NOTTINGHAM BRITISH SCHOOL – CURRICULUM DEVELOPMENT 2019

Year 9 - Biology

	October Assessment	December Assessment	March Assessment	June Assessment	Age Related Expectation By the end of the year every student will be able to ….
	Unit 1: Cells and cell processes 1.1 Characteristics of living organisms • Describe the characteristics of living organisms 1.2 Concept and use of a classification system • State that organisms can be classified into groups by the features that they share • Define *species* • Define and describe the *binomial system* of naming species • **Explain that classification systems aim to reflect evolutionary relationships** • **Explain that classification is traditionally based on studies of morphology and anatomy** • **Explain that the sequences of bases**	3.1 Diffusion • Define *diffusion* • Describe the importance of diffusion of gases and solutes • tate that substances move into and out of cells by diffusion through the cell membrane • **State that the energy for diffusion comes from the kinetic energy of random movement of molecules and ions** • **Investigate the factors that influence diffusion, limited to surface area, temperature, concentration gradients and distance** 3.2 Osmosis • Define *osmosis* • Investigate and describe the effects on plant tissues of immersing them in different solutions **by using the terms *turgid, turgor pressure, plasmolysis* and**	7.1 Diet • State what is meant by the term *balanced diet* for humans • Explain how age, gender and activity affect the dietary needs of humans including during pregnancy and whilst breast-feeding • Describe the effects of malnutrition in relation to starvation, constipation, coronary heart disease, obesity and scurvy • List the principal sources of, and describe the roles of: – carbohydrates – fats – proteins – vitamins, limited to C and D – mineral salts, limited to calcium and iron – fibre (roughage) – water	**Unit 4: Respiration and the human transport system** 9.1 Transport in animals **Describe the single circulation of a fish** **Describe the double circulation of a mammal** **Explain the advantages of a double circulation** 9.2 Heart Name and identify the structures of the mammalian heart; State that blood is pumped away from the heart into arteries and returns to the heart in veins **Explain the relative thickness:** – **of the muscle wall of the left and right ventricles** – **of the muscle wall of the atria compared to that of the ventricles** **Explain the importance of the septum**	**The assessment objectives (AOs) are:** AO1 Knowledge with understanding AO2 Handling information and problem solving AO3 Experimental skills and investigations **AO1 Knowledge with understanding** Candidates should be able to demonstrate knowledge and understanding of: • scientific phenomena, facts, laws, definitions, concepts and theories • scientific vocabulary, terminology and conventions (including symbols, quantities and units) • scientific instruments and apparatus, including techniques of operation and aspects of safety • scientific and technological applications with their social, economic and environmental implications. **AO2 Handling information and problem solving** Candidates should be able, in words or using other written forms of presentation (i.e. symbolic, graphical and numerical), to: • locate, select, organise and present information from a variety of sources • translate information from one form to another • manipulate numerical and other data • use information to identify patterns, report trends and draw inferences • present reasoned explanations for phenomena, patterns and relationships

