The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

01a Transport in Cells

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	Support
Lesson 1: Diffusion	Students will know how to calculate and compare surface area: volume Students will know why exchange surfaces in transport systems of multicellular organisms are important Students will learn that the small intestine has a specialised exchange surface to absorb nutrients into the bloodstream. The small intestine is 7m long so the nutrients have plenty of opportunity to be absorbed into the blood. The surface of the small intestine is folded and covered in villi (projections) DO NOT REFER TO THEM AS HAIRS which increase the surface area. In addition, the villi are covered in microvilli which further increase the surface area. The membrane is thin to provide a short diffusion pathway which means the nutrients don't have far to move from the lumen (hole running through a tubular organ) of the small intestine to the blood. There is a good blood supply to ensure the nutrients can easily pass to the blood. Students will learn that gas exchange occurs in the lungs in the alveoli. The alveoli are air sacs which provide a large surface area to allow oxygen to diffuse into the blood and carbon dioxide to diffuse from the blood into the alveoli to be exhaled. The alveoli are surrounded by a network of capillaries to provide a good blood supply and walls of the alveoli are thin to provide a short diffusion pathway. Student will know that gas exchange in fish occurs in the gills which have a large surface area and good blood supply	*Student will have heard the term diffusion in KS3 and should know that this is the method by which particles spread out. They will already know that is someone sprays an aerosol, the particles spread throughout the room and this is an example for diffusion.* Students will know that the air we breathe in contains Nitrogen, Oxygen and Carbon dioxide. We need the oxygen and we breathe out carbon dioxide *Students need to already know that the small intestine is where absorption of nutrients takes place. This means the nutrients move from a high concentration in the small intestine to a low concentration in the blood. Students will know that gas exchange occurs in the lungs and that oxygen is useful and carbon dioxide is a waste product which we breathe out.* *Students need to already know that fish have gills not lungs. Students will know that plants use carbon dioxide from the air and this enters the plant through the leaves and plants take in water through the roots which are underground*		Diffusion Surface area Maintains Villi	https://www.bbc.co.uk/bitesize/guides/zs63tv4/revision/1 https://www.bbc.co.uk/bitesize/guides/zyptv9q/revision/4 https://www.bbc.co.uk/bitesize/guides/zwqycdm/revision/6 *Knowledge Organiser B1* Model of a villi in AG18

	again to allow for efficient gas exchange (Structure of gills is not required for combined science but is for triple). Students will learn that roots have root hair cells which increase the surface area for mineral and water uptake. Students will learn that leaves have a large surface are and holes in the underside if the leaf which allow gases into and out of the leaf for respiration and photosynthesis.				
Lesson 1: Osmosis	Students will learn that Osmosis is the movement of water. Osmosis is defined as the movement of water from a dilute solution to a more concentrated solution across a partially permeable membrane. - A membrane that only lets certain substances pass through. Students will learn that a hypertonic solution is one that contains a higher concentration of solutes than inside the cell. When placed in a hypertonic solution, a cell will lose mass by osmosis- the water will move from a dilute area inside the cell to a more concentrated area outside the cell across the cell membrane. An isotonic solution is one that has the same concentration is the same inside and outside of the cell. This results in no net movement of water so there will be no change in mass. Students will learn that a hypotonic solution is one that contains a lower concentration of solutes than inside the cell and so water will move into the cell by osmosis and the cell will gain mass. Students will be able to plot data and identify the isotonic point of the cell.	*Students will know that cell membranes control what goes into and out of the cell.* *Students will know that when we have a certain volume of a solution; a dilute solution contains a lot of water but few solutes and a concentrated solution contains lots of solutes but only a little water. They will relate this to drinking cordial.* *Students will be able to calculate Mean when given a set of data and use %. Students will be able to draw a suitable scale to plot data and know that the independent variable (the one you change) goes on the X axis and the dependent variable (the one you measure) goes on the Y axis*	Translate mass data into graphical form Use % and calculate % change Plot and interpret graphs	Osmosis Region Partially Permeable	*Knowledge Organiser B1* https://www.bbc.co.uk/bitesize/guides/zs63tv4/revision/4 Onion + salt water plasmolysis practical – see Science Technicians folder, biology CPD
Lesson1: Active Transport	Students will learn that active transport is the movement of substances from a low concentration to a high concentration and this is referred to as 'against a concentration gradient. To do this energy is required from the process of respiration and this is why root hair cells contain lots of mitochondria	*Students will know that respiration is a chemical reaction that occurs in the mitochondria of cells and releases energy to allow living thing to move, grow, keep warm, build compounds* *Students will know that roots take up water for the plant and root hair cells are specialised cells with a large surface area and lots of mitochondria. Students will already know the reactants and products of*		Carrier Protein ATP	https://www.youtube.com/watch?v=AxXN-j6UzOY *Knowledge Organiser B1*

	Students will learn that mineral ions are absorbed into the plant root hair cells by active transport from dilute concentrations in the soil. Students will learn that plants need Nitrate, Phosphates, Potassium Ions and Magnesium ions for healthy growth. Students will learn that sugar molecules are absorbed from lower concentrations in the small intestine to a higher concentration in the blood by active transport. Glucose is a reactant of respiration. Students will create a Venn diagram or table comparing Osmosis, diffusion and active transport and summarise the differences between these 3 processes.	*photosynthesis and be able to write this as a word equation.*			https://www.bbc.co.uk/bitesize/guides/zc7k2nb/revision/8
Lesson 2: Osmosis **Required Practical**	Students will have 5 different concentrations of sucrose solution of different concentrations including distilled water. Students will learn that the units for concentration are moldm-3. Students will label boiling tubes with each different concentration and use a measuring cylinder to measure a certain volume of each concentration of solution and put into the corresponding boiling tube. Students will use a borer to bore cylinder from potatoes and then use a ruler to measure each cylinder to certain length with a ruler and cut it with a knife. Students will learn that using the borer to make cylinders ensures the surface area of the potatoes is the same for each one. Student will use a balance to find the starting mass of each cylinder and record the results in a table. Students will place one cylinder in each boiling tube and start a stopwatch. After a set amount of time, the student will remove the potatoes, pat with a paper towel to remove excess water that could add mass and use the balance to find the end mass of each. These results will be recorded in the table. Students will learn how to calculate change in mass and then % change in mass (because the starting masses were all different) and then plot a graph of their	*Students will know that a balance is used to measure the mass (grams) (don't let them use the word weigh), a stop watch measures length of time (seconds), a thermometer measures temperature (oC) and a ruler measures length (mm)* *Students will know that the independent variable in a practical is the one we change, dependent is the one we measure and the controls we keep the same to ensure results are valid.* *Students will already know that to improve reliability of results we would do the test 3 times, identify any anomalies (don't include these) then calculate the mean change in mass. Students will know that potatoes are made up of plant cells and be able to label the plant cell*	Use appropriate apparatus to record mass and time Use appropriate apparatus and techniques to observe and measure the process of osmosis Measure the rate of osmosis uptake Plan an experiment to test a hypothesis Risk assessment and health and safety Translate mass data into graphical form Form a conclusion from the data Find the isotonic point from a graph. Using scientific theories to explain findings		*Knowledge Organiser B1* https://www.youtube.com/watch?v=itp1Dpz0EnY

	results. Students will form a conclusion and be able to explain the conclusion using the science of osmosis and then use the graph to identify the isotonic point of the potato.				

