Adaptations for Nutrition (3.3): Eduqas A Level Biology Exam Questions by Topic

24 questions · 56 marks · about 67 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Component 3 · June 2022 · Q3(a)(i) · 1 mark

3. (a) Humans use holozoic nutrition.

(i) Define the term holozoic. [1]

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Question 2 · AS Component 2 · June 2018 · Q1(a) · 1 mark

1. Organisms display a wide range of feeding mechanisms. For example, *Amoeba* are holozoic and feed by ingesting food particles which are digested intracellularly, whereas fungi are saprotrophic.

(a) Define the term *saprotrophic*. [1]

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The rumen contains single-celled protoctists that consume other micro-organisms or particles of plant matter swallowed by the cow.

Image 2.4 is a photograph of a rumen protoctist containing several food vacuoles. Following endocytosis, it carries out intracellular digestion.

Image 2.4



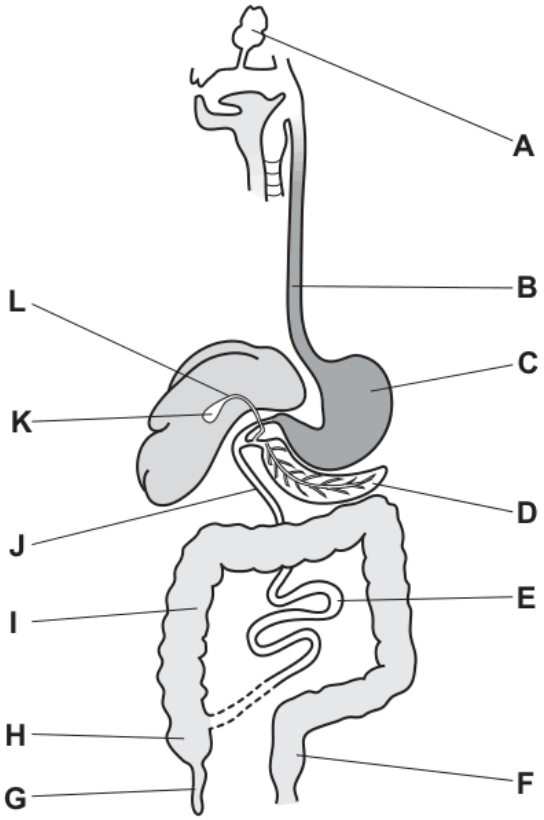
(iv) Describe the process of digestion inside the cell after the formation of the food vacuole. [2]

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Question 4 · A level Component 3 · Autumn 2021 · Q1(a) · 2 marks

1. Carbohydrates are an important part of the human diet and are digested in different places as they pass through the human digestive system. **Image 1.1** shows a diagram of the human digestive system.

Image 1.1



(a) Name the enzyme that digests starch **and** identify the structure(s) that produce this enzyme using letter(s) from **image 1.1**. [2]

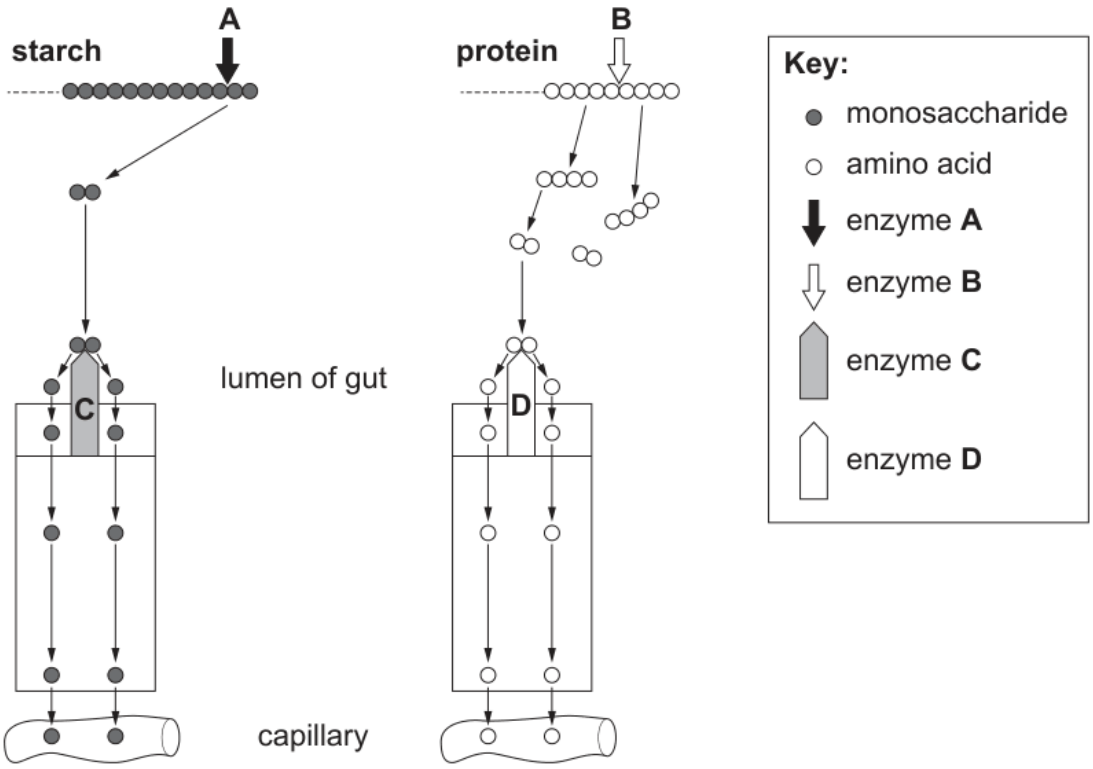
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2. The efficient digestion of molecules in food substances requires many different enzymes and different conditions. **Image 2.1** is a schematic diagram representing the breakdown and absorption of starch and protein.

