KESTEVEN AND SLEAFORD HIGH SCHOOL

Biology Scheme of Learning

Year 9 – Term 3/Unit B3

Intent – Rationale

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.

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.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
KS3 Topic B7.1 Cells and Tissues **KS3 Topic B7.6 Food and Digestion** **KS3 Topic B7.5 Photosynthesis** **KS3 Topic B8.8 Respiration** **GCSE B1 Cells and their specialisation, diffusion, osmosis and active transport.**	• GCSE Unit 8 Photosynthesis, 9 Respiration, 17 Organising an Ecosystem 18 Biodiversity and Ecosystems • A Level 1 Biological Molecules, 3 Organisms Exchange Substances with their Environment.
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Graph skills- drawing axes, plotting, drawing lines of best fit and tangent.	• L3 and L6 GB4def • L3 M2
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY *Digestive System*; Carol Ballard-612 *1001 Facts About the Human Body*; Sarah Brewer-612 *Amazing Voyage of the Cucumber Sandwich*; P. Rowan-612 *Digesting*; Angel Royston-612.3 *Disgusting Digestion*; Nick Arnold-612	• Plotting line graphs and drawing line of best fit and tangents • Calculating rates of reaction when studying enzyme catalysed reactions.

Biology Scheme of Learning

Year 9 – Term 3/Unit B3

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

State examples of cells, tissues, organs, and organ systems. Name organs found in a given organ system. Order cells, tissues, organs, and organ systems according to their relative sizes. Name all of the organs of the digestive system. Describe the functions of the organs of the digestive system. Summarise the process of digestion.

Describe the structure of simple sugars, starch, lipids, and proteins.

Describe how enzymes are used in digestion. Explain why high temperatures and changes in pH prevent enzymes from catalysing reactions. Explain why enzymes are needed for digestion.

For each food molecule, name the enzyme that acts on it, where it is produced, and which products are formed. Describe the functions of bile.

Apply

Carry out multiple food tests in an organised manner. Design a results table to clearly record results from food tests. Use the lock and key theory to explain why the shape of an enzyme is vital for it to function. Identify the key variables in a given investigation. Draw a tangent to a line and calculate the rate of a reaction with guidance.

Plot a line graph and use it to draw conclusions about how temperature and pH affect the rate of an enzyme-catalysed reaction. Plan and carry out an investigation in order to gather accurate results.

Calculate the mean rate of an enzyme-catalysed reaction.

Analyse data in order to determine whether a hypothesis is correct.

Extend

Relate levels of organisation to familiar organ systems in order to give examples of cells, tissues, and organs. Explain why the cells of multicellular organisms are organised into tissues, organs, and organ systems. Suggest the function of glandular, epithelial, and muscular tissue in organs.
Link the process of digestion to other processes in the body in order to explain its function.
Explain in detail how the small intestine is adapted to its function. Explain in detail what happens to food during digestion.
Explain which food molecules are polymers. Apply knowledge of the function of food molecules in the body to give diet advice. Suggest what a food contains using results from food tests, evaluating the observed data collected

Explain how enzymes speed up reactions. Explain how enzymes control metabolism. Plan an experiment to investigate how different catalysts affect the rate of a reaction. Explain in detail how a change in temperature or pH affects the rate of an enzyme-catalysed reaction. Apply knowledge of enzymes to explain how some organisms can survive in extreme conditions.

Draw tangents in order to calculate the rate of a reaction. Analyse results in order to evaluate a method and the validity of conclusions, explaining suggestions for possible improvements.
Explain how acid in the stomach increases the efficiency of pepsin. Explain how bile increases the efficiency of fat digestion.

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What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?
• **Absorption** The process by which a substance moves from one place into another substance or place (usually by diffusion or osmosis). • **Anaemia** A condition that occurs when there are not enough red blood cells in someone's blood. This can be caused by a lack of iron in the diet, because iron is an essential part of haemoglobin, which is the pigment in red blood cells that carries oxygen. • **Balanced diet** A diet that contains appropriate amounts of all the food types. Eating a balanced diet helps us to stay healthy. A balanced diet will be different for different people, depending on their age, what job they do, how active they are and so on. • **Benedict's solution** A solution that is used to test for the presence of reducing sugars, including glucose, lactose and maltose. If a very small amount of a suitable sugar is present, the result is a colour change from blue to green. If more sugar is present, the blue solution changes to yellow, orange or red. • **Biuret reagent** A chemical test that is used to detect the presence of protein in a sample of food. If protein is present, the solution turns from blue to purple. • **Carbohydrate** A chemical that is made from carbon, hydrogen and oxygen. Carbohydrates are important in the diet because they act as a short-term energy store. In the diet, carbohydrates can either be simple, such as sugars, or complex, such as starch. • **Catalyst** A substance that speeds up a chemical reaction without being used up or chemically changed. Catalysts are usually specific to one of a few chemical reactions. Biological catalysts that act in cells or organisms are made from proteins and are called enzymes. • **Deficiency disease** A disease caused by lack of a mineral or vitamin in the diet. • **Digestion** The process of breaking food down into useful small molecules that can then be absorbed into cells. In humans, digestion begins in the mouth with chewing (an example of physical digestion) and then continues with chemical digestion in the stomach and intestines, as a result of the action of enzymes. • **Digestive system** The set of organs in the body that is responsible for digestion. These include the stomach, intestines and liver. • **Enzyme** A complex molecule found in cells of an organism that speeds up biochemical reactions. • **Fat** A group of chemical compounds made from carbon, hydrogen and oxygen that are made by animals and plants as a way to store energy.	• L5 Enzymes Long answer question • Practical skills in required practicals • Summative assessment B3 Test

