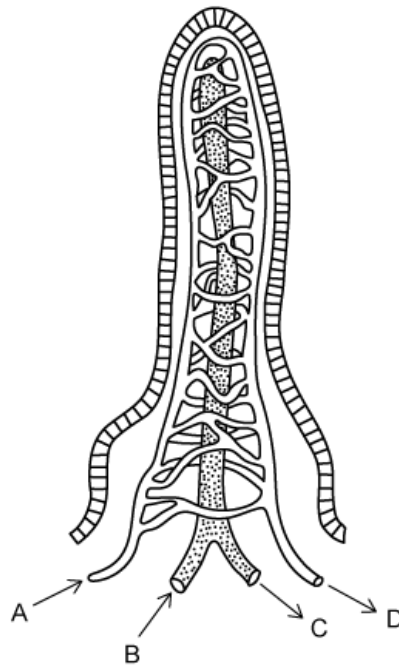


1.

The diagram below shows a villus.



In which vessel would the concentration of fatty acids be highest?

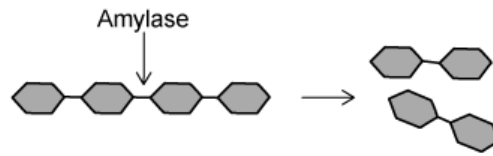
Answer: C

Vessels B and C are both lacteals, the lymphatic vessels of the small intestines that absorb fatty acids and glycerol (the products of lipid digestion). Lacteal B is entering the villus, where it will absorb fatty acids and glycerol, so lacteal C, which is leaving the villus, will have the highest concentration of fatty acids.

NOTE: Bile is made in the liver, and stored in the gallbladder

2.

The diagram below shows the activity of salivary amylase on a starch molecule.



Which of the following is **not** a function of salivary amylase?

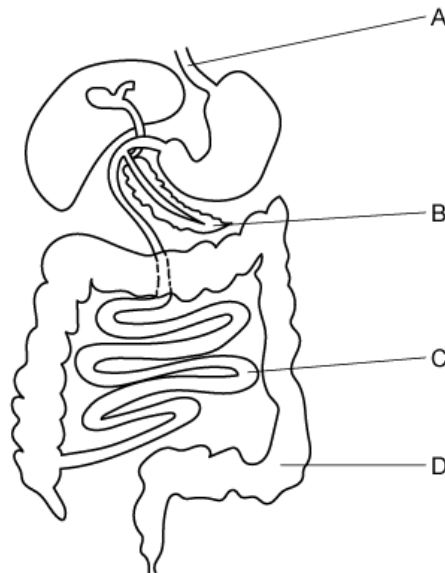
- A. Increasing the rate of breakdown of starch molecules
- B. Increasing the rate of starch breakdown into maltose molecules
- C. Breaking a large insoluble molecule into smaller soluble molecules
- D. Increasing the rate of starch breakdown into glucose molecules

Answer: D

3.

The diagram below shows part of the human digestive system.

In which structure is most of the water from food absorbed?



Answer: C

Although water is also absorbed in the colon (large intestine), most absorption occurs in the small intestine. This is because the absorption of soluble food molecules and salts (ions) from food occurs in the small intestine, lowering the water potential of the blood, drawing water in by osmosis.

4. Treatment for diarrhoea

- Oral rehydration therapy/ treatment
- The intake of water containing salt/minerals/ions and sugar

5. Why epithelial cells in villi has many microvilli and mitochondria microvilli

- Increases/large surface area
- For absorption / diffusion / active transport (into villus)

Mitochondria

- for respiration
- Provide energy/ATP
- For active uptake/transport

6. Functions of teeth

- bite / tear / cut / hold / rip (food)
- chewing / grinding / crushing / producing small(er) pieces / mechanical digestion (of food particles)
- increases the surface area (of food)
- (In animals teeth is used for) killing prey / defence (against danger) / cleaning fur

