88136002

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

BIOLOGY
HIGHER LEVEL
PAPER 2

Candidate session number

0	0							

Wednesday 13 November 2013 (afternoon)

2 hours 15 minutes

Examination code

8	8	1	3	–	6	0	0	2

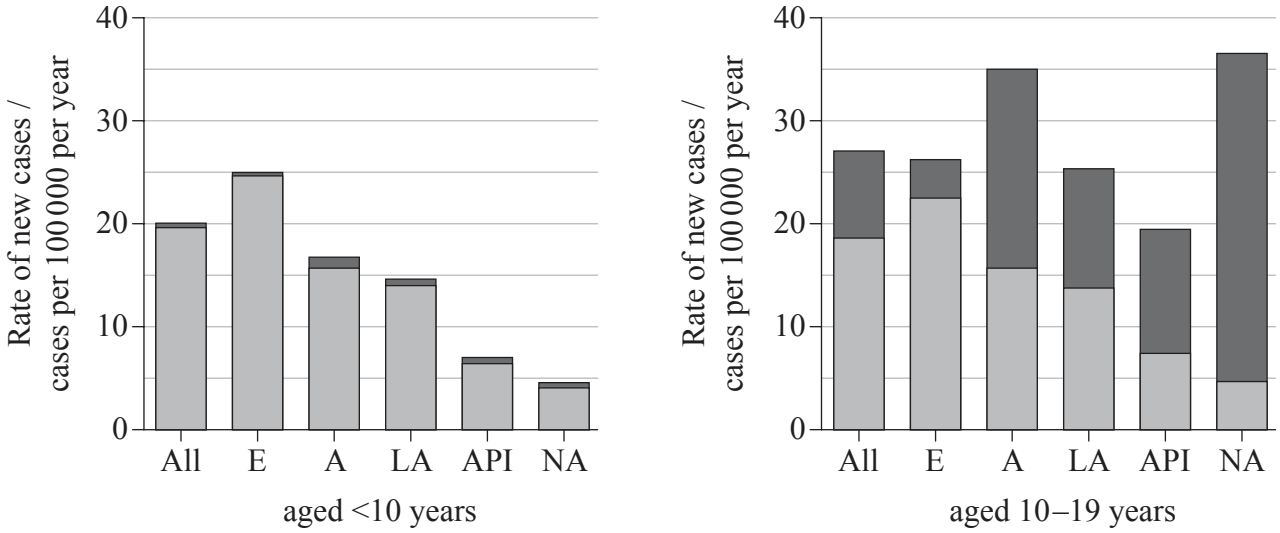
INSTRUCTIONS TO CANDIDATES

- 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 two questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[72 marks]*.

SECTION A

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

1. Diabetes in Youth is a study that examined diabetes (type I and type II) among children and adolescents in the United States. The graphs show the rate per year of new cases of type I and type II diabetes among young people (aged less than 20 years) by ethnicity between 2002–2005.



Key: type I type II

E: European A: African LA: Latin American

API: Asian/Pacific Islander NA: Native American

[Source: Adapted from www.cdc.gov/diabetes/pubs/estimates11.htm#fig2]

(a) Identify, among young people aged 10–19 years, which ethnic group showed the highest rate of new cases of type I diabetes and type II diabetes. *[1]*

Type I diabetes: . . . . . .

Type II diabetes: . . . . . .

(This question continues on the following page)

(Question 1 continued)

(b) Determine the rate of new cases of type II diabetes among children of African ethnicity aged 10–19 years. *[1]*

. . . . . .
. . . . . .

(c) Compare rates of diabetes between the two age groups studied. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(d) (i) Compare the relative proportions of type I and type II diabetes between the different ethnic groups. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

