base pair: A linking with T, and C linking with G.
<b>Cytosine</b>	One of four bases found in DNA. Often written as C.
<b>DNA</b>	Deoxyribonucleic acid. A polymer made of sugar and phosphate groups joined to bases. One molecule of DNA is found in each chromosome.
<b>double helix</b>	Two helices joined together.
<b>gene</b>	Section of the long strand of DNA found in a chromosome, which often contains instructions for a protein.
<b>Guanine</b>	One of four bases found in DNA. Often written as G.
<b>hydrogen bond</b>	Weak force of attraction caused by differences in the electrical charge on different parts of different molecules.
<b>Thymine</b>	One of four bases found in DNA. Often written as T.

## SB3d Protein synthesis

Word	Meaning
<b>codon</b>	A set of three bases (a triplet) found in DNA and RNA. The genetic code is formed from patterns of codons.
<b>Complementary</b>	Means 'fitting together'. Complementary bases in a DNA molecule fit together.
<b>genetic code</b>	A set of rules defining how the base order in DNA or RNA is turned into a specific sequence of amino acids joined in a polypeptide chain.
<b>messenger RNA (mRNA)</b>	A single strand of RNA produced in transcription.
<b>nuclear pore</b>	A small hole in the membrane around the nucleus.
<b>Polypeptide</b>	A chain of amino acids.
<b>ribonucleic acid</b>	See RNA.
<b>ribosome</b>	A protein that attaches to mRNA. It allows transfer RNA (tRNA) molecules to match up with the mRNA codons and also joins the amino acids together.
<b>RNA</b>	Abbreviation of ribonucleic acid. The molecule is made of phosphate groups and sugars (called ribose) linked together with one of four bases.
<b>RNA polymerase</b>	An enzyme that creates mRNA from DNA.
<b>template strand</b>	The strand of a DNA molecule that RNA polymerase uses to make mRNA.

<b>transcription</b>	The process by which the genetic code in one strand of DNA molecules is used to make mRNA.
<b>transfer RNA (tRNA)</b>	A molecule of RNA that carries an amino acid.
<b>translation</b>	The process by which the genetic code in a molecule of mRNA is used to make a polypeptide.
<b>Uracil</b>	A base found in RNA but not in DNA.

### SB3e Genetic variants and phenotypes

Word	Meaning
<b>allele</b>	Most genes come in different versions called alleles. So a gene for eye colour may have one version (allele) that can cause dark eyes, and another allele that can cause pale eyes.
<b>genetic disorder</b>	A problem caused by genes.
<b>mutation</b>	A change to a gene caused by a mistake in copying the DNA base pairs during cell division, or by the effects of radiation or of certain chemicals.
<b>Phenotype</b>	The characteristics that a certain set of alleles display.

### SB3f Mendel

Word	Meaning
<b>variation</b>	Differences in the characteristics of organisms.

### SB3g Alleles

Word	Meaning
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<b>allele</b>	Most genes come in different versions, called alleles. So a gene for eye colour may have a version (allele) that can cause dark eyes and an allele that can cause pale eyes.
<b>dominant</b>	Allele that will always affect the phenotype (as opposed to a recessive allele, whose effect will not be seen if a dominant allele is present).
<b>genetic diagram</b>	Diagram showing how the alleles in two parents may form different combinations in the offspring when the parents reproduce.
<b>genetic variation</b>	Also called inherited variation. Differences between organisms passed on to offspring by their parents in reproduction.
<b>genotype</b>	The alleles for a certain characteristic that are found in an organism. Written in a shorthand using letters to represent the alleles (with the dominant allele having a capital and being written first).
<b>Heterozygous</b>	When both the alleles for a gene are different in an organism.
<b>Homozygous</b>	When both the alleles for a gene are the same in an organism.
<b>monohybrid inheritance</b>	The study of how the alleles of just one gene are passed from parents to offspring.
<b>Phenotype</b>	The characteristics that a certain set of alleles produce.
<b>ratio</b>	A relationship between two quantities, usually showing the number of times one value is bigger than the other. For example, if there are six red buttons and two blue buttons, the ratio of red to blue is 3 to 1, also written 3:1.
<b>recessive</b>	Allele that will only affect the phenotype if the other allele is also recessive. It has no effect if the other allele is dominant.

<b>Zygote</b>	Another term for 'fertilised egg cell'.
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### SB3h Inheritance

Word	Meaning
<b>family pedigree chart</b>	A chart showing the phenotypes and sexes of several generations of the same family, to track how characteristics have been inherited.
<b>probability</b>	The likelihood of an event happening. Can be shown as a fraction from 0 to 1, a decimal from 0 to 1 or as a percentage from 0% to 100%.
<b>Punnett square</b>	Diagram used to predict the different characteristics in the offspring of two organisms with known combinations of alleles. You can use the square to work out the probability (how likely it is) that offspring will inherit a certain feature.
<b>sex chromosome</b>	Chromosome that determines the sex of an organism. In humans, males have one X sex chromosome and one Y sex chromosome, while females have two Xs.

### SB3i Multiple and missing alleles

Word	Meaning
<b>ABO blood group</b>	Blood group system in humans which produces four phenotypes: blood groups A, B, AB and O.
<b>carrier</b>	An individual that has inherited a recessive allele but does not show the phenotype caused by that allele. For example, a woman who has one allele for a sex-linked genetic disorder and one 'healthy' allele will not suffer from the disorder but can pass it on to a son.

<b>Codominant</b>	Two alleles that both affect the phenotype. For example a person with the blood group alleles I <sup>A</sup> and I <sup>B</sup> has blood group AB.
<b>sex-linked genetic disorder</b>	A disorder caused by genes that are inherited differently in males and females because they are carried on the sex chromosomes. An example is red-green colour blindness, which is more common in men than in women.

### SB3j Gene mutation

Word	Meaning
<b>Human Genome Project</b>	The project that mapped the base pairs in one human genome.
<b>Mutation</b>	A change to a gene, caused by a mistake in copying the DNA base pairs during cell division or by the effects of radiation or certain chemicals.
<b>Variation</b>	Differences in the characteristics of organisms.

### SB3k Variation

Word	Meaning
<b>acquired characteristic</b>	A characteristic that can change during life, due to a change in the environment. (See also environmental variation.)
<b>continuous variation</b>	Continuous data can take any value between two limits. Examples include length, mass, time. Continuous variation is when differences in a characteristic are continuous.

<b>discontinuous variation</b>	Data values that can only have one of a set number of options are discontinuous. Examples include shoe sizes and blood groups. Discontinuous variation is when differences in a characteristic are discontinuous.
<b>environmental variation</b>	Differences between organisms caused by environmental factors, such as amount of heat, light, damage. These differences are called acquired characteristics.
<b>genetic variation</b>	Differences between organisms caused by differences in the alleles they inherit from their parents, or differences in genes caused by mutation.
<b>mean</b>	An average calculated by adding up the values of a set of measurements and dividing by the number of measurements in the set.
<b>median</b>	The middle value in a data set.
<b>mode</b>	The most common value in a data set.

<b>normal distribution</b>	When many individuals have a middle value for a feature, with fewer individuals having greater or lesser values. This sort of data forms a bell shape on charts and graphs.
<b>range</b>	The difference between the highest and lowest values in a set of data (usually ignoring any outliers or anomalous results).

<p style="text-align: center;"><b>Topic 4 – Natural selection and genetic modification</b></p> <p style="text-align: center;"><b>Bold – Higher tier</b> Grey – Separate biology only</p>	D	J
4.1B Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection and explain the impact of these ideas on modern biology		
4.2 Explain Darwin’s theory of evolution by natural selection		
4.3 Explain how the emergence of resistant organisms supports Darwin’s theory of evolution including antibiotic resistance in bacteria		
4.4 Describe the evidence for human evolution, based on fossils, including: a Ardi from 4.4 million years ago b Lucy from 3.2 million years ago c Leakey’s discovery of fossils from 1.6 million years ago		
4.5 Describe the evidence for human evolution based on stone tools, including: a the development of stone tools over time b how these can be dated from their environment		
4.6B Describe how the anatomy of the pentadactyl limb provides scientists with evidence for evolution		
4.7 Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method		
4.8 Explain selective breeding and its impact on food plants and domesticated animals		
4.9B Describe the process of tissue culture and its advantages in medical research and plant breeding programmes		
4.10 Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics		
4.11 <b>Describe the main stages of genetic engineering including the use of:</b> <b>a restriction enzymes</b> <b>b ligase</b> <b>c sticky ends</b> <b>d vectors</b>		
4.12B Explain the advantages and disadvantages of genetic engineering to produce GM organisms including the modification of crop plants, including the introduction of genes for insect resistance from <i>Bacillus thuringiensis</i> into crop plants		
4.13B Explain the advantages and disadvantages of agricultural solutions to the demands of a growing human population, including use of fertilisers and biological control		
4.14 Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine, including practical and ethical implications		

## Topic 4 Natural Selection and GM- Core Questions

	Question	Answer
1B	What has been the impact of Darwin and Wallace's ideas on modern biology?	Led to the development of modern molecular biology and genetics. <u>Scientist thought about why things changed</u> rather than just classifying changes they saw.
2	What are the five key stages in Darwin's theory of evolution by natural selection?	<ol style="list-style-type: none"> <li>1. Genetic variation</li> <li>2. Change causes competition</li> <li>3. Natural selection (survival of the 'fittest')</li> <li>4. Inheritance (successful genes are passed on)</li> <li>5. Evolution (over many years)</li> </ol>
3	Explain how the emergence of resistant organisms supports Darwin's theory of evolution including antibiotic resistance in bacteria.	Bacteria <u>reproduce very quickly</u> compared to most other organisms. Helpful mutations inherited and population adapt to new conditions.
4	What fossil evidence do we have for the evolution of humans?	a Ardi from 4.4 million years ago b Lucy from 3.2 million years ago c Leakey's discovery of fossils from 1.6 million years ago
5	Describe the changes seen in fossils as early humans have evolved.	Humans have become <u>taller, larger skulls</u> (bigger brain volume) and have <u>shorter arms</u> .
6	Explain how we can date fossils and tools.	Carbon dating. Comparing them to other samples already dated. Using the age of the rock formation they were found in.
7	Describe how tools have developed over time	Tools have become sharper and changed shapes as humans evolved, more modern tools have become more <u>sophisticated</u>
8B	Describe how the anatomy of the pentadactyl limb provides scientists with evidence for evolution	Several organisms have a common ancestor. Changes in the length, thickness or fusion of the bones in the limb show how they have become adapted for different lifestyles and environments.
9	What are the five kingdoms used to classify all living organisms?	Animals, Plants, Fungi, Prokaryotes and Protists.
10	Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method	Some single-celled organisms were found to have genes more similar to plants and animals than to prokaryotes.
11	What are the three domains and how are organisms classified into them?	Archaea- no nucleus, genes contain unused sections of DNA Bacteria- no nucleus, no unused sections in genes Eukarya – has nucleus, unused sections in genes
12	What is a binomial name?	A two word Latin name (written in <i>italics</i> ) from the <u>genus</u> and <u>species</u> of an organism E.g. <i>Homo sapiens</i>
13	What is selective breeding?	Selecting organisms with desirable characteristics, Breeding them Selecting offspring that have inherited those characteristics for further rounds of breeding.