- **Fibre**When used to describe part of the diet, fibre refers to plant material (cellulose) that cannot be digested by humans. It is essential in order to keep the intestines healthy, providing them with solid material that the muscular walls can push along.
- **Gut flora** A general term for bacteria that live inside the digestive system.
- **Iodine solution** A dark brown solution that can be used to test for the presence of starch. If starch is present, the positive result is a blue-black colour.
- **Large intestine** The part of the digestive system that absorbs water and forms faeces from undigested food. It is also known as the colon.
- **Mineral** When used to describe something in the diet, 'mineral' refers to a chemical element that is needed in small quantities in the diet in order for someone to stay healthy.
- **Obese** When a person is very overweight. Obesity can cause significant health problems, including increased wear and tear on joints, increased risk of diabetes and increased risk of heart disease.
- **Oesophagus** Also known as the 'gullet', this is the tube from the throat to the stomach. Muscles in the wall of the oesophagus contract to push food down into the stomach. This process is known as peristalsis.
- **Pancreas** An organ in the digestive system that secretes enzymes for digestion, as well as secreting the hormones insulin and glucagon, which regulate the amount of sugar circulating in the blood and the amount of carbohydrate stored in the liver.
- **Protein** A long molecule made up from many amino acids joined together. In the diet, proteins are needed to repair tissues and for the growth of new cells.
- **Respiration** The chemical reactions that allow living things to release energy from compounds such as glucose.
  In general, aerobic respiration can be summarised with the following word equation:
  glucose + oxygen ? carbon dioxide + water
- **Rickets** A disease caused by a shortage of vitamin D in the body, usually because there is insufficient vitamin D in the diet. This leads to a softening of the bones, mainly in children. A common symptom is deformed, bowed legs.
- **Salivary glands** Glands in the mouth that produce saliva. Saliva is mainly water with some mucus, antibacterial agents and digestive enzymes (mainly amylase).
- **Scurvy** A disease caused by a lack of vitamin C in the diet. Scurvy can lead to spongy gums and tooth loss. Scurvy was a problem on board ocean ships many years ago, when fresh fruit and vegetables were not available.
- **Small intestine** The part of the digestive system in which the breakdown of complex molecules into smaller molecules is completed and the nutrients are absorbed into the blood. In humans it is around 7 m long, compared with the large intestine, which is approximately 1.5 m long.
- **Stomach** A muscular organ in the digestive system in which food is digested by physical and chemical digestion.
- **Villi** Finger-like projections lining the small intestine that increase the surface area for the absorption of nutrient molecules from digestion.
- **Vitamin**An organic (carbon-based) compound that is needed by an organism in small amounts in its diet because it cannot be made by the organism in sufficiently large quantities for healthy life.

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Intent – Concepts

Lesson title	Learning challenge I know/I can	Higher level challenge I can	Suggested activities and resources
L1 Tissues and Organs	a) How specialised cells become organised into tissues. b) How several different tissues work together to form an organ.	Give specific examples of the cells, tissues, organs organisational hierarchy in animals and plants	
L2 The Digestive System	Label the structure and function of the digestive system.	Relate the structure to function of the Digestive system	
L3 The Chemistry of Food	The structure of carbohydrate	Give specific examples of carbohydrate/protein/lipid	

	s, proteins and lipids. *Required Practical: How to test for the main food groups using standard food tests.*	monomers and polymers. Assess the limitations of the standard food tests	
L4 Catalysts and Enzymes	a) What a catalyst is. b) How enzymes work as biological catalysts. c) What metabolism is.	Understand the how an enzyme lowers activation energy and the concept of complementary shapes.	
L5 Factors affecting Enzyme Action	a) How temperature and pH affect enzyme action b) How different enzymes work fastest at different	Explain what happens to an enzyme at the molecular level when it becomes denatured	

	temperatures and pH values.		
L6 How the Digestive System works	a) How the food we eat is digested by the body b) The function of different digestive enzymes *Required practical: Investigate the effect of pH on the rate of reaction of amylase.*	Analyse and evaluate an investigation into the effect of pH on the rate of reaction catalysed by amylase.	
L7 Making Digest	How hydrochloric acid	Understand the benefit of emulsification of fat by bile.	

ion efficient	and bile make digestion more efficient		
L8	B3 TEST		