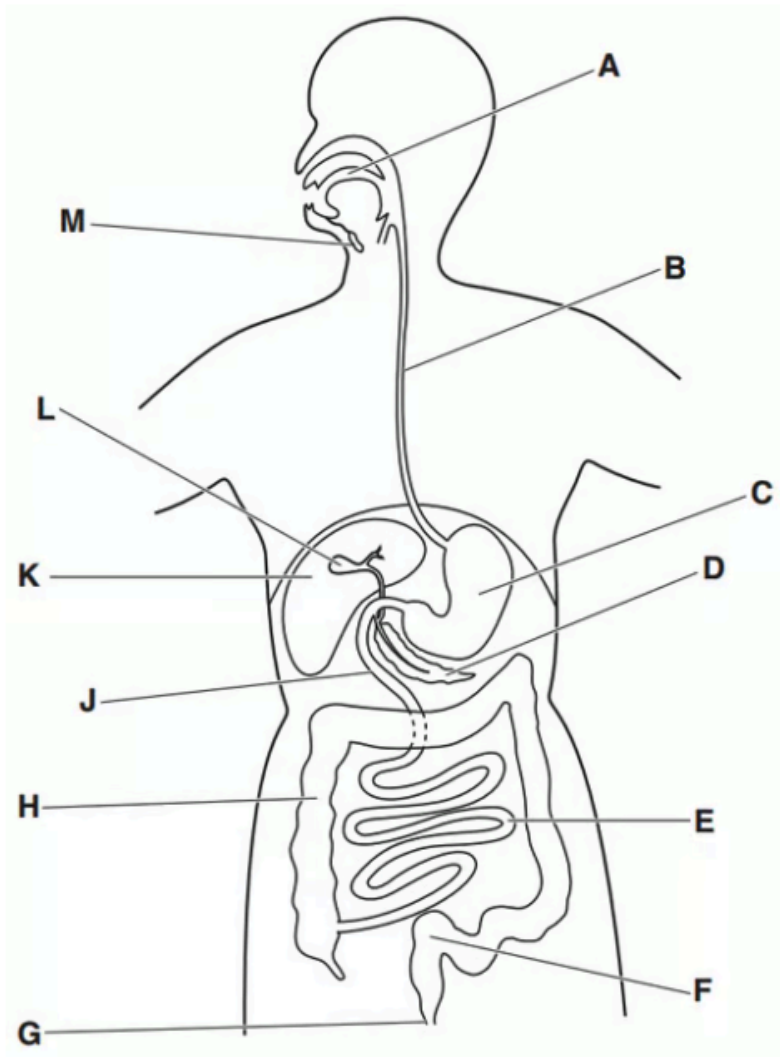
7. Importance of teeth in digestion

- Chewing) produces small pieces of food / breaks food down mechanically
- (This) increases the surface area (of food)
- (Smaller food pieces are) easier to swallow

8. Importance of chemical digestion

- (For the) production of small(er) / soluble / simpler molecules
- (Small molecules can be) absorbed / reference to absorption / large molecules cannot be absorbed; [1 mark]
- (Moves through) cell membranes / wall of intestine / into blood / into cells; [1 mark]

9.

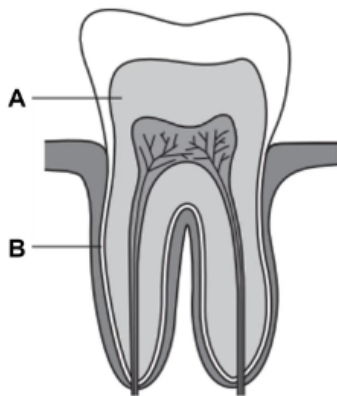


Complete the table:

Function	Letter from Fig. 2	Name of Structure
Site of starch digestion		
Reabsorption of water		
Secretion of pepsin		
Site of maltose digestion		
Secretion of bile		
Storage of faeces	F	rectum
Secretion of lipase and trypsin		

Function	Letter from Fig. 2	Name of Structure
Site of starch digestion	A	mouth / buccal cavity
	J/E	small intestine
Reabsorption of water	J/E	small intestine
	H	colon / large intestine
	F	rectum
Secretion of pepsin	C	stomach
Site of maltose digestion	J/E	small intestine
Secretion of bile	K	liver
	L	gall bladder
Storage of faeces	F	rectum
Secretion of lipase and trypsin	D	pancreas

10. Label A & B



A = dentine

B = cement

11. Explain how a women's dietary needs will change when she is pregnant

- Women will require more energy/food
- For the growth/development of foetus
- More carbohydrates/ proteins/ fats/ named vitamin/mineral need to be consumed
- Role of named nutrient (must be linked to named nutrient): eg. carbohydrates for energy / protein for growth etc