14	What has the impact of selective breeding been on food plants and domesticated animals?	Food plants (crops): higher yield, nutritional value, pest and disease resistance and also tolerance to common weather conditions. Domesticated animals: grow faster, healthier, are more fertile, produce higher yields of meat, milk or wool and have temperaments useful for their role.
15B	What is the process of tissue culture?	Growing cells or tissues in liquid containing nutrient or on solid agar. These cells may form a callus or be treated to form differentiated cells.
16B	What are the advantages of tissue culture in medical research and plant breeding programmes?	Cell communication can be studied. Also used to culture viruses that can't replicate outside a host cell. Study cancer cells Used to test how infected cells respond to a new medicine. Produces clones of plants close to extinction Cloning GM plants Making copies of plants that can't easily be grown from seed (e.g. orchids).
17	What is genetic engineering?	A process which involves modifying the genome of an organism to introduce desirable characteristics.
18	<b>Describe how a bacterium can be genetically modified to produce human insulin.</b>	<b>Restriction enzymes are used to remove the human insulin gene from the human chromosome and to cut open the plasmid- creating 'sticky ends' of overhanging bases. DNA ligase enzymes are used to insert the human gene into the plasmid. Then the plasmid containing human insulin gene inserted into a bacterium.</b>
19B	Give advantages to introducing genes for insect resistant from <i>Bacillus thuringiensis</i> into crop plants	It kills insects eating plant cells which means less insecticide need to be used, this in turn means less damage to the environment as less pesticide to harm all local organisms; higher yields will be produced too
20B	Give disadvantages to introducing genes for insect resistant from <i>Bacillus thuringiensis</i> into crop plants	BT could kill other local organisms which are harmless; the plant containing the BT gene could also reproduce with a normal plant, cross breeding such as this can cause limitation in biodiversity; insects could evolve resistance to BT toxin
21B	Explain the advantages and disadvantages using fertilisers to meet the food demands of a growing population	Advantage- increases soil fertility and therefore higher yield for farmer Disadvantage- could cause pollution and lead to the death of organisms in the water. Cause health problems for humans and animals if they drink water with high levels of fertiliser in it.
22B	Explain the advantages and disadvantages using biological control to meet the food demands of a growing population	Increases the amount of food we can produce and reduces the amount of chemicals applied to crops. This reduces the problem of damaging levels of biodiversity. Biological control can go wrong if the species introduced is not native and can become invasive (e.g. Harlequin ladybird).
23	Evaluate the benefits of genetic engineering in modern agriculture and medicine.	Benefits: Can get desirable characteristics quickly . Genes can be moved between species. E.g. insulin producing bacteria



23	Evaluate risks of genetic engineering in modern agriculture and medicine, including practical and ethical implications	Risks: risk of cross breeding, unknown health effects of eating GM foods. If the gene mutates further we are unsure of the effects.
24	Evaluate the benefits of selective breeding in modern agriculture and medicine.	Benefits: 'natural' process using only the genes that exist in the species, Achievable for many plant and animal owners. Can produce organisms better suited to our needs.
24	Evaluate the risks of selective breeding in modern agriculture and medicine, including practical and ethical implications	Risks: inbreeding, lack of genetic diversity that could cause a failure to meet the unknown needs of the future or put all organisms at risk of the same disease/ environmental condition.

## Key words for Unit 4- Natural selection and genetic modification

### SB4a – Evidence for human evolution

Word	Meaning
<b>Ardi</b>	Nickname for a 4.4-million-year-old fossilised specimen of <i>Ardipithecus ramidus</i> .
<b>binomial system</b>	System of naming organisms using two Latin words.
<b>Evolution</b>	A change in one or more characteristics of a population over a long period of time.
<b>Lucy</b>	Nickname for a 3.2-million-year-old fossilised specimen of <i>Australopithecus afarensis</i> .
<b>species</b>	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce. Organism names have two Latin words – the first is its genus and the second is its species.

### SB4b – Darwin's theory

Word	Meaning
<b>Ancestor</b>	An organism from which more recent organisms are descended.
<b>Antibiotic</b>	Medicine that helps people recover from a bacterial infection by killing the pathogen.
<b>competition</b>	There is competition between organisms that need the same things as each other (such as

Word	Meaning
	food). We say that they 'compete' for those things.
<b>genetic variation</b>	Differences between organisms caused by differences in genes and passed on to offspring by their parents through reproduction. Also called inherited variation.
<b>natural selection</b>	A process in which certain organisms are more likely to survive and reproduce than other members of the same species, because they possess certain genetic variations.
<b>resistant</b>	Unaffected or less affected by something.

### SB4c Development of evolution theory

Word	Meaning
pentadactyl limb	A limb that has five digits (fingers and thumbs). Amphibians, reptiles, birds and mammals share this characteristic.

### SB4d – Classification

Word	Meaning
<b>Classification</b>	Sorting things into groups.
<b>domain</b>	The three main groups that organisms are now sorted into: Archaea, Bacteria and Eukarya.
<b>genus</b>	A group of similar organisms. The genus name is the first word in the scientific name for a species (the second word is the 'species name'). Different closely related species belong to the same genus.

Word	Meaning
<b>kingdom</b>	There are five kingdoms into which organisms are divided: plants, animals, fungi, protists and prokaryotes.
<b>species</b>	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce. Organism names have two Latin words – the first is its genus and the second is its species.

### SB4e – Breeds and varieties

Word	Meaning
<b>artificial selection</b>	When people choose organisms with certain characteristics and use only those ones for breeding.
<b>breed</b>	Group of animals of the same species that have characteristics that make them different to other members of the species.
<b>disease resistance</b>	Unaffected or less affected by a certain disease.
<b>gene</b>	Section of the long strand of DNA found in a chromosome, which often contains instructions for a protein.
<b>genetic engineering</b>	Altering the genome of an organism, often by adding genes from another species. Also called genetic modification.
<b>genetically modified organism (GMO)</b>	Organism that has been produced using genetic engineering.
<b>Genome</b>	All the DNA in an organism. Each body cell contains a copy of the genome.

Word	Meaning
<b>GMO</b>	Short for 'genetically modified organism'.
<b>selective breeding</b>	When humans choose an organism that has a certain characteristic and then breed more of these organisms, making that chosen characteristic more and more obvious.
<b>variety</b>	Group of plants of the same species that have characteristics that make them different to other members of the species.
<b>yield</b>	The amount of useful product that you can get from something.

### SB4f Tissue culture

Word	Meaning
Callus	Small clump of unspecialised plant cells.
Clone	Offspring that is genetically identical to its parent.
Differentiate	When a cell becomes specialised for a particular function.
Extinction	When a species dies out.
reject (biology)	When the immune system attacks tissue and cells that it does not recognise.
stem cell	An unspecialised cell that continues to divide by mitosis to produce more stem cells and other cells that differentiate into specialised cells.
tissue culture	Growing tiny pieces of tissue or cells in or on a medium containing nutrients.

Word	Meaning
Virus	A particle that can infect cells and cause the cells to make copies of the virus.

## SB4g – Genes in agriculture and medicine

Word	Meaning
<b>allele</b>	Most genes come in different versions, called alleles. So a gene for eye colour may have a version (allele) that can cause dark eyes and an allele that can cause pale eyes.
<b>base</b>	There are four substances called bases that help make up DNA, often shown by the letters A, C, G and T. Pairs of bases form 'links' between two 'spines' formed of phosphate groups and a type of sugar.
<b>diabetes</b>	Disease in which the body cannot control the blood glucose concentration at the correct level.
<b>insulin</b>	The hormone that decreases blood glucose concentration. Used in the treatment of type 1 diabetes.
<b>Ligase</b>	An enzyme that joins two DNA molecules together.
<b>Plasmid</b>	A small loop of DNA found in the cytoplasm of bacteria.
<b>recombinant DNA</b>	DNA made by joining two sections of DNA together.
<b>restriction enzyme</b>	An enzyme that cuts DNA molecules into pieces.
<b>sticky end</b>	A short section of single-stranded DNA found at the end of a section of DNA that has been cut by a restriction enzyme.

Word	Meaning
<b>type 1 diabetes</b>	Type of diabetes in which the pancreas does not produce insulin.
<b>Vector</b>	Anything that transfers material from one organism to another.

## SB4h GM and agriculture

Word	Meaning
Bt toxin	A natural insecticide made by the bacterium <i>Bacillus thuringiensis</i> that kills some kinds of caterpillar.
Insecticide	A chemical substance used to kill insect pests of crops.
Monoculture	A large area of one kind of crop.
Pest	An animal that causes problems, such as by damaging crops.
resistance (biology)	Being unaffected or less affected by something.
Strain	Bacteria of a species that are slightly different to other strains of the species.
Yield	The amount of useful product obtained from an organism.

## SB4i Biological control and fertilisers

Word	Meaning
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biological control	Using living organisms to kill problem organisms such as pests or weeds.
fertiliser	Substances that add plant nutrients to soil, such as artificial fertilisers containing nitrogen compounds, or manure (a natural fertiliser made from animal waste).
pollution	Harm caused to the environment, for example by the addition of poisonous substances or by abnormally high amounts of a substance.

weeds	Plants that are growing where they are not wanted, and where they cause problems such as competing with crop plants for light, water and nutrients.
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<p><b>Topic 5 – Health, Disease and the Development of Medicines</b></p> <p style="text-align: center;"><b>Bold – Higher tier</b> <b>Grey – Separate biology only</b></p>	D	J
5.1 Describe health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, as defined by the World Health Organization (WHO)		
5.2 Describe the difference between communicable and non-communicable diseases		
5.3 Explain why the presence of one disease can lead to a higher susceptibility to other diseases		
5.4 Describe a pathogen as a disease-causing organism, including viruses, bacteria, fungi and protists		
5.5 Describe some common infections, including: a cholera (bacteria) causes diarrhoea b tuberculosis (bacteria) causes lung damage c Chalara ash dieback (fungi) causes leaf loss and bark lesions d malaria (protists) causes damage to blood and liver e HIV (virus) destroys white blood cells, leading to the onset of AIDS f stomach ulcers caused by Helicobacter (bacteria) g Ebola (virus) causes haemorrhagic fever		
5.6 Explain how pathogens are spread and how this spread can be reduced or prevented, including: a cholera (bacteria) – water b tuberculosis (bacteria) – airborne c Chalara ash dieback (fungi) – airborne d malaria (protists) – animal vectors e stomach ulcers caused by Helicobacter (bacteria) – oral transmission f Ebola (virus) – body fluids		
5.7B Describe the lifecycle of a virus, including lysogenic and lytic pathways		
5.8 Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including: a <i>Chlamydia</i> (bacteria) b HIV (virus)		
5.9B Describe how some plants defend themselves against attack from pests and pathogens by physical barriers, including the leaf cuticle and cell wall		
5.10B Describe how plants defend themselves against attack from pests and pathogens by producing chemicals, some of which can be used to treat human diseases or relieve symptoms		
5.11B Describe different ways plant diseases can be detected and identified, in the lab and in the field including the elimination of possible environmental causes, distribution analysis of affected plants, observation of visible symptoms and diagnostic testing to identify pathogens		
5.12 Describe how the physical barriers and chemical defences of the human body provide protection from pathogens, including: a physical barriers, including mucus, cilia and skin b chemical defence, including lysozymes and hydrochloric acid		
5.13 Explain the role of the specific immune system of the human body in defence against disease, including: a exposure to pathogen b the antigens trigger an immune response which causes the production of antibodies c the antigens also trigger production of memory lymphocytes d the role of memory lymphocytes in the secondary response to the antigen		
5.14 Explain the body's response to immunisation using an inactive form of a pathogen		
5.15B Discuss the advantages and disadvantages of immunisation, including the concept of herd immunity		
5.16 Explain that antibiotics can only be used to treat bacterial infections because they inhibit cell processes in the bacterium but not the host organism		
5.17B Explain the aseptic techniques used in culturing microorganisms in the laboratory, including the use of an autoclave to prepare sterile growth medium and petri dishes, the use of sterile inoculating loops to transfer microorganisms and the need to keep petri dishes and culture vials covered		
5.18B Core Practical: Investigate the effects of antiseptics, antibiotics or plant extracts on microbial cultures		
5.19B Calculate cross-sectional areas of bacterial cultures and clear agar jelly using $\pi r^2$		
5.20 Describe that the process of developing new medicines, including antibiotics, has many stages, including discovery, development, preclinical and clinical testing		
5.21B Describe the production of monoclonal antibodies, including: a use of lymphocytes which produce desired antibodies but do not divide b production of hybridoma cells c hybridoma cells produce antibodies as they divide		

