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**Knowledge Rich Curriculum Plan**

SCIENCE- Cells, inheritance and body organs



| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Prior Knowledge:***In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** | *Assessment* | **Support** |
| --- | --- | --- | --- | --- | --- | --- |
| ***01******Life processes*** | *Students will know that the characteristic processes of living things are movement, growth, nutrition, respiration, reproduction and sensitivity. They will know that living and dead things are/were made of cells.**Students will know how to classify objects as living, not alive or dead* | *Students need to already be able to classify (group) plants and animals based on their observable characteristics**Students need to already know that plants and animals reproduce* | *Communicate: Students will be able to justify opinions* | *Excretion- Getting rid of waste**Characteristic- A feature of a person, place or object**Stimulus- A change in the environment**Distinguish- Recognise the difference between things**Respond- To do something as a reaction to something* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/z9hyvcw/revision/1*](https://www.bbc.co.uk/bitesize/guides/z9hyvcw/revision/1) |
| ***02*** ***Microscopes (Theory)*** | *Students will know that a microscope is a piece of equipment used by scientists to observe objects too small to see with the naked eye.**Students will know that the microscopes we use in school are called light microscopes. Students will know how to name and locate the mirror, arm, eyepiece, slide and clips, stage, base, objective lens, focussing wheel. Students will define magnification as the number of times bigger the image is compared to the actual object and this is show as x(number)**Students will know that once placed on the stage, we use the lowest magnification of the objective lens to observe the specimen. magnification can then be increased by turning the objective lens. Students will know that by turning the fine focus, the clarity of the image will be improved Students will know that a specimen is a sample we observe.* | *Students need to know that lenses (glasses) can be used to make objects look bigger.* | *Enquire: Devise questions* | *Magnification- the number of times bigger an image is compared to the actual size**Enlarging- make or become larger**Apparent-seeming real or true, but not necessarily so* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class*[*https://www.bbc.co.uk/bitesize/guides/zk2pf4j/revision/1*](https://www.bbc.co.uk/bitesize/guides/zk2pf4j/revision/1) |
| ***03 Microscopes (application)*** | *Students will know that the nucleus contains DNA, the cytoplasm is a jelly substance where chemical reaction occur, cell membrane control what goes into and out of the cell, mitochondria release energy in a process called respiration and the ribosomes are where proteins are made.**Students will define the following: Respiration is a chemical reaction what happens in cells to release energy. Cellulose is a sugar and this is what the cell wall is made from. A pigment is a coloured substance (in the case of chlorophyll this is green)* | *Students need to already know that microscopes are used to see really small objects**Recall the names for parts of a microscope* | *Analyse: Discuss the limitations to light microscope.* | ***Microscope-*** *an optical instrument used for viewing very small objects, such as mineral samples or animal or plant cells, typically magnified several hundred times.****Unicellular****- organism are organisms made up of one cell only.****Multicellular****- organisms are organisms that are made up of more than one cell.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/zk2pf4j/revision/1*](https://www.bbc.co.uk/bitesize/guides/zk2pf4j/revision/1) |
| ***04******Organisms and organelles*** | *Students will know that cells are the basic unit of living things, they will know that a group of cells is a tissue, a group of tissues can form an organ and organs from organ systems. This is the case for multicellular organisms. Students will also know the names of the structures that can be found in cells, cell membrane, cell wall, nucleus, mitochondria, cytoplasm, vacuole,* | *MRS GREN for the 7 life processes**Parts of a microscope* | *Analyse: Discuss similarities and differences between animal and plant cells* | *Organism- an individual animal, plant, or single-celled life form.**Organelle- a subcellular structure that has one or more specific jobs to perform in the cell, much like an organ does in the body.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/znyycdm*](https://www.bbc.co.uk/bitesize/topics/znyycdm) |
