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Level 1 Biology, 2016

90929 Demonstrate understanding of biological ideas relating to a mammal(s) as a consumer(s)

9.30 a.m. Wednesday 23 November 2016
Credits: Three

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to a mammal(s) as a consumer(s).	Demonstrate in-depth understanding of biological ideas relating to a mammal(s) as a consumer(s).	Demonstrate comprehensive understanding of biological ideas relating to a mammal(s) as a consumer(s).

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Merit

TOTAL 17

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QUESTION ONE: PHYSICAL AND CHEMICAL DIGESTION IN A CARNIVORE

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www.biolib.cz/IMG/GAL/40325.jpg

http://images.otagomuseum.govt.nz:8080/img/collectionitem/nc/2013/nc2011-74_1!pub.jpg?width=590

The kekeno, or the New Zealand fur seal (*Arctocephalus forsteri*), is a marine carnivore that eats mainly squid and fish. Seals, like other mammals, depend on both physical (mechanical) and chemical digestion to process the food that they eat.

Compare and contrast physical and chemical digestion, discussing these processes with respect to the structures and functions of the digestive system of a typical carnivore such as the kekeno / seal.

Your answer should:

- describe the processes of physical and chemical digestion, and explain how they are different
- explain why both processes are necessary to gain maximum nutrient value from the food eaten
- use specific examples of physical and chemical digestion in a carnivore like the kekeno / seal.

Physical digestion is the process by which food is mechanically ~~brok~~ broken up from large molecules to small molecules using mainly the teeth. This is different to chemical digestion as chemical digestion is the use ~~of~~ of enzymes to break food down into either glucose, amino acids, fatty acids or glycerol. Physical digestion acts before chemical digestion as the crushing of food by the teeth aids the enzymes to act ~~of~~ upon the increased surface area of the food. Both these processes are important to gain maximum nutrient value as physical digestion crushes and churns food, increasing the area exposed for enzymes to act upon the food and break it down, into glucose, amino acids

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fatty acids & glycerol to be absorbed in the small intestine and assimilated into different uses in the body. In the seal, both physical & chemical digestion is used. A seals diet consists of mainly proteins and lipids so there is no need for the enzyme amylase to be present in the mouth as this acts upon starch - cellulose rich materials. However in the mouth of a seal is large pointed canines to rip flesh off prey, they have small insisors and large pointy molars called carnassials which cut and slice ~~meat~~ big portions of meat. The crushing of the fish and squid by the teeth is part of physical digestion and increasing the surface area of this food. The bolus is swallowed down the oesophagus and into the stomach where chemical digestion begins to take place. In the stomach, the enzyme pepsin (which acts on proteins) breaks down the fish/squid into polypeptides and then into amino acids. This is an example of chemical digestion. The amino acids are then absorbed by the small intestine and assimilated into the ~~body~~ bloodstream. Also the contraction of the stomach walls churn and mix food with the acid in the stomach which is another example of physical digestion. Another example of chemical digestion is when lipase acts upon the lipids in the duodenum. These lipids are broken down into fatty acids & glycerol which are then absorbed by the villi and used for not only energy but also the warmth of the mammal

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QUESTION TWO: RESPIRATION

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When running a marathon, the muscles of a runner must contract and relax to generate movement for a distance of 42 kilometres. This can take from two to five hours, requiring a large amount of energy to be produced by the muscle cells through the process of respiration, and a large supply of the raw materials needed for respiration. Some of these raw materials are provided by eating selected food leading up to the race, and absorbing the digested nutrients.

Students were provided with four food samples, and carried out a range of tests on all samples.

Test results for food samples

Test	Test for starch	Test for glucose	Test for proteins	Test for lipids
Positive result	blue-black colour	orange-red colour	violet-purple colour	see-through
Food sample A	orange	orange-red	pale blue	not see-through
Food sample B	blue-black	blue	pale blue	not see-through
Food sample C	orange	blue	pale blue	see-through
Food sample D	orange	blue	violet-purple	not see-through

Discuss which food sample the students should recommend for a marathon runner to eat leading up to the race, considering the energy requirements of the runner's muscles as they carry out the process of respiration.

