

WJEC (Wales) Biology A-level
Topic 2.4: Adaptations for
Nutrition
Questions by Topic - Mark
Scheme

1. Parasites {live in / on a} host and obtain nourishment {at the expense of / do harm to} the host; NOT feed (can be neutral)

Tapeworm / ticks / leeches / fleas / headlice / roundworm / plasmodium / malaria parasite / any parasite;
[2]

Autotrophs use {(simple) inorganic molecules / carbon dioxide and water} to synthesise {(complex) organic compounds / named organic compound / sugars}; NOT food

Plant / named Plant / Algae / Bacteria must be qualified by chemosynthetic;
[2]

Saprobionts {secrete enzymes onto the food outside the body / feed by extracellular digestion} and absorb (or e.q.) the (soluble) products (by diffusion); NOT ingest

Bacteria / Fungi / or named;
[2]

Question total 6

2.	Question	Marking details	Marks Available
2	(a)	(i) organism that lives {on/in} another {organism/ host}; causes {harm/ damages} to host/ at the expense of the host;	2
		(ii) Any three from {suckers/hooks} (for attachment to host gut); <u>large surface area to volume ratio</u> ; {thin/ flattened}{proglottids/ segments}; covering resistant to host's digestive enzymes; NOT immune system hermaphrodite/ OWI IE; produces large number of eggs; no digestive system;	3 max
		(iii) Any three from Carnivorous/ carnivore; {Large/ pointed} canines for {tearing/grasping flesh/ killing prey}; molars/premolars for {cutting/ slicing} meat; NOT tearing (small) incisors for {gripping/ stripping} flesh; <u>carnassials</u> teeth for {crushing/cutting}; vertical movement of jaws;	3 max
	(b)	(i) obtains {food/ nutrients} from another organism/heterotrophic;	1
		(ii) A {requires food digested by host/ no digestive system}, B {digests food itself/ has digestive system}; A absorbs food {externally/at surface}, B internal absorption;	2
		Question 2 Total	[11]

3.

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Tctal	Maths	Prac
3	(a)		Enzymes secreted outside of the body/extracellular digestion and the products of digestion are absorbed (1)	1			1		
	(b)	(i)	Scolex/hooks and suckers + attach to gut wall	1			1		
		(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		
		(iii)	Oxygen levels are too low for aerobic respiration in the intestine/ It has a low metabolic rate and {does not require aerobic respiration/does not move much/owtte (1)		1		1		
	(c)	(i)	Any four (x1) from (Thick) cuticle protects the worm from the effects of {acids/ enzymes} (1) Lime cell secretion neutralises acid (1) Microtriches increase surface area for absorption of digested food (1) Glands secrete mucus to protect the worm from digestive enzymes (1) Muscles allow tapeworm to increase contact with digested food (1)		4		4		
		(ii)	Enable the worm to absorb ions/amino acids/glucose/correct named product of digestion(1) Against concentration gradient (1)			2	2		
			Question 3 total	4	5	2	11	0	0

4.

Question		Marking details	Marks Available
4.	(a)	(i) C/ D;	1
		(ii) K <u>and</u> F;	1
		(iii) C;	1
(iv) E;		1	
(v) F;		1	
(vi) J;		1	
(b)	(i) Herbivorous/ herbivore;		1
	(ii) { <u>large/ridged/WM shape</u> } { <u>molars/premolars</u> } for <u>grinding</u> ; { <u>diastema/space with no teeth/ gap between teeth</u> } to assist with { <u>chewing/ (tongue to) manipulate food/ cud</u> }; { <u>well developed/ sharp/ long</u> } incisors for { <u>biting/ cutting/ slicing/ tearing</u> } (vegetation); loose articulation/ jaw moves in a {horizontal/ circular} plane; Very small/ no canines; open roots to allow continuous growth of molars;		3max
	(iii) Four <u>chambered</u> stomach (NOT four stomachs) / rumen/ large caecum; Contain cellulose digesting bacteria/ have cellulase producing bacteria; NOT cellulose eating bacteria Long gut {to allow extra time for digestion of cellulose/ cellulose harder to digest}; Cud is regurgitated for further chewing;		2
Question 4 Total			[12]

5.