	in DNA and of amino acids in proteins are used as a more accurate means of classification • **Explain that organisms which share a more recent ancestor (are more closely related) have base sequences in DNA that are more similar than those that share only a distant ancestor** 1.3 Features of organisms • List the features in the cells of all living organisms, limited to cytoplasm, cell membrane and DNA as genetic material, **ribosomes for protein synthesis and enzymes involved in respiration** • List the main features used to place all organisms into one of the **five** kingdoms**:** Animal, Plant, **Fungus,**	***flaccid*** ○ **Explain the importance of water potential and osmosis in the uptake of water by plants** • **Explain the importance of water potential and osmosis on animal cells and tissues** • Explain how plants are supported by the **turgor** pressure within cells, in terms of water pressure acting against an **inelastic** cell wall 3.3 Active transport • Define *active transport* • **Discuss the importance of active transport as a process for movement across membranes: – e.g. ion uptake by root hairs and uptake of glucose by epithelial cells of villi and kidney tubules** • **Explain how**	• **Explain the causes and effects of vitamin D and iron deficiencies** • **Explain the causes and effects of protein-energy malnutrition, e.g. kwashiorkor and marasmus** 7.2 Alimentary canal • Define *ingestion*, *mechanical digestion*, *chemical digestion*, *Absorption*, *assimilation* , egestion. • Identify the main regions of the alimentary canal and associated organs. • Describe the functions of the regions of the alimentary canal. 7.3 Mechanical digestion • Identify the types of human teeth • Describe the structure of human teeth • Describe the functions of the types of human teeth in mechanical digestion of food • State the causes of dental decay and	**Describe the functioning of the heart and the action of the valves** State that the activity of the heart may be monitored by ECG, pulse rate and listening to sounds of valves closing Investigate, state **and explain** the effect of physical activity on the pulse **(heart)** rate Describe coronary heart disease and state the possible risk factors . **Describe the roles of diet and exercise in the prevention of coronary heart disease** **Describe ways in which coronary heart disease may be treated, limited to drug treatment with aspirin and surgery (stents, angioplasty and by-pass)** 9.3 Blood and lymphatic vessels Describe the structure and functions of arteries, veins and capillaries and **explain how the structures are adapted for their functions** Name the main blood vessels to	• make predictions and hypotheses • solve problems, including some of a quantitative nature. **AO3 Experimental skills and investigations** Candidates should be able to: • demonstrate knowledge of how to safely use techniques, apparatus and materials (including following a sequence of instructions where appropriate) • plan experiments and investigations • make and record observations, measurements and estimates • interpret and evaluate experimental observations and data • evaluate methods and suggest possible improvements. **A Grade C Cambridge IGCSE Biology candidate will be able to:** • recall and communicate secure knowledge and understanding of scientific phenomena, facts, laws, definitions, concepts and theories • apply scientific concepts and theories to present simple explanations of familiar and some unfamiliar phenomena, to solve straightforward problems involving several stages, and to make detailed predictions and simple hypotheses • communicate and present scientific ideas, observations and data using a wide range of scientific terminology and conventions • select and process information from a given source, and use it to draw simple conclusions and

	Prokaryote, Protoctist • List the main features used to place organisms into groups within the animal kingdom, limited to: – the main groups of vertebrates: mammals, birds, reptiles, amphibians, fish – the main groups of arthropods: myriapods, insects, arachnids, crustaceans • **List the main features used to place organisms into groups within the plant kingdom, limited to ferns and flowering plants (dicotyledons and monocotyledons)** • **List the features of viruses, limited to protein coat and genetic material** 1.4 Dichotomous keys • Construct and use simple dichotomous keys based on easily	**protein molecules move particles across a membrane during active transport** 5 Enzymes • Define the term *catalyst* • Define *enzymes* • Describe why enzymes are important in all living organisms • Describe enzyme action with reference to the **active site**, substrate, **enzyme-substrate complex** and product • Describe **and explain the specificity of** enzymes in terms of the complementary shape **and fit of the active site** of an enzyme with the substrate • Investigate, describe **and explain** the effect of changes in temperature on enzyme activity **in terms of kinetic energy, shape and fit, frequency of**	Describe the proper care of teeth in terms of diet and regular brushing 7.4 Chemical digestion • State the significance of chemical digestion in the alimentary canal • State the functions of enzymes as follows: – amylase breaks down starch to simpler sugars – protease breaks down protein to amino acids – lipase breaks down fats to fatty acids and glycerol • State where, in the alimentary canal, amylase, protease and lipase are secreted • **Describe the digestion of starch in the alimentary canal** • **Describe pepsin and trypsin as two protease enzymes that function in different parts of the alimentary canal:** – **pepsin in the stomach** – **trypsin in the small**	and from the heart, lungs, kidne **Outline the lymphatic system in terms of lymphatic vessels and lymph nodes** **Describe the function of the lymphatic system** 9.4 Blood List the components of blood . Identify red and white blood cells **(lymphocytes and phagocytes),** as seen under the light microscope, on prepared slides and in diagrams and photomicrographs State the functions of the following components of blood: – red blood cells – white blood cells – platelets in clotting – plasma **Describe the transfer of materials between capillaries and tissue fluid (details of the roles of water potential and hydrostatic pressure are not required)** 12.1 Respiration State the uses of energy in the body of humans 12.2 Aerobic respiration Define *aerobic respiration*	state the scientific, technological, social, economic or environmental implications • solve problems involving more than one step, but with a limited range of variables or using familiar methods • analyse data to identify a pattern or trend, and select appropriate data to justify a conclusion • select, describe and evaluate techniques for a range of scientific operations and laboratory procedures. ## Mathematical requirements Calculators may be used in all parts of the examination. Candidates should be able to: • add, subtract, multiply and divide • use averages, decimals, fractions, percentages, ratios and reciprocals • use standard notation, including both positive and negative indices • understand significant figures and use them appropriately • recognise and use direct and inverse proportion • use positive, whole number indices in algebraic expressions • draw charts and graphs from given data • interpret charts and graphs • determine the gradient and intercept of a graph • select suitable scales and axes for graphs • make approximate evaluations of numerical expressions • recall and use equations for the areas of a rectangle, triangle and circle and the volumes of a rectangular block and a cylinder • use mathematical instruments (ruler, compasses, protractor and set square) • understand the meaning of angle, curve, circle,

identifiable features

2.1 Cell structure and organisation

- Describe and compare the structure of a plant cell with an animal cell, as seen under a light microscope
- State the functions of the structures seen under the light microscope in the plant cell and in the animal cell