Image 2.1



(a) (i) I. Use **Image 2.1** to complete **Table 2.2**. [3]

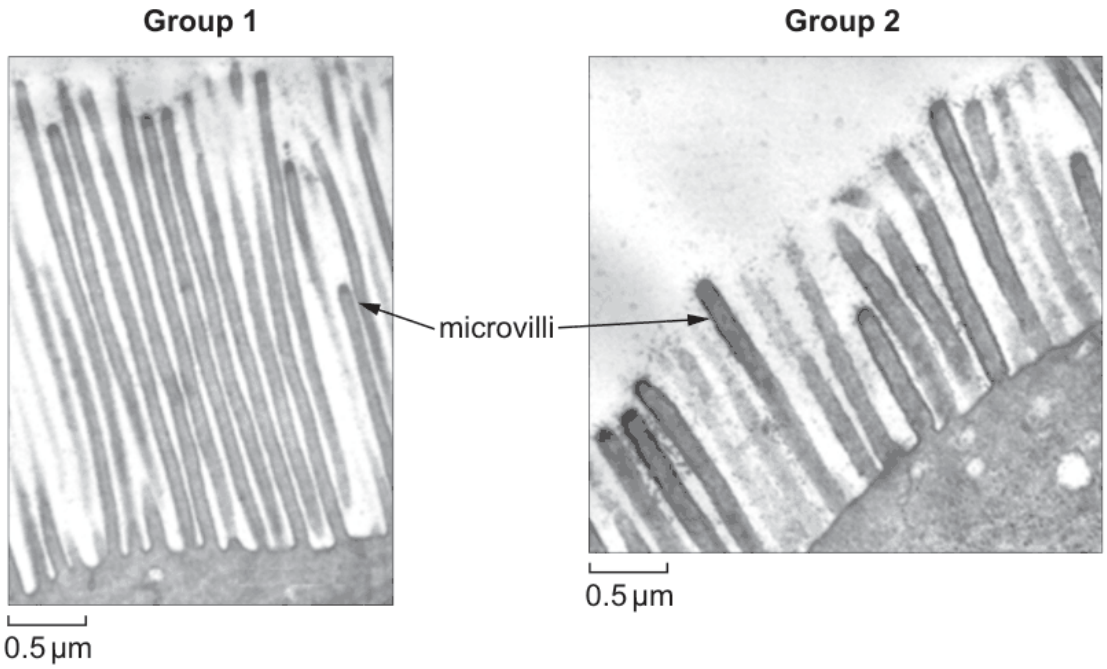
Table 2.2

Label	Enzyme name	Product
A	.....	.....
B	.....	.....
C	.....	.....

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Question 6 · A level Component 3 · June 2018 · Q4(b) · 3 marks

(b) The electron photomicrographs below show high magnification images of the surface of the epithelial cells covering the villi of a snake from each of Groups **1** and **2**.



Describe and explain the differences in the length and width of the microvilli seen in Group **1** compared to Group **2**. [3]

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Question 7 · A level Component 3 · June 2018 · Q4(c) · 2 marks

(c) Electron microscopy also showed that the epithelial cells from the snakes in Group **1** had the following differences compared to those from Group **2**.

Group 1	Group 2
large number of mitochondria	few mitochondria
cells arranged in a single layer	cells arranged in several layers

Explain the observations that were made for Group **1**. [2]

Question 8 · AS Component 2 · June 2024 · Q2(c)(i) · 1 mark

(c) Enzymes on the plasma membrane of epithelial cells in the small intestine hydrolyse tripeptides and dipeptides.

