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Biology
Standard level
Paper 2

Wednesday 11 November 2020 (afternoon)

Candidate session number

1 hour 15 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

15 pages

8820 – 6005

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A study was conducted to look at the short-term effects of a change in diet on the risk of disease in young adults. The table shows data on the habitual diet of the participants as well as the study diet followed for two weeks.

	Mean daily intake ± standard deviation	
	Habitual diet	**Study diet**
Energy / kJ	10 143±949	9992±479
Fat / g	100±6	99±5
Saturated fat / % total fat	37±2	60±1
Unsaturated fat / % total fat	63±2	40±1
Monounsaturated fat / % total fat	46±1	32±1
Polyunsaturated fat / % total fat	17±1	8±1
Carbohydrate / g	248±23	232±16
Protein / g	119±12	120±9

(a) Comment on the total energy content of the two diets. [1]

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(b) Distinguish between the two diets. [2]

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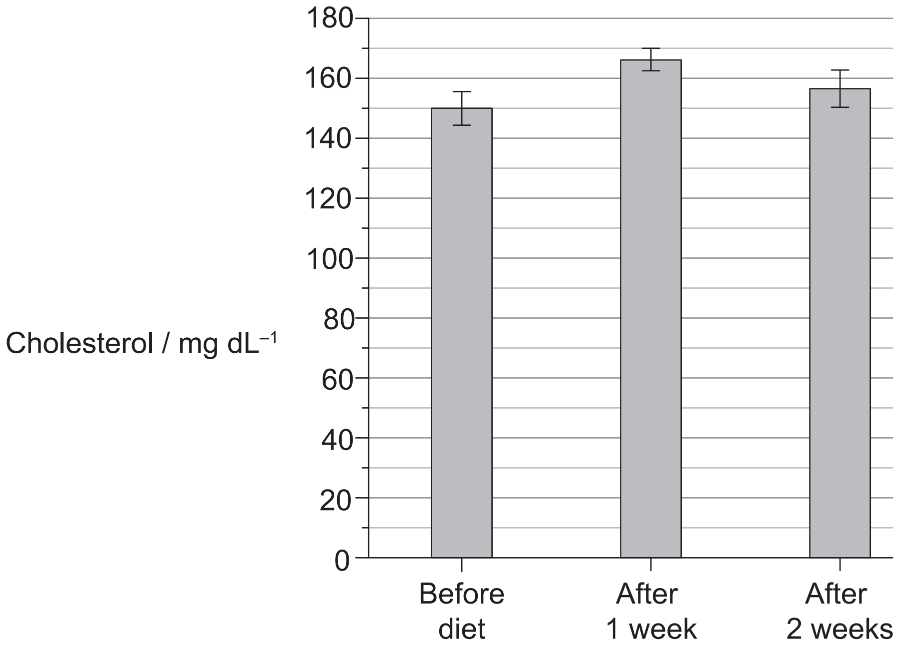
(This question continues on the following page)

(Question 1 continued)

Total blood plasma cholesterol levels were measured before the study began and once a week after starting the study diet. Mean results are shown in the bar chart, including the standard deviation.



(c) Calculate, showing your working, the percentage change in mean cholesterol level after **one week** on the study diet. [2]

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(This question continues on the following page)

(Question 1 continued)

Control of blood glucose concentration was investigated using an oral glucose tolerance test. For this test, the person was given a concentrated glucose drink (at time zero) and then blood samples were taken every 15 minutes to determine the plasma insulin level. This test was done before the study diet and after two weeks on the study diet. Mean results are shown in the graph, including the standard deviation.

(d) (i) Compare the data for plasma insulin levels before and after the study diet. [2]

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(ii) State which cells secrete insulin. [1]

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(iii) Outline the reason for plasma insulin levels changing in the first 30 minutes of the test. [1]

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(This question continues on the following page)

(Question 1 continued)

(e) The hypothesis made before the study was that saturated fats in the diet affected the risk of coronary artery blockage and diabetes. Using all the data in question 1, evaluate whether this hypothesis is supported by the study. [3]

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2. The photomicrograph below shows the protozoan *Paramecium caudatum*.

(a) (i) State the genus of this organism. [1]

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(ii) State the domain in which it is classified. [1]

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(b) Outline the method of nutrition carried out by *P. caudatum*. [1]

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(c) Outline **one** aspect of how *P. caudatum* carries out homeostasis. [2]

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(This question continues on the following page)

(Question 2 continued)

(d) Apart from the ribosomes, explain the evidence for the endosymbiotic theory of the origin of eukaryotic cells. [3]

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3. (a) Outline how the amphipathic properties of phospholipids play a role in membrane structure. [2]

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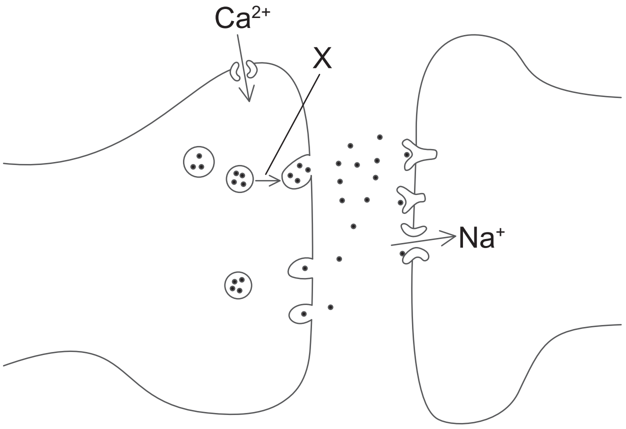
(b) The diagram shows part of two neurons.



(i) State the name of the structure shown. [1]

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(ii) X indicates the movement of a structure in the neuron. Explain what events trigger this movement and what happens next. [3]

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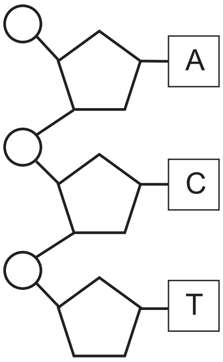
4. (a) Sketch the complementary strand to complete the section of a DNA diagram. [3]



(b) (i) Define mutation. [1]

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(ii) Explain how evolution by natural selection depends on mutations. [4]

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Turn over

Section B

Answer **one** question. Up to one additional mark is available for the construction of your answer. Answers must be written within the answer boxes provided.

5. Life is based on carbon compounds.

(a) Draw a molecular diagram of alpha-D-glucose. [3]

(b) Outline how carbon compounds are produced in cells using light energy. [5]

(c) Explain the transformations of carbon compounds in the carbon cycle. [7]

6. According to the cell theory, living organisms are composed of cells.

(a) Draw the ultrastructure of a prokaryotic cell based on electron micrographs. [3]

(b) Outline what occurs in cells in the first division of meiosis. [5]

(c) Explain the role of cells in the defence against infectious disease. [7]

References:

1. [**table/2 graphs: study diet**] Horowitz, J.F., Ortega, J.F., Hinko, A., Li, M., Nelson, R.K. and Mora-Rodriguez, R., 2018. Changes in markers for cardio-metabolic disease risk after only 1-2 weeks of a high saturated fat diet in overweight adults. *PLoS ONE*, 13(6), e0198372.

2. [**photomicrograph: protozoan *Paramecium caudatum***] Deuterostome, CC BY-SA 3.0 https://creativecommons.org/licenses/by-sa/3.0, via Wikimedia Commons.

3.(b) [**diagram: two neurons**] © International Baccalaureate Organization 2020.