Your answer should:

- describe the two types of cellular respiration, including the raw materials used for each process
- explain which type of cellular respiration would be more beneficial for the runner during the marathon race
- explain how some of the raw materials needed for respiration are absorbed in the small intestine and transported to the runner's muscles
- justify your choice of food sample.

The two types of cellular respiration is aerobic and anarobic respiration. Aerobic respiration is respiration that takes place with sufficient oxygen and energy is released over a long period of time and can be sustained.

Glucose + Oxygen ——→ carbon dioxide + ATP + Wat

Anarobic respiration occurs when nonsuffient oxyge

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is available and energy is released quickly and cannot be sustained eg a sprint.

Glucose → lactic acid + water

Glucose is required to carry out respiration as it provides energy to carry out life functions. The most appropriate type of respiration for a marathon runner would be aerobic respiration as this releases energy slower and so the runner can sustain sufficient energy for longer. For each glucose molecule, anarobic respiration will produce 2 ATP whereas aerobic will produce 38 ATP.

Glucose is important to carry out respiration and is absorbed by villi in the small intestine. These villi contain microvilli to increase the surface area of the amount absorbed to maximise absorption efficiency. A capillary network is very close to the surface of the villi in order for diffusion and absorption of nutrients to take place efficiently. Glucose is broken down from starch and carbohydrates and absorbed by the villi into the bloodstream and given to the cells of the body and to the muscles in order to provide them with energy however proteins are also important as they are broken down to amino acids and given to the muscles for growth and repair. This would be best to eat after the race. Before the race food sample A would be best with glucose as glucose is needed for respiration and gives energy to the working muscles of the body.

M5

QUESTION THREE: ENZYMES AND pH IN A HERBIVORE AND AN OMNIVORE

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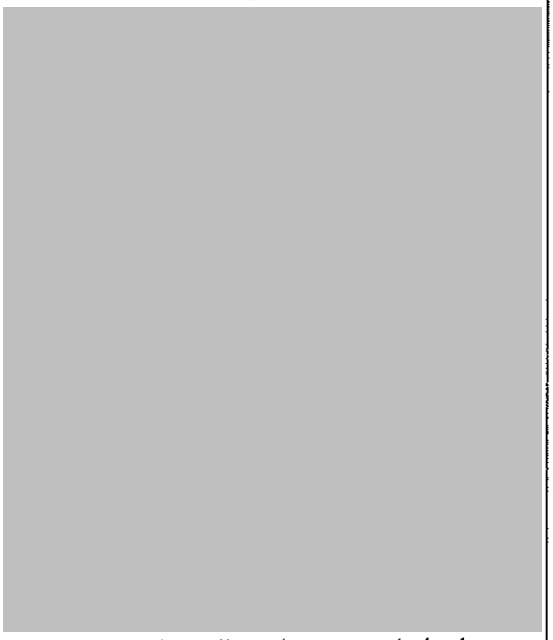
Horse digestive system

www.hygain.com.au/horses-digestive-system/

Human digestive system



www.2beingwell.com/wp-content/uploads/2013/11/digestive-system.jpg

The horse is a herbivore, consuming only plant material, whereas the human is an omnivore, consuming a wide range of foods. Both horses and humans have a range of enzymes in their digestive systems.

Discuss the role of specific enzymes within the digestive systems of a herbivore such as a horse and an omnivore such as a human, including the way that optimum pH levels are maintained.

Your answer should:

- describe the specific function of digestive enzymes within a herbivore such as a horse and an omnivore such as a human
- explain how pH can affect enzyme activity
- discuss similarities between how enzymes function in the digestive systems of a herbivore such as a horse and an omnivore such as a human, AND how optimum pH is maintained in different parts of these digestive systems.