(i) Suggest **one** advantage of using membrane-bound enzymes at this stage of digestion. [1]

Question 9 · AS Component 2 · June 2024 · Q2(c)(ii) · 2 marks

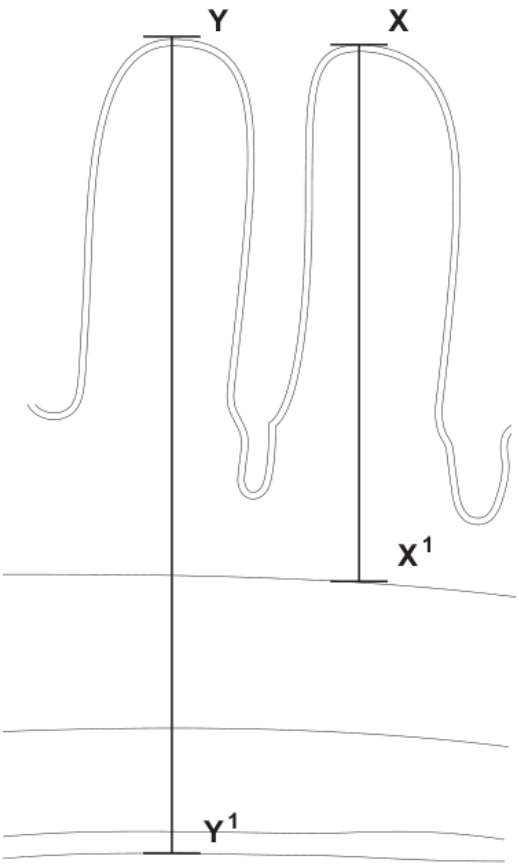
(ii) Describe and explain how **one** structural feature of the small intestine increases the efficiency of protein digestion. [2]

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Question 10 · AS Component 2 · June 2017 · Q3(b)(i) · 4 marks

(b) A student used the microscope to examine a T.S. slide of duodenum of a mammal and drew a low power plan.

Low Power Plan of TS Duodenum. (x10 eyepiece lens, x10 objective)



(i) Use clear label lines and the letters **A-D** to identify the following structures on the low power plan above. [4]

A Serosa

B Mucosa

C Circular muscle

D Longitudinal muscle

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Question 11 · AS Component 2 · June 2017 · Q3(c)(i) · 1 mark

(c) The protease enzyme trypsin is an endopeptidase secreted by the acinar cells of the pancreas. The enzyme is secreted in an inactive form called trypsinogen. Another enzyme called enterokinase converts the inactive trypsinogen to the active form, trypsin, in the duodenum.

(i) Explain why the enzyme is secreted in an inactive form. [1]

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Question 12 · AS Component 2 · June 2017 · Q3(c)(ii) · 3 marks

(ii) The optimum pH of trypsin is in the range 7.8 – 8.7. Explain how this pH is maintained in the duodenum. [3]

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Question 13 · A level Component 3 · June 2022 · Q3(a)(ii) · 2 marks

(ii) Pepsinogen is released into the stomach and converted to the active endopeptidase pepsin.

Explain why pepsinogen rather than pepsin is released by some of the cells lining the stomach and describe how it is activated. [2]

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(c) Casein is a protein found in milk. Scientists investigated the use of immobilised enzymes for the digestion of casein. They set up a column of immobilised enzymes and a solution of the protein casein was poured into the column. The resulting liquid was collected and analysed for free amino acids.

Three columns were set up, these contained either endopeptidase, exopeptidase or a mixture of endopeptidase and exopeptidase.

The results are shown in **Table 3.2**.

Table 3.2

Enzyme present	Free amino acids collected as a % of resulting liquid
endopeptidase	2
exopeptidase	5
endopeptidase and exopeptidase	17

(i) Explain the results shown in **Table 3.2**. [3]