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

02 – Disease

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	Support
Lesson 1: Communicable (infectious) diseases	Communicable diseases are diseases that spread because they are caused by pathogens Pathogens are microorganisms that cause disease The 4 pathogens are viruses, bacteria, protists and fungi They may infect plants or animals and can be spread by direct contact, by water or by air, sharing dirty needs, unprotected sexual intercourse, insects, dirty drinking water, undercooked/out of date food. The spread of diseases can be reduced or prevented by isolating patients who are ill, using antimicrobial cleaning products/sanitizer, cooking food properly, using condoms, using insect repellents/nets Non-specific defence systems of the human body against pathogens, including the: skin which forms a complete barrier, ciliated cells covered in mucus which traps pathogens and cilia waft to the throat, stomach acid, tears which contain enzymes.	*Students will already know that there are some diseases you can catch from other people and some diseases which you can't catch. Examples could be given.* *Students should have some knowledge of how diseases spread and ways to reduce the spread of disease.*	Describe and evaluate ways of tackling problems (WS1.4)	Microorganisms Pathogens Contaminated Symptoms Communicable	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1
Lesson 2: Viral Diseases	Viruses live and reproduce rapidly inside cells, causing cell damage which causes symptoms of the disease. Because viruses are inside cells, treatment are difficult so vaccinations are used to try to prevent you catching a virus. Measles is a viral disease showing symptoms of fever and a red skin rash. Measles is a serious illness that can be fatal if complications arise. The measles virus is spread by inhalation of droplets from sneezes and coughs. HIV is a sexually transmitted disease. It is spread by sexual contact or exchange of body fluids such as blood by sharing dirty	*Students familiar with concept that all living things are made from cells. Viruses are not cells* *Viruses are extremely small but can make us ill* *Students will have life experiences of having cold/flu which are caused by viruses.*		Symptoms Discolouration Chlorophyll Reading activity- TMV, HIV and Measles	https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1

	needles. It is caused by a virus what destroys white blood cells. Initially causes a flu-like illness. There is no treatment for HIV but antiretroviral drugs can be used to slow the rate at which the virus reproduces . Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers. Tobacco mosaic virus (TMV) is a widespread plant pathogen affecting many species of plants including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves. Chloroplasts are damaged which means there is less chlorophyll to absorb sunlight so less photosynthesis so less glucose made for growth.				
Lesson 3: Bacterial Disease	Bacteria reproduce in the body by binary fission and produce poisons (toxins) that damage tissues and make us feel ill (symptoms). Salmonella food poisoning is spread by bacteria ingested in food, or on food prepared in unhygienic conditions. In the UK, poultry are vaccinated against salmonella to control the spread. Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete. Gonorrhoea is a sexually transmitted disease (STD) with symptoms of a thick yellow or green discharge from the vagina or penis and pain on urinating. It is caused by a bacterium and was easily treated with the antibiotic penicillin until many resistant strains appeared. Gonorrhoea is spread by sexual contact. The spread can be controlled by treatment with antibiotics or the use of a barrier method of contraception such as a condom. Antibiotics are medication that are only used to treat bacterial infections. They are	*Students will have life experiences of having cold/flu which are caused by viruses.*		Binary Fission Antibiotics Penicillin Toxins Discharge Reading activity- Bacterial Infections	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1

	not effective against viruses are viruses are inside cells. The first antibiotic discovered by Alexander Fleming was penicillin. Bacteria can become resistant to antibiotics and: Should only be prescribed when needed The full course should be completed by the patient to reduce the chance of this happening.				
Lesson 4: Fungal Disease	Rose black spot is a fungal disease where purple or blackspots develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. Chloroplasts are damaged which means there is less chlorophyll to absorb sunlight so less photosynthesis so less glucose made for growth. It is spread in the environment by water or wind. Rose black spot can be treated by using fungicides and/or removing and destroying the affected leaves. Athletes foot is a fungal infection. Treated using antifungal cream/powder.	*Students may already know that mushrooms belong to the fungi family and that some can be dangerous. Students should already know that fungi are eukaryotic cells as they have DNA inside a nucleus.* *Students may have heard of athletes foot.*		Mycology Hyphae	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1
Lesson 5: Protist diseases	The pathogens that cause malaria are protists. The malarial protist has a life cycle that includes the mosquito. The mosquito bites and infected person, the protist travels to the liver of the host (the person) where it can reproduce. Infected liver cells burst releasing the protists into the blood infecting the red blood cells. Infected red blood cells burst and more protists are released infecting more red blood cells. If the infected person gets bitten, the protist will be carried to another person via the mosquito (vector). ,Malaria causes recurrent episodes of fever and can be fatal. The spread of malaria is controlled by preventing the vectors, mosquitos, from breeding and by using mosquito nets insect	*KS3-Structure of unicellular cells*	Describe and evaluate ways of tackling problems (WS1.4) WS1.3- Explain why data is needed to answer scientific questions and why it may be uncertain or incomplete/not available	Insecticide Stagnant Parasite Host Vector Fatal	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1

	repellents to avoid being bitten. Insecticides can be used to kill the mosquitos to prevent them from reproducing. Draining stagnant water removed their breeding place.				
Lesson 6: Cancer	Students will be able to describe cancer as the result of changes in the DNA in cells that lead to uncontrolled growth and division. Benign tumours are growths of abnormal cells which are contained in one area, usually within a membrane. They do not invade other parts of the body. Malignant tumour cells are cancers. They invade neighbouring tissues and spread to different parts of the body in the blood where they form secondary tumours. Scientists have identified lifestyle risk factors for various types of cancer. There are also genetic risk factors for some cancers.	*Students will already know that cancer is a disease which can be fatal. Some students may have life experiences relating to cancer.* *Students will know that smoking can cause cancer*		Benign Malignant Carcinogen	
Lesson 7: Life style	Students will know that there is a link between certain lifestyle choices and non-communicable disease: some factors interact to cause disease. The two main groups of factors are lifestyle choice and things that are taken into the body e.g., tobacco smoke or drugs including alcohol. They will know what COPD (chronic obstructive pulmonary disease) and cancer are together with possible factors that result in these diseases.eg., carcinogens result in cancers. Students will know how to describe the risk factors and occurrence of non-communicable disease.	*Students will recall the meaning of the term non-communicable and know some examples (previous lesson) They will know what the term 'risk factor' means and give some examples.*		Interact COPD Obstruct Chronic Pulmonary	
Lesson 8: Plant disease & Defences (Triple Biology only)	Plant diseases can be detected by: stunted growth spots on leaves areas of decay (rot) growths malformed stems or leaves discolouration	*Students will already know that TMV is a plant disease cause by a pathogen* *Students will already know that rose black spot is a fungal disease that affects plants.* *Students should already know that the phloem carries sugars for the plant*	WS1.4- Everyday applications	Mimicry Chlorosis Deterrent Reading Activity- Plant defences	B3 KO TRIPLE ONLY https://www.bbc.co.uk/bitesize/guides/zwkbqhv/revision/1

	the presence of pests. Identification can be made by: reference to a gardening manual or website taking infected plants to a laboratory to identify the pathogen using testing kits that contain monoclonal antibodies. Plants can be infected by a range of viral, bacterial and fungal pathogens as well as by insects. Students should review tobacco mosaic virus as a viral disease, black spot as a fungal disease and learn that aphids are insects which pierce the phloem to obtain glucose from the plant and as a consequence the plant would not have as much glucose for growth. Plants can be damaged by a range of ion deficiency conditions: stunted growth caused by nitrate deficiency (yellow leaves) chlorosis (yellow leaves) caused by magnesium deficiency. Nitrate ions are needed for protein synthesis and therefore growth, and magnesium ions needed to make chlorophyll. If no chlorophyll is made then photosynthesis cannot take place so no glucose is produced and so no/poor growth Plants have Physical defence responses to resist invasion of microorganisms. •• Cellulose cell walls. •• Tough waxy cuticle on leaves. •• Layers of dead cells around stems (bark on trees) which fall off. Chemical plant defence responses. •• Antibacterial chemicals. •• Poisons to deter herbivores. Mechanical adaptations. •• Thorns and hairs deter animals.				

