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Level 1 Biology, 2015

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

2.00 p.m. Friday 20 November 2015
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 2–12 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.

Excellence

TOTAL 21

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QUESTION ONE: TEETH FOR LIFE

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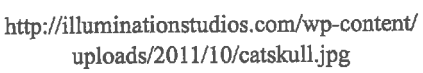
The pictures below show the skull of a carnivore and the skull of a herbivore. They have different structures to assist with the digestion of the different types of foods eaten.

Cat skull



http://illuminationstudios.com/wp-content/uploads/2011/10/catskull.jpg

Sheep skull

http://www.cpr-savers.com/assets/images/prodimages/T30018.jpg

(a) Define the term digestion.

Digestion is the process of making large food molecules into smaller molecules so that they can be absorbed and used by the body.

(b) Explain how the teeth and jaws of cats and sheep are adapted to deal with their different types of food.

In your answer you should:

- ~~name the type of digestion that uses the teeth~~
- explain how each animal's teeth are adapted to suit each animal's typical diet
- compare the teeth and jaw of the cat with the teeth and jaw of the sheep, and explain how and why they are different.

The type of digestion that uses teeth is physical or mechanical digestion. The teeth cut, grind or chew the food so that chemical digestion using enzymes can be more efficient. A cat's diet consists of proteins and lipids whereas

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the sheep's diet consists of tough plant material covered in a cellulose wall. To digest and extract nutrients from these diets cats and sheep have adapted teeth and jaws to help physical digestion.

The sheep and cat both have teeth for physical digestion. The cat has small incisors, large pointed canines and sharp molars called carnassials whereas the sheep has large ~~flat~~ incisors that bite against a bony pad, no canines and large, flat molars. This is because the cat mostly grips it's ~~protein~~ meat with it's canines so there is no need for them to be large but the sheep needs to crop grass very close to the source so it's incisors need to be large and bite against a bony pad. A cat needs large, pointed canines to kill prey, to grip meat and to rip and tear meat from bone whereas the sheep's diet doesn't need to be killed so canines aren't needed. The main difference between these two mammals are the molars at the back of the jaw. In cat's they are sharp, pointed carnassials and in a sheep they are large and flat. This is because the cat needs to be able to bite off sizeable chunks of its prey and to shear through bones whereas the sheep needs to ~~bite~~ be able to grind up the plant material because it ~~takes~~ has a very tough cellulose wall that is very hard to digest. The molars are helped by the action from the jaw in each mammal, in the cat the jaw moves up and down. This is the same with the sheep except it moves side to side as well. This is because the cat's molars act like scissors to efficiently break through meat whereas in the sheep, the side to side motion efficiently helps the large flat molars break up the tough plant material.

All of these adaptations help each animals quickly and efficiently break up ~~tough cellulo~~ their different diets.

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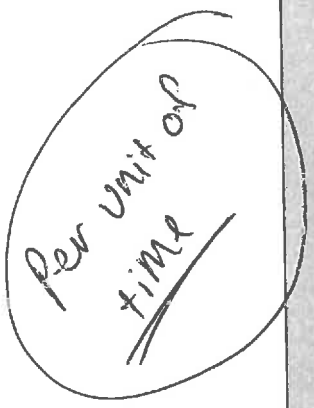
(c) The rates of substrate breakdown by salivary amylase and pepsin were tested across a range of different pH values, and the results are shown in the graph below.

Pepsin and Salivary Amylase Activity at Different pH Values



http://www.skill-guru.com/228/mcas-high-school-biology-test-spring-2011/questions

Referring to each of these enzymes, explain how these results relate to digestion in the mouth and in the stomach.

Your answer should include:

- ~~a definition of chemical digestion~~
- ~~a description of where each enzyme is produced, and where it carries out its function~~
- a discussion of how each enzyme's activity is affected by the pH changes that occur as food moves through the digestive system.

Chemical digestion is a form of digestion using enzymes. Enzymes are biological catalysts that speed up the rate of digestion by lowering the activation required. This means that large food molecules can be broken down into smaller molecules quicker and be absorbed and used up by the body.

