AS90462 Version 2
Describe diversity in the structure and function of animals
Level 2 Credits 3

This achievement standard involves describing diversity in aspects of the structure and function of multi-cellular animals in relation to a biological process.

NUTRITION

Part A. Description of 3 significant features or structures.	**Part B. Explanations of how two features or structures help the biological process to occur.**	**Part C. Discussion of one efficiency / advantage or limitation/disadvantage of the nutrition system.**

• Evidence can be written and/or diagrammatic
• Structures involved can relate to these aspects (descriptions need expansion):
  ○ Ingestion: taking in food, capture, physical digestion during ingestion.
  ○ Digestion: enzymatic / chemical digestion, extracellular and/or intracellular. Physical digestion in the gut.
  ○ Absorption and Assimilation
  ○ Egestion: removal of undigested food (do not confuse with excretion).
	• Evidence can be written and/or diagrammatic
	• Explanations must show how the structures in part A operate or how they contribute to the biological process of nutrition
	• Part A involves description of structures while part B involves explanations of functions or processes: why they have adapted each of your chosen animals to their way of life.
	• Processes include:
	  ○ Ingestion.
	  ○ Physical digestion.
	  ○ Chemical digestion mostly by enzymes either intracellular or extracellular.
	  ○ Absorption of digested material.
	  ○ Egestion of undigested food (not excretion).
		• Evidence can be written and/or diagrammatic
		• Discussion must show a depth of understanding that is more advanced than describe (Part A) and explain (part B). Students need to take a more comparative approach to the diversity they have already mentioned, relating their efficiencies (advantages) and limitations (disadvantages) to the way of life of their chosen animals.

EARTHWORM		
• Foods: partially decayed plant material and bacteria, soil ingested while burrowing. • Gut is complete, i.e. alimentary canal has 2 openings (mouth and anus), different zones / sections / structures specialise in different functions, (differentiation of structure and specialisation of function leads to greater efficiency. • Structures described. Pharynx: suction pump action, mucous, enzymes. • Crop: storage Gizzard: muscular with horny lining, grinding, increase in surface area. Intestine: long with dorsal groove (typhlosole) - increased surface area. Glands secrete enzymes, food absorbed into blood vessels. Structures described. • Undigested food and soil egested as casts at surface at night (lower risk of predators and desiccation)	• Pharynx large muscular chamber behind mouth, acts as a suction pump pulling food into mouth. = ingestion. Food movement lubricated by mucous through gut. • $CaCO_3$ secreted by oesophagus glands to neutralise any acidity hence earthworms prefer alkaline soil with high Ca content. • Food must be broken down physically into smaller sized particles to increase SA for enzyme action. Grinding action of gizzard achieves this. • Extracellular enzymatic digestion explained, within gut canal. • Enzymes digest (chemical breakdown) large insoluble molecules into smaller insoluble ones that can be absorbed. • Absorption in intestine, increased efficiency (increased SA) by dorsal fold or typhlosole. • Close association between digestive organs and transport system ensures soluble digested products are readily available to the tissues that require them • Role of blood system i.e. to carry away digested food and distribute to cells for respiration and assimilation.	• Gut with separate entrance (mouth) and exit (anus) is much more efficient. Allows differentiation of structure and function in different parts of the gut. i.e. 1-way gut or alimentary canal, e.g. Pharynx: suction. Crop: storage. Gizzard: grinding. Intestine digestion and absorption. • Foods: decaying organic matter, already partially digested by bacterial action. • Wide variety of enzymes secreted in different parts of the gut, with different environmental conditions (pH) allows increased efficiency of digestion. • Lack of hard structures to grind food (despite presence of gizzard) restricts animal to relatively soft or semi-digested material.