	•• Leaves which droop or curl when touched. •• Mimicry to trick animals.				

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

03 – Transport systems

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	Support
Lesson 1: Components of blood	Students will know that blood is a mixture of a watery solution called plasma, red blood cells, white blood cells and platelets. They will know that the function of plasma is to dissolve substances e.g., products of digestion and waste products e.g., urea and carbon dioxide and also to carry hormones. The function of red blood cells is to carry oxygen because the red blood cells have haemoglobin. White blood cells have the function of fighting disease (see topic B3).	*Students will recall that blood carrying oxygen is called oxygenated blood. Blood without oxygen is known as deoxygenated blood. Students will recall that red blood cells and white blood cells are specialised cells. They will describe that red blood cells have no nucleus and are packed with haemoglobin; white blood cells have enlarged nuclei and this allows them to fight infections.*		Plasma Platelets Urea Hormone Haemoglobin Aperture Oxygenated enlarged	Knowledge Organiser B2
Lesson 2: Blood vessels	They will know that there are three types of blood vessel: capillaries, arteries and veins. Capillaries are narrow aperture and have walls that are one cell thick; this makes them suitable vessels for exchange of substances. Arteries have muscular walls that assist with blood flow (emphasis is NOT to be 'pump blood') Veins are wider lumen but have valves that prevent backflow of blood and therefore maintain circulation in one direction. Students will know how to relate structure of blood vessel to the role played by the vessel e.g., size of lumen, type of wall.	*Students will now that blood travels round our body in tubes.* *Students will know that arteries carry blood away from the heart and veins bring blood to the heart.*		Lumen Capillaries	
Lesson 3: The heart and Circulation.	Students will know that the heart has 4 chambers known as right & left atria and right & left ventricles. They will know that the main vein enters the heart at the right atrium. The main artery enters the heart at the left atrium. The blood leaving the right ventricle follows the pulmonary artery and	*Students need to know the terms oxygenated and deoxygenated blood. They need to recall that all muscles need oxygen and glucose the function. Blood delivers oxygen and glucose and blood removes waste e.g., carbon dioxide to prevent toxins building up that could damage cells. They must know that arteries travel away*	Making Observations of biological specimens and produce labelled scientific drawings Using apparatus correctly Working Safely in the lab Making & Recording observations	Chamber Ventricle Atrium Pulmonary Coronary Cardiac Toxins Vena cava	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/zhnk7ty/revision/4 4 models of the heart in AG18

	the blood returning from the lungs travels in the pulmonary vein. They will know that the heart is a muscle. The walls of the heart on the left side are thicker because they need to use more force to push blood to the furthest parts of the body. The muscle is supplied with oxygen and nutrients by its own blood vessels. The main vessel supplying the heart muscle (cardiac muscle) is called the coronary artery. CRITICAL that students learn the exceptions that the pulmonary artery carries deoxygenated blood and the pulmonary vein carries oxygenated blood. Students will know how to describe the path that blood takes as it travels around the body. They will state that blood leaves the heart in the aorta and then travels around the network of blood vessels towards respiring cells in vessels called arteries. Blood in the arteries is loaded with oxygen and glucose that respiring cells need. To reach the cells, blood passes from arteries into capillaries where exchange of substances occurs because the walls of capillaries are very thin. Oxygen and glucose leave the blood and enter the respiring cells. Meanwhile, carbon dioxide passes from the cells into the blood to be carried away. The blood that leaves the capillaries is now called deoxygenated blood. This travels back towards the heart in vessels called veins eventually entering the heart in a main vein called the vena cava. Once in the heart, deoxygenated blood moves from the right atrium to the right ventricle and then leaves the heart to travel to the lungs in a new vessel known as the pulmonary artery. From the lungs, blood returns to the heart in a vessel known as the pulmonary vein. Students will learn that a typical heart beats approximately 60 - 80 times per minute at rest and that during exercise this can increase to approximately 140 beats per	*from the heart and veins travel towards the heart together with the idea that arteries are carrying oxygenated blood and veins carry deoxygenated blood. (* exceptions introduced in this lesson)*		Aorta Pace-maker	Can use a glass stirring rod to show blood flow through a dissection heart model

	minute. The reason for the increase is to provide MORE oxygen and glucose to respiring cells.				
Lesson 4: Lungs & gas exchange	Students will be able to name each part of the human breathing system: trachea, bronchus, bronchioles, alveoli, diaphragm, intercostal muscles. Students will know the role of each part: the muscles are involved in changing the volume of the lung capacity i.e. breathing in and out; the ribs protect the delicate lungs by encasing them; the trachea, bronchus, bronchioles and alveoli are the passageways that air travels through to eventually get into our blood. Gas exchange occurs in the tiny alveoli. The alveoli increase the surface area of our lungs to ensure lots of oxygen can pass through into the blood. Inhalation is when air is breathed in. Exhalation is when gas is breathed out. Students will know how the composition of gas changes between breathing in and then breathing out (more oxygen before gas exchange. More carbon dioxide after gas exchange; nitrogen is not absorbed into the blood. They will know how the rate of breathing changes during exercise and why this is necessary. They will describe how the alveoli are adapted for gas exchange (Topic B1).	*Students will know the composition of air: 78% nitrogen, 20%oxygen and less than 1% carbon dioxide.* *They will know how alveoli are adapted for gas exchange: moist membranes, increased surface area, thin epithelium*		Trachea Alveoli Diaphragm Intercostal Inhale Exhale Composition	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/zpd4wxs/revision/1 Lungs bell jar model
Lesson 5: Coronary heart disease	Students will know that coronary heart disease is an example of a non-communicable disease (it cannot be caught or spread to other people) It is a condition that affects the heart and the heart's blood vessels and it results from blocked coronary arteries. Blockages mean that blood carrying vital oxygen and glucose cannot reach the cardiac muscle. Blockages result from persistent poor diet and other lifestyle	*Recall the names of parts of the heart.* *Know that the heart has its own blood supply: coronary arteries* *Recall that all muscles need a supply of oxygen and glucose to function via respiration.* *Recall from KS3 that a healthy diet maintains optimum body conditions/function. Poor diets affect how our bodies form and perform.* *Some diseases can be spread (communicable) and others cannot be transmitted (non-communicable).*	WS 1.4 WS 1.3 Evaluate methods of treatment bearing in mind the benefits and risks associated with the treatment.	Coronary Artery Cholesterol Obesity Pressure Risk factor Cardio-vascular Stent Statin	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/zhnk7ty/revision/6#:~:text=The%20coronary%20arteries%20supply%20blood,heart%20muscle%20is%20cut%20off. Models of this in AG18 & Prep room 1 Coronary artery can be found on heart dissection samples