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
5	<p>Indicative content</p> <ul style="list-style-type: none"> • Wolves and dogs have carnivore dentition • Sharp incisors and long pointed canines • Carnassial teeth for shearing through bone, ligaments and tendons • (Relatively) short gut adapted for protein digestion • Salivary amylase hydrolyses starch to maltose • Optimum pH maintained by mineral salts/buffers in saliva • Starch digestion resumes in duodenum with pancreatic amylase • Maltose digested to glucose by maltase in small intestine • Domestic dogs fed on human food waste containing large amounts of starch • Some dogs better at digesting starch than others • Dogs that could digest starch well more likely to survive and breed/can live on human food waste • Wolves/wild dogs cannot digest starch as there is no selective advantage/wolves cannot produce amylase <p>7-9 marks Detailed explanation of carnivore dentition Detailed account of starch digestion Logical explanation of advantage of starch digestion in domesticated dogs</p> <p><i>The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.</i></p>	3	4	2	9		
	<p>4-6 marks Any two from: Explanation of carnivore dentition An account of starch digestion Attempt to account for advantage of starch digestion in early dogs</p> <p><i>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.</i></p> <p>1-3 marks Any one from: Brief explanation of carnivore dentition Brief account of starch digestion Attempt to give an advantage for starch digestion in early dogs</p> <p><i>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.</i></p> <p>0 marks <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i></p>						
	Question 5 total	3	4	2	9	0	0

6. (a)	Parasites (are organisms that) live {on/ in} {another organism/ host} <u>and</u> obtain {nourishment/ nutrients} from it; at the expense of /causing harm to the host;	2
6. (b)	attaches to gut wall by {hooks <u>and</u> suckers/ scolex}; {large/ high/ increased} <u>surface area to volume ratio</u> ; {digested products/ nutrients} in host gut absorbed into tapeworm; short diffusion pathway;	3 max

7. (a)

A Capillaries; NOT blood vessels; [1]

B Epithelium / epithelial cells; NOT endothelium; [1]

C Lacteal; NOT lymph; [1]

(b)

D Arteriole; [1]

E Venule; [1]

(c)

Microvilli: [1]

Increase SA for diffusion / uptake of molecule / digestion (of molecules); [1]

Mitochondria: [1]

(Synthesis of) ATP for active transport; [1]

(d)

Goblet cell / mucus secreting cell; NOT Brunner's gland. [1]

Secretes / makes mucus; Accept even if named incorrectly above. [1]

Question total [11]

8.

Question

Marking details

Marks Available

- 8 (a) A = Capillary (network)/ capillaries ;
 B = Epithelial cell/ epithelium/ epithelial layer;
 C = Lacteal/ lymph vessel; NOT lymph node

3

(b)

Feature	Explanation
Microvilli/ folded epithelium;	Increase/ large surface area/ greater {absorption/diffusion} (of digested products); increase catalytic surface area for digestion
(Dense/large) capillary network/ {good/rich} blood supply/ lots of capillaries;	{Transport/absorb} {glucose/amino acids} / maintain a {diffusion/concentration} gradient;
Presence of lacteal/ lymph vessel;	Absorb {lipids/fats/ fatty acids};
Thin epithelium/ epithelium one cell thick;	Short diffusion pathway;

Max 4

- (c) (i) Mucus;
 (ii) {Lubricates/ reduces friction} (for passage of food);
 Prevents {auto digestion of /digestion of/ autolysis of/ the effect of acid/ enzymes on} the gut wall;

1

2

- (d) Peristalsis;
 Correct action of circular and longitudinal muscles/ wave of muscle contraction;
 {Forces/pushes/ propels} food along/mixes food (for more efficient digestion/absorption); NOT move

3

- (e) Deamination/ amino group removed;
 (amino groups) to urea;
 remainder to {carbohydrate/ glycogen};

Max 2

Question 8 Total

[15]

9.

