



CHEMISTRY 2021

Unit 4

Key Topic Test 4 – Macronutrients

Recommended writing time*: 50 minutes

Total number of marks available: 50 marks

SOLUTIONS

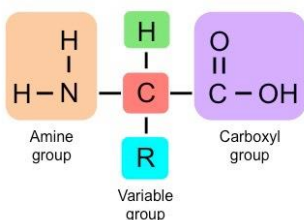
SECTION A: Multiple-choice questions (1 mark each)

Question 1

Answer: A

Explanation:

Option A is the only one that has the general structure of an amino acid.

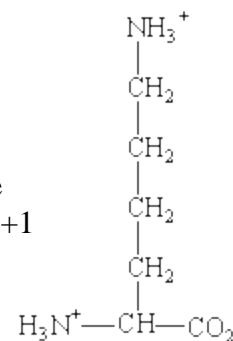


Question 2

Answer: A

Explanation:

Lysine has two amine groups which gain a proton at a pH of 7 to give both a positive charge. The carboxyl group will lose a proton to get a negative charge, resulting in a +1 charge overall.



Question 3

Answer: D

Explanation:

Hydrogen Bonding in the secondary structure of proteins occurs between carboxyl and amine groups.

Question 4

Answer: C

Explanation:

The tertiary structure of a protein is held together by covalent, ionic, Hydrogen, dipole –dipole bonding and dispersion forces.

Question 5

Answer: C

Explanation:

The double bonds in fatty acids have a cis arrangement which puts a kink in the chain that results in the chains being further apart.

Question 6

Answer: D

Explanation:

A triglyceride is formed when one glycerol molecule joins with 3 fatty acid molecules. The bond between the glycerol and each fatty acid is known as an ester linkage.

Question 7

Answer: A

Explanation:

Aspartame is much sweeter than glucose per gram.

Question 8

Answer: C

Explanation:

Each glucose molecule has a relative molecular mass of 180. When 100 glucose molecules join, 99 water molecules are produced, so the relative molecular mass of the polysaccharide is $(180 \times 100) - (18 \times 99) = 18\,000 - 1\,782 = 16\,218$

Question 9

Answer: B

Explanation:

Vitamin D is non-polar so will dissolve in body fat. It is non-essential as the body can produce it. While sunlight can cause the formation of vitamin D it does not contain vitamin D. Vitamin D has polar groups but the majority of the molecule is non-polar.

Question 10

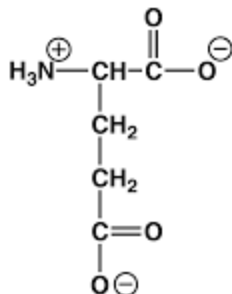
Answer: A

Explanation:

Cysteine contains sulfur which can form a disulfide link with another cysteine amino acid.

SECTION B: Short-answer questions**Question 1**

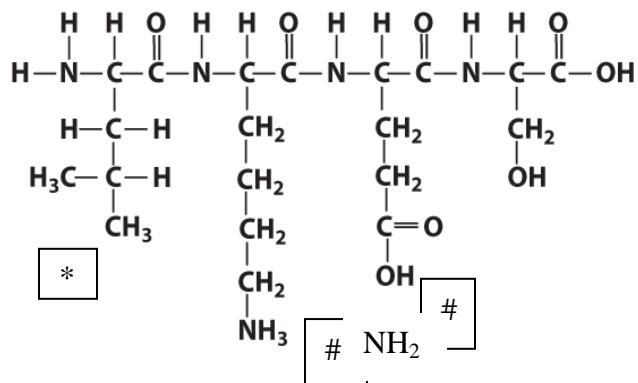
a.



2 marks

b. i. 4

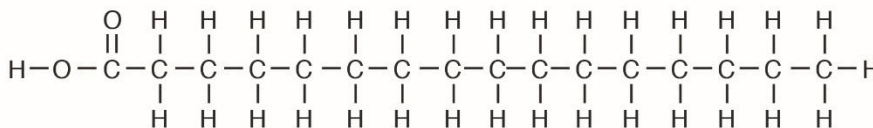
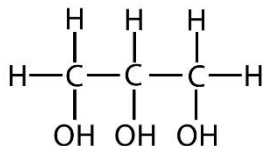
ii. iii. iv



5 marks
Total 7 marks

Question 2

a.



4 marks

- b. i. The triglyceride would be a solid* as the fatty acid is saturated. The chains are relatively straight and are able to pack closely together.*
- ii. As the length of the hydrocarbon chain is lengthened, the dispersion forces between the chains increase* and so the melting point increases.*

2 + 2 = 4 marks

Total 8 marks

Question 3

- a. i. Amylopectin has a more branched structure than amylose* which creates gaps in the structure that the water is able to reach and therefore enable the amylopectin to dissolve*.
- ii. Glucose has a lot of hydroxyl groups creating a highly polar molecule.* Hydrogen Bonds form between the hydroxyl groups and water.*
- iii. Vitamin C is water soluble* so it is easily eliminated by the body.* Vitamin D is insoluble in water but highly soluble in fat tissue* and can be produced by the body using sunlight.*

2 + 2 + 4 = 8 marks

- b. All 3 molecules are polymers of glucose.* Cellulose is a polymer of β -glucose with alternating CH_2OH groups*. Starch is a polymer of α -glucose with all CH_2OH groups orientated in the same direction.* Glycogen is a polymer of α -glucose with many side chains.*

4 marks

Total 12 marks

Question 4

- a. i. $\text{C}_{15}\text{H}_{28}\text{O}_2$
- ii. $\text{C}_3\text{H}_8\text{O}_3$
- iii. $\text{C}_6\text{H}_{12}\text{O}_6$
- iv. $\text{C}_6\text{H}_{12}\text{O}_6$, $\text{C}_3\text{H}_8\text{O}_3$
- v. $\text{C}_{15}\text{H}_{28}\text{O}_2$
- vi. $\text{C}_2\text{H}_5\text{NO}_2$
- vii. $\text{C}_{15}\text{H}_{28}\text{O}_2$, $\text{C}_{15}\text{H}_{30}\text{O}_2$

7 marks

- b. i. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
- ii. $\text{C}_6\text{H}_{12}\text{N}_2\text{O}_3\text{S}$
- iii. H_2O

3 marks

- c. i. An omega-6 acid has a double bond on the 6th carbon starting at the hydrocarbon end.
- ii. nuts, seeds, eggs. (any one)
- iii. glycerol

3 marks

Total 13 marks