<p><b>5.22B Explain the use of monoclonal antibodies, including:</b>  <b>a in pregnancy testing</b>  <b>b in diagnosis including locating the position of blood clots and cancer cells and in treatment of diseases including cancer</b>  <b>c the advantages of using monoclonal antibodies to target specific cells compared to drug and radiotherapy treatments</b></p>		
<p>5.23 Describe that many non-communicable human diseases are caused by the interaction of a number of factors, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition</p>		
<p>5.24 Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including:  a exercise and diet on obesity and malnutrition, including BMI and waist : hip calculations, using the BMI equation:  BMI = <math>\frac{\text{weight (kg)}}{(\text{height (m)})^2}</math>  b alcohol on liver diseases  c smoking on cardiovascular diseases</p>		
<p>5.25 Evaluate some different treatments for cardiovascular disease, including:  a life-long medication  b surgical procedures  c lifestyle changes</p>		



## CB5 – Health, disease and the development of medicines core questions

No.	Question	Answer
1.	How does the World Health Organisation define health?	A state of complete physical, mental and social well-being, not merely an absence of disease or infirmity.
2.	What is a disease?	A problem with the structure or function of the body that is not the result of an injury.
3.	What is a communicable disease?	A disease caused by pathogens that can pass from an infected person to other people.
4.	What is a non-communicable disease?	A disease which is not passed from person to person.
5.	What factors can interact to cause a non-communicable disease?	<ol style="list-style-type: none"> <li>1. Genetics</li> <li>2. Malnutrition</li> <li>3. Lifestyle</li> </ol>
6.	Give 3 lifestyle factors and the non-communicable diseases they may cause.	<ol style="list-style-type: none"> <li>1. Exercise and diet – obesity and malnutrition</li> <li>2. Alcohol – liver disease / cirrhosis</li> <li>3. Smoking – cardiovascular disease</li> </ol>
7.	Why does the presence of one disease lead to a greater chance of getting another disease?	<p>The first disease may:</p> <ul style="list-style-type: none"> <li>• Harm the immune system</li> <li>• Damage the body's natural defences</li> <li>• Stop an organ system from working effectively</li> </ul>
8.	What body measurements and calculations can be taken to measure overall health?	<p>BMI = <math>\frac{\text{Weight (kg)}}{\text{height (m}^2\text{)}}</math></p> <p>Hip:waist ratio</p>
9.	How can cardiovascular disease be treated?	<ol style="list-style-type: none"> <li>1. Life-long medication</li> <li>2. Surgical procedures</li> <li>3. Lifestyle changes</li> </ol>
10.	What is a pathogen?	An organism that causes a communicable disease
11.	What type of organisms are pathogens?	Bacteria, fungi, viruses and protists.
12.	Name and describe two common bacterial infections.	<ol style="list-style-type: none"> <li>1 Cholera (bacteria) causes diarrhoea</li> <li>2 Tuberculosis (bacteria) causes lung damage</li> </ol>
13.	Name and describe a common fungal infection.	Chalara ash dieback (fungi) causes leaf loss and
14.	Name and describe a common protist infection.	Malaria causes damage to blood and liver
15.	Name and describe a common viral infection.	HIV destroys white blood cells, leading to the onset of AIDS
16.	How are tuberculosis (bacteria) pathogens spread?	Airborne – through coughs and sneezes.
17.	How could the spread of tuberculosis be reduced or prevented?	Good hygiene
18.	How are Chalara ash dieback (a fungus) pathogens spread?	Airborne – as spores
19.	How could the spread of Chalara ash dieback be reduced or prevented?	Improve biosecurity- not importing or moving infected trees or soil
20.	How are cholera (bacteria) pathogens spread?	Through untreated water

21.	How could the spread of cholera be reduced or prevented?	Good hygiene, improving cleanliness of water supplies
22.	How are malaria (a protist) pathogens spread?	Animal vectors (e.g. mosquito)
23.	How could the spread of malaria be reduced or prevented?	Killing mosquitoes, use of mosquito nets
24. B	What are the two pathways in the viral lifecycle	Lytic and Lysogenic
25. B	Describe the basic structure of a virus	A strand of genetic material (DNA or RNA) inside a protein coat called a capsid.
26. B	Describe the lytic pathway	<ul style="list-style-type: none"> <li>• Virus enters living cell</li> <li>• injects genetic material</li> <li>• cell copies and makes new viral genetic material</li> <li>• Virus then causes cell to lyse before infecting new cells</li> </ul>
27. B	Describe the lysogenic pathway	<ul style="list-style-type: none"> <li>• Virus genetic material inserts into host cell genetic material</li> <li>• Virus genetic material is replicated every time the host cell divides</li> <li>• At some point, the virus genetic material triggers the lytic pathway and starts making viral proteins</li> </ul>
28. B	How can the effects of viruses and other antimicrobials on cells be studied?	Growing a bacterial lawn plate then calculating the area of clear agar using $\pi r^2$
29.	How are STIs (sexually transmitted diseases) transmitted?	By contact with sexual fluids (vaginal fluid and semen)
30.	Name two STIs and say what organism causes them.	<ol style="list-style-type: none"> <li>1. Chlamydia (bacteria)</li> <li>2. HIV (virus)</li> </ol>
31.	How can the spread of STIs be reduced or prevented?	<ol style="list-style-type: none"> <li>1. Screening the population for STIs</li> <li>2. Screening donated blood for STIs</li> <li>3. Use of condoms during sex</li> <li>4. Preventing drug users from sharing needles</li> </ol>
32B	Name two physical ways plants defend themselves from pests or pathogens	Waxy leaf cuticle, tough cell wall, hairs, spikes
33B	Name two chemical ways plants defend themselves from pests or pathogens	Poisons, insect repellents, lectins
34B	What other uses are there for plant defence chemicals?	Treat human diseases or relieve symptoms
35B	Give examples of plant extracts that are used in medicine	Aspirin- (painkiller) from meadowsweet and willow trees Aartemisinin-(antimalarial) from wormwood Digitalin- (heart medication) from foxgloves
36B	<b>Describe ways plant diseases can be detected and identified in the lab and field</b>	<ul style="list-style-type: none"> <li>• <b>elimination of possible environmental causes</b></li> <li>• <b>distribution analysis of affected plants</b></li> <li>• <b>observation of visible symptoms</b></li> <li>• <b>diagnostic testing to identify pathogens</b></li> </ul>

37	List 3 physical barriers which provide us with protection from pathogens.	<ol style="list-style-type: none"> <li>1. Mucus in the nose</li> <li>2. Cilia in the trachea</li> <li>3. Skin</li> </ol>
38	List 3 chemical barriers which provide us with protection from pathogens.	<ol style="list-style-type: none"> <li>1. Lysozymes in tears</li> <li>2. Saliva and vaginal fluid</li> <li>3. Hydrochloric acid in the stomach</li> </ol>
39	What type of protein do pathogens have on their surface?	Antigens
40	What type of lymphocyte will be activated by a pathogen getting into the body?	One which has antibodies which fit with the pathogen's antigens.
41	Describe 2 ways lymphocytes respond to an antigen.	<ol style="list-style-type: none"> <li>1. Divide to produce many identical lymphocytes.</li> <li>2. Secrete antibodies which destroy the pathogen.</li> </ol>
42	What are memory lymphocytes? What is their role?	<p>Lymphocytes which stay in the blood to respond to a second infection.</p> <p>The secondary response is much faster and you are immune to the pathogen.</p>
43	What is a vaccine?	A drug which triggers immunity to a pathogen. It contains an inactive form of the pathogen.
44	What are the advantages to immunisation?	<p>Protects an individual from a particular disease for many years.</p> <p>Some diseases are eradicated</p> <p>Reduces risk of epidemics</p> <p>Less chance of long term illness as a result of the infection</p> <p>Herd immunity protects those not immunised</p> <p>Using a vaccine is cheaper than treating a very ill person</p>
45	Name a disadvantage to immunisation.	Some chance of side effects- some side effects can be severe.
46	What is herd immunity?	When the <u>majority of people in a group are immunised</u> , this <u>provides protection to the few</u> people who are not by reducing the chance of coming into contact with an infected person.
47	Why are antibiotics useful? How do they work?	<p>They are used to treat bacterial infections.</p> <p><u>They kill the bacteria cells or inhibit their production by interrupting cell wall synthesis</u>, but do not harm the organism being treated.</p>
48	List the stages in the development of new drugs, including antibiotics.	<ul style="list-style-type: none"> <li>• Discovery</li> <li>• Development</li> <li>• Preclinical testing</li> <li>• Clinical testing</li> </ul>
49B	How are monoclonal antibodies produced?	<ol style="list-style-type: none"> <li>1. Encourage lymphocytes to produce desired antibodies (these do not divide)</li> <li>2. Fuse to a cancer cell to produce a hybridoma cell</li> <li>3. Hybridoma cells produce antibodies as they divide</li> </ol>

<b>50B</b>	<b>What are monoclonal antibodies used for?</b>	<b>a in pregnancy testing b in diagnosis including locating the position of blood clots and cancer cells and in treatment of diseases including cancer</b>
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## Key words for Unit 5- Health, disease and the development of medicine

### SB5a Health and disease

Word	Meaning
<b>cause</b>	A factor that, when it changes, makes something else change.
<b>communicable disease</b>	A disease caused by a pathogen that can be passed from an infected individual to others. Also called an infectious disease.
<b>Correlation</b>	When two factors change in a similar pattern, we say they are correlated.
<b>Disease</b>	Something that causes the body not to work properly.
<b>health</b>	A state of complete physical, social and mental well-being.
<b>immune system</b>	The system that helps protect the body from harm by diseases, especially communicable diseases.
<b>lifestyle</b>	The way we live, such as our diet, whether we smoke tobacco, and how much exercise we take. Lifestyle can affect whether we develop some diseases.
<b>non-communicable disease</b>	A disease that cannot be passed from individuals to those around them. Examples include inherited diseases and some diseases caused by lifestyle.
<b>pathogen</b>	A microorganism that causes a communicable disease.

### SB5b Non-communicable diseases

Word	Meaning
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<b>cirrhosis</b>	A disease of the liver, often caused by drinking a large amount of ethanol (alcohol) over a long period of time.
<b>deficiency disease</b>	A disease caused by a lack of a particular nutrient in the body, such as anaemia caused by a lack of iron.
<b>Drug</b>	A substance that we take into the body, which affects how the body works.
<b>genetic disorder</b>	A disease caused by faulty alleles of our genes.
<b>malnutrition</b>	Health problems caused by a diet that contains too little or too much of one or more nutrients.

### SB5c Cardiovascular disease

Word	Meaning
<b>body mass index (BMI)</b>	An estimate of how healthy a person's mass is for their height.
<b>cardiovascular disease</b>	A disease in which the heart or circulatory system does not function properly.
<b>heart attack</b>	When the heart stops pumping properly due to a lack of oxygen reaching part of it.
<b>obesity</b>	A condition in which someone is overweight for their height and has a BMI above 30.
<b>stent</b>	A small mesh tube used to widen narrowed blood vessels and allow blood to flow more easily.
<b>stroke</b>	Death of brain cells caused by a lack of blood, due to a blockage in a blood vessel in the brain.
<b>waist : hip (waist-to-hip) ratio</b>	A measure of the amount of fat in the body, calculated by dividing the waist measurement by the hip measurement.