Question		Marking details	Marks Available								
9	(a)	<table border="1"> <tr> <td>The main sites of mechanical digestion</td> <td>A & C; Ignore K</td> </tr> <tr> <td>The site of lipase production</td> <td>E;</td> </tr> <tr> <td>The digestion of protein begins</td> <td>C;</td> </tr> <tr> <td>The final stages of carbohydrate digestion</td> <td>F; Ignore K</td> </tr> </table>	The main sites of mechanical digestion	A & C; Ignore K	The site of lipase production	E;	The digestion of protein begins	C;	The final stages of carbohydrate digestion	F; Ignore K	4
		The main sites of mechanical digestion	A & C; Ignore K								
		The site of lipase production	E;								
		The digestion of protein begins	C;								
	The final stages of carbohydrate digestion	F; Ignore K									
(b)	(i) Increases the (total) surface area (of the lipids); {Increasing the rate of <u>digestion</u> / <u>broken down</u> more quickly / <u>broken down</u> more efficiently} <u>by lipase</u> ;		2								
	(ii) <u>Optimum</u> pH for enzymes / to <u>neutralise</u> {stomach acid / chyme}; Ignore: to create an alkaline pH		1								
(c)	(i) Arrow pointing at small intestine;		1								
	(ii) <ul style="list-style-type: none"> • (The tapeworm) lacks a digestive system; • (The small intestine) contains the {products of digestion / digested nutrients / named soluble nutrients / soluble nutrients} / nutrients can simply be {absorbed / diffuse} across the tapeworm's <u>body surface</u> / <u>membrane</u>; Accept skin 		2								
Question 9 total			[10]								

10.

- (a) A – E correct 1 mark each. [4]
- (b) (i) lacteal, absorption of fats [1]
- (ii) Capillaries ?? [1]
- (iii) Smooth muscle, move villus to change materials in contact with it;
Movement forces materials from lacteal; [1]
- (c) reduced surface area;
Reduced absorption of materials;
Digestive enzymes adsorbed or part of membrane;
Reduced efficiency of digestion;
Bacterial activity in large intestine increases. [4]
- (d) water absorbed from colon. [1]

Total 12 marks

11. (a)	Lipase	1
(b)	(i) Hydrolysis of lipids/fats (not: digestion) Releasing fatty acids Causing a more acid pH/reducing pH (linked with previous point) (any 2)	2
	(ii) Presence of <u>bile salts</u> (in tube B) causes the <u>emulsifying</u> of lipids Increasing surface area For action of lipase (not: ref enzymes) Fatty acids are released more quickly/eg so pH becomes acidic more quickly/in less time (any 3)	3
(c)	Lipase/enzyme is denatured/tertiary structure altered Active site has changed shape Lipid/substrate will not fit into active site No hydrolysis of lipid/no fatty acids released (any 3)	3
(d)	More fatty acids/products Quicker change in colour/faster reaction (any 1) (not: high fat content)	1
		Total 10 marks

12.

Question		Marking details	Marks Available
12	(a)	<p>All three for 1 mark:</p> <p>X = mouth / buccal cavity</p> <p>Y = stomach</p> <p>Z = duodenum Accept small intestine</p>	1
	(b)	amylase;	1
	(c)	to prevent {autolysis / self-digestion};	1
	(d)	different enzymes have different optimum pH / prevent enzymes denaturing;	1
	(e)	emulsify fats / fats broken down into smaller globules; increase surface area and {for action of lipase / increase rate of digestion of lipids};	2
Question12 total			[6]

14. (a) hooks and suckers; 3
attach (head/scolex) to intestinal wall;
can embed deeply into wall;
can't be removed by passage of gut contents/ peristalsis/
egestion;
- (b) absorbs digested products of host; 3
because it has a large surface area to volume ratio;
no need to digest own food;
- (c) little/no oxygen (available in environment/host gut); 1

15.

Question	Marking details	Marks Available
15. (a)	Teeth + reference to {chewing / grinding}/ reference to role of tongue; Contraction of {stomach/gut} wall/ peristalsis; Accept Bile + emulsification of fats	2
(b)	Both for one mark	1
(i)	A amylase C maltase	
	Both for one mark	1
	B maltose D glucose	
(ii)	Mouth / buccal cavity + Duodenum / small intestine (both needed for one mark)	1
(c)	(i) E endopeptidase; F exopeptidase;	2
	(ii) pepsinogen: <u>hydrochloric acid / HCl</u> ; Accept pepsin trypsinogen: enterokinase;	2
(iii)	Less mucus produced (because cells are killed)/ mucus lining destroyed; More {HCl/acid} produced (to compensate for neutralising action of NH ₃); Acid in food / HCl can {attack / damage/erode} lining of stomach (wall); Pepsin can cause <u>autolysis / self-digestion</u> ;	Max 3
Question15 Total		[12]

16.