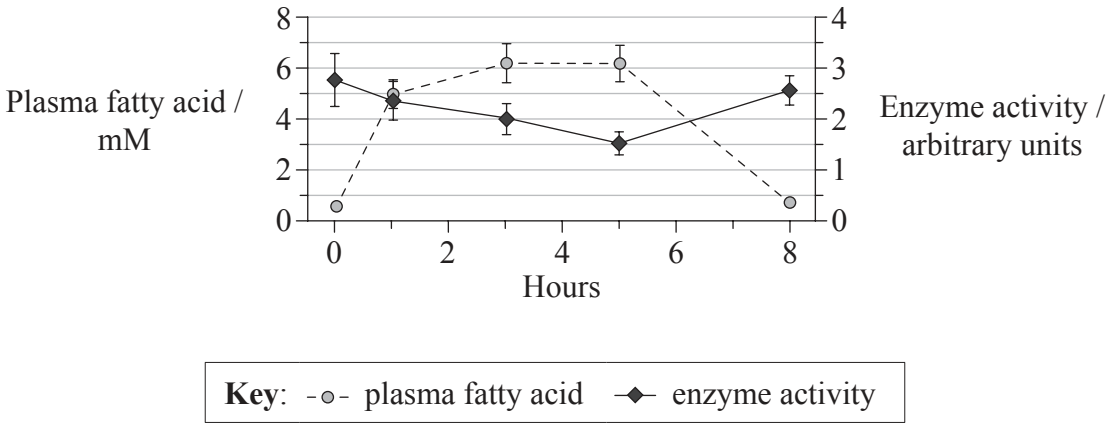
(ii) Suggest a reason for the different rates of type II diabetes among the ethnic groups. *[1]*

. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 1 continued)

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 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**, pp. 50 230–50 236]

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

. . . . . .
. . . . . .

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

. . . . . .

(This question continues on the following page)

(Question 1 continued)

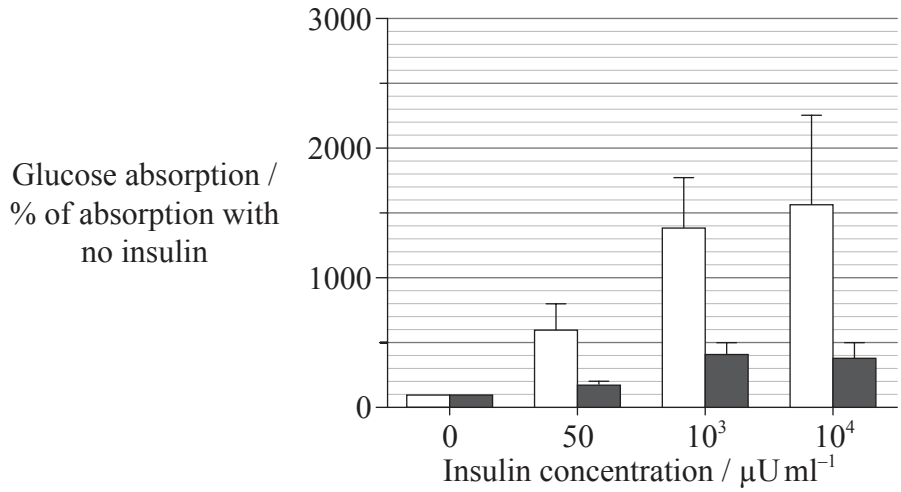
(g) Discuss, using the data, whether the effect of lipids on this enzyme is reversible. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(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**, pp. 50 230–50 236]

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

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 1 continued)

(i) 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]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

2. The diagram shows a human karyotype.

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

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

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 2 continued)

(b) Outline the inheritance of hemophilia in humans. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

