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International Baccalaureate®
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BIOLOGY
STANDARD LEVEL
PAPER 2

Candidate session number

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Wednesday 13 November 2013 (afternoon)

1 hour 15 minutes

Examination code

8	8	1	3	–	6	0	0	5

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.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[50 marks]*.

16EP01

SECTION A

*Answer **all** questions. Write your answers in the boxes provided.*

1. Skeletal muscle fibres normally respond to insulin by absorbing glucose. Failure of skeletal muscle to respond to insulin is a major factor in the development of type II diabetes.

(a) Distinguish between type I and type II diabetes. *[2]*

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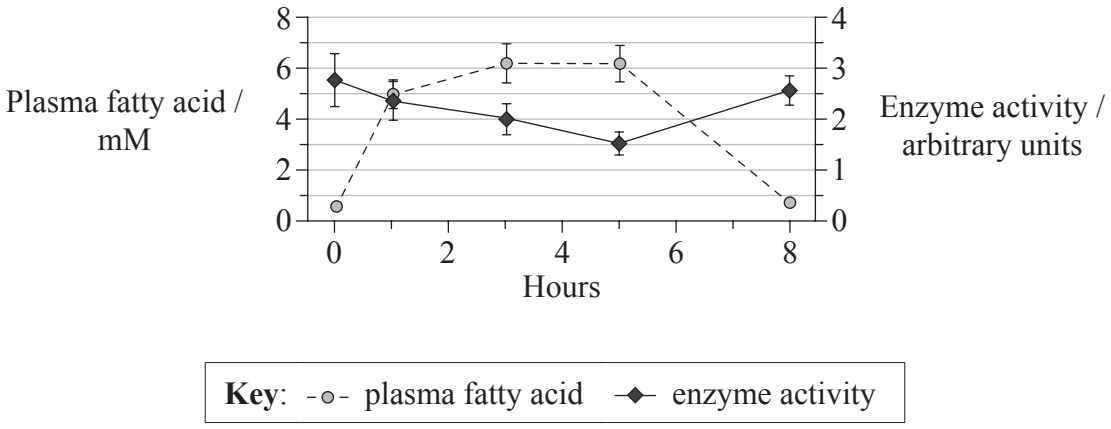
A study was undertaken to investigate the effect of plasma lipids on the process of glucose absorption in response to insulin by muscle fibers. Muscle was bathed in a lipid solution for 5 hours. The lipid was then washed out over the next 3 hours. The graph shows the level of plasma fatty acids and the activity of an enzyme involved in glucose absorption in response to insulin over the period of the study. (Values are means ± standard error)



[Source: Chunli Yu, *et al.* (2002), *The Journal of Biological Chemistry*, **277**, pages 50 230–50 236]

(This question continues on the following page)

(Question 1 continued)

(b) State the relationship between plasma fatty acid level and enzyme activity. *[1]*

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(c) Calculate the percentage change of enzyme activity after 5 hours exposure to lipids. *[1]*

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(d) Discuss, using the data, whether the effect of lipids on this enzyme is reversible. *[2]*

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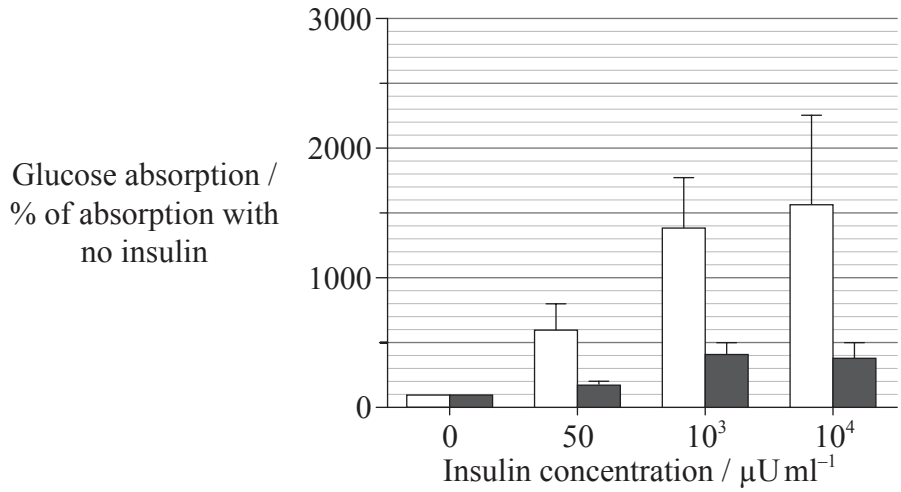
(Question 1 continued)

A further study was undertaken to look at the effect of increasing the concentration of insulin on glucose absorption in muscle bathed in lipids. A wide range of insulin concentrations were used in the same type of muscle. Glucose absorption was then measured after 5 hours.