## SB5d Pathogens

Word	Meaning
<b>AIDS (acquired immune deficiency syndrome)</b>	When HIV has damaged a person's immune system, so they are more likely to get secondary infections.
<b>chalara dieback</b>	A communicable disease of ash trees caused by a fungus. It produces lesions of the trunk and branches, and dieback of the top of the tree.
<b>Cholera</b>	A communicable disease caused by a bacterium, which causes extreme diarrhoea.
<b>Diarrhoea</b>	Loose or watery faeces.
<b>haemorrhagic fever</b>	A disease that includes a fever (high body temperature) and internal bleeding, such as caused by the Ebola virus.
<b>Host</b>	An individual or species that can be infected by a certain pathogen.
<b>HIV (human immunodeficiency virus)</b>	A virus that attacks white blood cells in the human immune system, often leading to AIDS.
<b>malaria</b>	A dangerous disease, caused by a protist, that causes serious fever, headaches and vomiting and can lead to death.
<b>protist</b>	A kingdom of eukaryotic and mainly single-celled organisms (also called 'protoctists').
<b>secondary infection</b>	An infection due to the immune system being weakened previously by a different pathogen.
<b>tuberculosis (TB)</b>	A communicable bacterial disease that infects the lungs.

<b>Ulcer</b>	A sore area in the stomach lining which can be caused by a bacterium.
<b>virus</b>	A microbe that multiplies by infecting a cell and taking over the cell's DNA copying processes. Virus particles have no cellular structure and so are not true organisms.
<b>white blood cell</b>	A type of blood cell that forms part of the body's defence system against disease.

## SB5e Spreading pathogens

Word	Meaning
<b>epidemic</b>	When many people over a large area are infected with the same pathogen at the same time.
<b>Hygiene</b>	Keeping things clean, by removing or killing pathogens.
<b>oral route</b>	When something enters the body through the mouth.
<b>Vector</b>	Something that transfers things from one place to another.

## SB5f Virus life cycles

Word	Meaning
<b>bacterial lawn plate</b>	A nutrient agar plate covered in a thin film of bacteria.
<b>Capsid</b>	The protein coat of a virus.
<b>cross-sectional area (of a cylinder)</b>	The area of a circle cut at right angles through a cylinder. It is calculated as $\pi r^2$ , where $r$ is the

	radius of the circle.
<b>Lysis</b>	When the cell membrane of a cell breaks open, releasing everything inside the cell.
<b>lysogenic pathway</b>	The pathway in a virus life cycle where the virus genetic material inserts into the cell's genetic material and is replicated each time the cell divides.
<b>lytic pathway</b>	The pathway where a virus enters a cell, takes over the cell's replication process to produce more viruses, and causes lysis of the cell as the new viruses are released.
<b>nutrient agar</b>	Agar containing nutrients; used for growing cells, such as in bacterial lawn plates.

### SB5g Plant defences

Word	Meaning
<b>aseptic techniques</b>	Techniques used to keep out unwanted microorganisms, such as out of cultures.
<b>Autoclave</b>	Machine used to sterilise equipment and culture media using pressure and heat.
<b>chemical defence</b>	Use of chemical compounds to defend against attacks by pathogens, such as lysozyme and hydrochloric acid in humans, and poisons and insect repellents in plants.
<b>cuticle</b>	An outer covering that is not made of cells. Plants have a cuticle covering the leaves.
<b>Pest</b>	Any unwanted organism, such as animals that damage crop plants.
<b>physical barrier</b>	A barrier that makes it difficult for pathogens to get into the body, such as skin, mucus and cilia in animals, and cuticles and cell walls in plants.

<b>symptom</b>	Something that is suffered when an organism is ill, such as pain, or is a sign of illness, such as a high temperature.
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### SB5h Plant diseases

Word	Meaning
<b>Diagnosis</b>	The identification of the cause of a problem.
<b>distribution analysis</b>	Looking at where damaged plants occur, to help identify the cause of damage.
<b>lesion</b>	An area of damage, such as the cracks in bark caused by chalara dieback fungus in ash trees.
<b>yield (crop)</b>	The amount of the harvested part of a crop, such as grain from wheat.

### SB5i Physical and chemical barriers

Word	Meaning
<b>chemical defence</b>	The use of chemical compounds to defend against attacks. Examples include lysozyme and hydrochloric acid.
<b><i>Chlamydia</i></b>	A bacterium that causes a sexually transmitted infection.
<b>ciliated cells</b>	A cell that lines certain tubes in the body and has cilia on its surface.
<b>hydrochloric acid</b>	Acid produced by cells lining the stomach, of about pH 2, which destroys many pathogens in food and drink.

<b>Lysozyme</b>	An enzyme produced in tears, saliva and mucus, which damages pathogens.
<b>Mucus</b>	A sticky substance secreted by cells that line many openings to the body.
<b>physical barrier</b>	A structure that stops something from entering a certain area. For example, the body has physical barriers, such as the skin, that stop microbes from getting inside the body.
<b>screening</b>	Tests on samples of body fluids to check if people have a certain condition, e.g. an STI.
<b>sexually transmitted infection (STI)</b>	A communicable disease that is passed from an infected person to an uninfected person during sexual activity.

## SB5j Immune system

Word	Meaning
<b>activate</b>	To make active, such as when a lymphocyte is triggered by a pathogen to start dividing rapidly.
<b>antibody</b>	A protein produced by lymphocytes. It attaches to a specific antigen on a microorganism and helps to destroy it.
<b>antigen</b>	A protein on the surface of a cell. White blood cells are able to recognise pathogens because of their antigens.
<b>herd immunity</b>	When the majority of people in a group are immunised, which provides protection to the few who are not by reducing their chance of meeting an infected person.

<b>immune</b>	When a person does not fall ill after infection, because their immune system attacks and destroys the pathogen quickly.
<b>immunisation</b>	Giving a vaccine that causes an immune response without the person becoming ill, and which will make the person immune to the pathogen.
<b>lymphocyte</b>	A type of white blood cell that produces antibodies.
<b>memory lymphocyte</b>	A lymphocyte that remains in the blood for a long time after an infection or vaccination.
<b>MMR</b>	Stands for measles, mumps and rubella. The vaccine given to develop immunity to these diseases.
<b>secondary response</b>	A much more rapid, and larger, production of antibodies to a pathogen when it infects the body again.
<b>vaccine</b>	A mixture containing weakened or inactive pathogens, or antigens from the pathogen. When put into the body it causes an immune response.

## SB5k Antibiotics

Word	Meaning
<b>Antibiotic</b>	A substance that, when inside the body, either kills bacteria or stops them growing.
<b>clinical trial</b>	Testing of a medicine on people.
<b>Colony</b>	A cluster of microorganisms living closely together.
<b>Dose</b>	The total amount of something received, such as of a medicine.



<b>Inhibit</b>	To stop or slow down a process.
<b>penicillin</b>	The first kind of antibiotic. It was extracted from a mould (fungus).
<b>pre-clinical testing</b>	Testing a drug before it is tried on humans, including testing on cells or tissues and on other animals.
<b>resistance (to an antibiotic)</b>	When a bacterium is no longer damaged by an antibiotic.
<b>side effect</b>	Unintended effect of a medicine, which may be harmful.

### SB5I Monoclonal antibodies

<b>Word</b>	<b>Meaning</b>
<b>cancer cell</b>	A cell that continues dividing uncontrollably, causing disease inside the body.
<b>Chemotherapy</b>	Use of drugs to treat a disease, such as in the treatment of cancer.

<b>clone</b>	Offspring from asexual reproduction. All the cells in a clone are genetically identical to each other and to the parent's cells.
<b>Diagnosis</b>	The identification of the cause of a problem.
<b>hybridoma cell</b>	A cell made by fusing a lymphocyte and a cancer cell.
<b>monoclonal antibodies</b>	Many identical antibodies.
<b>PET scanner</b>	A scanner used to identify the position of radioactive substances inside the body.
<b>Platelet</b>	Cell fragments that are important in the clotting mechanism of the blood.
<b>Radiotherapy</b>	Use of ionising radiation to treat diseases, such as to kill cancer cells.

## Unit 6 Plant structures and their functions – Learning points

<b>Topic 6 – Plant structures and their functions</b>	<b>U</b>	<b>L</b>
6.1 Describe photosynthetic organisms as the main producers of food and therefore biomass		
6.2 Describe photosynthesis in plants and algae as an endothermic reaction that uses light energy to react carbon dioxide and water to produce glucose and oxygen		
6.3 Explain the effect of temperature, light intensity and carbon dioxide concentration as limiting factors on the rate of photosynthesis		
6.4 Explain the interactions of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis		
6.5 Core Practical: Investigate the effect of light intensity on the rate of photosynthesis		
6.6 Explain how the rate of photosynthesis is directly proportional to light intensity and inversely proportional to the distance from a light source, including the use of the inverse square law calculation		
6.7 Explain how the structure of the root hair cells is adapted to absorb water and mineral ions		
6.8 Explain how the structures of the xylem and phloem are adapted to their function in the plant, including: a lignified dead cells in xylem transporting water and minerals through the plant b living cells in phloem using energy to transport sucrose around the plant		
6.9 Describe how water and mineral ions are transported through the plant by transpiration, including the structure and function of the stomata		
6.10 Describe how sucrose is transported around the plant by translocation		
6.12 Explain the effect of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement and temperature		
6.13 Demonstrate an understanding of rate calculations for transpiration		

## Unit 6 Plant structures and their functions – Core Questions

No.	Question	Answer
31.	What is a producer?	An organism such as a plant that makes its own food using photosynthesis.
32.	What is biomass?	The total mass in living organisms, usually shown as the mass after drying.
33.	Describe photosynthesis in plants and algae	An endothermic reaction that uses light energy to react carbon dioxide and water to produce glucose and oxygen
34.	List three limiting factors of photosynthesis	Temperature, light intensity and carbon dioxide concentration
35. H	How does temperature limit the rate of photosynthesis?	If the temperature is not high enough, the rate of photosynthesis will not increase as the enzymes responsible cannot perform at their optimum rate.
36. H	What is the effect of increasing temperature on the rate of photosynthesis?	<ul style="list-style-type: none"> <li>• The rate of photosynthesis will increase up to a maximum rate at the optimum temperature.</li> <li>• At higher temperatures the rate will decrease due to denaturation of the enzymes that carry out photosynthesis.</li> </ul>
37. H	How does carbon dioxide affect the rate of photosynthesis?	As the concentration of carbon dioxide increases, the rate of photosynthesis also increases.
38. H	How does light intensity limit the rate of photosynthesis?	If the light intensity is not high enough, there will not be enough energy for photosynthesis
39.	How can the effect of light intensity on rate of photosynthesis be investigated?	The rate of oxygen production by a plant can be measured at different light intensities.
40. H	How does the rate of photosynthesis change with light intensity?	The rate of photosynthesis is directly proportional to light intensity.
41. H	How does the rate of photosynthesis change with distance from a light source?	The rate of photosynthesis is inversely proportional to the distance from the light source- following the inverse square law.
42.	How is the structure of a root hair cell adapted to absorb water and mineral ions?	<ol style="list-style-type: none"> <li>a) Large surface area to volume ratio</li> <li>b) Maximises contact with the soil</li> <li>c) Thin cell walls to allow water molecules through quickly</li> </ol>
43.	How are the structures of the xylem and phloem adapted to their function in the plant?	<ol style="list-style-type: none"> <li>a) lignified dead cells in xylem transport water and minerals through the plant</li> <li>b) living cells in phloem use energy to transport sucrose around the plant</li> </ol>
44.	What is transpiration?	The transportation of water molecules and mineral ions through the plant.
45.	Describe the structure and function of the stomata	Stomata are pores in the underside of leaves that allow the diffusion of gases in and out of the leaf. Guard cells around the pore open and close it.
46.	How is sucrose transported around the plant by translocation?	The cells of the phloem tissue use energy to pump sucrose into the phloem, and the pressure causes the sucrose solution to flow around the plant.