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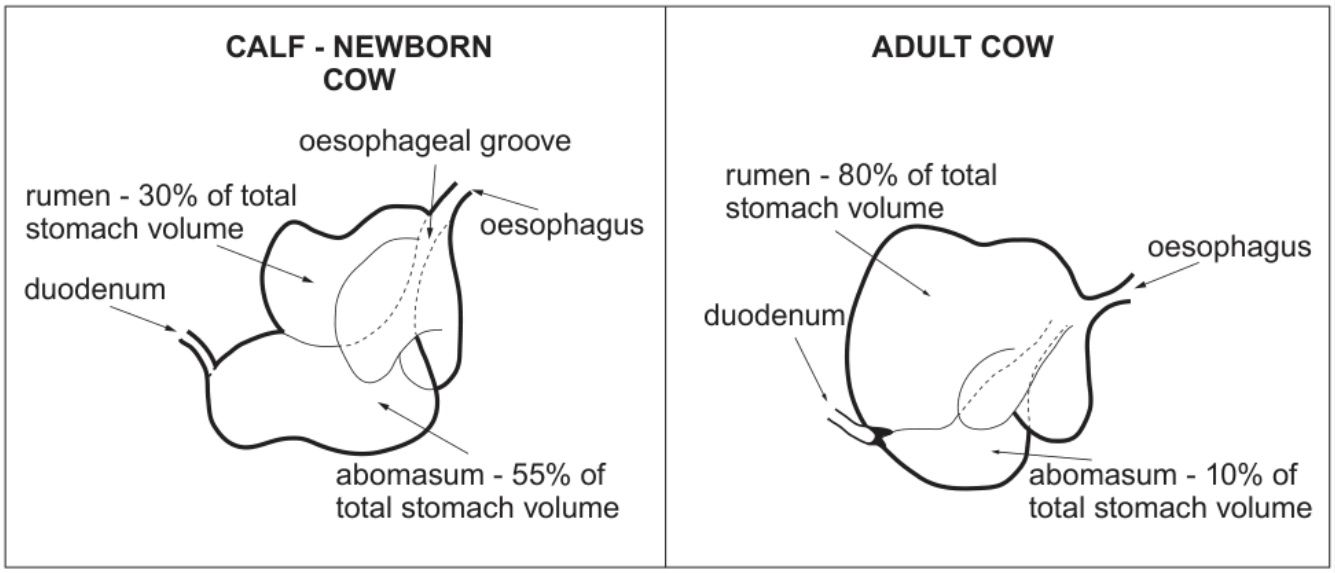
Question 15 · A level Component 3 · June 2017 · Q5(a) · 3 marks

5. Rennet is a mixture of enzymes that are produced by young ruminants to help improve the effectiveness of the digestion of casein (milk protein). Chymosin is the main enzyme in the mixture and is responsible for breaking a specific chemical bond in k-casein, one of the proteins found in casein. This enables digested k-casein to coagulate the other proteins found in milk and form a semi-solid mass.

(a) Chymosin is secreted as a precursor molecule by cells in gastric glands found in the abomasum (true stomach). Pepsinogen and hydrochloric acid are also secreted by these glands. Explain the role of these **three** secretions in digesting milk protein. [3]

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In the ruminant gut, the relative proportions of the compartments of the stomach called the rumen and abomasum (true stomach) change as the animal grows older. The relative proportions of the rumen and abomasum of a newborn cow and adult cow are shown in the diagram below.



(b) With reference to their diets, explain the changes in the proportions of the rumen and abomasum as a calf grows older and its diet changes from milk to grass. [5]

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Question 17 · information from earlier in the question

(c) The structure of the gut of a cow, horse and dog is shown in **Image 2.3** (not drawn to scale). Cows and horses are herbivores and dogs are carnivores.