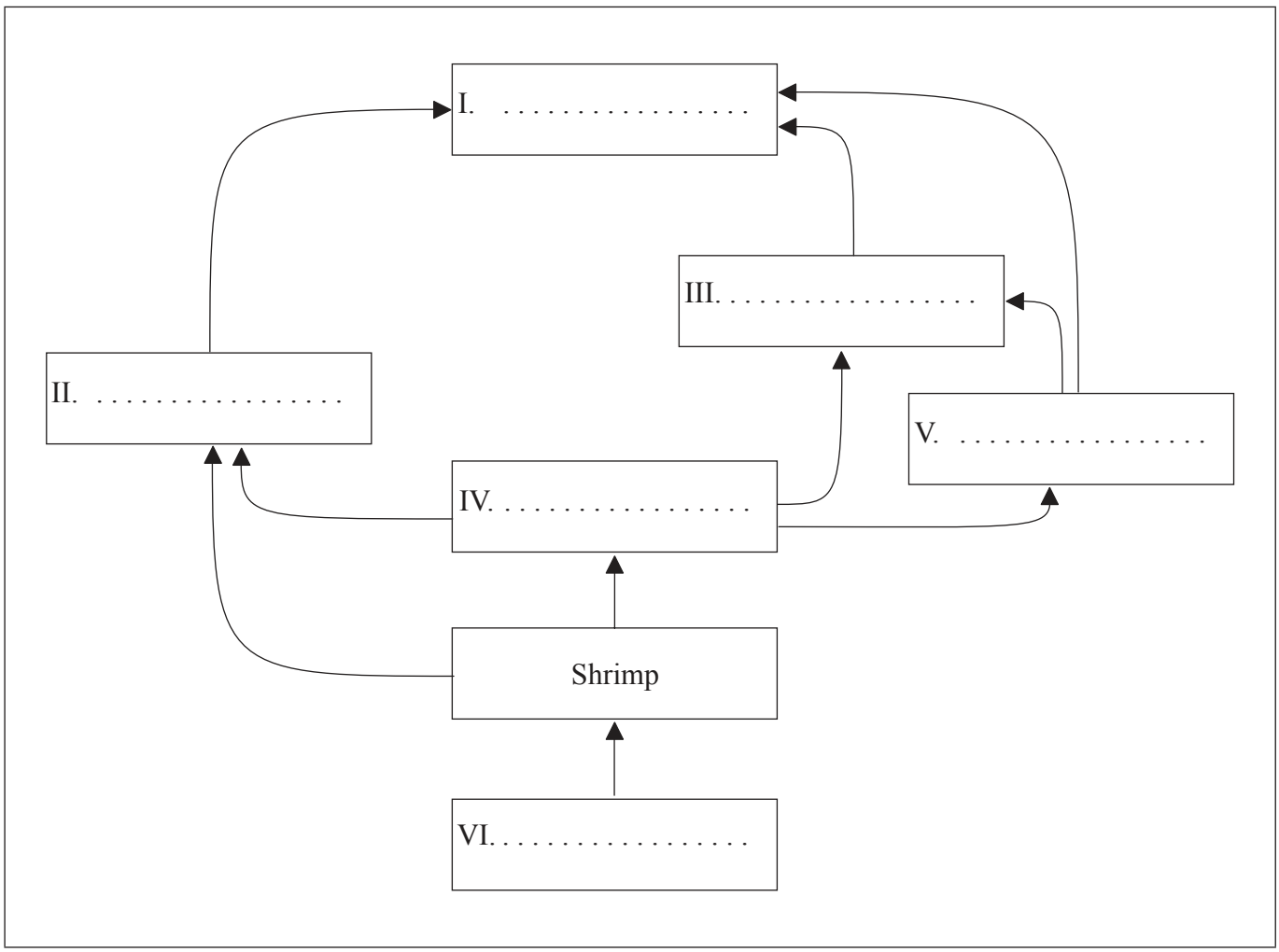
(c) Using an example, describe polygenic inheritance. *[3]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

3. The table provides some information about organisms found in an Arctic environment.

Organism	Prey/food	Predators
Arctic cod	Shrimp	Arctic fox, Narwhal, Seal
Arctic fox	Arctic cod, Seal	Polar bear
Narwhal	Arctic cod, Shrimp	Polar bear
Phytoplankton	None	Shrimp
Polar bear	Arctic fox, Narwhal, Seal	None
Seal	Arctic cod	Arctic fox, Polar bear
Shrimp	Phytoplankton	Arctic cod, Narwhal

(a) (i) Label the diagram to complete the food web for the organisms in the table above. *[2]*



(This question continues on the following page)

(Question 3 continued)