47.	List environmental factors that could affect the rate of water uptake by a plant	Light intensity, air movement, temperature
48.	What is a potometer?	Apparatus for measuring the rate of transpiration in a plant.
49.	How is the rate of transpiration calculated?	Measure the distance the bubble in the potometer has moved in (e.g.) 20 minutes: $\frac{\text{Distance moved (mm)}}{\text{Time taken (min)}} = \text{rate of transpiration (mm/min)}$

## SB6a – Photosynthesis

Word	Meaning
<b>biomass</b>	The total mass in living organisms, usually shown as the mass after drying.
<b>cellulose</b>	Plant cell walls are made of tough cellulose, which support the cell and allow it to keep its shape.
<b>chloroplast</b>	A green disc containing chlorophyll, found in plant cells. This is where the plant makes glucose through photosynthesis.
<b>endothermic reaction</b>	A type of reaction in which energy from the surroundings is transferred to the products, e.g. photosynthesis.
<b>food chain</b>	A diagram that uses arrows to show the flow of energy through organisms that depend on each other for food.
<b>gas exchange</b>	A process in which one gas diffuses across a membrane and another gas diffuses in the opposite direction.
<b>glucose</b>	The sugar produced by photosynthesis and needed for respiration.
<b>guard cell</b>	A pair of guard cells open and close plant stomata.
<b>lipid</b>	A substance in a large group of compounds that includes fats and oils.
<b>palisade cell</b>	Tall, column-shaped cell near the upper surface of a plant leaf.
<b>photosynthesis</b>	A series of enzyme-catalysed reactions carried out in the green parts of plants. Carbon dioxide and water combine to form glucose. This process requires energy transferred by light.

Word	Meaning
<b>polymer</b>	A long-chain molecule made by joining many smaller molecules (monomers) together.
<b>producer</b>	An organism such as a plant that makes its own food using photosynthesis.
<b>protein</b>	A polymer made up of amino acids.
<b>protist</b>	An organism that belongs to a kingdom of eukaryotic and mainly single-celled organisms (also called a protoctist).
<b>respiration</b>	A series of reactions occurring in all living cells, in which glucose is broken down to release energy.
<b>starch</b>	A polymer carbohydrate that is made by the joining together of glucose molecules.
<b>stoma</b>	A tiny pore in the lower surface of a leaf, which, when open, allows gases to diffuse into and out of the leaf. Plural is stomata.
<b>storage organ</b>	A plant organ used to store energy-rich substances such as starch – for example, a potato.
<b>sucrose</b>	The type of sugar found in the phloem of plants and used as table sugar.

## SB6b – Factors that affect photosynthesis

Word	Meaning
<b>concentration</b>	The amount of something found in a certain volume of another substance. For example, the amount of a solute dissolved in a certain volume of solvent.
<b>direct proportion</b>	A linear relationship in which the percentage change in a variable occurs with an equal percentage change in another variable. A direct proportion is seen as a

Word	Meaning
	straight line through the origin when the two variables are plotted on a graph.
<b>inverse proportion</b>	A non-linear relationship where one variable decreases in size at the same rate as another increases.
<b>inverse square law</b>	A mathematical relationship in which a quantity varies in inverse proportion to the square of the distance from the source of the quantity.
<b>limiting factor</b>	A single factor that, when in short supply, can limit the rate of a process such as photosynthesis.
<b>linear relationship</b>	A relationship between two variables (quantities) shown by a straight line on a graph.
<b>rate</b>	How quickly something happens.

#### SB6c – Absorbing water and mineral ions

Word	Meaning
<b>active transport</b>	The movement of particles across a cell membrane from a region of lower concentration to a region of higher concentration ( <i>against</i> the concentration gradient). This process requires energy.
<b>concentration gradient</b>	The difference between two concentrations.
<b>diffusion</b>	The random movement and spreading of particles. There is a net (overall) diffusion of particles from regions of higher concentration to regions of lower concentration.
<b>fluid</b>	A liquid or a gas.
<b>mineral ion</b>	Ion from a naturally occurring salt.
<b>nitrate</b>	A compound that contains nitrogen in the form of a nitrate ion.

Word	Meaning
<b>osmosis</b>	The overall movement of <i>solvent</i> molecules in a solution across a partially permeable membrane, from a dilute solution to a more concentrated one.
<b>partially permeable membrane</b>	Describes a membrane that will allow certain particles to pass through it but not others. Another term for semi-permeable membrane.
<b>protein</b>	A polymer made up of amino acids.
<b>root hair cell</b>	A cell found on the surface of plant roots that has a large surface area to absorb water and dissolved mineral salts quickly from the soil.
<b>wilt</b>	Drooping of parts of a plant caused by a lack of water.

#### SB6d – Transpiration and translocation

Word	Meaning
<b>companion cell</b>	A specialised cell located in the phloem tissue of plants. They pump sucrose into sieve cells.
<b>lignin</b>	A type of polymer that is combined with cellulose in some plant cell walls to make the cells woody, e.g. in xylem cells.
<b>phloem tissue</b>	Living tissue formed of sieve tubes and companion cells that transports sugars and other soluble compounds around a plant.
<b>potometer</b>	A device used for measuring the rate of water uptake by a plant.
<b>sieve tube/cell</b>	Tubes formed of phloem sieve cells (so called because the cells have holes in their ends). The tubes carry sugars and other soluble compounds around the plant.
<b>translocation</b>	The transport of sugars (mainly sucrose) and other soluble compounds in the phloem tissue of a plant.

Word	Meaning
<b>transpiration</b>	The flow of water into a root, up the stem and out of the leaves.
<b>xylem vessel/cell</b>	A long, thick-walled tube found in plants, formed from many dead xylem cells. The vessels carry water and dissolved mineral salts through the plant.

### SB6e Plant adaptations

Word	Meaning
<b>conifer</b>	A type of tree that has needle-shaped leaves and has seeds contained in cones (not fruits).
<b>cuticle</b>	An outer covering that is not made of cells. Plant leaves have a cuticle covering the leaves.
<b>deciduous</b>	Describes a plant that sheds its leaves at a certain time of year. Deciduous plants shed their leaves in winter.
<b>epidermis cells</b>	Cells that form a surface layer in a plant or animal organ.
<b>spongy cells</b>	Irregularly shaped cells in a plant leaf that form air spaces.
<b>stoma</b>	A tiny hole in a leaf through which gases can diffuse into and out of the leaf. It is opened and closed by two guard cells. Plural is stomata.

### SB6f Plant hormones

Word	Meaning
<b>auxins</b>	A group of plant hormones that affect the growth and elongations of cells.
<b>ethene</b>	A gaseous plant hormone that is involved in the ripening of fruit.
<b>gibberellins</b>	A group of plant hormones that cause seeds to germinate and flowers and fruits to form.
<b>gravitropism</b>	A growth response to the stimulus of gravity.
<b>phototropism</b>	A growth response to the stimulus of light.
<b>plant hormone</b>	A substance released by certain cells in a plant that has an effect on other cells, usually causing the cells to grow and develop in a certain way.
<b>response</b>	An action that occurs due to a stimulus.
<b>stimulus</b>	Change in a factor (inside or outside an organism) that is detected. For example, plants detect light. Plural is stimuli.
<b>tropism</b>	A response to a stimulus in which an organism grows towards or away from the stimulus. A positive tropism is a growth towards a stimulus, and a negative tropism is a growth away from the stimulus.

### SB6g Uses of plant hormones

Word	Meaning
<b>ethene</b>	A gaseous plant hormone that is involved in the ripening of fruit.
<b>gibberellins</b>	A group of plant hormones that cause seeds to germinate and flowers and fruits to form.

<b>photoperiodism</b>	The response of an organism to the number of daylight hours in a day.
<b>rooting powder</b>	A powder containing plant hormones into which cuttings are dipped to speed up the growth of new roots.
<b>selective weedkiller</b>	A substance that kills a certain type of plant only, leaving others unaffected.



## Unit 7 – Animal coordination, control and homeostasis

Learning point	U	L
7.1 Describe where hormones are produced and how they are transported from endocrine glands to their target organs, including the pituitary gland, thyroid gland, pancreas, adrenal glands, ovaries and testes		
7.2 Explain that adrenalin is produced by the adrenal glands to prepare the body for fight or flight, including: a increased heart rate b increased blood pressure c increased blood flow to the muscles d raised blood sugar levels by stimulating the liver to change glycogen into glucose		
7.3 Explain how thyroxine controls metabolic rate as an example of negative feedback, including: a low levels of thyroxine stimulates production of TRH in hypothalamus b this causes release of TSH from the pituitary gland c TSH acts on the thyroid to produce thyroxine d when thyroxine levels are normal thyroxine inhibits the release of TRH and the production of TSH		
7.4 Describe the stages of the menstrual cycle, including the roles of the hormones oestrogen and progesterone, in the control of the menstrual cycle		
7.5 Explain the interactions of oestrogen, progesterone, FSH and LH in the control of the menstrual cycle, including the repair and maintenance of the uterus wall, ovulation and menstruation		
7.6 Explain how hormonal contraception influences the menstrual cycle and prevents pregnancy		
7.7 Evaluate hormonal and barrier methods of contraception 2c, 2d 4a 7.8 Explain the use of hormones in Assisted Reproductive Technology (ART) including IVF and clomifene therapy		
7.9 Explain the importance of maintaining a constant internal environment in response to internal and external change		
7.10B Explain the importance of homeostasis, including: a thermoregulation – the effect on enzyme activity b osmoregulation – the effect on animal cells		
7.11B Explain how thermoregulation takes place, with reference to the function of the skin, including: a the role of the dermis b the role of the epidermis c the role of the hypothalamus		
7.12B Explain how thermoregulation takes place, with reference to: a shivering b vasoconstriction c vasodilation		
7.13 Explain how the hormone insulin controls blood glucose concentration		
7.14 Explain how blood glucose concentration is regulated by glucagon		
7.15 Explain the cause of type 1 diabetes and how it is controlled 7.16 Explain the cause of type 2 diabetes and how it is controlled 7.17 Evaluate the correlation between body mass and type 2 diabetes including waist:hip calculations and BMI		
7.18B Describe the structure of the urinary system 7.19B Explain how the structure of the nephron is related to its function in filtering the blood and forming urine including: a filtration in the glomerulus and Bowman’s capsule b selective reabsorption of glucose c reabsorption of water		
7.20B Explain the effect of ADH on the permeability of the collecting duct in regulating the water content of the blood		
7.21B Describe the treatments for kidney failure, including kidney dialysis and organ donation		
7.22B State that urea is produced from the breakdown of excess amino acids in the liver		