Image 2.3

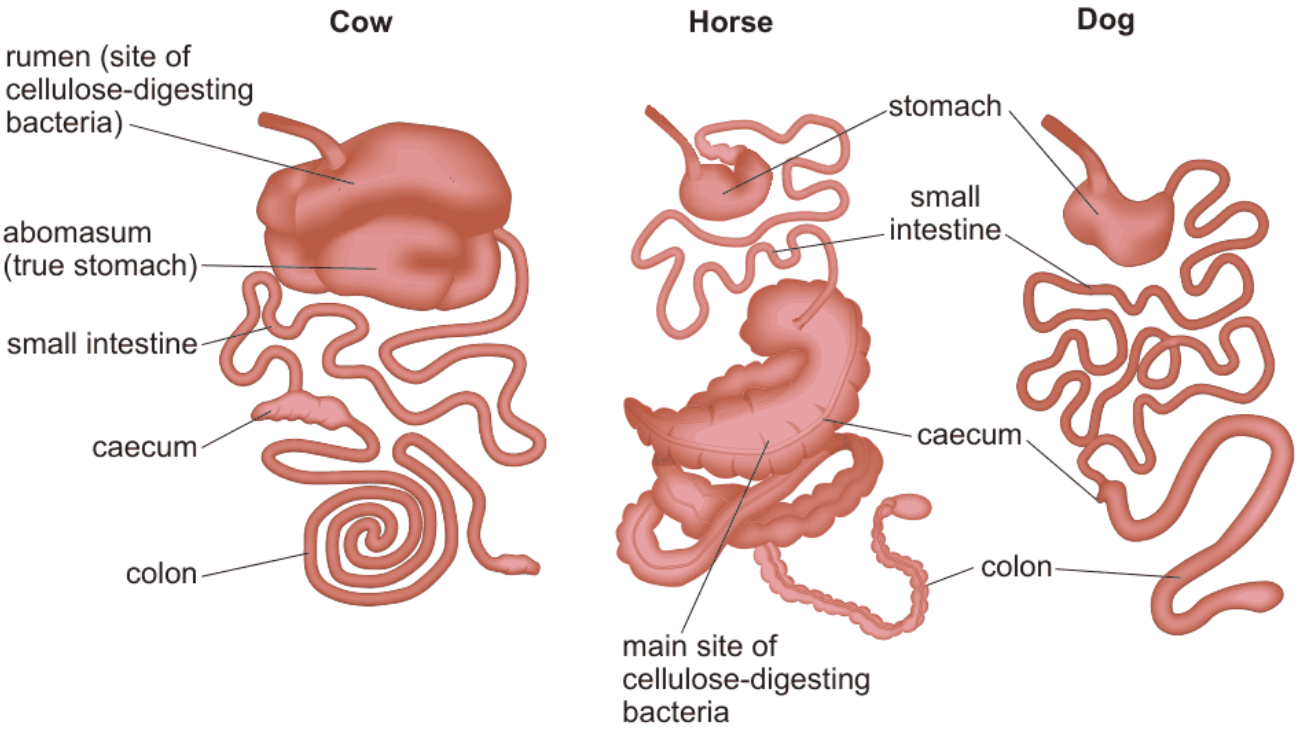


Table 2.4

	Relative volume of entire gut / %		
Part of gut	Cow	Horse	Dog
rumen	62.8	–	–
stomach	8	8.5	62.3
small intestine	18.5	30.2	23.3
caecum	2.8	15.9	1.3
colon	7.9	45.4	13.1

Question 17 · A level Component 3 · June 2024 · Q2(c)(ii) · 2 marks

(ii) Cows are classified as mammals and so their young feed on milk.
With reference to their diet, explain why the abomasum of a newborn calf is proportionally larger at birth than in an adult cow. [2]

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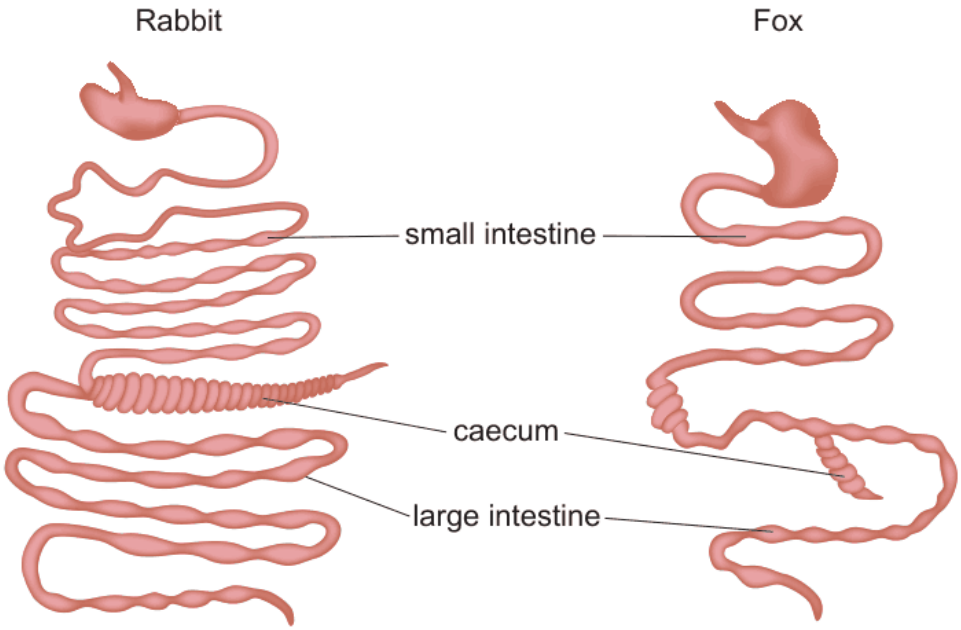
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4. (a) Rabbits and foxes are mammals that consume different proportions of macronutrients. **Image 4.1** shows the digestive systems of a rabbit (a herbivore) and a fox (a carnivore).

Image 4.1



(i) Most products of digestion are absorbed in the ileum which is the longest section of the small intestine. With reference to its diet, explain why a fox has a proportionally shorter ileum than a rabbit. [2]

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2. Polar bears (*Ursus maritimus*) and cows (*Bos taurus*) are mammals that need a great deal of protein and energy in order to grow their large mass of tissue.

Polar bears are carnivores that live in the Arctic Circle. Their prey includes seals, which provide a diet high in proteins and lipids.

Image 2.1 shows the skull of a polar bear.

Image 2.1



(a) Identify **two** features, visible in **Image 2.1**, that show adaptations to the polar bear's carnivorous diet. Explain how each is an adaptation for such a diet. [2]

Feature 1: .....