- **State that almost all cells, except prokaryotes, have mitochondria and rough endoplasmic reticulum**

- **Identify mitochondria and rough endoplasmic reticulum in diagrams and images of cells**

- **State that aerobic respiration occurs in mitochondria**

- **State that cells with high rates of metabolism require effective collisions and denaturation**

- Investigate, describe **and explain** the effect of changes in pH on enzyme activity **in terms of shape and fit and denaturation**

Unit 2: Animal nutrition

4 Biological molecules

- List the chemical elements that make up:
  - carbohydrates
  - fats
  - proteins
- State that large molecules are made from

smaller molecules, limited to:

- starch and glycogen from glucose
- cellulose from glucose
- proteins from amino acids
- fats and oils from fatty acids and glycerol

- **Relate the shape and structure of protein molecules to their function, limited to the active site of enzymes and the binding site of antibodies**
- **Describe the structure of DNA as:**
  - **two strands coiled**

intestine

- State **(explain)** the functions of the hydrochloric acid in gastric juice
- **Outline the role of bile**

7.5 Absorption

Identify the small intestine as the region for the absorption of digested food

Describe the significance of villi and microvilli i

Describe the structure of a villus

Describe the roles of capillaries and lacteals in villi

State where water is absorbed

Unit 3: Plant nutrition and transport

6.1 Photosynthesis

Define *photosynthesis*

State the word equation for photosynthesis:

State the balanced chemical equation for photosynthesis

State the word equation for aerobic respiration as

State the balanced chemical equation for aerobic respiration as

Investigate the uptake of oxygen by respiring organisms, such as arthropods and germinating seeds

Investigate the effect of temperature on the rate of respiration of germinating seeds

12.3 Anaerobic respiration

Define *anaerobic respiration*

State the word equations for anaerobic respiration in muscles during vigorous exercise (glucose →lactic acid) and the microorganism yeast (glucose →alcohol + carbon dioxide)

State the balanced chemical equation for anaerobic respiration in the microorganism yeast as

State that anaerobic respiration releases much less energy per glucose molecule than aerobic respiration.

State that lactic acid builds up in muscles and blood during

radius, diameter, circumference, square, parallelogram, rectangle and diagonal

• solve equations of the form x = y + z and x = yz for any one term when the other two are known.

Presentation of data

The solidus (/) is to be used for separating the quantity and the unit in tables, graphs and charts, e.g.

time / s for time in seconds.

(a) Tables

• Each column of a table should be headed with the physical quantity and the appropriate unit, e.g. time / s.

• The column headings of the table can then be directly transferred to the axes of a constructed graph.

(b) Graphs

• Unless instructed otherwise, the independent variable should be plotted on the x-axis (horizontal axis) and the dependent variable plotted on the y-axis (vertical axis).

• Each axis should be labelled with the physical quantity and the appropriate unit, e.g. time / s.

• Unless otherwise instructed the scales for the axes should allow more than half of the graph grid to be used in both directions, and be based on sensible ratios, e.g. 2 cm on the graph grid representing 1, 2 or 5 units of the variable.

• The graph is the whole diagrammatic presentation, including the best-fit line when appropriate. It may have one or more sets of data plotted on it.

• Points on the graph should be clearly marked as crosses (x) or encircled dots (⊙).