12. Outline where & how mechanical digestion occurs in the alimentary canal

- Food is broken down into smaller pieces without chemical change
- The mouth / buccal cavity (in context mechanical)
 - Chewing / mastication
 - Role of a named teeth e.g. molars/pre-molars/canines

- Reference to the involvement of tongue (in mechanical digestion)
- Reference to movement of the jaw
- Stomach (in context of mechanical)
 - Churning / muscular action of the stomach

13. Where maltase acts

On the membranes of the epithelial cells/ epithelium, in the small intestine

14. Functions of the pancreas in digestion

- Produces digestive enzymes
- Protease, (pancreatic) amylase and lipase
- These enzymes are used in digestion to break down proteins, starch and lipids
- Secretes an alkaline fluid into the duodenum
- To increase the pH of the fluid/chyme coming from the stomach

15.

Normally the epithelial cells in the lining of the stomach are protected from the effects of gastric juice by a layer of mucus secreted by goblet cells found in the stomach lining.

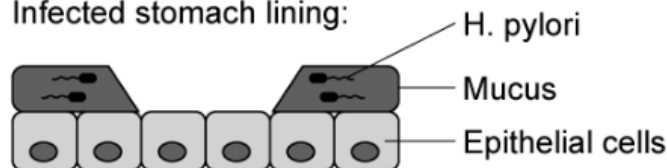
Sometimes a type of bacteria called *Helicobacter pylori* can penetrate the mucus layer and cause damage to the goblet cells. This leads to the formation of a peptic ulcer.

Fig. 1 compares a healthy stomach lining with one that has been infected by *H. pylori*.

Healthy stomach lining:



Infected stomach lining:



Suggest how *H. pylori* may lead to formation of peptic ulcer

- Less/no mucus secreted by damaged/infected goblet cells
- This leaves epithelial cells exposed / no protection against (the effects of) gastric juice/hydrochloric acid
- Gastric juice/hydrochloric acid may cause damage to epithelial cells / stomach lining (resulting in an ulcer)

Patients suffering from peptic ulcers may receive treatment with substances called proton pump inhibitors (PPI's). These substances will suppress the cells in the lining of the stomach that produce hydrochloric acid.

Explain how PPIs could act as treatment for peptic ulcers

- (It would lead to) less hydrochloric acid being produced
- (This would) prevent further damage to the lining / allow the lining to heal/repair

Suggest the effect of PPIs on digestion in the stomach

- It may lead to an increase in the pH of the gastric juice (due to less HCl produced)
- This (increase in pH) may not be the optimum for pepsin to work
- There may be a decrease in protein digestion

16. Outline the process of starch digestion in the human body

- Starch digestion begins in the mouth
- When amylase (in saliva) starts to break down starch into maltose
- This will continue in the duodenum
- With the secretion of amylase from the pancreas;
- Membranes of cells of the epithelium lining (in the small intestine) secrete maltase
- Maltase will digest / break down maltose into glucose
- Glucose is soluble and can be absorbed into the blood

17. Purpose of gallbladder

- Stores bile produced by the liver
- Secretes it into the duodenum via the bile duct

18.

The gallbladder may become inflamed or blocked by gallstones, which may cause much pain. In such cases, it is best to surgically remove the gallbladder. Doctors may recommend that patients with no gallbladder follow a low fat diet after surgery.

Suggest a possible reason for this recommendation.

- Without gallbladder less concentrated / smaller volume of bile will enter duodenum
- This will decrease the emulsification of large fat droplets
- Which results in less / smaller surface area (of droplets)
- Which will decrease rate at which lipase can break down lipids into fatty acids & glycerol