	choices e.g., high cholesterol, smoking, high salt intake, high blood pressure, low exercise levels, obesity AND in families where there is a history of CHD. The term 'risk factor' means things that increase your chance of developing a condition'. Cardio-vascular disease (CVD) includes CHD but also refers to strokes, aortic disease and arterial disease. Students will know how CHD can be treated with mechanical devices called stents or with chemical intervention known as statins. The stent is a wire mesh that supports the walls of the artery and maintain a thoroughfare for red blood cells, etc. Statins are drugs that reduce the formation of blockages in blood vessels and lower cholesterol levels. Students will know how to evaluate both alternatives.				
Lesson 6: Plant organs and leaf structure	Students will know that the leaf is a plant organ along with roots, stem and flowers. They will know that it is made of distinct and observable tissues known as upper epidermis, palisade mesophyll, sponge mesophyll, lower epidermis (including guard cell pairs surrounding the spaces known as stomata). They will know that the upper surface is often protected by a waxy cuticle. They will know the role of guard cells in supporting gas exchange and preventing unnecessary water loss. They will know the role of root hair cells in facilitating water uptake.	*They will know that a plant is a multicellular organism with 4 main organs: leaf, roots, stem and flower. They will know that specialised cells known as phloem and xylem are located in the stems of plants. They will recall the adaptation of root hair cells to support water and mineral uptake.*		Epidermis Mesophyll Stomata Humidity	Knowledge organiser B2
Lesson 7: Xylem and Phloem	Students will know how water is moved(transpiration) from the soil through the roots, up the stem and into the leaves to support cells that are carrying out photosynthesis. They will know how the phloem is involved in movement of glucose (translocation) to all parts of the plant to support life processes. Students will learn how various factors affect the rate of these transport processes e.g., humidity, air movement, air temperature.	*Students will already know that the stem support the plant ensuring it is upright. The stem also carries water from the roots up to the rest of the plant.*		Phloem Xylem Transpiration Translocation	

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

04 Digestive system

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	Support
Lesson 1: Digestive system, definition and bio mols.	Students will know that food travels through the digestive system passing through the following organs in sequence: mouth, oesophagus, stomach, small intestine, large intestine and leaves via the anus. They will know that enzymes are added break down the food. They will know that the stomach secretes HCl and the liver produces bile which is stored in the gall bladder. Students will know that digestion involves the chemical breakdown of large insoluble molecules that cannot be absorbed into small soluble molecules that can be absorbed.	*Students need to already know that the body makes chemicals called enzymes. In Y7 they will have covered the names of the organs involved in the digestive system.* *Students need to already know how small intestines are adapted for optimum exchange of substances (Y10, topic 1)*		Oesophagus Pancreas Enzyme Saliva Gastric juice Amylase Carbohydrase Protease Lipase Substrate Products Insoluble Villi Secrete absorb	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/z89mk2p/revision/1 Bums to gum 2 models of torsos Large water bottle with holes & a long 'food molecule'
Lesson 2: Food test lesson 1 **Lesson 3: Food test lesson 2**	Students will know that Benedict's reagent is used to test for glucose: if present it will change from clear blue to brick red precipitate. Biuret solution is the reagent to demonstrate the presence of protein; the positive test result is a lilac solution. Ethanol is the reagent used to show the presence of fats; a positive result is observed if there will be a cloudy white precipitate. Students will know how to prepare samples of food to be tested with the reagents listed above. They will use a pestle and mortar to grind the food to a paste. They will filter the mixture to remove insoluble material. They will use the filtrate test with individual reagents using a fresh sample for each reagent. They will work safely with the chemicals by referring to hazard symbols and CLEAPPS wallets on display in laboratories. They will record all observations in a suitable results table.	*Students need to already know that there are three main nutrients in food: carbohydrates, proteins and fats. These are the basic molecules needed by humans.* *Students need to already know how to use a pestle and mortar; how to use a filter paper with a funnel; how to work safely with apparatus and chemicals in a laboratory. They will be able to design a suitable results table with clear column headings (name of reagent) and labels for rows (name of food being tested.)*	Using Apparatus Working safely Making and recording observations	Reagent Precipitate Pestle and mortar	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/zs9krwx/revision/2 Banana food test with starch molecules & sugar – see science technicians folder, biology CPD

Lesson 5: Enzymes	Students will know that enzymes are biological catalysts. They speed up the chemical digestion of nutrients in food. They will know that enzyme models involve a shape in the structure known as the active site. They will know that some enzymes work best in high pH whilst others work better in low ph. They will know that all enzymes work best at an optimum temperature. In humans, the optimum is 37oC.	*Students need to already know that food has key nutrients known as carbohydrates, proteins and fats (lipids). They will know the products of digestion: amino acids, fatty acids and glycerol and glucose. Students need to already know how to interpret graphs by reading the labels on the x and y axis to deduce what the changes on the graph represent.*	WS 1.2 Students should be able to use other models to explain enzyme action.	Enzyme Catalyst Fatty acid Glycerol Active site Denatured Optimum	Knowledge Organiser B2 https://www.bbc.co.uk/bitesize/guides/z88hcj6/revision/1 Cat milk practical Natural sources of enzymes – including pineapple on jelly – see science technicians folder, biology CPD
Lesson 6: Factors affecting enzyme activity	They will know that the active site can change shape in different PH or at different temperatures. This change may affect how well the enzyme can breakdown substrates. We say the enzyme of denatured. Students will know how enzymes are affected by changes in the pH or temperature. They will know that when temperatures exceed the optimum, the enzyme becomes denatured.				Photographic film practical – see science technicians folder, biology CPD
Lesson 7: How do enzymes work	Student will know that there are 3 groups of enzymes: carbohydrates, proteases, and lipases. They will state that amylase from the salivary gland (a carbohydrase) digests starch into glucose; protease produced by the stomach and pancreas digests protein into amino acids; lipase made in the pancreas breaks down fats into fatty acids and glycerol. Bile is not an enzyme but aid the digestion of fat by emulsifying the fats providing a larger surface area for lipase to act	*Bile helps to digest fat*		Amylase Protease Lipase	https://www.youtube.com/watch?v=gUncqL1ul8Q
Lesson 8: Required Practical - effect of pH on enzyme activity	Students will know that we can simulate digestion in a test tube using enzyme and substrate solution. We can use the model to investigate optimum conditions for amylase. They will know that a spotting tile and a pipette are used to when testing samples because only small quantities are required. They will evaluate what a suitable time interval would be between taking samples in order to ensure that suitable data is collated.	*Students will know the 3 types of variable (Independent + the factor that is being investigated, dependent = the factor that can be measured to allow us to see the effect and control = factors that must stay the same throughout the investigation.) They will recall that the enzyme called amylase controls the breakdown of starch into glucose. They will know that iodine can be used to identify the presence of starch and that a positive result involves the orange colour changing to blue-black. They will*	AID CAR Forming a conclusion and explaining results using high level scientific terminology Presenting results in graphical form Further investigations	Simulation Model Substrate Enzyme Pipette Interval	Knowledge organiser B2

