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NZQA

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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.

Achievement

TOTAL 12

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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 ~~break down~~ physical breakdown of large insoluble food molecules to smaller soluble food molecules eg. mastication Chemical digestion is the break down of large insoluble food molecules to smaller soluble food molecules using enzymes or digestive juices. Both processes are necessary as they aid in digestion, physical digestion increases the surface area of food or help in mixing food with digestive juices increasing the rate of digestion as there is more area for enzymes & ~~gastric~~ digestive juices to work on. Enzymes & digestive juices in chemical digestion help break chemical bonds between large food molecules. For instance, as the seal ~~eat~~ ingests its food, ~~the teeth~~ its teeth cuts swallowable chunks of food & its saliva moistens & lubricates the food making it easier to swallow. This is how mechanical/physical digestion occurs in the mouth

of the seal. Since carnivores do not produce enzymes in their salivary glands, no chemical digestion occurs in the mouth of the seal. As the food moves to the stomach of the seal the ~~contractions~~ churning by contractions of stomach wall helps in mixing the food with enzymes & gastric juices (mechanical/physical digestion). The acidic condition of the stomach due to the presence of HCl causes proteins to denature, exposing bonds holding the molecule together allowing the enzyme pepsin which is found in the stomach to break long chains of amino acids making up a protein to individual molecules (chemical digestion) making it easier to be absorbed in the bloodstream

* into smaller food molecules to be absorbed in the bloodstream

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QUESTION TWO: RESPIRATION

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 2 types of cellular respiration is: aerobic respiration & anaerobic respiration. Both types of respiration needs the raw material glucose however aerobic respiration needs also ~~the~~ oxygen to further break down & gain the maximum amount of energy from the glucose molecule. While anaerobic respiration would allow the runner to reach a high speed fast, the runner can not maintain it's speed for a long period of time as anaerobic respiration causes the build up of the waste lactic acid even though it provides energy faster than oxygen can be transported by the blood. Also, to generate

movement for a distance of 42 kilometers the runner requires a large amount of energy and while anaerobic respiration produces energy quickly, it only produces 2 ATP (energy) ~~molecule~~ per molecule while aerobic ~~produces~~ respiration produces approximately 36 ATP per molecule allowing the runner to generate movement for a greater distance. ~~Starch digestion~~ carbohydrates / starch are broken down to glucose by the enzyme amylase/maltase in the digestive system. Villis in the small intestine provide a greater surface in the small intestine for a more efficient rate of absorption, these villis contain a capillary network that is close to the surface of the villi to provide a short diffusion distance of glucose into the blood stream which then transports it to the cells that require energy (runner's muscles) so the cell has the raw material it needs for cellular respiration. (Oxygen transported by circulatory system from lungs to runner's muscles). Students should recommend sample A as it is the only food sample that tested positive for glucose which is a raw material needed for the 2 types of cellular respiration to occur.