19. Health problems caused by eating a high-fat diet

- Obesity
- Coronary heart disease

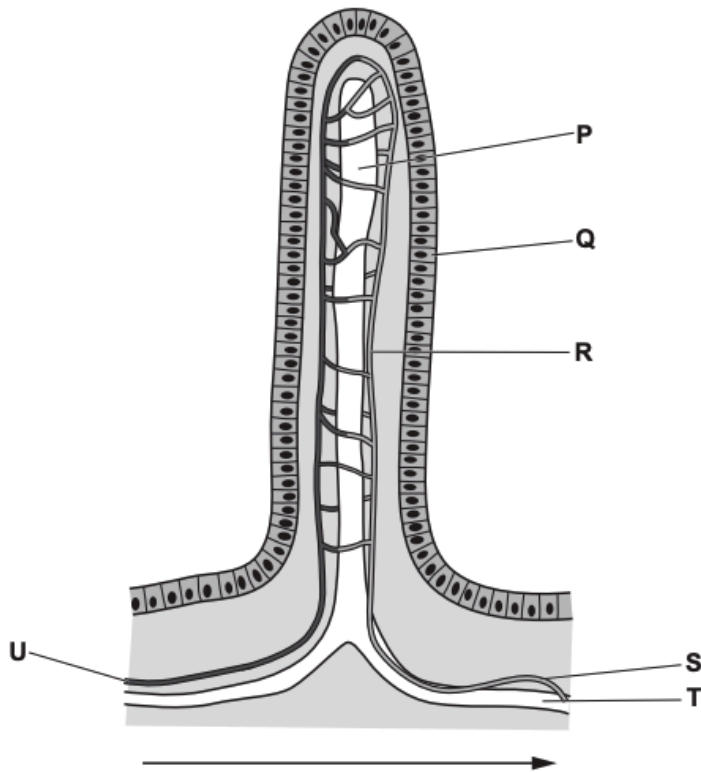
20. State the function of villi

Absorption of nutrients into the blood

21. Describe structure of a villus

- Have a large surface area / increase the surface area (of the small intestine/ileum)
- Microvilli further increase the surface area
- Blood vessels / capillaries flow near the surface of villi
- The lacteal / lymph/lymphatic vessels pass through the middle of each villus
- Are surrounded by intestinal epithelium cells

22. Role of villi in alimentary canal



P	Lacteal	absorb fats / fatty acids / glycerol
T	Lymphatic vessel	returns lymph / fats to blood / to circulatory system
Q	Epithelial cell	<ul style="list-style-type: none"> - has microvilli which increase the surface area of absorption - one cell thick for short diffusion distance / fast diffusion - site of breakdown of maltose to glucose - glucose uptake by active transport
R	Capillary	<ul style="list-style-type: none"> - absorption of amino acids / glucose / salts / water / products of digestion / soluble nutrients - has thin walls/ is one cell thick

		<ul style="list-style-type: none">- blood flowing to maintain concentration gradient- transports absorbed nutrients to S / venule / vein
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23. Proteins found in blood

- Haemoglobin
- Fibrinogen
- Antibodies
- Glucagon
- Insulin

24. Effects of cholera bacterium on the digestive system

- (Bacteria) produce toxins / a toxin
- The toxin causes secretion of chloride ions / Cl⁻
- (The chloride ions are secreted) into the small intestine
- Water potential (of small intestine) decreases / is lowered/reduced
- Water moves into the gut/intestine (due to reduced water potential)
- (Water moves into intestine) by osmosis
- (The increased volume of water in the intestine) results in diarrhoea

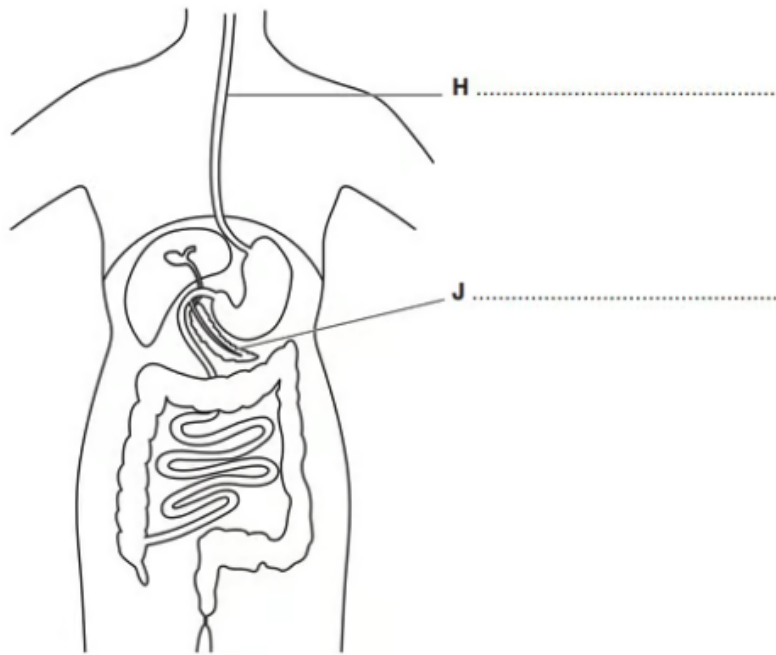
25. Mechanical/ physical digestion:

- It is the breakdown of large pieces of food into smaller ones
- Without chemical change to the food molecules

26. Examples of physical digestion

- Chewing action of teeth
- Churning action of stomach
- Emulsification of fats by bile

NOTE:



H = oesophagus

J = pancreas

Egestion: the process that removes faeces from the body.