Salivary amylase is an enzyme that is produced in the salivary glands and acts upon carbohydrates in the mouth. Pepsin is an enzyme that is produced in the stomach and acts upon protein there also.

Enzymes have an optimum pH at which they work at their

so it digests more per unit of time

best. Below these pH levels the enzymes will remain inactive and won't chemical digest large molecules making digestion ineffective. Above these pH levels the active site where the different food molecule bonds are broken apart, is destroyed and denatured so the enzyme can't digest food molecules. This explains why specific enzymes are in specific places. Salivary amylase works at an optimum pH of 7 (neutral), which is also the pH of the mouth. If the salivary amylase where to continue working in the stomach it would denature because the pH is 2 to, much to low for salivary amylase, destroying the active site. This is the same for pepsin. Pepsin breaks down ~~carbohydrates~~ Proteins and has an optimum pH of 2. If pepsin where to work in the mouth, it wouldn't have the acidic conditions required from the hydrochloric acid so it would remain inactive and not chemically digest food molecules. This is why salivary amylase functions in the mouth and pepsin functions in the stomach, chemically digesting food fast and efficiently

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E7

QUESTION TWO: DIGESTIVE SYSTEMS

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http://www.mirror.co.uk/news/uk-news/hero-bengal-cat-leo-scares-98886

http://cache2.asset-cache.net/gc/dv1637031-studio-cut-out-of-a-sheep-gettyimages.jpg?v=1&c=IWSAsset&k=2&d=PbAEhIrzoCHBv40PPIGN5LT4ISBLbqOzsOGL5AT2frA%3D

https://classconnection.s3.amazonaws.com/235/flashcards/2166235/jpg/picture11367354350876.jpg

Compare and contrast the digestive system of the cat with the digestive system of the sheep.

In your answer you should:

- describe the similarities AND differences in the features of the cat's and sheep's digestive systems
- explain how the different digestive systems are suited to the dietary requirements of a carnivore and a herbivore.

Sheep and cats both have stomachs, small intestines and large intestines to break down and absorb food and water but they have a few differences.

e cat and sheep both have stomachs to digest food.

* A cat has a one chambered stomach where pepsin breaks down their protein rich diet whereas a sheep has a 4-chambered stomach. the rumen, reticulum, omasum and abomasum. The rumen contains microbes that produce cellulase that break down cellulose, the reticulum sends the cud back into the mouth for reingestion. The omasum has many folds and absorbs water and the abomasum is a true stomach containing enzymes. This is because the cat's diet of protein is far easily to digest and the body already creates pepsin to digest it whereas the sheep's diet is very hard to digest with it's tough cellulose wall and it needs to have microbes to make cellulase as it can't produce it itself.

to absorb nutrients

The cat and sheep both have small intestines but the cat's is much ~~smaller~~ shorter. This is because the protein in the cats diet can rot very easily so it needs a short tract whereas the sheep's diet is very hard to extract nutrients out of so it needs to extract as much as possible so it can have the substances to respire. They both have villi to increase the efficiency of absorption.

The cat and sheep both have large intestines to absorb water except the cat's is shorter. This is because the sheep needs to absorb more water than the cat. ~~The cats large intestine is also smaller because the food it doesn't contain much~~

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QUESTION THREE: DIGESTION AND TRANSPORT

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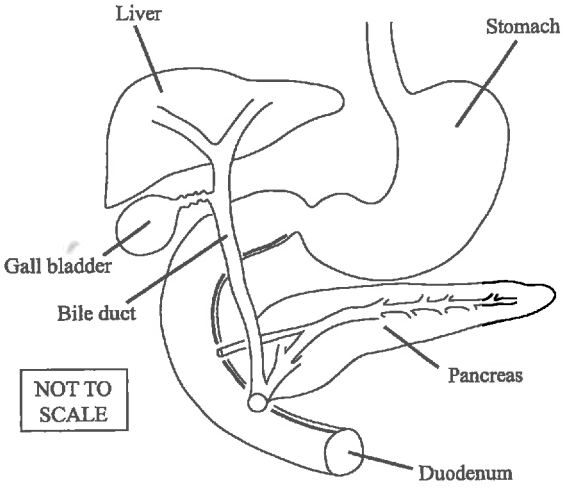
Once chyme (a thick semifluid of partly digested material) leaves the stomach, it enters the first part of the small intestine (duodenum), where further digestion can occur.