	Students will know how to use iodine solution to demonstrate that starch is or is not present in a solution. They will know how to use the hazard symbols and CLEAPSS cards to ensure safe practical work. They will know how to use a spotting tile to track the colour changes over time. They will know how to interpret qualitative data in their results in order to infer the optimum pH for amylase activity.	*recall that room temperature is not the optimum temperature for enzymes and link this to the need to conduct the main parts of the activity in a water bath (apart from the sampling in the spotting tile). Students will know how to use CLEAPSS safety cards to carry out risk assessments. Students will know how to use AIDCAR to identify the apparatus, variables (independent, dependent and control): pH, time for the reaction to be complete and then control concentration, temperature, volumes.*			
Lesson 9: Adaptations for efficiency	Absorption occurs in the small intestine. The small intestine has structures known as villi that increase the surface area that facilitates passage of the products of digestion into the blood. Students will know how the small intestine is adapted for absorption of soluble products of digestion. They will describe the thin walls provide a short diffusion pathway, good blood supply maintains a concentration gradient, villi and microvilli provide a large surface area, lots of mitochondria to release energy for active transport of nutrients.			Villi Microvilli Concentration gradient	https://www.youtube.com/watch?v=1773d-z6jil

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

05 Bioenergetics

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	Support
Lesson 1: Photosynthesis	Photosynthesis is represented by the equation: carbon dioxide + water ->glucose + oxygen Students should recognise the chemical symbols: (Light & Chlorophyll can be above& below the arrow) 6CO2 + 6H2O ->6O2 + C6H12O6. Students should be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.	*Plants are producers. They produce their own food through photosynthesis. He reactants in, and products of, photosynthesis, and a word summary for photosynthesis* *The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere* *The adaptations of leaves for photosynthesis.*	WS 4.1 Use scientific vocabulary, terminology and definitions.	Endothermic - accompanied by or requiring the absorption of heat. Reactant – A substance which takes part in a reaction. Product – A substance formed as a result of a chemical reaction.	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser
Lesson 2: Factors that affect the rate of photosynthesis	Students should be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyllin the rate of photosynthesis. Students should be able to: Measure and calculate rates of photosynthesis Extract and interpret graphs of photosynthesis rate involving one limiting factor Plot and draw appropriate graphs selecting appropriate scale for axes Translate information between graphical and numeric form. (HT only) These factors interact and any one of them may be the factor that limits photosynthesis. (HT only) Students should be able to explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor. (HT only) Students should understand and use inverse proportion. the inverse square law and light intensity in the context of	*The reactants in, and products of, photosynthesis, and a word summary for photosynthesis* *The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere* *The adaptations of leaves for photosynthesis.*	(HT Only) - WS 1.4 Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based. WS 4.1 Use scientific vocabulary, terminology and definitions.	Chlorophyll - a green pigment, present in all green plants. Concentration - the relative amount of a given substance contained within a solution or in a particular volume of space. Pigment - the natural colouring matter of animal or plant tissue. Limiting - setting or serving as a limit to something	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser

	photosynthesis. (HT only) Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit. MS 3a, 3d (HT only) WS 1.4 • Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses. Evaluate the use of greenhouses and hydroponics in terms of economics				
Lesson 3: **Required practical** **Activity 5: investigate the effect of light intensity on the rate of photosynthesis** **HIGHER ONLY**	Required practical activity 5: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed. Students will understand and use inverse proportion – the inverse square law and light intensity.	*Control, independent & dependant variables. -The reactants in, and products of, photosynthesis, and a word summary for photosynthesis* *-The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere* *-The adaptations of leaves for photosynthesis.*	Apparatus used to measure O2 gas production (variables) Using a thermometer to monitor temperature Rate of production of gas Test a hypothesis based on scientific theories/explanations Repeatability Record observations Processing data into graphical form Inverse square law	Intensity – the quality or state of being intense Aquatic – relating to water.	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.youtube.com/watch?v=id0aO_OdFwA https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser

Lesson 4: Uses of glucose.	The glucose produced in photosynthesis may be: -used for respiration converted into insoluble starch for storage used to produce fat or oil for storage used to produce cellulose, which strengthens the cell wall used to produce amino acids for protein synthesis. To produce proteins, plants also use nitrate ions that are absorbed from the soil. Students will use the Red Stripy, Cats mnemonic to recall the uses.	*Students will know that glucose is a product of photosynthesis.*	Testing leaves for starch		https://www.youtube.com/watch?v=KIqMBY51YrM
Lesson 5: Aerobic Vs Anaerobic respiration.	<u>Aerobic respiration</u>: • Students should be able to describe cellular respiration as an exothermic reaction which is continuously occurring in living cells. Respiration occurs in the mitochondria. • Student will be able to recognise why breathing is different to respiration • Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen), to transfer energy. • Organisms need energy for: Chemical reactions to build larger molecules Movement Keeping warm. • Aerobic respiration is represented by the equation: glucose + oxygen carbon dioxide + water • Students should recognise the chemical symbols: C6H12O6, O2, CO2 and H2O. Students will know that the reactants (glucose) come from eating and (oxygen) breathing, <u>Anaerobic</u>:	*Students will already know the parts of the cell in order to recognise mitochondria are the site of respiration and the cell membrane controls what enters and leaves the cell.* *Students will know the lungs are part of a system called the respiratory system. This often causes the misconception that breathing and respiration are the same thing.* • *Cellular respiration* • *Aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life* • *The process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration* *The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism*	WS 4.1 Use scientific vocabulary, terminology and definitions.	Aerobic - relating to, involving, or requiring oxygen. Breathing – the process of taking air into and expelling it from the lungs. Respiration - a chemical reaction which occurs in all living cells, releasing energy from glucose. Anaerobic - relating to, involving, or requiring an absence of oxygen	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser

	• Anaerobic respiration in muscles is represented by the equation: glucose lactic acid • As the oxidation of glucose is incomplete in anaerobic respiration much less energy is transferred than in aerobic respiration. . Compare and contrast aerobic and anaerobic respiration.				
Lesson 5b Fermentation of Yeast	• Anaerobic respiration in plant and yeast cells is represented by the equation: glucose -> ethanol + carbon dioxide Anaerobic respiration in yeast cells is called fermentation and has economic importance in the manufacture of bread and alcoholic drinks		Investigating the effect of temperature on fermentation	Fermentation	
Lesson 6: Changes during exercise	• During exercise the human body reacts to the increased demand for energy. • The heart rate, breathing rate and breath volume increase during exercise to supply the muscles with more oxygenated blood. If insufficient oxygen is supplied anaerobic respiration takes place in muscles. The incomplete oxidation of glucose causes a build-up of lactic acid and creates an oxygen debt. During long periods of vigorous activity muscles become fatigued and stop contracting efficiently. • Investigations into the effect of exercise on the body. (HT only) Blood flowing through the muscles transports the lactic acid to the liver where it is converted back into glucose. Oxygen debt is the amount of extra oxygen the body needs after exercise to react with the accumulated lactic acid and remove it from the cells.	• Heart Rate and breathing rate increase during exercise. Blood transport oxygen around the body.		Heart rate – the speed at which the heart beats. Breathing rate - The number of breaths you take per minute.	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser

Lesson 7: Metabolism	• Students should be able to explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids. • Metabolism is the sum of all the reactions in a cell or the body. • The energy transferred by respiration in cells is used by the organism for the continual enzyme-controlled processes of metabolism that synthesise new molecules. • Metabolism includes: •• conversion of glucose to starch, glycogen and cellulose •• the formation of lipid molecules from a molecule of glycerol and three molecules of fatty acids •• the use of glucose and nitrate ions to form amino acids which in turn are used to synthesise proteins •• respiration •• breakdown of excess proteins to form urea for excretion. All of these aspects are covered in more detail in the relevant specification section but are linked together here.	• *aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life* • *A word summary for aerobic respiration* • *The process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration* *The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.*	WS 4.1 Use scientific vocabulary, terminology and definitions.	Metabolism - The sum of all the reactions in a cell or the body These reactions synthesise (make) molecules or break them down and involve enzymes Enzyme – A Biological catalyst which speeds up chemical reactions.	https://www.bbc.co.uk/bitesize/topics/zgws7p3 https://www.savemyexams.co.uk/gcse/biology/aqa/18/revision-notes/4-bioenergetics/4-1-photosynthesis/4-1-1-photosynthetic-reaction/ B4 Knowledge Organiser

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

06 Defence against disease

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	Support
Lesson 1: Non-specific defences and WBC action	Non-specific defence systems of the human body against pathogens, including the: skin which forms a complete barrier, ciliated cells covered in mucus which traps pathogens and cilia waft to the throat, stomach acid, tears which contain enzymes. If a pathogen enters the body the immune system tries to destroy the pathogen. Pathogens have antigens on their surface. Antigens are proteins found on the surface of pathogens. White blood cells recognise antigens that don't belong to the body and respond to destroy the pathogen White blood cells help to defend against pathogens by: phagocytosis – They engulf and ingest the pathogen antibody production – They make specific antibodies to attach to the antigens on the pathogens to destroy them antitoxin production- Produce antitoxins to neutralise the toxins made by bacterial cells. Antibodies remain in the body providing immunity to a particular disease. Students should be able to describe a graph comparing primary and secondary response.	*Students should have some knowledge of how diseases spread and ways to reduce the spread of disease.* *Students will already know that white blood cells are in our blood for fight infections. Students will know the immune system is the system in the body responsible for defending the body against disease. Student will already know the non specific first lines of defence (skin, HCl, mucus, cilia)*	Describe and evaluate ways of tackling problems (WS1.4) Antigens Antibodies Toxins Antitoxins Ingest Enzymes Reading task- White blood cells	Microorganisms Pathogens Contaminated Symptoms Antigens Antibodies Toxins Antitoxins Ingest Enzymes Reading task- White blood cells	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/1 B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/8 https://www.bbc.co.uk/bitesize/guides/zxr7ng8/revision/9 https://www.youtube.com/watch?v=p5OWjdGWN1Q https://www.youtube.com/watch?v=qWSWWPZYGHU
Lesson 2: Vaccinations	Students will learn how the first vaccine was developed by looking at the story of James Phipps. Students should be able to explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population. Vaccination involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies. If	*Students will know that vaccinations are given as a way to reduce the spread of disease* *Students will know that some vaccines have unwanted side effects.*	Processing data into graphical form Interpreting data.	Vaccinations comprehension	B3 infection and response KO https://www.bbc.co.uk/bitesize/guides/z8fkmsg/revision/1 https://www.youtube.com/watch?v=23fQscOSqVU

	the same pathogen re-enters the body the white blood cells respond quickly to produce the correct antibodies, preventing infection. Some people choose not to get vaccinated as they are scared of needles, worried about side effects, it goes against religious beliefs.				
Lesson 4: Discovery and development of drugs	Students will learn the Traditionally drugs were extracted from plants and microorganisms. Painkillers include paracetamol, ibuprofen The heart drug digitalis originates from foxgloves. The painkiller aspirin originates from willow. Penicillin was the first antibiotic discovered by Alexander Fleming from the Penicillium mould. Most new drugs are synthesised by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant. New medical drugs have to be tested and trialled before being used to check that they are safe and effective. New drugs are extensively tested for toxicity, efficacy and dose. Preclinical testing is done in a laboratory using cells, tissues and live animals. Clinical trials use healthy volunteers and patients. Very low doses of the drug are given at the start of the clinical trial. If the drug is found to be safe, further clinical trials are carried out to find the optimum dose for the drug. In double blind trials, some patients are given a placebo.	*Plant adaptations. Chemicals produced by plants are an adaptation to prevent them being eaten* *Drugs are chemicals that effect the body.* *KS3- The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.* *Students may hear the term 'drugs' and have the misconception that all drugs are dangerous.*	Students should be able to describe the process of discovery and development of potential new medicines, including preclinical and clinical testing. WS1.4 Explain everyday applications of science WS1.6 Understand the importance of peer review	Toxicity Efficacy Dosage Antibiotics) Painkillers Placebo Reading Activity: Drugs discovery	B3 infection and response KO

Lesson 5 & 6 – Required practical (efficacy of antiseptics) TRIPLE ONLY CARRY OUT FULL PRACTICAL	Students will learn that bacteria reproduce by a process of binary fission… once every 20 minutes] Students will investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition. Students will learn that aseptic techniques ensure the microorganisms being investigated do not escape or become contaminated with an unwanted microorganism. This can be achieved by: • Wiping bench with disinfectant/alcohol. • Not fully removing the lid . • Using sterile loops when transferring cultures. • Flaming culture bottle necks to prevent contamination. • Sterilising (using an autoclave) or disposing of all used equipment • Incubation at 25oC	• *Discovery of antibiotics by Alexander Fleming involved the use of bacterial growth on petri dishes* • *Antibiotics are only used to treat bacterial infections* • *Students will already know the names of some common antimicrobial cleaning products* • *Students should already know that* πr2 is used to calculate area of a circle. *Students should already know how to express answers in standard form*	In doing this practical student should cover these parts of the apparatus and techniques requirements. AT 1 – use appropriate apparatus to record length and area. AT 3 – use appropriate apparatus and techniques to observe and measure the process of bacterial growth. AT 4 – safe and ethical use of bacteria to measure physiological function and response to antibiotics and antiseptics in the environment. AT 8 – the use of appropriate techniques and qualitative reagents in problem-solving contexts to find the best antibiotic to use or the best concentration of antiseptic to use. **<u>Key opportunities for skills development:</u>** In doing this practical there are key opportunities for students to develop the following skills. WS 2.1 – develop hypotheses about the effectiveness of the antibiotics or antiseptics to be used. WS 2.2 – plan experiments to make observations, test hypotheses and explore phenomena. WS 2.4 – have due regard for accuracy of measurements, and health and safety when using bacterial cultures.	Aseptic techniques Clear zone Zone of inhibition Antimicrobial Reproducible results Reading a method	B3 KO TRIPLE ONLY https://www.youtube.com/watch?v=AlGcpC0aqNU