27. Outline the roles of bile in the body

- emulsification ;
- increased surface area of fat (globules) ;
- faster, digestion / breakdown (of fat) ;
- by lipase / to fatty acids and glycerol ;
- neutralises, (stomach) acid / chyme / gastric juice ;
- alters / increases, pH for (pancreatic / intestinal) enzymes
- denatures, pepsin / stomach, enzymes ;

28. Why mucus (protective substance) is necessary in the intestines

- To protect intestine from bacteria / viruses / microorganisms / parasites / pathogens
- To protect intestine from (named) toxins
- To protect intestine from (named) enzymes / prevents self digestion
- To protect intestine from hydrochloric acid / alkali / base / extreme pH
- To protect intestine from physical damage by food passing through intestine

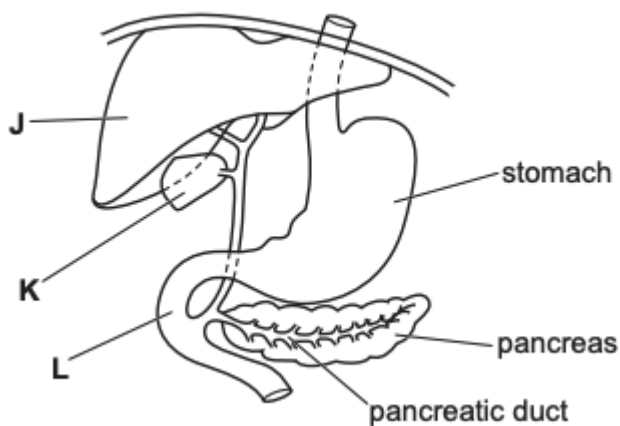
29. Describe role of lacteals

- absorbs, fats / fatty acids (and glycerol)
- transports fats / fatty acids into lymph vessels / lymphatic system / lymph

30. Importance of vitamin C in the diet

- helps with, cell / tissue, repair / healing
- helps to reduce risk of infection
- prevents scurvy / bleeding gums
- formation of, collagen / hair / nails
- anti-ageing of skin
- improves (named) mineral ion absorption
- required for protein synthesis
- Antioxidant

31. Label J,K and L



J = liver

K = gallbladder

L = duodenum/ small intestine

32. Hormones secreted by pancreas:

Insulin, glucagon

33. Enzymes secreted by pancreas:

Amylase, trypsin, lipase

34.

Chloride ions also move along the pancreatic duct.

CFTR proteins in the cells lining the pancreatic duct move chloride ions out of the cells into the duct.

Fig. 3.2 is a diagram of a cell from the lining of the pancreatic duct showing the location and activity of CFTR proteins.

