

Life Sciences, Grade 11, Animal Nutrition

Written questions

Question 1: Digestion and Absorption

1.1 **Digestion** is the breakdown of large, complex, insoluble food molecules into small, simple, soluble molecules. **Mechanical Digestion** is the physical breakdown of food (e.g., chewing food with teeth, churning of food in the stomach). **Chemical Digestion** is the chemical breakdown of food molecules into simpler forms using enzymes (e.g., starch broken down by amylase).

1.2 The oesophagus moves food from the mouth to the stomach through a wave-like muscular contraction process called **peristalsis**.

1.3 The small intestine is adapted for efficient absorption due to: * Its inner surface having numerous finger-like projections called **villi**, which greatly increase the surface area for absorption. * Each villus is covered with even smaller microscopic folds called **microvilli** on the surface of its cells, further increasing the surface area. * Villi are richly supplied with blood capillaries and a lacteal, allowing absorbed nutrients to quickly enter the bloodstream or lymphatic system.

Question 2: Specific Digestive Processes and Enzymes

2.1 In the stomach, food undergoes both mechanical and chemical digestion. The muscular walls of the stomach churn the food, mixing it with gastric juices. Gastric juices contain **hydrochloric acid (HCl)**, which serves to kill bacteria, activate enzymes like pepsin, and provide an acidic medium for pepsin to function. Pepsin begins the chemical digestion of proteins. The food is converted into a semi-liquid mixture called chyme.

2.2 **Emulsification** is the process of breaking down large fat globules into smaller fat droplets. This process occurs in the **small intestine** and is carried out by **bile**, which is produced by the liver and stored in the gallbladder. Emulsification increases the surface area of fats, making them more accessible for digestion by lipase enzymes.

2.3 The **large intestine** primarily absorbs excess water and salts from the remaining undigested food material. It also forms and stores faeces before their elimination from the body through egestion.

Question 3: Blood Glucose Regulation and Disorders

3.1 When **blood glucose levels are HIGH** (e.g., after a meal), the **beta cells** in the pancreas detect this and release **insulin** into the bloodstream. Insulin causes the liver to convert excess glucose into **glycogen** for storage. It also stimulates body cells to increase their uptake of glucose for cellular respiration. As blood glucose levels lower, beta cells detect this and slow down insulin release.

3.2 When **blood glucose levels are LOW** (e.g., after not eating for some hours), the **alpha cells** in the pancreas detect this and release **glucagon** into the bloodstream. Glucagon causes the liver to convert its stored **glycogen back into glucose** and release it into the bloodstream, thereby increasing blood glucose levels.

3.3 **Diabetes Mellitus** is a disease where either the pancreas doesn't secrete enough insulin or the body can't respond to the insulin produced, leading to chronically high blood glucose (hyperglycaemia). * **Type 1 Diabetes**: Caused by **insufficient secretion of insulin** (often an autoimmune destruction of beta cells). It is typically treated with **insulin injections**. * **Type 2 Diabetes**: Caused by the **inability of secreted insulin to stimulate the cellular uptake of glucose** from the blood (insulin resistance). It often occurs when a person carries too much fat (especially abdominal fat), which interferes with hormone action. It is typically treated with **dietary changes, exercise, and drugs** to reduce glucose levels.