The specific role of enzymes is to break down carbohydrates into glucose, proteins into amino acids and lipids into fatty acids and glycerol to be absorbed by the small intestine and assimilated by the body. PH will affect enzyme activity as if the PH is far away from its optimum, the active site will lose shape so the substrate can no longer fit and denature so they will no longer

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function. A herbivores diet consists of cellulose rich material that is tough to break down however this is broken down by the enzyme amylase. Amylase is produced in the salavary glands and secreted into the saliva at its optimum PH of 7. This digestive enzymes purpose is to break down cellulose rich plant material into glucose which can be used for energy for the body and to carry out life processes. In an Omnivore, there is also ~~salivarty~~ amylase produced in the salivary glands which is secreted into the saliva to ~~[illegible]~~ break down carbohydrates into glucose at the PH of 7. Both herbivores and omnivores contain ~~[illegible]~~ lipase in their ~~[illegible]~~ duodenum which optimums PH is 7. This is sustained by the ~~acidity~~ alkaline fluid of bile which is produced in the liver and stored in the gallbladder to neutralise the acidity of the chyme for lipase to be at its optimum. This increases efficiently of enzyme function as lipase is now at ~~optimum~~ PH in order to break down lipids to fatty acids and glycerol. An ommvore contains pepsin in the stomach which optimum PHis 1-2. This is sustained by the acidity of the hydrochloric acid in the stomach and the gastric juices. Pepsin acts upon proteins so this is not needed in herbivores as they purely have a cellulose rich diet. So overall amylase and lipase both work the same in herbivores & omnivores ~~[illegible]~~ and at the PH of 7 however if PH is changed, enzymes can denature and no longer function.

MC

Merit exemplar 2016

Subject:	Biology Level 1	Standard:	90929	Total score:	17

Q	Grade score	Annotation
1	M6	Incorrectly identified that physical digestion breaks down large insoluble food MOLECULES into smaller soluble food MOLECULES, it should be large bits into smaller bits – physical digestion does not breakdown at the molecular level. Correctly identifies that chemical digestion uses enzymes (A) Correctly identifies that physical digestion increases the surface area of the food to increase the rate of chemical digestion as it increases the area exposed for the enzymes to act upon (M) Explains how chemical digestion breaks down so the glucose, fatty acids etc can be absorbed (M) Correctly identifies and explains what the different teeth in the seal do (M) Correct knows that chemical digestion does not occur in the mouth but that pepsin digests the protein in the stomach (M) But doesn't compare and contrast the TWO processes and discuss why both are needed in the seal therefore not E
2	M5	Correctly identifies and describes aerobic respiration (A) and anaerobic respiration (A) although the equation of anaerobic respiration does not include ATP / energy they clearly know that anaerobic respiration uses less oxygen Has identifies that aerobic respiration is best for the runner as it releases energy slowly and can be sustained over for longer (M) also has gone on to explain that aerobic respiration produces 38 ATP's and anaerobic produces only 2ATP's which could also have been that M point Correctly explains how the glucose gets to the muscles cells (M) – TWO M points therefore M5 Incorrectly identified Sample A as best so no more marks.
3	M6	Enzymes break down carbohydrates into glucose, proteins into amino acids and lipids into fatty acids and glycerol (A) pH will affect enzymes activity as if not at optimum they will denature / active site change shape so they will no longer work (M) Has idea that different parts of digestive system in the organisms have different pH's so that the enzymes can work at their optimum pH and has given examples of specific examples in the digestive system (M) Has identified a number of digestive fluids that occur in the digestive system to help maintain the optimum pH so that the enzymes can work best (M) THREE M points therefore M6 but hasn't really discussed clearly the role of the digestive juices throughout the digestive system and how they maintain the optimum conditions for each specific enzyme to work best OR discussed the similarities between the digestive systems of the human and the horse.