| ***05 Animal or plant cell?*** | *Students will know that...animal cells and plant cells contain organelles, such as nucleus, ribosomes, mitochondria, cell membrane, (animal cell) chloroplast, cell wall and permanent vacuole. (plant cell)**Students will know how...to compare animal and plant cells. Stating that plant cells have chloroplast because they need light energy from the sun. They have a cell wall and a Permanent vacuole.* | *Roles of key organelles from previous lesson* | *Communicate: construct explanations.* | *Magnification: the amount of times bigger an image is in comparison to the actual size* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/znyycdm*](https://www.bbc.co.uk/bitesize/topics/znyycdm) |
| ***06 Specialised cells*** | *Students will know that cells are generally too small to be seen without a microscope, but have a range of 3D shapes and sizes.**Students will know how to link shapes and sizes of cells to their function. Specialised cells will include red blood cells, ciliated cells, root hair cells, muscle cells, sperm cells and nerve cells.* | *Students need to already know that living things are made of cells. Students will already know that there are different systems in the body.* | *Analyse: Analyse patterns to link the specialised cells with their function* | *Specialised: something that is designed to do a particular job* *Unicellular: Only made of one cell**Multicellular: Made of many cells**Flagellum: (Tail) A structure that are responsible for allowing some cells to move**Cilia: Projections on the surface of some cells which ‘waft’* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/znyycdm/articles/zfj3rwx*](https://www.bbc.co.uk/bitesize/topics/znyycdm/articles/zfj3rwx) |
| ***07 Diffusion*** | *Students will know that diffusion is the net movement of particles from an area of their higher concentration to an area of their lower concentration. Students will draw and interpret diagrams showing diffusion occurring. Students will know that an area of high concentration means there are a lot of particles in a given volume and a low concentration means there are fewer particles in the given volume.* | *Students need to already know that the 3 states of matter are solids, liquids and gases.* | *Communicate: construct explanations of how diffusion occurs in liquids and gases but not in solids.*  | *Diffusion- The movement of particles from an area of high concentration to an area of low concentration down the concentration gradient.**Variable- an element, feature, or factor that is liable to vary or change.**Reliable- consistently good in quality or performance; able to be trusted.**Accurate- correct in all details; exact* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/zych6g8/articles/znqbcj6*](https://www.bbc.co.uk/bitesize/topics/zych6g8/articles/znqbcj6) |
| ***08 Diffusion practical*** | *Students will use 2 different temperatures of water. First, they will place 4 different colours of skittles round the edge of a petri dish. They will use a thermometer to take the temperature of a measured volume of water and then slowly add the water to the dish. Start the stopwatch and record the time it takes the colours to meet. Repeat again with the next temperature.* | *Students need to already know that a thermometer is used to measure temperature, a stop watch to measure time and measuring cylinder to measure volume. Students will already know that particle arrangements of solids, liquids and gases and some may know that particles have more kinetic energy when we increase the temperature.* | *Enquire: Plan variables and test hypothesis* | *Variable- an element, feature, or factor that is liable to vary or change.**Reliable- consistently good in quality or performance; able to be trusted.**Accurate- correct in all details; exact* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.youtube.com/watch?v=aTn56X\_fa7Y*](https://www.youtube.com/watch?v=aTn56X_fa7Y) |
| ***09 Who discovered DNA?*** | *Students will recognise structures that can sometimes be seen in the nucleus that are described as chromosomes. They will know that sex cells (sperm and egg cells have 23 chromosomes unlike normal cells which have 46 chromosomes). Students will know that DNA was first represented in a model by Watson and Crick. They will know that DNA can be extracted from kiwi fruit (and other cells). They will know that the chemical known as DNA has a structure that is described as a double helix.* | *Students will know that cells store information about characteristics in nucleus. Information is stored as DNA.* | *Solve: Review theories and interrogate sources* | ***DNA*** *(Deoxyribonucleic acid) is a chemical found in cells. It is stored in the nucleus and it is the store of genetic information.****Genome*** *is the complete set of genetic information held in a cell.* ***Helix*** *is a coiled shape eg., a spiral staircase.****Extract*** *means ‘to remove’ or ‘take out’* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/articles/z4pd382#:~:text=At%20midday%20on%2028%20February,of%20deoxyribonucleic%20acid%2C%20or%20DNA*](https://www.bbc.co.uk/bitesize/articles/z4pd382#:~:text=At%20midday%20on%2028%20February,of%20deoxyribonucleic%20acid%2C%20or%20DNA)*.*  |