			MS 5c – calculate cross-sectional areas of bacterial cultures and clear agar jelly using πr2.		
TRIPLE ONLY - Lesson 7: Monoclonal antibodies (HT only)	Monoclonal antibodies are produced from a single clone of cells. The antibodies are specific to one binding site on one protein antigen and so are able to target a specific chemical or specific cells in the body. They are produced by stimulating mouse lymphocytes to make a particular antibody. The lymphocytes are combined with a particular kind of tumour cell to make a cell called a hybridoma cell. The hybridoma cell can both divide and makes the antibody. Single hybridoma cells are cloned to produce many identical cells that all produce the same antibody. A large amount of the antibody can be collected and purified. Students should be able to describe some of the ways in which monoclonal antibodies can be used. Some examples include: for diagnosis such as in pregnancy tests in laboratories to measure the levels of hormones and other chemicals in blood, or to detect pathogens in research to locate or identify specific molecules in a cell or tissue by binding to them with a fluorescent dye to treat some diseases: for cancer the monoclonal antibody can be bound to a radioactive substance, a toxic drug or a chemical which stops cells growing and dividing. It delivers the substance to the cancer cells without harming other cells in the body. Students are not expected to recall any specific tests or treatments but given	• *White blood cells produce antibodies that stick to microbes' antigens and kill them.*	WS 1.3 Appreciate the power of monoclonal antibodies and consider any ethical issues.	Hybridoma Monoclonal Reading activity- Uses of monoclonal antibodies	B3 KO TRIPLE ONLY https://www.youtube.com/watch?v=vKn8u9MoElY https://www.youtube.com/watch?v=I6jE99Fjbvo https://www.bbc.co.uk/bitesize/guides/zt8t3k7/revision/1 https://www.youtube.com/watch?v=XrUW54Ea598

	appropriate information they should be able to explain how they work. Monoclonal antibodies create more side effects than expected. They are not yet as widely used as everyone hoped when they were first developed.				
TRIPLE ONLY – Lesson 8 – Plant defences	Plant diseases can be detected by: stunted growth spots on leaves areas of decay (rot) growths malformed stems or leaves discolouration the presence of pests. Identification can be made by: reference to a gardening manual or website taking infected plants to a laboratory to identify the pathogen using testing kits that contain monoclonal antibodies. Plants can be infected by a range of viral, bacterial and fungal pathogens as well as by insects. Students should review tobacco mosaic virus as a viral disease, black spot as a fungal disease and learn that aphids are insects which pierce the phloem to obtain glucose from the plant and as a consequence the plant would not have as much glucose for growth. Plants can be damaged by a range of Ion deficiency conditions: stunted growth caused by nitrate deficiency (yellow leaves) chlorosis (yellow leaves) caused by magnesium deficiency. Nitrate ions are needed for protein synthesis and therefore growth, and magnesium ions needed to make chlorophyll. If no chlorophyll is made then photosynthesis cannot take	*Students will already know that TMV is a plant disease cause by a pathogen* *Students will already know that rose black spot is a fungal disease that affects plants.* *Students should already know that the phloem carries sugars for the plant*	WS1.4- Everyday applications	Mimicry Chlorosis Deterrent Reading Activity- Plant defences	B3 KO TRIPLE ONLY https://www.bbc.co.uk/bitesize/guides/zwkbqhv/revision/1

	place so no glucose is produced and so no/poor growth Plants have Physical defence responses to resist invasion of microorganisms. •• Cellulose cell walls. •• Tough waxy cuticle on leaves. •• Layers of dead cells around stems (bark on trees) which fall off. Chemical plant defence responses. •• Antibacterial chemicals. •• Poisons to deter herbivores. Mechanical adaptations. •• Thorns and hairs deter animals. •• Leaves which droop or curl when touched. •• Mimicry to trick animals.				

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

07 Nervous system

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	Support
Lesson 1 - Structure and function of nerve cells	*The 2 systems involved in the control are nervous responses and chemical responses* *A reflex is a fast automatic response that doesn't involve the conscious part of the brain* *Students should recognise the different types of neurones.(Sensory, motor, relay neurones)*	*Nerve cells carry electrical impulses around the body. They are specialised cells that are long and thin and insulated.*		*Homeostasis* *Internal conditions* *Enzymes* *Optimal*	*https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/1* *https://www.bbc.co.uk/bitesize/guides/zprxy4j/revision/1*
Lesson 2 Required Practical Reaction Time	*Students will learn that reaction time is the length of time taken to respond to a stimulus and certain factors can cause a longer or shorter reaction time (not fast or slow)* *Units are milliseconds* *Student need to be aware of the equation used to convert distance into reaction time* $t = \sqrt{(2d/a)}$ *Students should also be able to use a conversion table.*	*Students may already know that alcohol and drugs can affect reaction times.*	*AT1 Use of apparatus to record time* *AT3 Processing data to calculate reaction time* *AT4 safe and ethical use of humans to measure physiological function of reaction time and response to a chosen factor* *WS 2.1 Design a hypothesis* *WS 2.2 Describe a method, identify variables* *WS 2.3 Suggest a method* *WS 2.4 Reducing risk and awareness of Health and Safety*	*Reaction time*	*https://www.bbc.co.uk/bitesize/guides/zprxy4j/revision/4*
Lesson 3 – Reflex arc & Synapses	*A reflex is a fast automatic response that doesn't involve the conscious part of the brain* *The stages are:* *Stimulus- A change in the environment* *Receptors- Cells that detect change* *Sensory neurone- carries the impulse to the CNS* *Relay neurone- connects the sensory and motor neurone in the CNS* *Motor- carries the impulse from the CNS to the effector* *Effector- muscle or a gland* *Response- what the body does* *Students should recognise the different types of neurones.*	*Students will have life experiences of responding quickly to dangers in the environment.* *Students will know that alcohol and drugs affect our nervous system.*		*Receptors* *Coordination centre* *Effectors* *Stimuli* *Reflex* *Synapse*	https://www.youtube.com/watch?v=HiuXfbwND9s

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	Support
HIGHER ONLY	*A synapse is a gap between 2 neurones* *Higher tier students will learn how impulses diffuse across a synapse as a chemical message.*				
TRIPLE ONLY – Lesson 5 - The Brain	*Students will learn that the brain is made of billions of neurones and that different regions are responsible for different functions.* *Students will identify and describe the role of the:* *Cerebral Cortex (Outer layer) which is split into two hemispheres and is highly folded. It controls intelligence, personality, conscious thought and high-level functions, such as language and verbal memory* *Cerebellum- controls balance, co-ordination of movement and muscular activity.* *Medulla which controls unconscious activities such as heart rate and breathing rate,* *Pituitary- master gland* *Hypothalamus which is the regulating centre for temperature and water balance within the body.* *HIGHER ONLY- Students will learn that the brain is a difficult organ to study. Scientists can use non invasive methods to map areas of the brain using electrical stimulation and MRI scanning techniques. EEGs are then created and studied.*	*Students should already know that the brain is part of the CNS*	*WS 1.5 Evaluate the benefits and risks of procedures carried out on the brain and nervous system*	*Hemisphere* *Neurology* *MRI* *EEG* *Non invasive* *Phineas Gage* *Reading Activity*	*https://www.bbc.co.uk/bitesize/guides/zprxy4j/revision/5*
TRIPLE ONLY – Lesson 6 – The eye and Vision	*Students will learn that light enters the eye via the pupil. The cornea refracts light onto the lens which refracts the light onto the retina which contains photoreceptors and it located at the back of the eye. The retina detects light*	*Students will know the eye is the sense organ for vision.* *Students would already have some knowledge af the location of the pupil.* *Students will already know that problems with vision can be correct through the use of glasses or surgery.*	*WS1.2 Interpret ray diagrams* *WS1.4 The use of technologies in science*	*Accommodation* *Concave* *Convex* *Refract* *Myopia* *Hyperopia*	*https://www.bbc.co.uk/bitesize/guides/zprxy4j/revision/7*