• Large 'dots' are penalised. Each data point should be plotted to an accuracy of better than one

	large numbers of mitochondria to provide sufficient energy 2.2 Levels of organisation Relate the structure of the following to their functions: – ciliated cells – movement of mucus in the trachea and bronchi – root hair cells – absorption – xylem vessels – conduction and support – palisade mesophyll cells – photosynthesis – nerve cells – conduction of impulses – red blood cells – transport of oxygen – sperm and egg cells – reproduction • Define *tissue organ, organ system* • State examples of tissues, organs and organ systems • Identify the different levels of organisation in drawings, diagrams	**together to form a double helix** – **each strand contains chemicals called bases** – **cross-links between the strands are formed by pairs of bases** – **the bases always pair up in the same way: A with T, and C with G (full names are not required)** • **Describe the roles of water as a solvent in organisms with respect to digestion, excretion and transport** • Describe the use of: – iodine solution to test for starch – Benedict's solution to test for reducing sugars – biuret test for proteins – ethanol emulsion test for fats and oils – DCPIP test for vitamin C	**Explain that chlorophyll transfers light energy into chemical energy in molecules, for the synthesis of carbohydrates** **Outline the subsequent use and storage of the carbohydrates made in photosynthesis** Identify chloroplasts, cuticle, guard cells and stomata, upper and lower epidermis, palisade mesophyll, spongy mesophyll, vascular bundles, xylem and phloem in leaves of a dicotyledonous plant **Explain how the internal structure of a leaf is adapted for photosynthesis** Investigate the necessity for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls Investigate and describe the effects of varying light intensity, carbon dioxide concentration and	**vigorous exercise causing an oxygen debt** **Outline how the oxygen debt is removed during recover** 11 Gas exchange in humans List the features of gas exchange surfaces in humans Name and identify the organs in the human beeathing system **State the functions of the cartilage in the trachea** **Explain the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes leading to the ventilation of the lungs** State **and explain** the differences in composition between inspired and expired air Use limewater as a test for carbon dioxide to investigate the differences in composition between inspired and expired air Investigate, describe **and explain** the link between physical activity on rate and depth of breathing **in terms of**	half of each of the smallest squares on the grid. • A best-fit line (trend line) should be a single, thin, smooth straight line or curve. The line does not need to coincide exactly with any of the points; where there is scatter evident in the data, Examiners would expect a roughly even distribution of points either side of the line over its entire length. Points that are clearly anomalous should be ignored when drawing the best-fit line. (c) Numerical results • Data should be recorded so as to reflect the precision of the measuring instrument. • The number of significant figures given for calculated quantities should be appropriate to the least number of significant figures in the raw data used. (d) Pie charts • These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie charts should preferably contain no more than six sectors. (e) Bar charts • These should be drawn when one of the variables is not numerical. They should be made up of narrow blocks of equal width that do not touch. (f) Histograms • These should be drawn when plotting frequency graphs with continuous data. The blocks should be drawn in order of increasing or decreasing magnitude and they should touch. **<u>The practical skills needed:</u>**

	and images of familiar **and unfamiliar** material 2.3 Size of specimens Calculate magnification and size of biological specimens using millimetres **and micrometres** as		temperature on the rate of photosynthesis, e.g. in submerged aquatic plants **Define the term *limiting factor* as something present in the environment in such short supply that it restricts life processes** **Identify and explain the limiting factors of photosynthesis in different environmental conditions** **Describe the use of carbon dioxide enrichment, optimum light and optimum temperatures in glasshouses in temperate and tropical countries** **Use hydrogencarbonate indicator solution to investigate the effect of gas exchange of an aquatic plant kept in the light and in the dark** 6.3 Mineral requirements Describe the importance of: – nitrate ions for making amino acids – magnesium ions for making chlorophyll	**the increased carbon dioxide concentration in the blood, detected by the brain, causing an increased rate of breathing** **Explain the role of goblet cells, mucus and ciliated cells in protecting the gas exchange system from pathogens and particles**	recall of familiar, and unfamiliar, techniques to record observations and make deductions from them • recall of simple chemical tests, e.g. for food substances and the use of hydrogencarbonate indicator, litmus and Universal Indicator paper • recognise, observe, record and measure images of familiar, and unfamiliar, biological specimens • making a clear line drawing from an image of a specimen, calculating the magnification and adding labels as required. record readings from diagrams of apparatus, including: – reading a scale with appropriate accuracy and precision – interpolating between scale divisions – taking repeated measurements, where appropriate, to obtain an average value • describe, explain or comment on experimental arrangements and techniques • interpret and evaluate observations and experimental data • complete tables of data, and process data, using a calculator where necessary perform simple arithmetical calculations • plot graphs and/or interpret graphical information • draw an appropriate conclusion, justifying it by reference to the data and using an appropriate explanation • identify sources of error and suggest possible improvements in procedures • plan an experiment or investigation, including making reasoned predictions of expected results and suggesting suitable apparatus and techniques

			Explain the effects of nitrate ion and magnesium ion deficiency on plant growth		