| ***10 Inheritance*** | *Students will know that DNA is a chemical stored in the nucleus of cells. DNA has the genetic code. Each characteristic has a code known as a gene. Genes are the unit of inheritance. If a characteristic has different versions eg., eye colour, there will be different versions of that gene known as alleles. Alleles (alternative forms of a gene) can be described as dominant and recessive. If a gene is dominant, the cell will show that characteristic. If a gene is recessive, the cell will only show that characteristic if there are two copies of the recessive gene. A cell which has two copies of an allele will be described as homozygous. A cell that has two different copies of a gene will be known as heterozygous. If the genetic code for a characteristic is altered in any way, the new version of that gene is described as a mutation. Mutations occur is DNA is caused by exposure to radiation or chemical mutagenic agents. Examples of mutations to genes and their effect on whole organisms include Downs Syndrome, Polydactyl and Cystic Fibrosis.* | *Students will recall that the nucleus of a cell is the place where genetic material is stored. They will know that genetic material is called DNA. They will know that sexual reproduction gives rise to a unique individual because both parents have contributed DNA to the new life through specialised cells known as gametes. They will know that a gamete is a sperm cell or an egg cell. They will know that sexual reproduction is the term that applies to the fusion of two sex cells (NOT the act of intercourse.) They will be able to state that fertilisation is the specific word used to describe how the genetic material from two parent gametes are fused to create the new life.Screen reader support enabled.* |  | ***Genes*** *are sections of a chromosome. They are made of DNA.* ***Alleles*** *are alternative forms of a gene.****Heterozygous*** *are different copies of an allele****Homozygous*** *are same copies of an allele****Characteristic*** *means a feature of a distinctive property of an object or thing.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/zpffr82*](https://www.bbc.co.uk/bitesize/topics/zpffr82) |
| ***11 How are my characteristic determined?*** | *Students will know that a Punnett square is the tool that we use to represent patterns of inheritance. The Punnett square is another phrase for 'genetic cross diagram'. They will be able to draw Punnett squares for the following combinations of parents: tow homozygous dominant parents will produce 100% homozygous dominant offspring; two homozygous recessive parents will produce 100% homozygous recessive offspring; in examples where two parents are heterozygous, the offspring will not be as straightforward to predict and a punnet square will be required to demonstrate the probability of each combination of alleles. Students will need to describe the combination of alleles inherited using the words genotype and the appearance that results from that combination using the word phenotype. Students will know that Gregor Mendel is a scientist credited with the early work on inheritance.* | *Students will recall that the nucleus of a cell is the place where genetic material is stored. They will know that genetic material is called DNA. They will know that sexual reproduction gives rise to a unique individual because both parents have contributed DNA to the new life through specialised cells known as gametes. They will know that a gamete is a sperm cell or an egg cell. They will know that sexual reproduction is the term that applies to the fusion of two sex cells (NOT the act of intercourse.) They will be able to state that fertilisation is the specific word used to describe how the genetic material from two parent gametes are fused to create the new life.* | *Analyse: Draw conclusions from Punnett squares and predict the outcomes of genetic crosses* | *offspring are the young born of living organisms, produced either by a single organism or, in the case of sexual reproduction, two organisms. Genotype* *the complete set of genes present in an organism's DNA**Phenotype* t*he observable traits or characteristics of an organism which is the result of the interaction of genes and environmental factors.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/zpffr82*](https://www.bbc.co.uk/bitesize/topics/zpffr82) |