<b>Unit 7 core questions</b>	
1. Which system contains a collection of glands which produce hormones?	The endocrine system
2. Which gland produces insulin?	The pancreas
3. Which gland produces adrenaline?	The adrenal glands
4. State 3 ways in which adrenaline prepares the body for fight or flight	<ul style="list-style-type: none"> <li>• Increased heart rate</li> <li>• Increased blood flow to muscles</li> <li>• Increased blood pressure</li> <li>• Stimulates liver to convert glycogen to glucose</li> </ul>
5. Where is TRH produced?	Hypothalamus
6. Which gland releases TSH?	<ul style="list-style-type: none"> <li>• The pituitary gland</li> </ul>
7. Which gland produces Thyroxine?	Thyroid gland
8. How is the regulation of thyroxine production an example of negative feedback?	As thyroxine levels increase TRH production is decreased
9. State 2 hormones which control the menstrual cycle	<b>FSH</b> Oestrogen <b>LH</b> Progesterone
10. What is ovulation?	When an egg cell is released from an ovary
11. On what days of the menstrual cycle does menstruation occur?	Days 1-5
12. When does ovulation usually happen?	Day 14
<b>13. (H) What does FSH do?</b>	<b>Stimulates growth and maturation of egg follicle</b>
<b>14. (H) The surge in LH at day 14 triggers....</b>	<b>Ovulation (release of egg)</b>
15. Towards the end of the cycle the fall in oestrogen and progesterone trigger....	Menstruation
16. What does hormonal contraception prevent?	The maturation of the egg follicle
17. Name 2 methods of contraception apart from the pill	Condom Diaphragm
18. What is the name for maintaining a constant internal environment? B	Homeostasis
19. Your blood vessels widening in response to getting hot is called... B	Vasodilation
20. Your blood vessels narrowing in response to getting cold is called... B	Vasoconstriction
21. Which hormone is released in response to high blood glucose?	Insulin
22. Which hormone is released in response to low blood glucose?	Glucagon
23. How is glucose stored in the liver and muscle cells?	As glycogen
24. What causes Type 1 diabetes?	Insulin is not produced from the pancreas
25. How can type 1 diabetes be treated?	Injecting insulin

26. What causes Type 2 diabetes?	Cells do not respond to the effect of insulin
27. How can Type 2 diabetes be treated?	Exercise; healthy diet; Medication
28. How is urea made in the body? B	urea is made from the breakdown of amino acids in the liver
29. Name 5 parts of the urinary system B	Renal arteries and veins; kidneys; ureters; bladder and urethra
30. Describe the function of the kidneys B	The kidneys removes substances from the blood to make urine
31. How is kidney failure treated? B	Kidney transplant Dialysis
32. Describe problems with organ donation B	The antigens on the organ tissue need to match otherwise the recipients body may attack the donated organ
33. What is a nephron? B	A microscopic tubule found in the kidney
34. Name 3 parts of a nephron B	Bowman's capsule, Convoluted tubules; Loop of Henle and Collecting Ducts
35. What is the function of the Bowman's capsule? B	To filter the blood to separate small molecules like water, urea and glucose from big molecules such as proteins and blood cells
36. What is ADH? B	Antidiuretic hormone which controls the water levels in blood
37. Describe negative feedback	An increase in one factor causes a decrease in another factor (and vice versa)

## SB7a Hormones

Word	Meaning
<b>adrenal gland</b>	A gland located on top of a kidney that produces the hormone adrenalin. It can be referred to as an adrenal.
<b>endocrine gland</b>	An organ that makes and releases hormones into the blood.
<b>hormone</b>	Chemical messenger that is released into the blood from an endocrine gland and causes target cells to change how they work.
<b>hormonal system</b>	The collection of glands in the body that release hormones. This system controls long-term or widespread responses by the body to changes inside and outside the body.
<b>ovary</b>	Organ in the female reproductive system that releases egg cells and the hormones oestrogen and progesterone.
<b>pancreas</b>	Organ in the body that produces some digestive enzymes, as well as the hormones insulin and glucagon.
<b>pituitary gland</b>	An organ just below the brain that controls many activities of the body (e.g. metabolic rate and the menstrual cycle) by the release of hormones into the blood. It can be referred to as the pituitary.
<b>sex hormone</b>	Any hormone that affects reproduction (e.g. oestrogen, testosterone).
<b>target organ</b>	An organ on which a hormone has an effect.

<b>testis</b>	An organ in the male reproductive system that produces sperm cells and the hormone testosterone. Plural is testes.
<b>thyroid gland</b>	A gland that releases the hormone thyroxine into the blood.

## SB7b Hormonal control of metabolic rate

Word	Meaning
<b>adrenalin</b>	A hormone that is released from the adrenal glands when you are nervous or excited.
<b>fight-or-flight response</b>	Several responses that prepare the body for sudden action, including increased heart rate, increased blood flow to muscles, and release of glucose into the blood.
<b>glycogen</b>	A polymer storage material made from glucose, particularly in liver cells
<b>metabolic rate</b>	The overall rate at which chemical reactions take place in the body.
<b>negative feedback</b>	A control mechanism in which a change in a condition, such as temperature, causes the opposite change to happen and so brings the condition back to a normal level.
<b>resting metabolic rate</b>	The metabolic rate when the body is at rest.
<b>thyroxine</b>	A hormone released by the thyroid gland, which affects metabolic rate by changing how certain cells work (e.g. causes heart cells to contract more strongly).

## SB7c The menstrual cycle

Word	Meaning
<b>contraception</b>	The prevention of pregnancy.
<b>fertilisation</b>	Fusing of a male gamete with a female gamete.
<b>menopause</b>	When the menstrual cycle stops completely.
<b>menstrual cycle</b>	A monthly cycle involving the reproductive organs in women.
<b>menstruation</b>	The breakdown and loss of the thickened part of the uterus lining at the start of a woman's menstrual cycle.
<b>oestrogen</b>	A hormone produced by the ovaries which is important in the menstrual cycle.
<b>ovulation</b>	The release of an egg from an ovary.
<b>period</b>	The 'bleed' that occurs during menstruation.
<b>pregnancy</b>	The time during which a fertilised egg develops in the uterus until the birth of the baby.
<b>progesterone</b>	One of the hormones released by the ovaries.
<b>puberty</b>	The stage of life when the body develops in ways that make it able to reproduce (e.g. production of sperm cells in testes, and the release of egg cells from ovaries).

## SB7d Hormones and the menstrual cycle

Word	Meaning
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<b>Assisted Reproductive Technology (ART)</b>	Technology that helps to increase the chance of pregnancy, such as the use of hormones to stimulate egg release.
<b>clomifene therapy</b>	A form of therapy used to stimulate ovulation.
<b>corpus luteum</b>	A structure formed from the egg follicle after an egg cell is released from an ovary. It produces progesterone.
<b>egg follicle</b>	Cells in the ovary that surround a developing egg. The follicle produce hormones, such as oestrogen.
<b>follicle-stimulating hormone (FSH)</b>	A hormone produced by the pituitary gland that causes egg cells to mature in ovaries.
<b>in vitro fertilisation (IVF)</b>	Fertilising an egg cell by placing it in a sterile container then adding sperm cells.
<b>luteinising hormone</b>	A hormone produced by the pituitary gland that causes ovulation.

## SB7e Control of blood glucose

Word	Meaning
<b>diabetes</b>	A disease in which the body cannot control blood glucose concentration at the correct level.
<b>glucagon</b>	A hormone that increases blood glucose concentration.
<b>homeostasis</b>	Controlling the internal environment of the body at stable levels.
<b>insulin</b>	A hormone that decreases blood glucose concentration by causing cells to take in

	glucose. It is used in the treatment of type 1 diabetes.
<b>type 1 diabetes</b>	A type of diabetes in which the pancreas does not produce insulin.

### SB7f Type 2 diabetes

Word	Meaning
<b>body mass index (BMI)</b>	An estimate of the amount of fat in a person's body, using their mass and height, on which judgements of health are made.
<b>correlation</b>	A relationship between two variables, so that if one variable changes so does the other correlation can be positive or negative.
<b>type 2 diabetes</b>	A type of diabetes in which cells do not respond to insulin, or too little insulin is produced.
<b>waist : hip ratio</b>	An estimate of the amount of the fat in the body, calculated by dividing the waist measurement by the hip measurement. It can be used to make judgements about health.

### SB7g Thermoregulation

Word	Meaning
<b>dermis</b>	Layer below the epidermis of the skin, which contains temperature receptors, sweat glands and erector muscles.
<b>epidermis</b>	Outer layer of skin.
<b>erector muscle</b>	Muscle in the skin dermis that contracts and raises a body hair.

<b>fever</b>	A core body temperature that is too high (above 38 °C).
<b>hypothalamus</b>	Part of the brain that monitors and controls body temperature.
<b>hypothermia</b>	A core body temperature that is too low (below 36 °C).
<b>negative feedback</b>	Where a change in a system causes a response that brings about the opposite change, returning the system to a 'normal' level.
<b>shivering</b>	Rapid contraction and relaxation of muscles that causes the body to warm up.
<b>thermoregulation</b>	The control of body temperature, especially in core parts of the body (e.g. heart, liver and brain).
<b>vasoconstriction</b>	Narrowing of blood vessels, which reduces blood flow.
<b>vasodilation</b>	Widening of blood vessels, which increases blood flow.

### SB7h Osmoregulation

Word	Meaning
<b>antigen</b>	A substance on the outside of a cell that the immune system uses to identify whether the cell is from the same body or a different one.
<b>dialysis</b>	Process used to clean the blood of people with kidney failure. It involves the exchange of substances between blood and dialysis fluid across a partially permeable membrane.

<b>kidney</b>	The organ that removes urea, excess water and other substances from the blood to form urine.
<b>kidney failure</b>	When both kidneys do not work properly.
<b>organ donation</b>	The transfer of a healthy organ (e.g. kidney) into the body of someone whose own organ has failed.
<b>osmoregulation</b>	The control of the balance of water and mineral ions in the body.
<b>rejection</b>	When the immune system attacks cells, tissues or an organ that has been placed in the body.
<b>urea</b>	A waste product from the breakdown of excess amino acids in the liver.
<b>urinary system</b>	Body system that removes excess substances and waste products from the body in urine.

<b>filtration (in kidney)</b>	Separating large molecules from smaller ones, as in the glomerulus and Bowman's capsule of a nephron.
<b>first convoluted tubule</b>	Part of a nephron where selective reabsorption of glucose and some mineral ions takes place.
<b>glomerulus</b>	A network of blood capillaries associated with the Bowman's capsule of a nephron.
<b>loop of Henle</b>	Long loop of a nephron involved in osmoregulation.
<b>microvilli</b>	Finger-like projections of the cell surface membrane that greatly increase its surface area.
<b>nephron</b>	Long tubule found in the kidney where filtration of blood occurs, and reabsorption of useful substances, leaving waste and excess substances in urine.
<b>permeability</b>	A measure of how well a membrane allows substances to pass through it. More permeable membranes allow more substances through.
<b>pituitary gland</b>	Part of the brain that detects changes in the body and controls them by releasing many hormones.
<b>selective reabsorption</b>	Taking back particular (useful) substances, such as glucose and some mineral ions, into the nephron.
<b>urine</b>	A fluid produced by the kidneys, containing urea and other waste or excess substances dissolved in water.

## SB7i The kidneys

<b>Word</b>	<b>Meaning</b>
<b>active transport</b>	The movement of particles across a cell membrane from a region of lower concentration to a region of higher concentration ( <i>against</i> the concentration gradient). The process requires energy.
<b>ADH</b>	Antidiuretic hormone. Hormone produced by the pituitary gland that increases the permeability of the collecting duct in a nephron to water.
<b>Bowman's capsule</b>	The start of a nephron where filtration occurs.
<b>collecting duct</b>	The final part of a nephron.
<b>dehydrated</b>	Lacking in water.

