Student Name: _____

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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

QUESTION BOOK

*The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

Conditions and restrictions

- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.
- A scientific calculator is permitted in this test.
- VCAA Chemistry data booklet will be provided

Materials supplied

- Question and answer book of 10 pages.

Instructions

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks are **not** deducted for incorrect answers.
If more than one answer is completed for any question, no mark will be given.

Question 1

Metabolism refers to;

A. The hydrolysis reactions involved in digestion of food
B. The hydrolysis reactions involved in digestion of food and condensation reactions in the body
C. The hydrolysis, condensation and oxidation reactions occurring in the body
D. All chemical reactions in the body

Question 2

Protein undergoes hydrolysis before passing from the stomach and small intestine because the;

A. tertiary structure needs to be broken down
B. protein is a large a molecule to pass into the blood
C. process produces energy
D. all chemical bonds in the protein need to be broken

Question 3

Lactose intolerance involves;

A. side reactions occurring that irritate digestive organs
B. the inability to produce the enzyme lactase
C. the low pH of lactic acid irritating digestive organs
D. the lining in the stomach breaking down

Question 4

A sportswoman competing in a triathalon might;

A. eat a snack high in glucose during a race as it has a high GI value
B. drink fruit juice during a race as it has a high GI value
C. eat a snack high in glucose the night before a race as it has a high GI value
D. eat a snack high in fibre during a race as this is a healthy food

Question 5

When a protein undergoes hydrolysis;

A. the secondary, tertiary and quaternary structures are broken down

B. the protein is oxidised and energy is produced

C. covalent bonds in the primary structure are broken

D. water adds a proton to the amine group and removes a proton from the carboxyl group

Question 6

Co-factors CAN NOT;

A. be a metal ion

B. be derived from a vitamin

C. change the shape of an enzyme

D. be a type of enzyme

Question 7

The joining of amino acids to form a protein is known as;

A. condensation polymerisation

B. hydrolysis

C. addition polymerisation

D. oxidation

Question 8

Compared to inorganic catalysts, enzymes,

A. catalyse a broader range of reactions

B. operate under a larger range of temperatures

C. are effective over a greater range of pH values

D. are composed of proteins rather than a range of chemicals

Question 9

When fats undergo oxidation the part of the molecule most likely to react is;

A. the double bond

B. the ester group

C. the carboxyl group

D. the CH_3 group at the end of the chain

Question 10

The number of chiral carbons in α-glucose is;

A. 2

B. 3

C. 4

D. 5

SECTION B- Short-answer questions

Instructions for Section B

Questions must be answered in the spaces provided in this book.
To obtain full marks for your responses you should:

- Give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- Show all workings in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.

Make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, $H_2(g)$; NaCl(s).

Question 1

Sucrose can be hydrolysed to form glucose and fructose by the enzyme invertase.

a. What functional group is present;

i. in both glucose and fructose?

_____

ii. between the glucose and fructose moieties in sucrose?

_____

1 + 1 = 2 marks

b. Describe how sucrose would interact with invertase by referring to any bonding involved in order to undergo hydrolysis.

_____

_____

_____

_____

3 marks

c. The active site of an enzyme can be altered by co-factors.
i. What are the 2 main types of co-factors?

_____

_____

ii. Describe one way that co-factors can interact with an enzyme.

_____

_____

2+ 1 = 3 marks

d. Enzymes are less active at low and high temperatures. Why do enzymes have a lower activity at;
i. low temperatures?

_____

_____

ii. high temperatures?

_____

_____

2 + 2 = 4 marks
Total 12 marks

Question 2

Give reasons why;

a. Fructose has a higher GI value than glucose.

_____

_____

2 marks

b. potatoes (with a high proportion of amylopectin) have a higher GI value and are more easily digested than grains (with a high proportion of amylose).

_____

_____

_____

_____

4 marks

c. fats and oils deteriorate over time.

_____

_____

2 marks

d. cellulose cannot be hydrolysed by humans, whereas starch can be.

_____

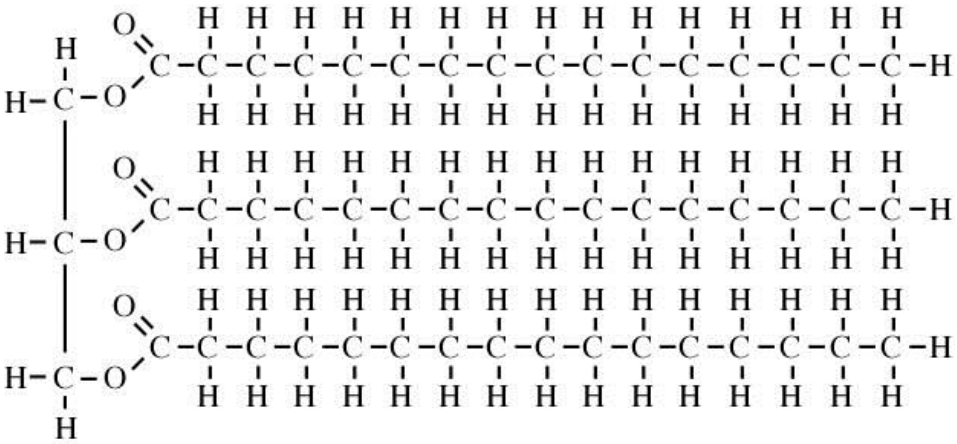
_____

2 marks

Total 10 marks

Question 3

Triglycerides such as the one below can be digested in the stomach.



a. What functional group is present in the triglyceride?

_____

1 mark

b. Give the semi-structural formula of the fatty acid that is formed when the triglyceride above undergoes hydrolysis.

_____

2 marks

c. Fats can be used as an energy source. Write a balanced equation using molecular formulae for the complete oxidation of the triglyceride above.

_____

3 marks

d. Antioxidants are often added to food. What is their role?

_____

_____

2 marks
Total 8 marks

Question 4

a. Draw the skeletal structure of the dipeptide val-lys.

2 marks

b. As the dipeptide enters the stomach, which has a pH of 1, the structure will change slightly. Redraw the structure as it would appear in the stomach.

2 marks

c. Explain why the enzyme will not function effectively outside of the stomach.

_____

_____

_____

2 marks

d. An enzyme is used to break the dipeptide into its individual amino acids. At a pH of 1, what bond could form between the Z group on the:

i. valine amino acid and the enzyme?

_____

ii. serine amino acid and the enzyme?

_____

2 marks

Total 8 marks

END OF KEY TOPIC TEST