| ***12 DNA, chromosomes, genes and genomes*** | *Students will distinguish between DNA, chromosome, gene and genome using scale and meaning of the words. Students will know that DNA is an abbreviation for a longer chemical name deoxyribonucleic acid (they do not need to know the chemical name). DNA is made of two long molecule chains and they form a double-strand known as the double-helix. A gene is a short section of DNA that codes for one characteristic. In particular a gene codes for a specific protein. Chromosomes are thread-like structures found in the nucleus of cells. They are made from DNA and they have lots of genes stored along their length. The full collection of the genes found within a cell are known as the genome. They will know that the word 'polymer' means a chemical made up of many repeating units. Critically, students should know that scientists suggest that as little as 2% of DNA is used to code for characteristics. This material is used to control when genes are used.* | *Students will know that cells store genetic material in the nucleus in the form of DNA. The genetic material is called genes. They will know that human cells have 46 chromosomes unless they are gametes which only have half the number of chromosomes. The word to describe how genes are passed from parent to child (offspring) is inheritance.* |  | *DNA-  genetic information. It has all the instructions that a living organism needs to grow, reproduce and function.**Genome- The entire genetic material of an organism. It is found in the nucleus of a cell, and is composed of a chemical called DNA* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/zp7thyc/revision/2*](https://www.bbc.co.uk/bitesize/guides/zp7thyc/revision/2) |
| ***13 What are the function of different body cells?*** | *Students will know that cells are specialised to perform particular roles. red blood cell, a mature cell has no nucleus so more oxygen can be carried. It has a bi concave shape to create a larger surface area. Neurons are long and have connections at each age. They can carry electrical signals, sperm have a long tail for swimming, they have a pointed head that contains enzymes so they can fertilise an egg cell. root hair cells have a large surface area, palisade cell have a large surface area and have chloroplast. Students will know how to link each adaptation with the job.* | *Students will have knowledge specialised plant and animal cells.* | *Communicate: construct explanations* | *Enzymes**Biconcave**Neurons**Surface area**Palisade cells**Chloroplast**adaptations* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)* |
| ***14 The needs of our cells*** | *Students will need to know that oxygen and glucose are needed for the cells to respire and release energy, carbon dioxide and water. Students will know that cells are building blocks for living things, similar groups of cells make up tissues. A group of tissues work together to form an organ, organs work together to form an organ system. Students will be able to name examples of organ systems in the body to be; digestive system, respiratory system, circulatory system, nervous system.*  | *Students will know the organelles and their function in an animal cell.*  | *Communicate: Construct explanations* | *Hierarchy- Any system of persons or things ranked one above another.**Tissue – Any of the distinct types of material of which animals or plants are made, consisting of specialized cells and their products.**Organ - A part of an organism that is typically self-contained and has a specific vital function* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/z9hyvcw/revision/6*](https://www.bbc.co.uk/bitesize/guides/z9hyvcw/revision/6) |
| ***16 The digestive system*** | *Students will know that the digestive system is responsible for digestion. Digestion is the breakdown of large food molecules into smaller molecules. The organs make up the digestive system are the mouth, oesophagus, stomach, small intestines, large intestines, anus. They will know the role of each organ. The mouth carries out mechanical digestion of the food by teeth and mixes with saliva, enzymes start off chemical digestion. Oesophagus – moves food from the mouth to the stomach by peristalsisStomach – mechanical digestion by contractions of the stomach muscles. Acid kills bacteria. Enzymes continue chemical digestion. Small intestine - is where chemical digestion is completed, and small molecules diffuse into the bloodstream and are absorbed.Large intestine - is where water is absorbed from undigested food.**Students will know how chemical are involved in the digestive system* | *Students need to already know that a group of organs make up a system, names of some key organs in the digestive system and the location of them. E.g. the stomach, small intestine, mouth.* |  | *Digestion- The breakdown of large food molecules into smaller ones**Villi- Small projections (sticky out bits) covering the inside of the small intestine wall**Soluble- (of a substance) able to be dissolved, especially in water.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/zf339j6/articles/zv8m7yc*](https://www.bbc.co.uk/bitesize/topics/zf339j6/articles/zv8m7yc) |