MAMMALS / HUMANS		
• Ingestion; types and action of teeth, incisors, canines, premolars and molars. • Ingestion; relationship between tooth number and structure to diet. E.g., Humans all types as range of food types • Swallowing, action of salivary amylase, mucous etc • Stomach, storage, physical and chemical digestion, role of HCl, pepsin (and rennin) • Duodenum: action of bile, pancreatic enzymes (trypsin, lipase, amylase), • Ileum and absorption, surface area increase by villi, route taken by glucose, amino acids and fatty acids to liver. Enzymes of the ileum. • Appendix and how it is a vestigial organ in humans. • Colon, water absorption (reabsorption), bacteria (E. coli), rectum. • Control of digestive processes; e.g. Hormones from stomach that stimulate the release of digestive enzymes and the hunger centre of the brain.	• Ingestion process explained, i.e. structures described related to food capture and ingestion process. Details depend on example chosen. • Action of different types of teeth explained, e.g. Nipping incisors, stabbing canines, grinding and crushing cheek teeth and how we don't have any large specialised teeth due to our wide range of diet • Processing of food by the stomach and intestine explained digestion and absorption in the intestine. • Specific details of absorption in ileum (villi structure and function) explained. • Action of bile and/or pancreatic enzymes explained. • Enzymes needed so that large insoluble molecules are broken down into smaller insoluble ones that can be absorbed. • Water absorption in colon explained, egestion via anus.	• Gut with separate entrance (mouth) and exit (anus) is much more efficient. Allows differentiation of structure and function in different parts of the gut. i.e. 1-way gut or alimentary canal. • Wide variety of enzymes secreted in different parts of the gut, with different environmental conditions (e.g. acidic stomach, alkaline intestine) allow increased efficiency of digestion and the ability to cope with all the different food types. • Action of bile and pancreatic enzymes further increase the efficiency of digestive process - bitter lipid digestion, specialist enzymes. • Homoeothermic (up to 37°C) body temperature means there is a continual need for relatively large quantities of relatively high-energy food. • Close association between digestive organs and transport system ensures soluble digested products are readily available to the tissues that require them. • Length of digestive system relates to diet with humans quite long and complex because of the different compartments needed to contain the different enzymes and digest the different food types. • Long large intestines to absorb max water out of the digestive system.

MAMMALS/ COWS		
• Ingestion; types and action of teeth, incisors only on bottom jaw dental plate on top, canines absent, very large molars. • Ingestion; relationship between tooth number and structure to diet. E.g., grinding molars of herbivores • Swallowing, action of bicarbonate and phosphate to buffer and control pH • Stomach: first three stomachs contain microbes which carryout anaerobic respiration to breakdown the tough cellulose making VFA, absorption of these through the stomach walls physical and chemical digestion, 4th stomach contains HCl, pepsin which breaks down protein • Duodenum: action of bile, pancreatic enzymes (trypsin, lipase, amylase). • Ileum and absorption, surface area increase by villi, route taken by glucose, amino acids and fatty acids to liver. Enzymes of the ileum. • Appendix and its role - contains more microbes which carry on cellulose digestion. • Colon, water absorption (reabsorption), bacteria (E. coli), rectum. • Ruminants: large volumes of vegetation, regurgitated and chewed as cud, specialised stomach structures. • Control of digestive processes; e.g. Hormones from stomach that stimulate the release of digestive enzymes and the hunger centre of the brain.	• Ingestion process explained, i.e. structures described related to food capture and ingestion process. Details depend on example chosen. • Action of different types of teeth explained, e.g. grinding and crushing cheek teeth to work on the tough cellulose. • Processing of food by the stomachs and intestine explained digestion and absorption in the intestine. • How the microbes aid digestion and the use of bicarbonates and phosphates to control pH • Why chewing the cud is important to digestion • Specific details of the folds in the 1st three stomachs and how they aid absorption • Specific details of absorption in ileum (villi structure and function) explained. • Action of bile and/or pancreatic enzymes explained. • Enzymes needed so that large insoluble molecules are broken down into smaller insoluble ones that can be absorbed. • Water absorption in colon explained, egestion via anus.	• Gut with separate entrance (mouth) and exit (anus) is much more efficient. Allows differentiation of structure and function in different parts of the gut i.e. 1-way gut or alimentary canal. • Adaptations of the gut allow the exploitation of a wide variety of diets, e.g. Ruminants with complex stomach system and herbivores with large caecum / appendix systems allow exploitation of low grade vegetation. • Wide variety of enzymes secreted in different parts of the gut, with different environmental conditions (e.g. acidic stomach, alkaline intestine) allow increased efficiency of digestion. • Action of bile and pancreatic enzymes further increase the efficiency of digestive process - bitter lipid digestion, specialist enzymes. • Homoeothermic (up to 37°C) body temperature means there is a continual need for relatively large quantities of relatively high-energy food. • Length of digestive system relates to diet with cows having the 4 stomachs to give the microbes time to digest the tough cellulose. • Very large caecum containing more microbes and get more nutrients out of the cellulose • Shorter large intestines which absorb less water so cows must drink lots of it. • Close association between digestive organs and transport system ensures soluble digested products are readily available to the tissues that require them.