Question			Marking details	Marks Available															
16	(a)	(i)	ileum	1															
		(ii)	Hepatic portal vein;	1															
		(iii)		4															
			<table border="1"> <thead> <tr> <th>Letter</th> <th>Name</th> <th>Role in digestion</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>Microvilli;</td> <td>Increases surface area</td> </tr> <tr> <td>C</td> <td>Mucosa;</td> <td>Contains glands that release secretions</td> </tr> <tr> <td>D</td> <td>Submucosa;</td> <td>Contains vessels to transport products of digestion</td> </tr> <tr> <td>E</td> <td>Muscle layer</td> <td>Peristalsis/ or description;</td> </tr> </tbody> </table>	Letter	Name	Role in digestion	B	Microvilli;	Increases surface area	C	Mucosa;	Contains glands that release secretions	D	Submucosa;	Contains vessels to transport products of digestion	E	Muscle layer	Peristalsis/ or description;	
		Letter	Name	Role in digestion															
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C	Mucosa;	Contains glands that release secretions																	
D	Submucosa;	Contains vessels to transport products of digestion																	
E	Muscle layer	Peristalsis/ or description;																	
			Question 3 Total	[6]															

17. Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
17	(a)	(i)	Accept range between (-) 31 to 31.43% = 2 marks If incorrect award 1 mark for (140µm – 96µm)/140µm x 100		1 1		2	2	
		(ii)	Both needed for 1 mark: A = capillary B = lacteal/ lymph vessel/ lymphatic vessel	1			1		1
		(iii)	Any two (x1) from (Group 2) are not {eating/ absorbing lipids} (so don't need lacteals) (1) (cells in) both groups need blood to bring {oxygen/glucose} for {respiration/ ATP production}(1) lacteals remove substances but capillaries deliver as well as remove/ owtte (1)		2		2		
	(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		
	(c)		Answers relate to Group 1 – accept reverse arguments: mitochondria ATP synthesis + {for active transport/enzyme production} (1) single layer of cells reduces distance for nutrients to pass into {capillaries/lacteals/ bloodstream}/ increase rate of absorption for uptake (1)	1	1		2		
	(d)		Burmese pythons can go without food for 1 year – 4 weeks not an issue (1) Killing/experiments on animals/no obvious benefit (1)			2	2		
			Question 17 total	2	7	3	12	2	1

	Mouth	Stomach	Duodenum	Ileum	Large Intestine
Villi present			*	*	
Site of mechanical breakdown of food	*	*			
Connects with bile duct			*		
Microorganisms secrete vitamins					*
Carbohydrate digestion takes place	*		*	*	
pH 2-3		*			
Brunner's glands secretes alkaline fluid			*		
Main region of water absorption					*
Protein digestion begins		*			

1 mark for each correct line

[Total 9 marks]

19.

Question		Marking details	Marks Available
19	(a)	ectoparasite lives {on the outside of / in } a host (organism) endoparasite lives inside a host organism;	1
	(b)	Head lice have claws / pincers to hold onto hair; Accept {eggs / nits} are {glued onto / attached} hairs <i>Taenia</i> has hooks <u>and</u> suckers to cling to wall of (small) intestine; Reject hookers	2
	(c)	Any two from: {eggs / embryos} passed out in faeces; NOT pig infective stage develops in a secondary host / pig; humans eat {undercooked / raw} infected {pork / secondary host};	2
	(d)	Any two from: tapeworm {absorbs nutrients from gut contents / causes malnutrition}; block gut lumen; (larval forms) can form cysts in vital organs;	Max 2
		Question 5 Total	[7]

- 20.**
- (a) An organism that lives on, in or off a host [1]
 - The host is harmed. [1]
 - (b) Possession of hooks / suckers/ thick cuticle (any 2) [2]
 - (c) (i) Digestive system (allow: circulatory/respiratory system) [1]
 - (ii) Absorption of host nutrients [1]
 - over the parasite's body surface [1]