Crewe Engineering & Design UTC

Curriculum Summary - Biology (Year 10)

Autumn

B9: Respiration
In this chapter students will study respiration and should be able to recall that this is one of the most important processes in living cells. They should be able to describe the process of respiration and write the word equation, and higher-tier students should also be able to write the balanced symbol equation.

Students will look at mitochondria as the site of respiration, linking this with B1.2 *Animal and plant cells* and cell specialisation in B1.4 and B1.5. Students should be able to list examples of living processes that need the energy released from respiration. They should link this with work in B1.9 *Active transport*, in particular the transport of mineral ions into the root hair cell.

Students will study the response of humans to exercise, including changes in heart rate, breathing rate, and breakdown of glycogen, all to increase the rate of respiration in muscle cells. They should link this with work on the heart and blood vessels in B4 *Organising animals and plants*.

In studying anaerobic respiration, students should be aware of this process in mammalian muscles and be able to write the word equation. Students should be aware that anaerobic respiration occurs in yeast cells and some plant cells. They should know that fermentation is an economically important reaction and be able to write the word equation, with higher-tier students knowing the balanced symbol equation for fermentation. Higher-tier students should also be able to link aerobic respiration in mammalian muscles to oxygen debt.

Students will study metabolism and should be able to list common metabolic reactions. They should link these with B8.1 *Photosynthesis* and B8.3 *How plants use glucose*. Finally higher-tier students should recall the roles of lactic acid, urea formation, and the liver.

B1: Cells and organisation
In this chapter, students will learn about microscopy and cells, and will be able to explain how the development of microscopy techniques, particularly electron microscopy, has enabled scientists to investigate the sub-cellular structures. Students will be able to differentiate between animal and plant cells, differentiate between eukaryotic and prokaryotic cells, and identify adaptations of specialised animal and plant cells. They will also be able to use the formula M=I/A.
Students will also learn about the transport of material into and out of cells by diffusion, osmosis, and active transport. It is important that students understand that in diffusion material moves with a concentration gradient (from an area of high concentration to an area of low concentration); in active transport material moves against a concentration gradient (from an area of low concentration to an area of high concentration); and that osmosis is the movement of water across a partially permeable membrane to reduce a concentration gradient.
When studying the processes for transferring material, students will also be able to explain how adaptations of exchange surfaces and link these to the processes of material transport.

B2: Cell division
In this chapter, students will learn about the process of cell division and after finishing the chapter should be able to describe the three overall stages of the cell cycle. Students will develop an understanding of mitosis as a stage within the cell cycle, but do not need to know about the different phases of the mitosis stage. They should be able to state the genetic material in the nucleus is doubled *before* the cell divides into two.

Along with cell division, students will study cell differentiation, and students should be able to make connections between cell differentiation and the specialised cells and adaptations they studied in *Chapter B1 Cell structure and transport*.

Students will also learn that stem cells are undifferentiated cells that have the potential to become a specialised cell within an organism. Students should be able to describe some potential uses of stem cells, as well as the disadvantages and objections to the use of stem cells, particularly in relation to medical treatments.

Crewe Engineering & Design UTC

Curriculum Summary - Biology (Year 10)

Spring

B3: Organisation and the digestive system

In this chapter, students will learn about the principles of organisation. Building on their knowledge of differentiation and specialisation of cells, they should be able to define a tissue, an organ, and an organ system. They will study the human digestive system as an organ system in which several organs work together to digest and absorb food, breaking down large insoluble molecules so they can be absorbed into the bloodstream. They should link this with earlier work on diffusion and exchange surfaces in B1 *Cell structure and transport*.

Students should understand the hierarchical organisation of the digestive system – for instance, the stomach is one organ, made up of muscular tissue, glandular tissue, and epithelial tissue, which digests food (especially protein).

In studying chemical digestion, students should recognise carbohydrates, proteins, and lipids as large molecules that need to be digested and be able to name the molecules they are broken down into. They should be familiar with the enzymes that digest carbohydrates, proteins, and lipids, along with the sites of production of these enzymes in the digestive system.

By the end of the chapter, students should be familiar with enzyme action and understand that enzymes are proteins with a specific shape including the active site. They should recall the lock and key model in which the substrate has a specific shape complementary to the active site, allowing it to bind to the active site where the reaction takes place, releasing products. They should be able to define enzymes as biological catalysts that are reused after each reaction. Students will study the effect of high temperature and extremes of pH on enzymes in changing the active site, which denatures the enzyme. They should be aware of how each part of the digestive system is adapted to provide an optimum pH for each enzyme, including the role of bile in the small intestine.

B8: Photosynthesis

In this chapter, students will study photosynthesis in both plants and algae. They should be familiar with the word equation for photosynthesis, and the symbol equation in the case of higher-tier students. They should be aware that photosynthesis is an endothermic reaction.

Students will study the adaptations of leaves to achieve maximum efficiency in photosynthesis. They should link this work with B1.2 *Animal and plant cells*, B1.5 *Specialisation in plant cells*, and B4.6 *Tissues and organs in plants*. Students will study factors that affect the rate of photosynthesis. They should understand the concept of limiting factors. They should have carried out data interpretation exercises and be able to explain the results. Higher-tier students should understand that that any one factor could become limiting as the factors interact. These students should be confident in analysing two or three factors displayed on a graph and deciding which factor is limiting. They should be confident describing the inverse square law as applied to light intensity.