<b>Unit 8 Exchange and transport in animals</b>	U	L
Learning point		
8.1 Describe the need to transport substances into and out of a range of organisms, including oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea		
8.2 Explain the need for exchange surfaces and a transport system in multicellular organisms including the calculation of surface area : volume ratio		
8.3 Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries		
8.6 Explain how the structure of the blood is related to its function: a red blood cells (erythrocytes) b white blood cells (phagocytes and lymphocytes) c plasma d platelets		
8.7 Explain how the structure of the blood vessels is related to their function		
8.8 Explain how the structure of the heart and circulatory system is related to its function, including the role of the major blood vessels, the valves and the relative thickness of chamber walls		
8.9 Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration		
8.10 Compare the process of aerobic respiration with the process of anaerobic respiration		
8.11 Core Practical: Investigate the rate of respiration in living organisms		
8.12 Calculate heart rate, stroke volume and cardiac output, using the equation cardiac output = stroke volume × heart rate		

### Unit 8 Exchange and Transport in Animals – Core Questions

1.	Which gas do we need for respiration?	Oxygen
2.	Which gas is a waste product of respiration?	Carbon Dioxide
3.	Where are food molecules absorbed into the blood?	Small intestine
4.	How is urea formed?	From the breakdown of amino acids in the liver
5.	State 3 ways the alveoli are adapted for gas exchange	<ul style="list-style-type: none"> <li>• Large surface area to volume rate</li> <li>• Thin alveolus cell wall</li> <li>• Thin capillary cell wall</li> <li>• Lots of capillaries</li> </ul>
6.	State 3 factors affecting the rate of diffusion	<ul style="list-style-type: none"> <li>• Surface area</li> <li>• Concentration gradient</li> <li>• Diffusion distance</li> </ul>
7.	What is the function of red blood cells?	To transport oxygen
8.	What is the function of white blood cells?	They are part of the immune system and help defend the body against infection



9.	What is transported in plasma?	Transports dissolved substances around the body such as nutrients, hormones, water, waste products, urea, carbon dioxide
10.	What is the function of platelets?	Help the blood to clot
11.	How are arteries adapted to their function?	Arteries transport blood away from the heart under high pressure so therefore have a very thick outer wall and layers of muscle and elastic fibres
12.	How are veins adapted to their function?	Pump deoxygenated blood back to the heart. Lower pressure so thin walls and thin layers of muscle and elastic fibres, valves
13.	How are capillaries adapted to their function?	Capillaries have very thin walls (only one cell thick) which allows for the diffusion of substances across capillary wall.
14.	What is the function of valves?	To prevent the backflow of blood into the heart
15.	Which side of the heart pumps oxygenated blood around the body?	The left side
16.	Which side of the heart is thicker?	The left ventricle
17.	Describe the direction of blood through the heart and lungs when returning from the body. (6 bullet points)	<ul style="list-style-type: none"> <li>• Deoxygenated blood enters right atrium</li> <li>• Flows into right ventricle</li> <li>• Pumped to lungs where oxygen binds to the red blood cells</li> <li>• Oxygenated blood flows to left atrium</li> <li>• Then to left ventricle</li> <li>• Left ventricle pumps oxygenated blood to rest of body</li> </ul>
18.	What does exothermic mean?	Energy is given out
19.	Write the word equation for aerobic respiration	glucose + oxygen → carbon dioxide + water (+ energy)
20.	Write the word equation for anaerobic respiration	glucose → lactic acid
21.	Write the equation for cardiac output	Cardiac output = stroke volume x heart rate

## SB8a Efficient transport and exchange

Word	Meaning
<b>aerobic respiration</b>	A type of respiration in which oxygen is used to release energy from substances such as glucose.
<b>alveolus</b>	A small pocket in the lungs in which gases are exchanged between the air and the blood. (Plural is alveoli.)
<b>capillary</b>	A tiny blood vessel with thin walls to allow for the transfer of substances between the blood and tissues.
<b>circulatory system</b>	The system that moves blood through the body. It consists of the heart, arteries, veins and capillaries.
<b>diffusion</b>	The random movement and spreading of particles. There is a net (overall) diffusion of particles from a region of higher concentration to a region of lower concentration.
<b>excretion</b>	The removal of waste materials that have been produced inside an organism.
<b>gas exchange</b>	A process in which one gas diffuses across a membrane and another gas diffuses in the opposite direction.
<b>metabolism</b>	All the chemical reactions that occur in an organism.
<b>multicellular organism</b>	An organism that is made up of many cells.
<b>surface area : volume (SA : V) ratio</b>	The total amount of surface area of an object divided by its volume. The bigger the ratio, the more surface area something has per unit volume.
<b>urea</b>	A waste product made in the liver from excess amino acids.

## SB8b Factors affecting diffusion

Word	Meaning
<b>concentration</b>	The amount of solute dissolved in a certain amount of solution.
<b>concentration gradient</b>	The difference between two concentrations. There will be an overall movement of particles <i>down</i> a concentration gradient, from higher concentration to lower concentration.
<b>directly proportional</b>	A relationship between two variables in which if one variable doubles, the other also doubles.
<b>Fick's law</b>	The relationship between the different variables that affect diffusion: $\text{rate of diffusion} \propto \frac{\text{surface area} \times \text{concentration difference}}{\text{thickness of membrane}}$
<b>inversely proportional</b>	A relationship between two variables in which if one variable doubles, the other halves.
<b>linear relationship</b>	A relationship between two variables shown by a straight line on a graph.

## SB8c The circulatory system

Word	Meaning
<b>antibody</b>	A protein produced by lymphocytes. It attaches to a specific antigen on a microorganism and helps to destroy or neutralise it.
<b>artery</b>	A blood vessel that carries blood away from the heart.

Word	Meaning
<b>blood</b>	The fluid that carries oxygen and other substances from the heart to the body.
<b>capillary</b>	A tiny blood vessel with thin walls to allow for the transfer of substances between the blood and tissues.
<b>erythrocyte</b>	Another term for red blood cell.
<b>haemoglobin</b>	The red, iron-containing pigment found in red blood cells.
<b>heart</b>	A muscular organ in the circulatory system that pumps blood around the body.
<b>lymphocyte</b>	A type of white blood cell that produces antibodies.
<b>phagocyte</b>	A white blood cell that is capable of engulfing microorganisms such as bacteria.
<b>plasma</b>	The straw-coloured liquid component of blood.
<b>platelet</b>	Cell fragments that are important in the clotting mechanism of the blood.
<b>pulse</b>	A shock wave caused by the contraction of the heart muscles, which travels through the walls of arteries leading from the heart.
<b>red blood cell</b>	A biconcave disc containing haemoglobin that gives blood its red colour and carries oxygen around the body to the tissues. Also known as an erythrocyte.
<b>valve</b>	A structure made of flaps of tissue that stops blood flowing in the wrong direction.
<b>vein</b>	A blood vessel that transports blood towards the heart.
<b>white blood cell</b>	A type of blood cell that forms part of the body's defence system against disease. There are many different types of white blood cell, including lymphocytes and phagocytes.

## SB8d The heart

Word	Meaning
<b>aorta</b>	The major artery leading away from the heart.
<b>atrium</b>	An upper chamber in the heart that receives blood from the veins. (Plural is atria.)
<b>cardiac output</b>	The volume of blood the heart can pump out in one minute. It is calculated using the equation: cardiac output = stroke volume × heart rate
<b>chamber</b>	An enclosed space. A human heart has four chambers.
<b>contract</b>	To become smaller. When muscles contract, they shorten and become fatter.
<b>deoxygenated blood</b>	Blood in which the red blood cells are only carrying small amounts of oxygen. Deoxygenated blood is a dark red colour.
<b>heart attack</b>	When the heart stops pumping properly due to a lack of oxygen reaching part of it.
<b>heart rate</b>	The number of heart beats in a unit of time, usually per minute (beats/min).
<b>heart valve</b>	A structure made of flaps of tissue between an atrium and a ventricle of the heart. The heart valve stops blood flowing in the wrong direction when the heart muscle contracts.
<b>impulse</b>	An electrical signal transmitted along a neurone.
<b>oxygenated blood</b>	Blood in which the red blood cells are carrying large amounts of oxygen. Oxygenated blood is a bright red colour.
<b>pulmonary artery</b>	An artery that carries deoxygenated blood from the right atrium to the lungs.
<b>pulmonary vein</b>	A vein that carries oxygenated blood from the lungs to the left atrium.

Word	Meaning
<b>glucose</b>	A sugar produced by the digestion of carbohydrates and needed for respiration.
<b>lactic acid</b>	The waste product of anaerobic respiration in animal cells.
<b>mitochondrion</b>	A sub-cellular structure (organelle) in the cytoplasm of eukaryotic cells, where aerobic respiration occurs. (Plural is mitochondria.)
<b>septum</b>	A wall of tissue. The septum in the heart completely separates the chambers on the right from those on the left.
<b>stroke volume</b>	The volume of blood the heart can pump out with each beat.
<b>tendon</b>	A strand of tissue used to connect other tissues. The tendons in the heart connect the valves with the heart walls.
<b>vena cava</b>	A major vein leading to the heart.
<b>ventricle</b>	A lower chamber in the heart that pumps blood out into the arteries.

Word	Meaning
	transfer usually causes the temperature of the surroundings to rise.

## SB8e Cellular respiration

Word	Meaning
<b>aerobic respiration</b>	A type of respiration in which oxygen is used to release energy from substances such as glucose.
<b>anaerobic respiration</b>	A type of respiration that does not need oxygen.
<b>cellular respiration</b>	Chemical process by which living cells produce energy in the cell.
<b>exothermic</b>	A type of reaction in which energy is transferred to the surroundings from the reactants. This energy

Unit 9- Ecosystems and material cycles	U	L
9.1 Describe the different levels of organisation from individual organisms, populations, communities, to the whole ecosystem		
9.2 Explain how communities can be affected by abiotic and biotic factors, including: a temperature, light, water, pollutants b competition, predation		
9.3 Describe the importance of interdependence in a community		
9.4 Describe how the survival of some organisms is dependent on other species, including parasitism and mutualism		
9.5 <i>Core Practical</i> : Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects		
9.6 Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects		
9.7B Explain how some energy is transferred to less useful forms at each trophic level and that this affects the number of organisms at each trophic level, limits the length of a food chain and determines the shape of a pyramid of biomass in an ecosystem		
9.8B Calculate the efficiency of energy transfers between trophic levels and percentage calculations of biomass		
9.9 Explain the positive and negative human interactions within ecosystems and their impacts on biodiversity, including: a fish farming b introduction of non-indigenous species c eutrophication		
9.10 Explain the benefits of maintaining local and global biodiversity, including the conservation of animal species and the impact of reforestation		
9.11B Describe the biological factors affecting levels of food security, including: a increasing human population b increasing animal farming and the increased meat and fish consumption c the impact of new pests and pathogens d environmental change caused by human activity e sustainability issues, e.g. use of land for biofuel production and the cost of agricultural inputs		
9.12 Describe how different materials cycle through the abiotic and biotic components of an ecosystem		
9.13 Explain the importance of the carbon cycle, including the processes involved and the role of microorganisms as decomposers		
9.14 Explain the importance of the water cycle, including the processes involved and the production of potable water in areas of drought including desalination		
9.15 Explain how nitrates are made available for plant uptake, including the use of fertilisers, crop rotation and the role of bacteria in the nitrogen cycle		
9.16B (H) <b>Evaluate the use of indicator species as evidence to assess the level of pollution, including:</b> <b>a polluted water – bloodworm, sludgeworm</b> <b>b clean water – freshwater shrimps, stonefly</b> <b>c air quality – different species of lichen, blackspot fungus on roses</b>		
9.17B Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in food preservation		
9.18B Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in composting		
9.19B Calculate rate changes in the decay of biological material		