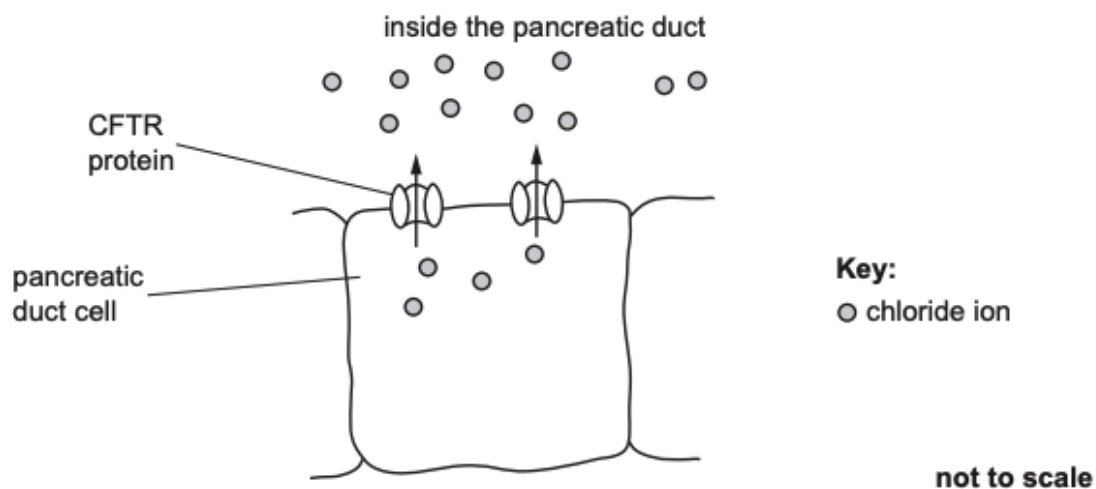


Fig. 3.2

Explain how CFTR proteins move chloride ions across the membrane of the cell shown in Fig. 3.2.

- active transport
- against a concentration gradient / from low concentration to high concentration ;
- protein changes shape to move (chloride) ions ;
- uses energy ;

The movement of chloride ions into the pancreatic duct causes water to move from the cells into the duct to help the flow of liquid in the duct.

Explain how water moves from the cell shown in Fig. 3.2 into the pancreatic duct.

- idea of presence of chloride ions (in duct) decreases water potential ;
- (water moves by) osmosis ;
- down water potential gradient / from high water potential to low water potential ;
- (movement of water) through partially permeable membrane ;

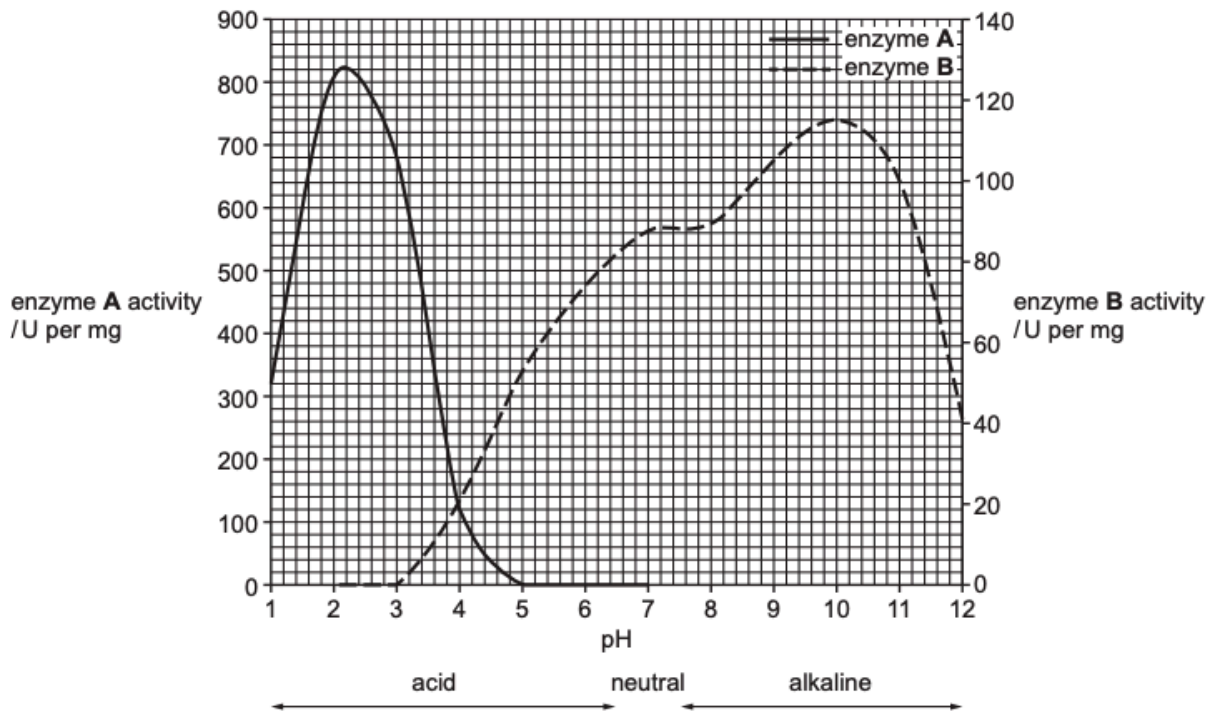
35. **Function of human teeth:** physical/mechanical digestion

36. **Enamel:** visible outer layer of teeth

37. **Process of tooth decay in humans**

- Sugar/food/plaque left on teeth
- Respiration of sugar by bacteria
- Produces lactic acid
- Lactic acid dissolves enamel/dentine

38. Activity of two protease enzymes, A and B, measured at different pHs. Both enzymes are found in the human alimentary canal:



Describe and explain the roles of A and B, in the alimentary canal.