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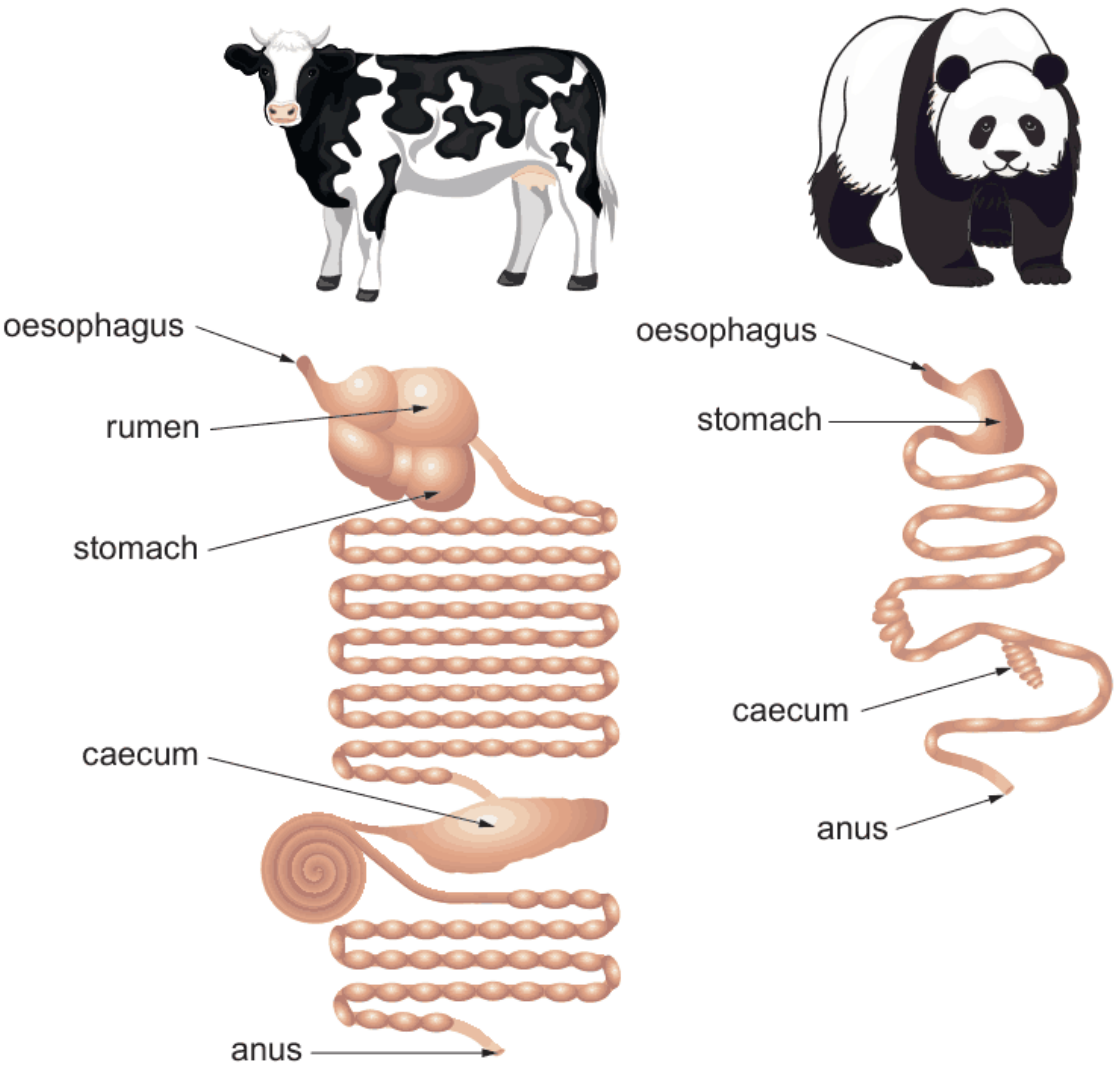
Feature 2: .....

.....

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Image 4.3 shows the digestive tract of a cow and a giant panda.

Image 4.3



(iii) Describe how **and** explain why the gut of the panda differs from the gut of a cow. [4]

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Question 21 · A level Component 3 · June 2025 · Q4(a) · 1 mark

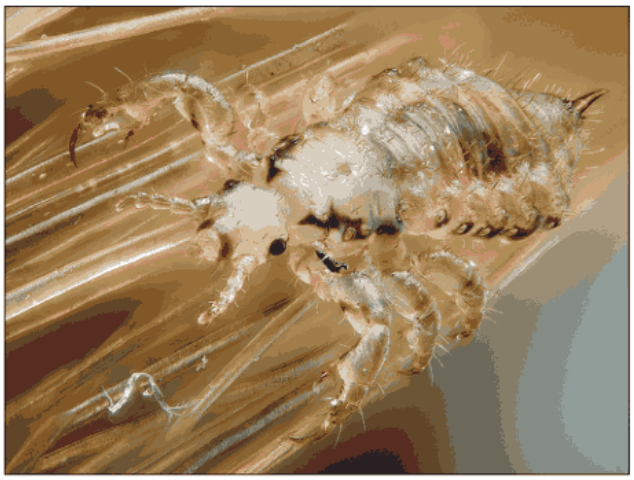
4. Parasites are organisms which obtain nourishment at the expense of the host. Parasites of humans include *Taenia solium* (pork tapeworm) and *Pediculus capitus* (headlouse). These are shown in **Image 4.1**.