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	Support
	and sends an electrical impulse along the optic nerve to the brain. *The sclera is the white part of the eye. The iris is the coloured part of the eye and contains muscles the control the size of the pupil.* *Accomodation is the process of changing the shape of the lens to focus on near or distant objects.* *To focus on a distant object the lens would be flat so only slight refraction, the suspensory ligaments pull tight and the ciliary muscles relax* *To focus on close objects the lens is curved (thicker) so stronger refraction, the suspensory ligaments are loose and the ciliary muscles contract* *Students will learn that Myopia (short sighted cannot see distance the light rays do not focus on the retina correctly which causes a blurred image,* *Students will learn that myopia is corrected using glasses with a concave lens.* *Students will learn that hyperopia (longsighted cannot see close up) the light rays do not focus onto the retina correctly and a blurred image is perceived. This is corrected using glasses with a convex lens. Laser eye surgery or contact lenses are also used to correct problems with vision*	*Students should already know that muscles contract* *Students will describe light as rays and already be able to draw ray diagrams.*			Several models of the eye

The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Biology Year 10

08 TRIPLE advanced Ecology

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	Support
Lesson 1 Classification	*-Students will learn that traditionally living things have been classified into groups depending on their structure and characteristics in a system developed by Carl Linnaeus. Linnaeus classified living things into kingdom, phylum, class, order, family, genus and species. Organisms are named by the binomial system of genus and species.* *-Students will be able to use information given to show understanding of the Linnaean system.* *-Students will learn how to describe the impact of developments in biology on classification systems.* *-Students will learn that when evidence of internal structures became more developed due to improvements in microscopes, and the understanding of biochemical processes progressed, new models of classification were proposed. Due to evidence available from chemical analysis there is now a 'three-domain system' developed by Carl Woese. In this system organisms are divided into:* *1.Archaea (primitive bacteria usually living in extreme environments)* *2. Bacteria (true bacteria)* *3.Eukaryota (which includes protists, fungi, plants and animals).* *-Students will learn that evolutionary trees are a method used by scientists to show how they believe organisms are related. They use current classification data for living organisms and fossil data for extinct organisms.*	*-Students should already know that different organisms can be grouped and classified.* *- Students should already know that scientists do this to make it easier to study them and to make sense of the world and to see if and how organisms are related or not.* *-Students should already know that due to new scientific findings the classification system has evolved over time.* *-Students should have already studied classification in Ks2 and be familiar with the Carl Linnaeus classification system (studied taxonomy) and the modern classification system.* *- Students should already know that domain is the highest rank and kingdom is the 2nd highest rank based on the modern classification system.* *-Students should already know that the binomial naming system of a species consists of both the genus and species of the organism.* *- Students should already know that the five kingdoms of classification are; Plantae, animalia, fungi, protoctista and prokaryotae*	*-Understand how scientific methods and theories develop over time.* *-Interpret evolutionary trees.*	*Classification* *Taxonomy* *Binomial naming system.* *Evolutionary trees*	*https://www.bbc.co.uk/bitesize/topics/zppffcw* Classification sorting tiles in prep room 1
Lesson 2 – Adaptations and extremophiles	• Students will know that organisms are adapted to live in their natural environment. Organisms have features (adaptations) that enable them to	***Students need to already know that environment can affect the needs of living things, the arctic is Tundra (cold), the desert is arid (hot and dry).***		*Adaptation,* *Physical adaptation,* *Behavioural adaptation,*	*https://www.bbc.co.uk/bitesize/guides/z9pd6yc/revision/9*

	survive in the conditions in which they normally live. These adaptations may be structural, behavioural or functional. Students will know how to explain an animal is adapted and how this depends on the animal habitat. Students will know that plants are adapted to live in their natural environment. Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations may be structural, behavioural or functional. Some organisms live in environments that are very extreme, such as at high temperature, pressure, or salt concentration. These organisms are called extremophiles. Bacteria living in deep sea vents are extremophiles.	*Students need to already know that Plants are living things and can respond the environment.*		*Functional adaptatioln, structural adaptation, constrict, extremophile* *Extremophiles* *Waxy Cuticle* *Transpiration* *Photosynthesis* *Humidity*	https://www.youtube.com/watch?v=DTQtoZwIdN8 https://www.youtube.com/watch?v=2Kt_6BwYtG4 Bird beaks practical
Lesson 3 – Feeding relationships and predator prey cycles	• Students will know that within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community. This is called interdependence. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant. Students will know how to extract and interpret information from charts, charts graphs and tables relating to the interaction of organisms within a community.	*Students need to already know that food chains show energy transfer between organisms. they can provide appropriate suggestions of what organisms are competing for.*	Extract and interpret information from charts, graphs and tables.	*Organism* *Species* *Community* *Interdependence*	https://www.bbc.co.uk/bitesize/guides/z9nwtv4/revision/2 https://www.kayscience.com/d/predator-prey-relationships-2
Lesson 4 - Sampling Techniques RP	• Students will know that a range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem.	• *Students need to already know that Predators are at the top of a food chain. Producers start a food chain as they can photosynthesise* *Students need to already know how to interpret graphs, calculate means plot and draw appropriate graphs selecting appropriate scales for the axes*	Apply a range of techniques, including the use of transects and quadrats, and the measurement of an abiotic factor. Estimates of population size based on sampling.	*Abundance* *Distribution* *Habitat* *Bias* *Transects* *Quadrat* *Biotic*	https://www.bbc.co.uk/bitesize/guides/z83qcj6/revision/3 https://www.kayscience.com/d/quadrats-using-transects-2

	Students will know how to measure the population size of a common species in a habitat such as daisies. Use sampling techniques to investigate the effect of a factor on the distribution of this species.		Develop hypotheses regarding distribution of a species as a consequence of a factor. Plan experiments to test hypotheses on distribution. Apply a range of techniques, including the use of transects and quadrats, and the measurement of an abiotic factor.	*Abiotic*	*https://www.kayscience.com/d/quadrats-calculating-percentage-cover-2*
TRIPLE ONLY – Pyramid of numbers and Biomass	Describe pyramids of biomass, Explain how biomass is lost between the different trophic levels. Students should be able to calculate the efficiency of biomass transfers between trophic levels by percentages or fractions of mass. Students will be able to explain how this affects the number of organisms at each trophic level. Losses of biomass are due to: • not all the ingested material is absorbed, some is egested as faeces • some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine. Large amounts of glucose are used in respiration.	Producers are mostly plants and algae. Pyramids of biomass reveal the mass of living material at each stage in a chain.	Calculate the efficiency of biomass transfer between trophic levels.	*Biomass* *Ingested* *Respiration* *Trophic* *Egested* *Efficiency*	https://www.youtube.com/watch?v=sgh1OWm0oTQ https://www.bbc.co.uk/bitesize/guides/zs7gw6f/revision/3
TRIPLE ONLY - Investigating decay TRIPLE	Temperature, water and availability of oxygen affect the rate of decay of biological material. Students should be able to: • calculate rate changes in the decay of biological material • translate information between numerical and graphical form • plot and draw appropriate graphs selecting appropriate scales for the axes. Gardeners and farmers try to provide optimum conditions for rapid decay of waste biological material. The compost produced is used as a natural fertiliser for growing garden plants or crops. Anaerobic decay produces methane gas. Biogas	*Materials decay given the correct conditions. Composting breaks down materials to release nutrients*		*Fertiliser* *Appropriate* *Optimum* *Anaerobic* *Decay* *Decomposition*	https://www.bbc.co.uk/bitesize/guides/zy7gw6f/revision/1 https://www.youtube.com/watch?v=jWMtWJyFaPU

	generators can be used to produce methane gas as a fuel.				