- They both help break down protein → amino acids
- Reference to specificity
- Both enzymes are active between pH 3 and pH 5

A:

- A is pepsin
- Functions in the stomach
- Where HCl is present / in acidic conditions
- Optimum pH at 2
- Shows, no activity / is denatured, from pH 5

B:

- B is trypsin
- Functions in small intestine / secreted from pancreas
- Where bile neutralises (stomach) acid / in alkaline conditions
- Optimum pH at 10

- Enzyme shows, no activity / is denatured, from pH 3

39. Location of maltase in the small intestine: membrane of epithelium

40. Role of HCl in alimentary canal

- It is secreted in the stomach
- It kills, bacteria / pathogens in food
- It denatures enzymes in bacteria / harmful microorganisms in food
- It provides acidic/suitable/low/optimum pH for pepsin/protease enzymes
- It activates pepsin/ protease enzyme

41. Function of pepsin

- Breaks down proteins to amino acids
- In acidic conditions

42. Assimilation

- movement of digested food molecules into cells
- food molecules become part of cells

43. Role of the microvilli

- Increases surface area
- For absorption

44. Function of large intestine in alimentary canal

reabsorbs water / ions / vitamins

45. How food eaten by humans is reduced to smaller pieces and how this makes chemical digestion more efficient.

- mechanical / physical digestion
- decreases particle size which increases surface area of food for chemical digestion
- for enzyme activity
- any further detail of enzyme activity
- chewing / crushing / grinding in the mouth by teeth
- incisors / canines cut the food
- premolars crush the food
- mixing of saliva with food / formation of bolus of food for swallowing
- churning action of stomach / formation of chyme
- action of muscles in the stomach wall
- emulsification by bile
- occurs in small intestine / duodenum / ileum

- bile breaks fat globules into smaller pieces / large fat droplets into small(er) droplets

46. Why large insoluble molecules should be broken down by chemical digestion

- become soluble
- for absorption
- small enough, for diffusion / active transport

47. Why lactase is important for nutrition of babies

- lactose is found in milk
- lactase breaks down lactose
- young babies are dependent on lactose / milk for their nutrition

48. How cholera causes diarrhoea

- cholera bacterium release toxins
- causes chloride ions to be secreted
- chloride ions in small intestine / duodenum / ileum
- osmotic movement / lowers water potential in gut
- water moves into gut or more water remains in intestines / gut

49. Describe what happens to carbohydrates in the human body between ingestion and assimilation in the liver.

- ingestion / digestion occurs in mouth
- chemical digestion / absorption occurs in the small intestine / duodenum / ileum

Ingestion of large biological molecules

- mechanical / physical digestion: breaking carbohydrate / food into small pieces
- teeth chew/grind/bite; tongue swallows; moves through oesophagus; churned in stomach

Chemical digestion

- chemical digestion: breakdown of insoluble molecules into smaller soluble molecules
- salivary glands / pancreas secrete amylase
- amylase breaks down starch to maltose
- maltase is on epithelium of the small intestine / duodenum / ileum
- maltase breaks down maltose to glucose
- bile neutralises stomach acid
- neutral / 7 / 8 pH for amylase / maltase to work

Absorption into the blood via the alimentary canal

- by diffusion / active transport into villi / microvilli / capillaries
- microvilli / villi / folds increase the surface area for absorption