| ***17 Circulatory system*** | *Students will know that the circulatory system contains the heart, blood and blood vessels. They will know the difference between an artery vein and capillary. Arteries carry blood away from the heart under high pressure, veins carry blood back to the heart under a lower pressure. Capillaries carry blood under low pressure and deliver useful substances such as glucose and oxygen to each cell. They carry waste products away. The blood contains red blood cells, white blood cells, platelets and plasma. Red blood cells carry oxygen, white blood cells fight infection, plasma is the liquid that carries sugar, carbon dioxide etc. Platelets help to form scabs if the skin gets cut.**Students will know how to label the key structure of the heart, right and left atrium, right and left ventricle. Label the key structures in blood to be plasma, red blood cells, white blood cells and platelets.* | *Students need to already know that the heart pumps blood around the body**Students need to already know how to describe the role of the heart, blood vessels and blood* |  | *Digestion- The breakdown of large food molecules into smaller ones**Villi- Small projections (sticky out bits) covering the inside of the small intestine wall* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1*  | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zkq7wnb*](https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zkq7wnb) |
| ***18 The respiratory system*** | *Students will know that the respiratory system contains structures such as the nose, trachea, bronchus, lungs, bronchioles, alveoli. Oxygen diffuses into the blood stream from the alveoli into the blood stream and carbon dioxide diffuses into the alveoli from the blood stream. They will know this as gas exchange.**Students will know how to define the terms breathing and respiration* | *Students will need to know that oxygen is taken in and carbon dioxide is a waste product. Oxygen is transported around the body by red blood cells.*  |  | *Diffusion: the movement of particles from an area of high concentration to low concentration* *Breathing – A muscular contraction carried out by some animals so that enough oxygen can get into their bodies. Many living things like plants do not do this.**Respiration - A chemical reaction to release energy that happens inside the cells of all living things including plants.* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/ztkr82p/revision/1*](https://www.bbc.co.uk/bitesize/guides/ztkr82p/revision/1) |
| ***20 Skeletal and muscular systems*** | *Students will be able to name the bones in the skeletal system to be skull, neck bones, rib cage, pelvis, femur and fibula. Students will know that the skeletal system has four purposes; support, protection, movement and making blood cells. Bones are a store of minerals and are used for the attachment of muscles.*  | *Students will be able to name some of the bones in the skeletal system from KS2 and PE.*  |  | *Bones- Hard, living tissue that make up the skeleton**Muscles- made up of soft tissue and our skeletal muscles contract to enable us to move**Antagonistic muscles- pairs of muscles that work together, when one contracts the other relaxes* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/topics/znyycdm/articles/zgbddp3*](https://www.bbc.co.uk/bitesize/topics/znyycdm/articles/zgbddp3) |
| ***22 Effects of exercise on the body*** | *Students will know that...heart rate and respiratory rate increase during exercise because of the increased need for energy. Heart rate increases to provide the working cells with oxygen and glucose. Respiratory rate increases to provide more oxygen required for respiration.**Students will know how to investigate the effects of exercise by taking their heart rate before and immediately after exercise.* | *Students need to already know that...respiration is a chemical reaction that occurs at the mitochondria and provides energy to cells.**Students need to already know how...to plan scientific investigations using AIDCAR* |  | *Heart rate- the speed at which the heart beats.**Respiratory rate-   the number of breaths you take per minute.**Reliable- consistently good in quality or performance; able to be trusted.**Accurate- correct in all details; exact* | *Retrieval questions**Simple exam questions**End of topic test* *Summative assessment 1* | *Knowledge organiser (provided on Teams and in class)*[*https://www.bbc.co.uk/bitesize/guides/zghmp39/revision/1*](https://www.bbc.co.uk/bitesize/guides/zghmp39/revision/1) |