7. Human nutrition

7.4 Chemical digestion

Paper 3 and 4

Marking scheme

Q1.

(c)		4	

large molecule	enzyme	small molecule
protein	(named) protease ;	amino acids
starch ;	amylase	glucose
fats and oils	lipase ;	(fatty acids and) glycerol ;

Q2.

(c)	breakdown of large molecules into small molecules ; insoluble molecules to soluble molecules ;	2	

(e)(i)	killing bacteria / microorganisms ;	1	
(e)(ii)	hydrochloric ;	1	
(f)		6	

enzyme	substrate	products	organ that secretes the enzyme
amylase	starch	(named) (simple) sugars / glucose ;	salivary glands / pancreas ;
lipase ;	fats / oils ;	fatty acids and glycerol	pancreas
protease	protein ;	amino acids	stomach / small intestine / pancreas ;

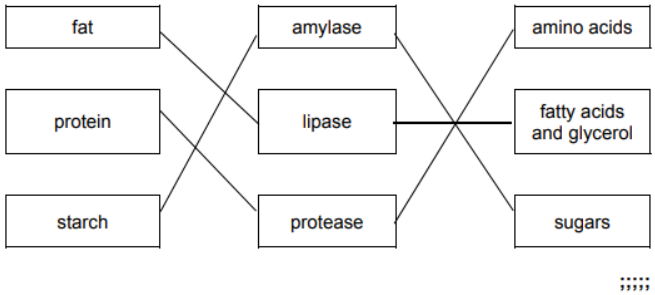
Q3.

	stomach ; bacteria ; absorbed ; enzymes ; water ;	5	

Q4.

(b)	fatty acids ; glycerol ;	2	

Q5.

(c)	 ;;;;;	**5**	6 correct links = 5 4 or 5 correct links = 4 3 correct links = 3 2 correct links = 2 1 correct link = 1

Q6.

	food type / enzyme acting on the food type / simpler chemicals produced protein / protease / amino acids ; starch ; / amylase / glucose / sugar ; fats ; / lipase ; / fatty acids and glycerol	**5**	**A** (poly)peptides **A** maltose **A** lipids / oils

Q7.

(c)(i)	*tissue:* phloem ; *molecule:* amino acids ;	**2**	

(c)(ii)	*any six from:* 1 (starch is broken down by) physical / mechanical, digestion ; 2 (physical digestion / AW) uses teeth / occurs in the, mouth / (involves churning) in stomach ; 3 (physical digestion) increases surface area (for faster enzyme activity) ; 4 chemical digestion / break down (of insoluble molecules) into (smaller) soluble molecules (by enzymes) ; 5 salivary glands / pancreas, secrete / make, amylase ; 6 amylase (breaks down) starch to maltose ; 7 maltase is found on epithelium (lining) of, small intestine / duodenum / ileum ; 8 (maltase) breaks down maltose to glucose ; 9 (optimum) pH for, amylase / maltase / carbohydrase is, neutral / 7 / 8 ;	**6**	

Q8.

(b)(i)	*any four from:* pH decreases / (solution) becomes acidic ; (pH changes because) fatty acids are produced ; lipase, digests / breaks down, fat ; fatty acids, produced / AW, faster in test-tube **C** than **B** ; bile, emulsifies fats / converts large particles of fat to small particles ; bile increases the surface area (for lipase action) ;	**4**	
(b)(ii)	compare with tubes **B** and **C** to assess effect of lipase and / or bile ; shows that bile, does not (chemically) digest fats / does not make solution acidic ; shows that, lipase / enzyme, is required (for breakdown of fats in milk) ;	**2**	**A** control (experiment)

Q9.

(a)(i)	*any two from:* become soluble ; for absorption ; small enough, for diffusion / active transport ;	**2**	
(a)(ii)	water ;	**1**	
(b)	*any six from:* **1** protein → amino acids ; **2** ref to specificity ; **3** both enzymes are active between pH 3 and pH5 ; **A** at pH4 **4** **A** is pepsin ; **5** optimum pH at 2 ; **6** enzyme shows, no activity / is denatured, from pH 5 ; **7** (functions) in stomach ; **8** where HCl is present / in acid conditions ; **9** **B** is trypsin ; **10** optimum pH at 10 ; **11** enzyme shows, no activity / is denatured, from pH 3 ; **12** (functions) in small intestine / secreted from pancreas ; **13** bile neutralises (stomach) acid / in alkaline conditions ;	**6**	MP1 **A** breaks down proteins (to, polypeptides / peptides) MP13 **A** pancreatic juice neutralises stomach acid
(c)	(membrane of) epithelium ;	**1**	

Q10.

(a)	*one mark per row* enzyme / organ that secretes the enzyme / number identifying the organ on Fig. 2.1 / substrate / product or products amylase / salivary gland(s) / 1 / starch / maltose ; pepsin / protease / stomach / gastric gland / 3 / protein / amino acid(s) ; lipase / pancreas / 4 / fat / lipid / oil / fatty acids and glycerol ; maltase / small intestine / duodenum / ileum / **5** / maltase / glucose ;	**4**	**A** pepsinogen **A** (poly)peptides / peptones **A** epithelium of small intestine
(b)	*any three from:* **1** ref to hydrochloric acid in the stomach ; **2** kills, bacteria / pathogens (in food) ; **3** denatures enzymes in, bacteria / (harmful) microorganisms (in food) ; **4** provides, acid / suitable / low / optimum / best, pH for, pepsin / protease / (digestive) enzymes ; **5** AVP ; e.g. activation of pepsinogen	**3**	

Q11.

(b)	*hormones:* insulin ; glucagon ; *enzymes:* amylase / carbohydrase ; trypsin / protease ; lipase ;	**5**	*enzymes and hormones can be in any order in each column*

Q12.

(b)	*any four from:* 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 / AW ; denatures, pepsin / stomach, enzymes ; AVP ;	**4**	

Q13.

(c)	glucose ; pepsin / trypsin / protease ; fatty acids and glycerol ; lactase ; (DNA) ligase ; cuts / breaks / digests, DNA (molecule / strand(s)) / gene / plasmid ;	6	**A** other named proteases **A** makes sticky ends

Q14.

(a)	*one mark per row:* substance / enzyme / product(s) starch / amylase / maltose / glucose / (simple) sugar(s) fat / lipase / fatty acid(s) and glycerol protein / protease / pepsin / trypsin / amino acids ;;;	3

Q15.

(b)(i)	**S** – amylase ; **T** – maltase ;	2	

Q16.

(a)(i)	provides, suitable / optimum, pH for (correct named) enzyme action ; activates, enzyme / pepsin ; kills / AW, bacteria / viruses / pathogens / microbes ; AVP ;	2	
(a)(ii)	(catalyses) breaks down / (chemically) digests, of protein ; to amino acids ;	2	

Q17.

(b)	production of, small(er) / soluble / simple(r), molecules ; (small molecules can be) absorbed / ref. to absorption ; **ora** (moves through) cell membranes / wall of intestine / into blood / into cells ;	2	

Q18.

(b)(i)		**3**	

enzyme	substrate	product(s)
amylase	starch	glucose / maltose ;
maltase	maltose	glucose ;
protease	protein	amino acids ;

Q19.

(b)(i)	amylase ;	**1**	
(b)(ii)	mouth ; small intestine ;	**2**	