Key: □ control muscle with no lipid ■ muscle bathed in lipid

[Source: Chunli Yu, *et al.* (2002), *The Journal of Biological Chemistry*, **277**, pages 50 230–50 236]

(e) Calculate the increase in glucose absorption when insulin is increased from 0 to 10^3 μU ml^{-1} for the muscle bathed in lipid. *[1]*

. . . . . % of absorption with no insulin

(This question continues on the following page)

(Question 1 continued)

(f) Comment on the effect of increased insulin concentration on glucose absorption in the muscle bathed in lipid. *[2]*

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(g) Some investigators suggest that there is a strong relationship between high lipid diet and the body's response to insulin. Using the data provided, evaluate this hypothesis. *[2]*

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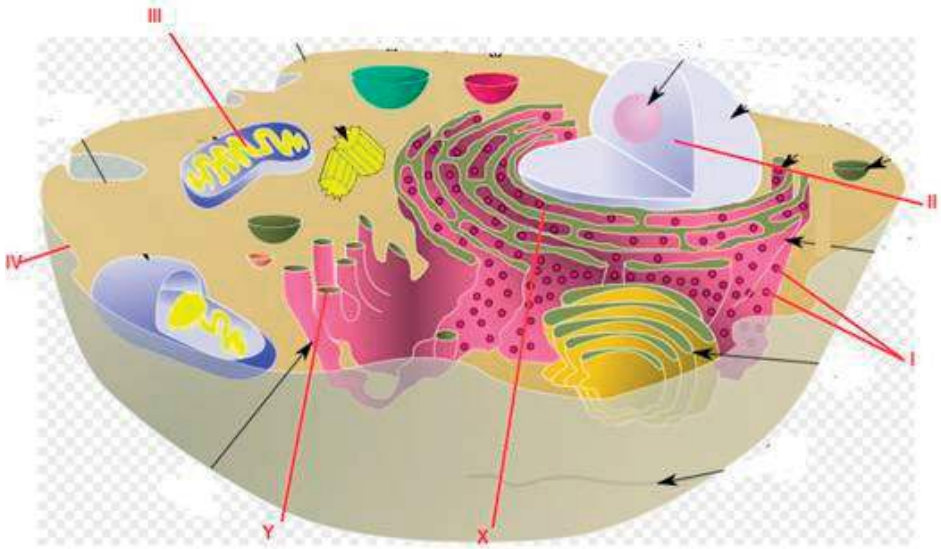
2. The diagram shows some of the structures in an animal cell.



[Source: http://commons.wikimedia.org/wiki/File:Biological_cell.svg]

(a) (i) Label structures I, II, III and IV. *[2]*

I. . . . . .

II. . . . . .

III. . . . . .

IV. . . . . .

(ii) State **one** function of structure III. *[1]*

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(This question continues on the following page)

(Question 2 continued)

(b) Explain how materials are transported within a cell between structures X and Y. *[2]*

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3. (a) Draw a labelled diagram of the structure of DNA, showing the arrangement of subunits. *[3]*

(b) Explain DNA replication. *[3]*

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4. The diagram shows a human karyotype.

[Source: http://en.wikipedia.org/wiki/File:NHGRI_human_male_karyotype.png, courtesy of the National Human Genome Research Institute.]

(a) (i) State the technique used to collect cells for pre-natal testing. *[1]*

. . . . . .

(ii) State the method used to arrange the chromosomes in a karyotype. *[1]*

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(This question continues on the following page)

(Question 4 continued)

(iii) State at what stage in the cell cycle the cells would be when this photograph was taken. *[1]*

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(b) Analyse this karyotype. *[2]*

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(Question 4 continued)

(c) Albinism is inherited as a recessive trait; the alleles of the gene involved are A and a. An individual with albinism produces little or no pigment in the eyes, skin and hair. In a family, one sister has albinism while the parents and other sister have normal pigmentation.

(i) Determine, using a Punnett grid to show your reasoning, the possible genotypes of the sister with normal pigmentation. *[2]*

(ii) Deduce the probability that the next child of this couple will have albinism. *[1]*

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SECTION B

*Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers in the boxes provided.*

5. (a) All organisms take in and also release carbon compounds. Draw a labelled diagram of the carbon cycle. *[5]*

(b) Describe how the rate of photosynthesis can be measured. *[6]*

(c) Explain the mechanism of ventilation in humans. *[7]*

6. (a) Reproduction can cause populations to increase rapidly. Draw a labelled graph showing a sigmoid population growth curve. *[4]*

(b) Explain the various possible consequences of overproduction of offspring. *[6]*

(c) Outline the role of hormones in the menstrual cycle. *[8]*

7. (a) Draw a labelled diagram to show the molecular structure of a membrane. *[4]*

(b) Some proteins in membranes act as enzymes. Outline enzyme-substrate specificity. *[6]*

(c) Membranes of pre-synaptic and post-synaptic neurons play an important role in transmission of nerve impulses. Explain the principles of synaptic transmission. *[8]*