Increased blood glucose concentration

- insulin secreted / produced from pancreas

- insulin reduces blood glucose concentration
- negative feedback / homeostasis

Assimilation in the liver

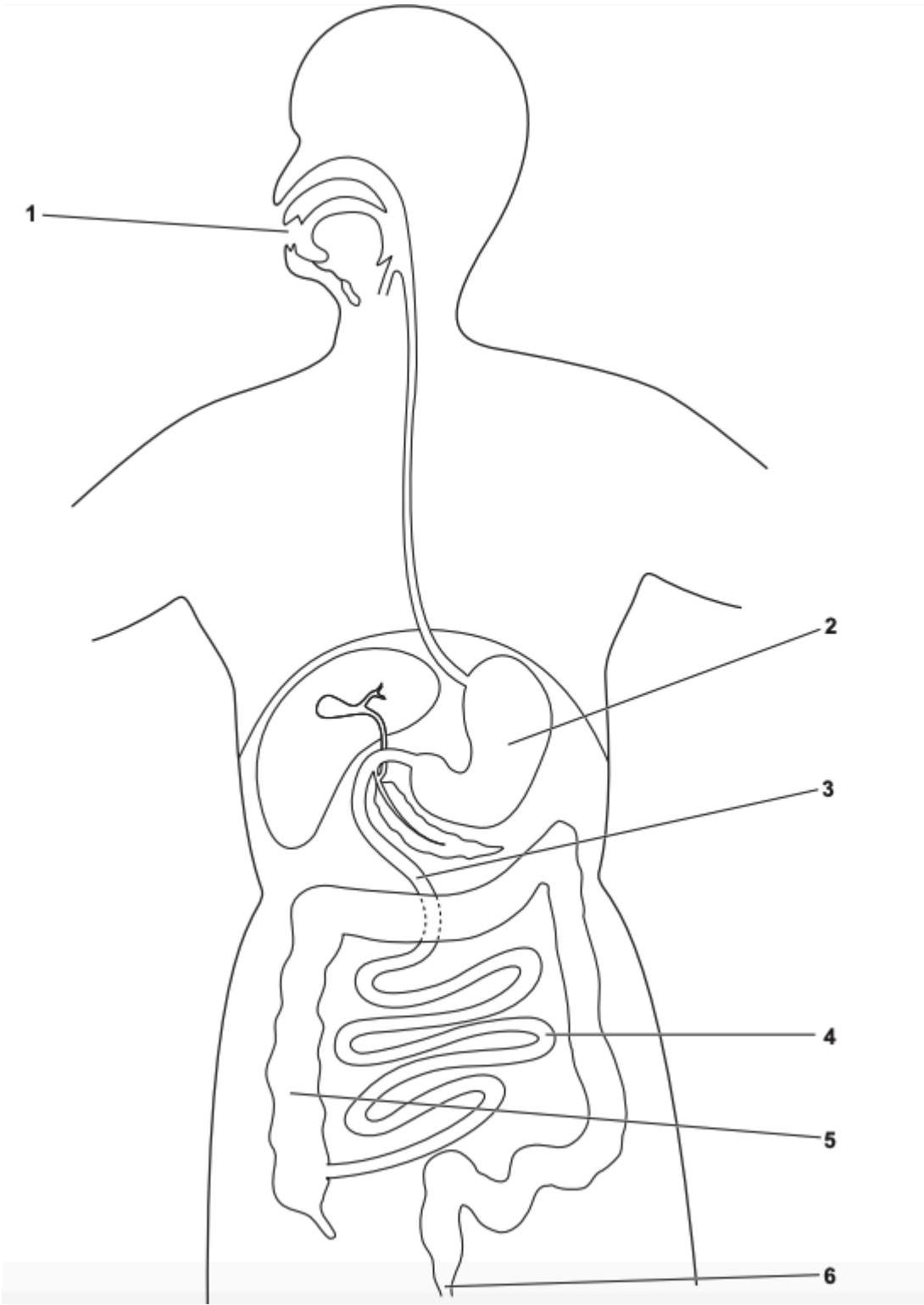
- glucose is stored as / converted to glycogen in liver
- assimilated into cell/tissues to become part of cell // respiration, for release of energy

50. Importance of calcium ions in a balanced diet

- for the formation / maintenance of healthy / strong bones
- for the formation / maintenance of healthy / strong teeth

51. Importance of iron ions in a balanced diet

- found in haemoglobin (molecule) / red blood cell
- transport oxygen
- prevent anaemia



- A – absorption
- C – chemical digestion
- E – egestion
- I – ingestion
- M – mechanical digestion

number from Fig. 4.1	name of the organ	letter or letters of all the processes that occur in the organ
1	mouth	I, C, M
2	stomach	C, M (A)
3	duodenum	A, C (M)
4	ileum	A, C
5	colon	A
6	anus	E