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A4

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

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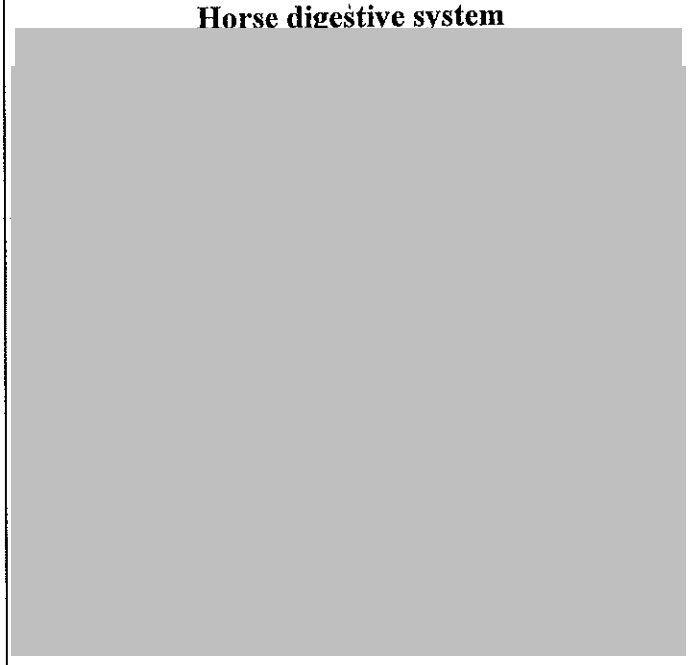
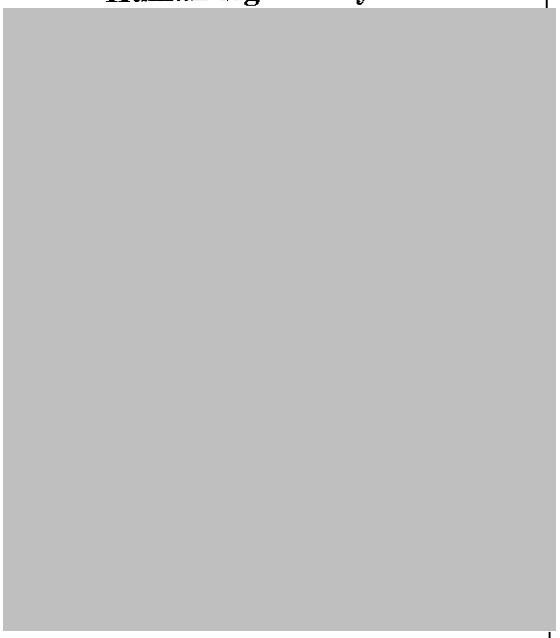
Horse digestive system



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 enzyme salivary amylase breaks down carbohydrates to maltose. The enzyme pepsin breaks down proteins to amino acids. The enzyme lipase breaks down fats / lipids to fatty acids & glycerol. Different enzymes work best at different pHs if the enzyme an enzyme is in a different pH then the enzyme will stop working or even denature. For example the mouth has a pH of 6.5 - 7 & the enzyme amylase works best at neutral conditions, since the pH of the mouth is neutral large amylase can work & breakdown molecules efficiently in the mouth.

however, after the food is swallowed & the food moves to the stomach (pH 1-2) amylase stops working & becomes denatured due to the low pH level of the stomach. This is why the gut is separated to different sections, maintaining optimum pH. Since the mouth has a pH that is slightly alkaline or neutral, the enzyme amylase can work efficiently in the mouth. The stomach has a pH that is acidic allowing the enzyme pepsin to work & break down protein to amino acids efficiently, as the food moves to the small intestine where pH returns to slightly basic or neutral the enzymes in the pancreatic juice (lipase, amylase, trypsin) that produces glucose, amino acids, & fatty acid & glycerol in the small intestine can work efficiently as these enzymes works best at neutral or slightly basic pH. Omnivores such as humans has enzymes that herbivores produce as both omnivores & herbivores eat plant material therefore omnivores & herbivores need enzymes to help them break tough cellulose cell wall of plant material.

- Herbivores - only eat plant material
- Omnivores - eat both meat & plant material

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A3

Achieve exemplar 2016

Subject:	Biology Level 1	Standard:	90929	Total score:	12

Q	Grade score	Annotation
1	M5	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 (M) Correctly identifies that chemical digestion breaks bonds so that the food is smaller so it can be absorbed (M) - TWO M points therefore M5 Physical digestion occurs in the mouth but no examples of teeth types and what they do so only A point. Correctly knows that chemical digestion doesn't occur in mouth (no enzyme produced here) but doesn't give enough detail of the chemical digestion that occurs in the stomach for M as they do not name pepsin.
2	A4	Correctly identifies aerobic respiration as needing oxygen (A) and anaerobic as causes a build-up if lactic acid (A) Infers that aerobic is better as they talk about aerobic producing more energy per glucose molecule – 2 vs 36 and that the runner needs more energy to run the distance of 42Km (A) Correctly explains how the glucose gets to the muscles cells at a Merit level (but need TWO M points to get M5) Incorrectly identifies Food Sample A
3	A3	Identifies different enzymes and what they do (A) Different enzymes work in different pH and if is in a different pH it will denature (A) but this student has backed up this statement with talking about pH of the mouth and stomach (M) but didn't name the enzyme being explained – need TWO M points to get M5 Enzymes work at specific pH's (A) Nothing about how enzymes work or any digestive juices explained so doesn't go higher