Image 4.1

Taenia



Pediculus



(a) *Taenia* is an endoparasite and *Pediculus* is an ectoparasite.
Define each of these terms. [1]

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Question 22 · A level Component 3 · June 2025 · Q4(b) · 4 marks

(b) Explain why *Taenia* does not have a digestive system but *Pediculus* does have a digestive system. [4]

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Question 23 · AS Component 2 · June 2018 · Q1(b)(i) · 1 mark

(b) The parasitic tapeworm *Taenia solium* is an endoparasite that completes its life cycle in two different species of animal, humans and pigs. As an adult, *T. solium* lives in the human intestine. The tapeworm has no mouth or alimentary canal and relies on anaerobic respiration to provide energy.

(i) Describe how the tapeworm is adapted to resist peristalsis in the human intestine. [1]

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Question 24 · AS Component 2 · June 2018 · Q1(b)(ii) · 2 marks

(ii) Explain why the tapeworm does not need a mouth or alimentary canal. [2]

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Mark schemes

Question 1 · A level Component 3 · June 2022 · Q3(a)(i) · 1 mark

3	(a)	(i)	Internal digestion of food substances/ ingested and digested	1	1

Question 2 · AS Component 2 · June 2018 · Q1(a) · 1 mark

1	(a)	Enzymes secreted outside of the body/extracellular digestion **and** the products of digestion are absorbed (1)	1			1	

Question 3 · AS Component 2 · June 2024 · Q2(b)(iv) · 2 marks

(iv)	Food vacuole fuses with lysosome (1) (Lysosomal) enzymes / named enzyme hydrolyses large molecules / named molecule / description of (1)	2	2

Question 4 · A level Component 3 · Autumn 2021 · Q1(a) · 2 marks

1	(a)	Amylase (1) A and D (1)	2	2

Question 5 · A level Component 3 · June 2024 · Q2(a)(i)I · 3 marks

2	(a)	(i)	I			

Label	Enzyme name	Product
A	(salivary / pancreatic) amylase	Maltose Ignore disaccharide
B	pepsin / trypsin Accept endopeptidase	{Polypeptides / dipeptides / peptides} reject amino acids
C	maltase	Glucose Reject beta glucose

1 mark per line [3]

3 3

Question 6 · A level Component 3 · June 2018 · Q4(b) · 3 marks

(b)	longer to increase surface area/ larger number to increase surface area/ORA (1) thinner to decrease diffusion distance/ORA (1) Group 1 need to {digest food/absorb nutrients} (1)	2 1	3

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Question 7 · A level Component 3 · June 2018 · Q4(c) · 2 marks

(c)	*Answers relate to Group 1 – accept reverse arguments:* **mitochondria** ATP synthesis + {for active transport/enzyme production} (1) 1 **single layer of cells** reduces distance for nutrients to pass into {capillaries/lacteals/ bloodstream}/ increase rate of absorption for uptake (1) 1		2

Question 8 · AS Component 2 · June 2024 · Q2(c)(i) · 1 mark

(c)	(i)	Enzymes (attached to plasma membrane) are not lost in faeces / can be used more than once (after product molecules are released) / fewer enzyme molecules need to be produced. (1) Accept amino acids released in close proximity to {cotransport proteins / eq}.	1	1

Question 9 · AS Component 2 · June 2024 · Q2(c)(ii) · 2 marks

(ii)	Marks are paired Either; (many) microvilli on epithelial cells / villi on small intestine / small intestine is very long / wall of small intestine is folded. (1) Larger surface area for more {enzyme molecules / digestion} (1) or; Muscles contract to move food / bolus (1) increases contact between contents / substrates and enzyme (active sites) (1) or; intestine is very long (1) more time for digestion (1) or glands produce alkaline secretions (1) to give optimum pH for protease enzymes (1)	2	2

Question 10 · AS Component 2 · June 2017 · Q3(b)(i) · 4 marks

(b)	(i)	Serosa (1) Mucosa (1) circular muscle (1) longitudinal muscle	4	4

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Question 11 · AS Component 2 · June 2017 · Q3(c)(i) · 1 mark

(c)	(i)	Active form would {digest/ break down} cells/ autolysis/ ORA	1	1

Question 12 · AS Component 2 · June 2017 · Q3(c)(ii) · 3 marks

(ii)	Alkaline secretion/ bile (1) from Brunner's glands / pancreas/ liver cells/ gall bladder (1) Neutralise acid from stomach / increase pH / act as buffer (1)	3	3