(a) Explain how digestion occurs in the small intestine.

In your answer you should:

- ~~complete the table below~~
- explain how digestion is carried out by named enzymes and other substances that are released into the small intestine, including the substrates used and the products formed.

Digestive tract from the stomach to the duodenum



Adapted from: http://www.upmc.com/patients-visitors/education/gastro/Pages/ercp.aspx

Table of digestive enzymes and their substrates

Substrate	Enzyme	Product(s)
Lipids	Lipase	3 fatty acids & Glycerol.
Pep Protein	Protease	Amino acids
Starch	Amylase	Glucose

Lipase acts up lipids and creates fatty acids and glycerol. Lipase has increased efficient because of bile that is released into small intestine. Bile is made from dead red blood cells in the liver and emulsifies lipids into small droplets, increasing the surface area. Increasing the surface area means that lipase can act upon the lipids quicker making digestion more efficient.

Protease acts upon proteins in the small intestine. The ~~proteins~~ chyme has been neutralised by the sodium bicarbonate in the bile, making it neutral, this allows

protease to act upon the proteins creating amino acids that can be absorbed by the body.

Amylase acts upon starch (carbohydrates) in the duodenum. This forms glucose that can be absorbed and used by the body.

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Question Three continues on the following page.

(b) Discuss how the structures in the small intestine enable the nutrients to be effectively absorbed, then transported and assimilated into other cells around the body.

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Adapted from: http://www.daviddarling.info/images/small_intestine_cross-section.jpg

In your answer you should:

- explain how the structures in the small intestine help increase absorption and transport of named substances to other cells within the body
- discuss how the final products of digestion are transported to other regions in the body, and what these products are used for in the cells.

One of the structures in the small intestines that help absorption is villi. Villi are finger-like projections on the intestine wall that increase the surface area. The villi are covered in micro-villi that increase the surface area even more. There is a capillary network next to the surface that means there is a short diffusion distance for glucose, amino acids and water, so it can to be transported around the body quickly. There is also a lateral that absorbs fatty acids. This makes absorption fast and efficient.

The glucose, amino acids and water travel in the circulatory system to all the cells in the body. Amino acid are used for growth. The glucose ~~and water~~ is used in the cells to respire. This creates ATP energy that is broken down

E

Extra paper if required.
Write the question number(s) if applicable.

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36 to release energy in the body. The lateral transports the fatty acids in the lymph system. These are used for energy as well as warmth and protection.

Excellence exemplar for 90929 2015		Total score	21
Q	**Grade score**	**Annotation**	
1	E7	a. Definition incorrect b. Correctly identified that teeth do physical digestion = A Has idea that cat has large pointed canines to kill prey , grip meat, rip etc. and that sheep doesn't have canines as it doesn't kill only eats grass. Also that the cats molars / carnassial are pointed so they can shear through bones while sheep's molars are flat to grind the tough grass = E has compared and linked structure to function clearly c. Definition of chemical digestion correct = A Good answer but hasn't said what salivary amylase does to starch/ carbohydrates therefore couldn't get above A on this section	
2	E7	Clearly has discussed why sheep have microbes in their rumen; to produce cellulase to break down the cellulose because the sheep can't make the enzyme themselves to break down cellulose and that cats have pepsin in their stomach to break down the protein rich diet = E Also has idea as to why the sheep needs more than one stomach and cats need only one stomach = E TWO E = E7	
	E7	a. Table correct Has idea of where bile is produced and what bile does = M Knows that enzymes are added but only lists enzymes doesn't say where they come from therefore not M b. Has correct idea about villi = A Has idea that capillary network absorbs amino acids and glucose. Also has idea of what glucose is used for = E Knows that the lacteal absorbs fatty acids but not enough detail on what amino acids or fats are used for to get E8	