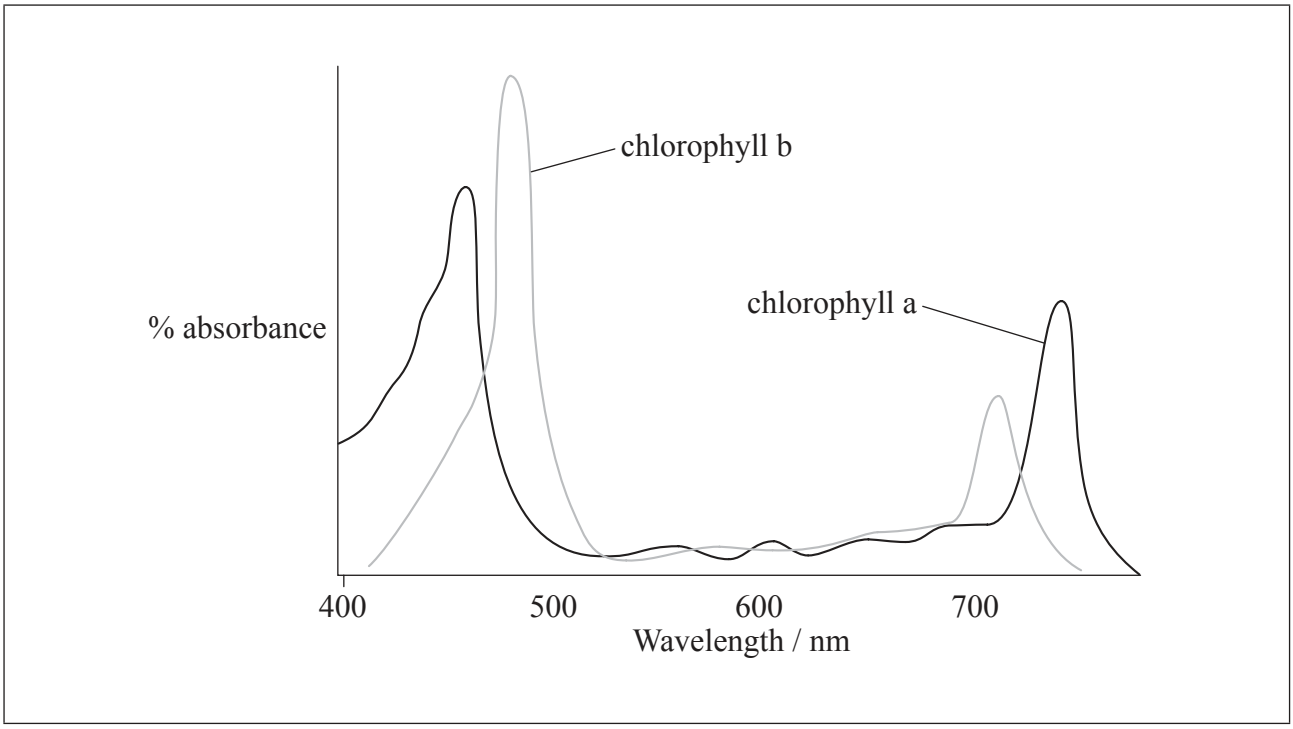
(ii) Deduce the trophic level of Artic cod. *[1]*

. . . . . .

(b) Distinguish between the movement of energy and nutrients in an ecosystem. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

4. (a) The graph shows the absorption spectrum for two types of chlorophyll.



[Source: © International Baccalaureate Organization 2014]

(i) Sketch on the graph, the action spectrum of photosynthesis. *[1]*

(ii) Explain the relationship between the absorption spectrum for chlorophyll and action spectrum of photosynthesis for green plants. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 4 continued)

(b) Outline photoactivation of photosystem II in the light-dependent reaction of photosynthesis. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

SECTION B

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

5. (a) Water is essential to life on Earth. Outline **two** properties of water that are important for living organisms. *[4]*

(b) Describe how water is transported in angiospermophytes. *[6]*

(c) Explain the roles of the structures in the kidney that maintain the water balance of the blood in humans. *[8]*

6. (a) Draw a labelled diagram of *Escherichia coli* as an example of a prokaryote. *[4]*

(b) Explain the process of transcription in prokaryotes. *[8]*

(c) Some prokaryotes cause infectious diseases which stimulate the body's immune system. Outline the principles that form the basis of immunity. *[6]*

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

(b) Some proteins in membranes act as enzymes. Describe a model that accounts for the ability of enzymes to catalyse reactions. *[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]*

8. (a) Outline the role of condensation and hydrolysis in the relationship between amino acids and polypeptides. *[4]*

(b) The protein hemoglobin transports oxygen to cells. Describe the processes that occur in the mitochondria of cells when oxygen is present. *[8]*

(c) Sickle-cell anemia affects the ability of red blood cells to transport oxygen. Explain the consequence of the mutation causing sickle-cell anemia in relation to the processes of transcription and translation. *[6]*