Question 13 · A level Component 3 · June 2022 · Q3(a)(ii) · 2 marks

(ii)	Could digest the cell/ prevent autolysis (1) Only converted when {<u>hydrochloric acid/ HCl</u>} is present (1)	1	1	2

Question 14 · A level Component 3 · June 2022 · Q3(c)(i) · 3 marks

(c)	(i)	Endopeptidase {breaks bonds in the middle of the chain / produces shorter polypeptides} (1) Exopeptidase only removes terminal amino acids + so (more) free amino acids produced (1) Combination gives more ends for exopeptidase to work on so most free amino acids released (1)	3	3

Question 15 · A level Component 3 · June 2017 · Q5(a) · 3 marks

5	(a)	**Any three (x1) from :** • {HCl/ H^+} activates {enzyme precursor / chymosin precursor / pepsinogen} (1) • Also provides optimum pH (1) • Chymosin causes coagulation of milk proteins which increases the time taken to pass through stomach (1) • (Pepsinogen activated into) pepsin which {digests/ hydrolyses/ breaks down}{ proteins / peptide bonds} (1)		3	3	

Question 16 · A level Component 3 · June 2017 · Q5(b) · 5 marks

(b)		**calf**: A. abomasum involved in protein digestion (1) **B.** therefore abomasum is larger (1) **adult**: C. Diet mainly {grass/ cellulose rich} which is difficult to digest (1) D. rumen contains bacteria that can digest cellulose (1) E. diet low in protein / abomasum digests mainly <u>bacterial</u> protein (1) F. therefore rumen is larger (1)	1 1	 1 1 1 1	5	

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Question 17 · A level Component 3 · June 2024 · Q2(c)(ii) · 2 marks

(ii)	(New born cow feeds on milk) which has high protein (content) (1) Protein digested in {abomasum / true stomach} (1)	2	2	

Question 18 · AS Component 2 · June 2023 · Q4(a)(i) · 2 marks

4	(a)	(i)	(diet) Fox- (proportionally) more products of protein digestion/named product of digestion enters ileum (as it has already been digested in the stomach/duodenum) (1) (length of ileum) so ileum is shorter as less time/s.a. needed for (sufficient) absorption. (1) Accept converse. (diet) Rabbit - fewer products of digestion/named product of digestion/more indigestible or undigested material enters ileum. (1) (length of ileum) so ileum is longer to allow more time/s.a. for absorption (accept continued digestion). (1)	1	1	2

Question 19 · AS Component 2 · June 2024 · Q2(a) · 2 marks

2	(a)	**Any two (×1) from** • {Long / pointed} canines for {piercing / seizing} {prey / tissue / muscle} (1) • {Sharp / pointed} incisors / incisors on upper and lower jaw} for {gripping / tearing} (muscle) (1) • {Premolars / molars} have pointed {cusps / description of} for {cutting / slicing / crushing} (accept carnassials, if remainder of description is clear) (1) • (Large) recesses on the {skull / lower jaw} for {large / powerful} muscles (can exert large force on prey) (1)	2	2

Question 20 · AS Component 2 · Autumn 2020 · Q4(b)(iii) · 4 marks

(iii)	A. Stomach is less complex in giant panda/no rumen (1) B. Short small intestine in giant panda/longer in herbivores (1) Accept overall length of tract/intestines C. Less time needed/ easier to digest proteins in carnivores / gives longer time for digestion of plant material in herbivores (1) D. Shorter/smaller caecum (from diagram) (1) Accept ORA for cow	4	4

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Question 21 · A level Component 3 · June 2025 · Q4(a) · 1 mark

4	(a)	Endoparasite – lives {within / in} a {host / organism} **and** Ectoparasite – live on the {surface / outside / owtte} of a {host / organism} (1)	1	1	

Question 22 · A level Component 3 · June 2025 · Q4(b) · 4 marks

(b)	*Taenia* A. Absorbs nutrients from the {gut / digestive system / owtte} across its {cuticle / surface / membrane / skin} (1) B. (Has no digestive system) as nutrients {have already been digested / predigested} by the host (1) *Pediculus* C. {Bites the scalp to take / feeds on / sucks} blood from host (1) D. (Digestive system needed) {break down / digest} {haemoglobin / blood / plasma proteins} (1)	2	2	4	

Question 23 · AS Component 2 · June 2018 · Q1(b)(i) · 1 mark

	(b)	(i)	Scolex/hooks and suckers + attach to gut wall	1			1		

Question 24 · AS Component 2 · June 2018 · Q1(b)(ii) · 2 marks

	(ii)	Nutrients absorbed through its body surface (so it doesn't need a mouth)(1) Food is pre-digested (so does not need an alimentary canal) (1)	2			2		

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