CHEMISTRY 2021

Unit 4

Key Topic Test 5 – Metabolism of food in the human body

Recommended writing time*: 50 minutes

Total number of marks available: 50 marks

SOLUTIONS

SECTION A: Multiple-choice questions (1 mark each)

Question 1

Answer: D

Explanation:

All of the reactions in the human body can be regarded as metabolism.

Question 2

Answer: B

Explanation:

Protein needs to be broken down into smaller amino acids in order for the amino acids to be absorbed into the bloodstream. Not all of the covalent bonds are broken – just the peptide links.

Question 3

Answer: B

Explanation:

Lactose intolerance occurs when someone cannot produce the enzyme, lactase.

Question 4

Answer: A

Explanation:

During a triathalon an athlete needs nutrients that can be rapidly digested and used to provide energy. High GI foods such as glucose are ideal.

Question 5

Answer: C

Explanation:

Hydrolysis involves breaking down protein into amino acids. To do this, covalent bonds are broken.

Question 6

Answer: D

Explanation:

Co-factors can be metal ions or derived from vitamins. They change the shape of an enzyme but are not an enzyme themselves.

Question 7

Answer: A

Explanation:

The joining of amino acids is known as condensation polymerisation.

Question 8

Answer: D

Explanation:

Enzymes are made up of protein while inorganic catalysts are not.

Question 9

Answer: A

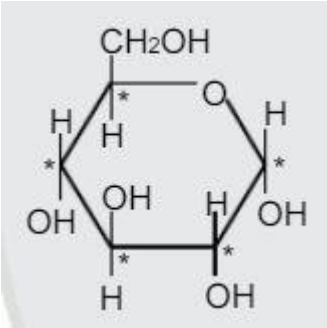
Explanation:

When fats are oxidised, the double bond is broken.

Question 10

Answer: D

Explanation:



SECTION B: Short-answer questions

Question 1

a.

i. Hydroxyl

ii. Ether linkage (glycosidic linkage)

2 x 1 = 2 marks

b. The sucrose would form hydrogen bonds* with the invertase. The ether linkage in the sucrose would then be broken*. The hydrogen bonds would then break*, allowing the monosaccharides to leave the invertase.

3 marks

c. **i.** Coenzymes* and metal ions.*

ii. They can act as carriers of electrons or groups of atoms. (either one)

2 + 1 = 3 marks

d. **i.** At low temperatures, there are very few collisions between the reactants and the enzyme* so the rate of reaction is slow.*

ii. At high temperatures the enzyme becomes denatured* as the bonds in the secondary and tertiary structure are broken.*

2 + 2 = 4 marks

Total 12 marks

Question 2

a. Fructose needs to be converted to glucose* which then undergoes respiration. *

2 marks

b. Amylopectin consists of branched chains of starch* which provides gaps for water which increases the rate of hydrolysis*. Amylose consists of straight chains preventing water from permeating the structure*. The higher the GI value the quicker that the starch can be digested*.

4 marks

c. Fats and oils can undergo oxidation* when the fat or oil can become rancid.*

2 marks

d. Humans do not produce an enzyme that will hydrolyse cellulose* however they do produce an enzyme that will hydrolyse starch.*

2 marks

Total 10 marks

Question 3

a. ester

1 mark

b. $CH_3(CH_2)_{14}COOH$ or $CH_3(CH_2)_{14}CO_2H$ (1 mark for correct formula, 1 mark for semi-structural format)

2 marks

c. $4C_{51}H_{101}O_{6(s)} + 293O_{2(g)} \rightarrow 204CO_{2(g)} + 202H_2O_{(l)}$
(1 mark for correct triglyceride formula, 1 mark for correct co-efficient for CO_2 and H_2O and 1 marks for correct triglyceride and oxygen co-efficient.)

3 marks

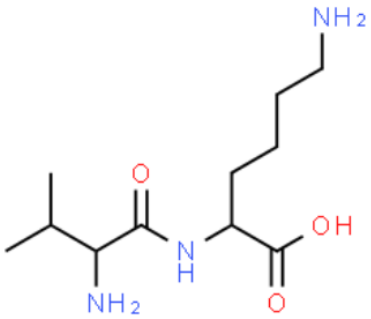
d. Anti-oxidants are added to food to prevent the oxidation of fats.* This involves them providing hydrogen to react with free radicals.*

2 marks

Total 8 marks

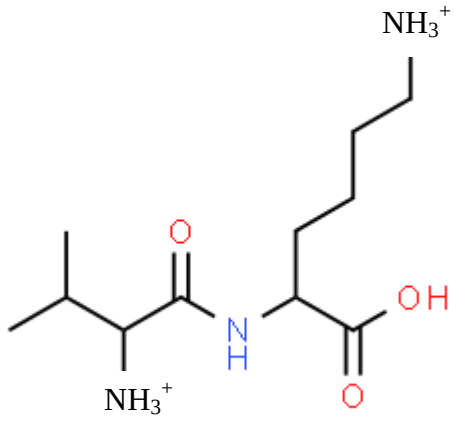
Question 4

a.



2 marks

b. The structure should have an extra H atom and a negative charge on each NH_2 group. There should be no change to the COOH group.



2 marks

c. Outside of the stomach the pH will be different* which will possibly remove the extra H atom or remove the H from the carboxylic acid group.*

2 marks

d. **i.** dispersion forces

ii. ionic bond or ion-dipole bond.

2 marks

Total 8 marks