All students should be aware of the fate of glucose – its use in respiration, and how it can be assimilated into starch and cellulose. They should link this with B1.2 *Animal and plant cells*, B1.7 *Osmosis*, and B9 *Respiration*. Students should also consider the need for nitrate ions as well as glucose to make proteins, and how glucose can be used to make lipids. They should link this with B3.3 *The chemistry of food* where they carried out food tests.

Finally, students will consider the use of greenhouses and study how the conditions can be monitored and manipulated to achieve the highest rate of photosynthesis. Higher-tier students should have an appreciation of the economics of increasing the rate of photosynthesis – they should be aware that using a greenhouse is expensive and weigh it up against the profit gained in increased biomass.

Crewe Engineering & Design UTC

Spring Page 2

B4: Organising animals and plants

In this chapter, students will learn about the organisation of animals and plants. They should be able to recognise the components of blood, describe their functions, and summarise the process of blood clotting. They should recognise the three main types of blood vessel, link their structures with their functions, and understand the importance of a double circulatory system.

In studying the heart, students should be able to describe the main structures of the human heart and their functions. They should be aware of problems that can develop in the blood vessels and their treatments. They should know how the heartbeat is maintained by the pacemaker, and why some people may have problems with their heart and may need an artificial pacemaker or artificial heart. Students should be able to compare different treatments for heart problems.

Students will study breathing and gas exchange and should recognise the main structures of the gas exchange system along with their functions. They should know that gas exchange happens in the alveoli and describe adaptations of alveoli. They should be able to describe the processes of ventilation and gas exchange and the differences in composition of inhaled and exhaled air.

In studying plant tissues and organs, students should be familiar with the different plant tissues and their functions. They should recognise plant organs such as the leaf. They should understand that the roots, stem, and leaves form a plant organ system for transport of substances around the plant. They should be able to state the functions of xylem and phloem tissue. In studying transpiration, they should understand the function of stomata and recognise factors that affect transpiration rate.

Crewe Engineering & Design UTC

Curriculum Summary - Biology (Year 10)

Summer

B5: Communicable disease

In this chapter, students will see how the concept of health (as a state of physical and mental well-being) is affected by communicable (infectious) diseases. They will look at the different pathogens that can cause communicable disease, including bacteria, viruses, and protists, and how these can be spread between organisms – both animals and plants. As part of this, they will look at the development of simple hygiene methods to prevent the spread of pathogens as well as the isolation of individuals who are infected, the destruction of or control of vectors, and the use of vaccination.

Students should be able describe the different pathogens, the symptoms and treatments of a range of different animal and plant diseases, and the different defence mechanisms of the human body and plants. They should also complete the required practical to grow bacteria in the laboratory to investigate the effect of disinfectants and antibiotics.

B6: Preventing and treating disease

In this chapter, students will study the prevention of disease by vaccination. They should know how the immune system works and what is meant by an antigen. They should appreciate that the shapes of antigens and antibodies are complementary. They should understand what a vaccine contains and how it works, giving examples, and the concept of herd immunity. They should understand that memory cells remain in the body to provide long-term immunity.

Students will study the treatment of disease by drugs including painkillers and antibiotics. They should understand that painkillers such as aspirin and paracetamol treat the symptoms and not the cause of disease. They should be aware that antibiotics are drugs used to cure bacterial infections. They should know how they work and be aware of the current crisis of antibiotic-resistant strains of bacteria, linking it to work in B14.8 *Antibiotic resistant bacteria*. Students have studied the discovery of drugs in plants and microbes, including the discovery of penicillin. They should be aware of how drugs are made today to be effective and safe and be able to outline the processes of clinical trials including double blind trials and using placebos.

Summer Page 3

B7: Non communicable diseases

In this chapter, students will study non-communicable diseases and should understand what is meant by risk factors for a disease. They will analyse the impact of disease at several different levels. Students should recognise correlations between data sets and the need for evidence to secure a causal mechanism. They should understand the difference between correlated data and causal mechanisms and be able to read graphs and quote data to support correlations and causations.

Students will study cancer and the different types of tumour, along with the general causes and treatment of cancer. They should link this to mitosis and the cell cycle in B2 *Cell division*.

Students should be aware of the risks of diseases from smoking, linked to work on the heart and blood vessels in B4 *Organising animals and plants*. They should recall the roles of nicotine, carbon monoxide, and tar, and understand how each specifically affects health, as well as recalling the dangers of smoking whilst pregnant. They should have applied the concept of a causal mechanism to data on smoking and developing lung cancer. Students should understand the impact of smoking on the heart. In considering the effect of diet and exercise on disease, students should appreciate the connection between obesity and other diseases such as type 2 diabetes.

Crewe Engineering & Design UTC

Students have studied alcohol and health and should understand the effect of alcohol on the brain and liver, and of drinking alcohol during pregnancy. Finally, students should be aware of the sources and carcinogenic effects of ionising radiation.