Student Name: _____

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CHEMISTRY 2021

Unit 4
Key Topic Test 4 – Macronutrients

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

An example of an α-amino acid is;

A. $NH_2CH(CH_2COOH)COOH$

B. $NH_2CH_2CH_2COOH$

C. $NH_2CH_2NH_2$

D. $NH_2C(CH_3)_2COOH$

Question 2

An amino acid with an overall charge of +1 at a pH of 7 is;

A. lysine

B. aspartic acid

C. isoleucine

D. theonine

Question 3

The secondary structure of a protein is held together by Hydrogen Bonds between the functional groups;

A. hydroxyl and the "R" group

B. hydroxyl and amine

C. carboxyl and hydroxyl

D. carboxyl and amine

Question 4

The tertiary structure of a protein is held together by;

A. hydrogen bonding

B. covalent bonding

C. covalent, ionic, Hydrogen, dipole –dipole bonding and dispersion forces

D. ionic, Hydrogen, dipole –dipole bonding and dispersion forces but not covalent bonding

Question 5

As the number of double bonds in a fatty acid increases, the;

A. melting point increases

B. Hydrogen Bonds between the chains increase

C. chains move further apart due to the cis arrangement around the double bonds

D. degree of saturation increases

Question 6

When one glycerol molecule reacts with fatty acid molecules to form a triglyceride;

A. 3 fatty acids react with 3 water molecules

B. 3 water molecules form for each fatty acid molecule that reacts

C. the product is soluble in water

D. ester linkages form between one glycerol molecule and 3 fatty acid molecules

Question 7

Compared to glucose, aspartame has;

A. a similar energy content

B. a lower molar mass

C. more hydroxyl groups

D. greater sweetness per gram

Question 8

The molar mass (in g mol^{-1}) of a polysaccharide with 100 glucose molecules is;

A. 19 782

B. 18 000

C. 16 218

D. 16 200

Question 9

Vitamin D;

A. is regarded as essential

B. is soluble in body fat

C. is present in sunlight

D. has no polar groups

Question 10

The amino acid that can form covalent bonds in the tertiary structure of a protein is;

A. cysteine
B. arginine
C. phenylalanine
D. theonine

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.

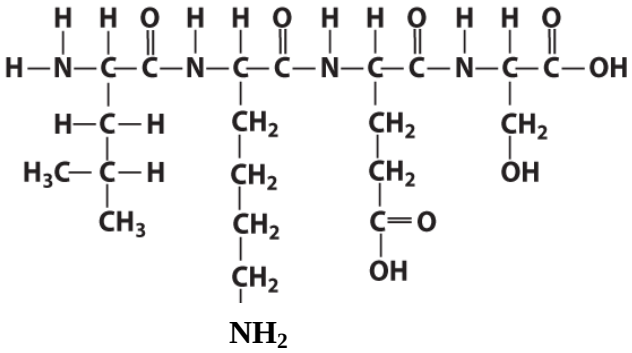
Make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, $H_2(g)$; NaCl(s).

Question 1

a. Draw the structure of glutamic acid at a pH of 7.

2 marks

b. Referring to the diagram below;



i. How many amino acids are in the polypeptide shown above?

_____

ii. circle all peptide links

iii. place an asterix (*) against the side chain that would only form dispersion forces with other atoms.

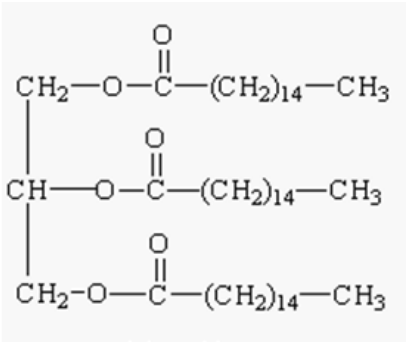
iv. Place a hash (#) against the two atoms that could cause coiling or pleating in the secondary structure of a protein.

1 + 1 + 1 + 2 = 5 marks

Total 7 marks

Question 2

The structure of a triglyceride is shown below;



a. The triglyceride is formed from 2 different molecules. Draw the full structure of these 2 molecules.

4 marks

b. **i.** Would you expect this triglyceride to be solid or liquid at room temperature? Why?

_____

_____

_____

ii. If the length of the hydrocarbon chain is increased, what would happen to the melting point of the triglyceride? Why?

_____

_____

_____

2 + 2 = 4 marks

Total 8 marks

Question 3

a. Give reasons for the following;

i. Amylopectin is much more soluble in water than amylose.

_____

_____

_____

ii. Glucose is very soluble in water.

_____

_____

_____

iii. Vitamin C needs to be regularly consumed, whilst vitamin D does not.

_____

_____

_____

_____

_____

_____

2 + 2 + 4 = 8 marks

b. Describe the similarities and differences in structure between cellulose, glycogen and starch.

_____

_____

_____

_____

_____

_____

4 marks
Total 12 marks

Question 4

Consider the following list of molecules

$C_6H_{12}O_6$, $C_3H_8O_3$, $C_2H_5NO_2$, $C_{15}H_{30}O_2$, $C_{15}H_{28}O_2$

a. Which molecule or molecules;

i. is an unsaturated fatty acid

_____

ii. reacts with a fatty acid to form a triglyceride

_____

iii. will undergo a condensation reaction to form an ether or glycosidic link

_____

iv. contain hydroxyl groups

_____

v. contains a C=C double bond

_____

vi. can undergo condensation to form a dipeptide

_____

vii. are insoluble in water

_____

7 x 1 = 7 marks

b. Write the molecular formulae for;

i. the disaccharide formed by the condensation reaction of 2 monosaccharides

_____

ii. the dipeptide formed by the condensation reaction of cysteine and alanine

_____

iii. the small molecule formed by the condensation reaction of cysteine and alanine

_____

3 marks

c. Linolenic acid is an omega-6 fatty acid.

i. What is an omega-6 amino acid?

_____

ii. What type of food might be a source of this fatty acid?

_____

iii. What molecule would you react with linolenic acid to form a triglyceride?

_____

3 marks

Total 13 marks

END OF KEY TOPIC TEST