## CB9 Ecosystems and Material Cycles – Core Questions

1.	All the organisms that live and interact in an ecosystem form a.....	Community
2.	A community is made up of ..... of different species	Populations
3.	What does interdependence mean?	Interdependence is the dynamic relationship between all living things
4.	State 4 abiotic factors	<ul style="list-style-type: none"> <li>• Temperature</li> <li>• Light</li> <li>• Water</li> <li>• Pollutants</li> </ul>
5.	State 2 biotic factors	<ul style="list-style-type: none"> <li>• Competition</li> <li>• Predation</li> </ul>
6.	What is a parasite?	An organism whose survival depends on the presence of another species from which it takes food and other resources
7.	Give 4 examples of parasitism	<ul style="list-style-type: none"> <li>• Fleas</li> <li>• head lice</li> <li>• tape worms</li> <li>• mistletoe</li> </ul>
8.	What does the term 'mutualism' mean?	Organisms that exist in a close, mutually beneficial relationship where both aid the survival of the other.
9.	Give 4 examples of mutualism	<ul style="list-style-type: none"> <li>• Oxpeckers that clean other species</li> <li>• Cleaner fish</li> <li>• Nitrogen fixing bacteria</li> <li>• Chemosynthetic bacteria in tube worms in deep sea vents</li> </ul>
10.	Why are food chains not usually longer than five steps? (B)	Energy is lost at each stage (trophic level) in a food chain as it is transferred into less useful forms. This means that the length of an individual food chain is limited.
11.	What does a pyramid of biomass show? (B)	The amount of energy at each trophic level
12.	How does fish farming help aquatic ecosystems?	It prevents overfishing of wild fish
13.	State 2 problems with fish farming	Fish are kept in small space, therefore: <ul style="list-style-type: none"> <li>• Un-eaten food and faeces sinks to bottom of water and can affect wild organisms that live there.</li> <li>• Parasites and disease can spread more easily</li> </ul>
14.	What is a non-indigenous species?	A species that is not natural to that environment

15.	How can the introduction of non-indigenous species affect an ecosystem?	It can cause problems for the native species that already exist in the ecosystem
16.	What can happen in an aquatic system if too much fertiliser is used on the soil	Eutrophication
17.	State the 2 nutrients found in fertiliser that can cause eutrophication	Nitrate Phosphate
18.	How does eutrophication cause a problem?	The algal bloom blocks sunlight. Plants die and bacteria builds up in the water. The bacteria uses up all the oxygen and all living things in the ecosystem die.
19.	How does reforestation benefit biodiversity?	It increases the number of species in the area
20.	What is conservation?	When an effort is made to protect a rare or endangered species or habitat
21.	What is food security?	Food security is having access to safe and healthy food at all times
22.	State 2 biological factors which could affect food security	<ul style="list-style-type: none"> <li>• Increasing human population</li> <li>• Increasing animal farming</li> <li>• Impact of pests and pathogens</li> <li>• Environmental change caused by human activity</li> <li>• Sustainability issues</li> </ul>
23.	What is the equation for photosynthesis?	Carbon dioxide + Water → Glucose and Oxygen Light is used to do this
24.	What is the word equation for respiration?	Glucose and Oxygen → Carbon dioxide + Water + (Energy)
25.	Which common greenhouse gas is released in combustion that is also released in respiration?	Carbon dioxide
26.	Which gas comprises nearly 80% of our atmosphere but cannot be used directly by plants and animals?	Nitrogen
27.	Where do nitrogen fixing bacteria live and what do they do?	The live in the soil or root nodules and they can 'fix' nitrogen gas from the air
28.	Which weather phenomenon can also convert nitrogen gas into nitrates?	Lightning
29.	What is the role of decomposers? Give two examples.	Break down dead animals and plants Fungi, worms
30.	What can nitrifying bacteria in the soil do?	Convert ammonia into nitrates
31.	Why do plants need nitrates?	To make proteins for growth

32.	What is the role of denitrifying bacteria?	Convert nitrates to nitrogen gas and return it to the atmosphere.
33.	Identify 2 processes which cause water to change state in the water cycle	<ul style="list-style-type: none"> <li>• Evaporation</li> <li>• Condensation</li> </ul>
34.	What is desalination?	Obtaining fresh water from the sea or salty water
35.	Name three indicator species and the condition of the environment it is in? (B)	<ul style="list-style-type: none"> <li>• Polluted water indicator- bloodworm, sludge worm</li> <li>• Clean water indicator- stonefly, freshwater shrimps</li> <li>• Air quality indicator- lichen species, black spot fungus on roses</li> </ul>
36.	State 3 factors that affect the rate of decomposition of food	<ul style="list-style-type: none"> <li>• Temperature</li> <li>• Water content</li> <li>• Oxygen</li> </ul>



### SB9a Ecosystems

Word	Meaning
<b>abundance</b>	A measure of how common something is.
<b>community</b>	All the different organisms living and interacting with one another in a particular area.
<b>ecosystem</b>	An area in which all the living organisms and all the non-living physical factors in an area form a stable relationship that needs no input from outside the area to remain stable.
<b>food web</b>	A diagram of interlinked food chains. It shows how the feeding relationships in a community are interdependent.
<b>habitat</b>	The place in which an organism lives, e.g. woodland or sea shore.
<b>interdependent</b>	When organisms in an area need each other for resources, e.g. for food and shelter.
<b>population</b>	A group of one species living in the same area.
<b>quadrat</b>	A square frame of known area, such as 1 m <sup>2</sup> , that is placed on the ground to get a sample of the organisms living in a small area.
<b>resources</b>	Something that an organism needs to stay alive such as food, water and space.
<b>sample</b>	A small portion of an area or population.

### SB9b Energy transfer

Word	Meaning
<b>biomass</b>	Mass of tissues in an organism.
<b>biotic (factor)</b>	Factors caused by living organisms in an environment, such as competition or predation.

<b>pyramid of biomass</b>	Diagram showing the amount of biomass at different trophic levels of a food chain.
<b>Sankey diagram</b>	A diagram showing energy transfers, where the width of each arrow is proportional to the amount of energy the arrow represents.
<b>trophic level</b>	Feeding level in a food chain, such as producer or primary consumer.

### SB9c Abiotic factors and communities

Word	Meaning
<b>abiotic factors</b>	Non-living conditions that can influence where plants or animals live (e.g. temperature, the amount of light).
<b>adaptation</b>	The features of an organism that enable it to do a certain function (job).

<b>belt transect</b>	A line in an environment along which samples are taken to measure the effect of an abiotic factor on the distribution of organisms.
<b>distribution</b>	The places in which a certain organism can be found in an area.
<b>drought</b>	Lack of water.
<b>pollutant</b>	A substance that harms living organisms when released into the environment.
<b>pollution</b>	Harm caused to the environment, such as by adding poisonous substances or by abnormally high amounts of a substance.

### SB9d Biotic factors and communities

Word	Meaning
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<b>biodiversity</b>	The variety of species in an area.
<b>biotic factors</b>	Living components (the organisms) in an ecosystem.
<b>compete</b>	When organisms interact to get a limited resource that they need.
<b>competition</b>	When organisms need the same resources as each other, they struggle against each other to get those resources. We say that they 'compete' for those things.
<b>predation</b>	When one animal species kills and eats another animal species.
<b>predator–prey cycle</b>	The regular variation in numbers of predators and numbers of prey within a feeding relationship.

#### SB9e Assessing pollution

Word	Meaning
<b>aquatic</b>	Living in water.
<b>blackspot fungus</b>	Pathogen of roses that is killed by acidic air pollution.
<b>eutrophication</b>	Adding more nutrients to an ecosystem than it normally has.
<b>indicator species</b>	Organism whose presence indicates the presence or absence of certain types of pollution.
<b>invertebrate</b>	Animal without bones, such as an insect or worm.
<b>lichen</b>	A mutualistic relationship between a fungus and an alga. The presence of some species can indicate different levels of air pollution.
<b>pollution</b>	Harm caused to the environment, such as by adding poisonous substances or abnormally high amounts of a substance.
<b>sewage</b>	Human waste collected for treatment.

#### SB9f Parasitism and mutualism

Word	Meaning
<b>host</b>	An individual that can be infected by a certain pathogen.
<b>mutualism</b>	A relationship between individuals of different species where both individuals benefit, e.g. by getting more food or shelter than if they were on their own.
<b>parasite</b>	An organism that lives on or in a host organism and takes food from it while it is alive.
<b>parasitism</b>	A feeding relationship in which a parasite benefits and its host is harmed.

#### SB9g Biodiversity and humans

Word	Meaning
<b>eutrophication</b>	The addition of more nutrients to an ecosystem than it normally has.
<b>fish farming</b>	Growing fish in a contained area, usually to supply humans with food.
<b>indigenous</b>	Organisms that have always been in an area. (Another word for native.)
<b>native</b>	See indigenous.
<b>non-indigenous</b>	Organisms that have been introduced to an area where they haven't been before.
<b>overfishing</b>	Taking more fish from a population than are replaced by the fish reproducing so that the population number falls each year.

#### SB9h Preserving biodiversity

Word	Meaning
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<b>captivity</b>	Keeping something in unnatural surroundings, such as animals in a zoo.
<b>conservation</b>	The protection of an area or species to prevent damage.
<b>endangered</b>	An area or species that is at great risk of destruction.
<b>reforestation</b>	Planting new forests where old forests have been cut down.

### SB9i Food security

Word	Meaning
<b>agricultural input</b>	Something needed for growing food, such as farm equipment, fertilisers or pesticides for crops.
<b>biofuel</b>	Fuel produced from biomass.
<b>climate change</b>	Change in weather patterns around the world.
<b>food security</b>	Having access to enough safe and healthy food at all times.
<b>sustainability</b>	Ability to continue something, such as food production, at the same level without negative effects now or in the future.
<b>vector (disease)</b>	Something that transfers things from one place to another, for example an organism that carries a pathogen from one infected person to another, such as the mosquito that carries the malaria protist.
<b>yield</b>	The amount of useful product that you can get from something.

### SB9j The water cycle

Word	Meaning
<b>desalination</b>	A process that produces fresh drinking water by separating the water from the salts in salty water.

<b>distillation</b>	The process of separating a liquid from a mixture by evaporating the liquid and then condensing it (so that it can be collected).
<b>potable</b>	Suitable for drinking.
<b>water cycle</b>	A sequence of processes by which water moves through abiotic and biotic parts of an ecosystem.

### SB9k The carbon cycle

Word	Meaning
<b>biomass</b>	The total mass in living organisms, usually shown as the mass after drying.
<b>carbon cycle</b>	A sequence of processes by which carbon moves from the atmosphere, through living and dead organisms, into sediments and into the atmosphere again.
<b>decay</b>	A process in which complex substances in dead plant and animal biomass are broken down by decomposers into simpler substances.
<b>decomposer</b>	An organism that feeds on dead material, causing decay.
<b>faeces</b>	Undigested food that forms a waste material.
<b>fossil fuel</b>	A fuel formed from the dead remains of organisms over millions of years, i.e. coal, oil and natural gas.

### SB9l The nitrogen cycle

Word	Meaning
<b>crop rotation</b>	Where a different crop is planted in the same field each year in a 3- or 4-year cycle, such as potatoes, oats, beans and cabbages. This helps to control the build-up of soil pests for each crop.
<b>manure</b>	A mixture containing animal waste that is added to soil to improve its fertility.

<b>nitrate</b>	A compound that contains nitrogen in the form of a nitrate ion.
<b>nitrogen cycle</b>	A sequence of processes by which nitrogen moves from the atmosphere through living and dead organisms, into the soil and back to the atmosphere.
<b>nitrogen-fixing bacteria</b>	Bacteria that can take nitrogen from the atmosphere and convert it to more complex nitrogen compounds such as ammonia.

<b>irradiate</b>	Exposing something to ionising radiation, for example using gamma rays to kill decomposers in certain foods.
<b>preservation</b>	Keeping something from being damaged.

### SB9m Rates of decomposition

<b>Word</b>	<b>Meaning</b>
<b>compost</b>	Waste vegetable material that has been decomposed for use in increasing the fertility of garden soil.
<b>decomposer</b>	Microorganism that breaks down dead plant and animal tissue and animal waste as it feeds and grows. Examples include fungi and bacteria.
<b>fertility (of soil)</b>	The nutrient content of a soil, which affects how well plants grow.

