22086009

International Baccalaureate
Baccalauréat International
Bachillerato Internacional

BIOLOGY
HIGHER LEVEL
PAPER 3

Thursday 15 May 2008 (morning)

1 hour 15 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

• Write your session number in the boxes above.
• Do not open this examination paper until instructed to do so.
• Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
• At the end of the examination, indicate the letters of the Options answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.

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Option D — Evolution

D1. Molecular and radioactive dating of fossils are used to determine the phylogeny of organisms. Turtles are organisms with a long evolutionary history, making them an ideal group to study. Below is a phylogeny of some turtle genera developed using both fossil and molecular dating.
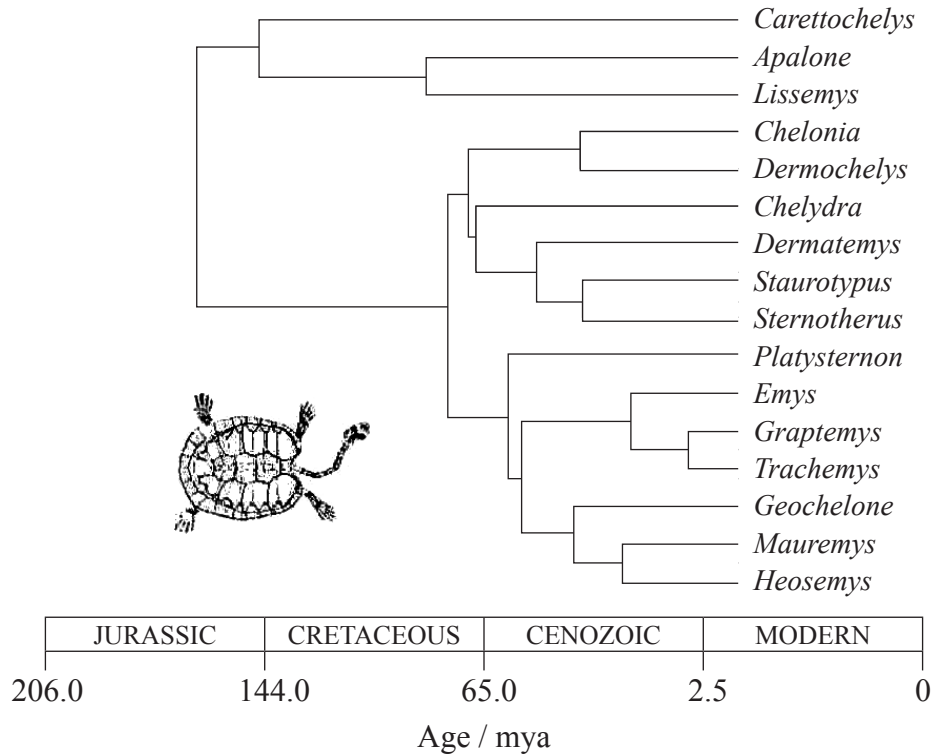
[Source: Thomas J. Near, Peter A. Meylan, and H. Bradley Shaffer, 'Assessing Concordance of Fossil Calibration Points in Molecular Clock Studies: An Example Using Turtles', The American Naturalist (Feb 2005), vol. 165, issue 2, pp. 137–146. Copyright © 2008. University of Chicago Press.]

    (a)   Identify the oldest turtle genus. *[1]*

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    (b)   Compare the phylogeny of *Chelonia* with *Graptemys*. *[2]*

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(This question continues on the following page)

(Question D1 continued)

    (c)   Discuss which turtle genera are most closely related.   *[3]*

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D2.   (a)   Discuss the difficulties for biologists in defining the term *species*.   *[2]*

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    (b)   Outline the process of speciation.   *[2]*

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D3. (a) Describe the physical features of humans that define them as primates.   *[4]*

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(b) Discuss the evidence for the theory that modern humans are descended from African apes.   *[6]*

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Option E — Neurobiology and Behaviour

E1. Crayfish are crustaceans known for their aggressive behaviour. Researchers observed this aggressive behaviour to determine what was most important to the crayfish of genus *Orconectes*: shelter, dead food source, or live food source. The researchers recorded the number of fights and the length of time pairs of crayfish spent fighting in three different areas.
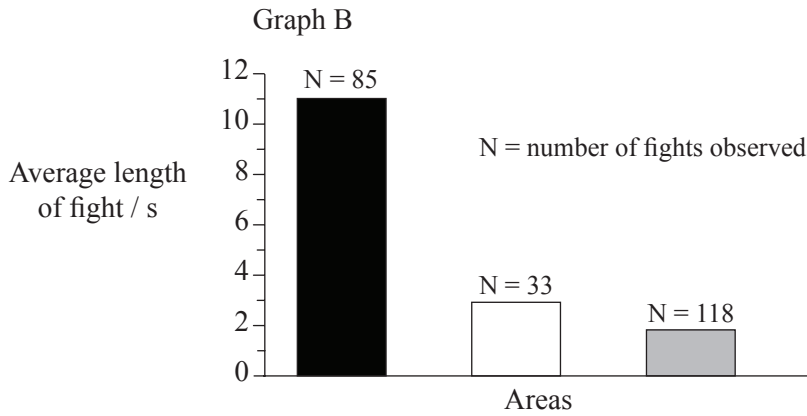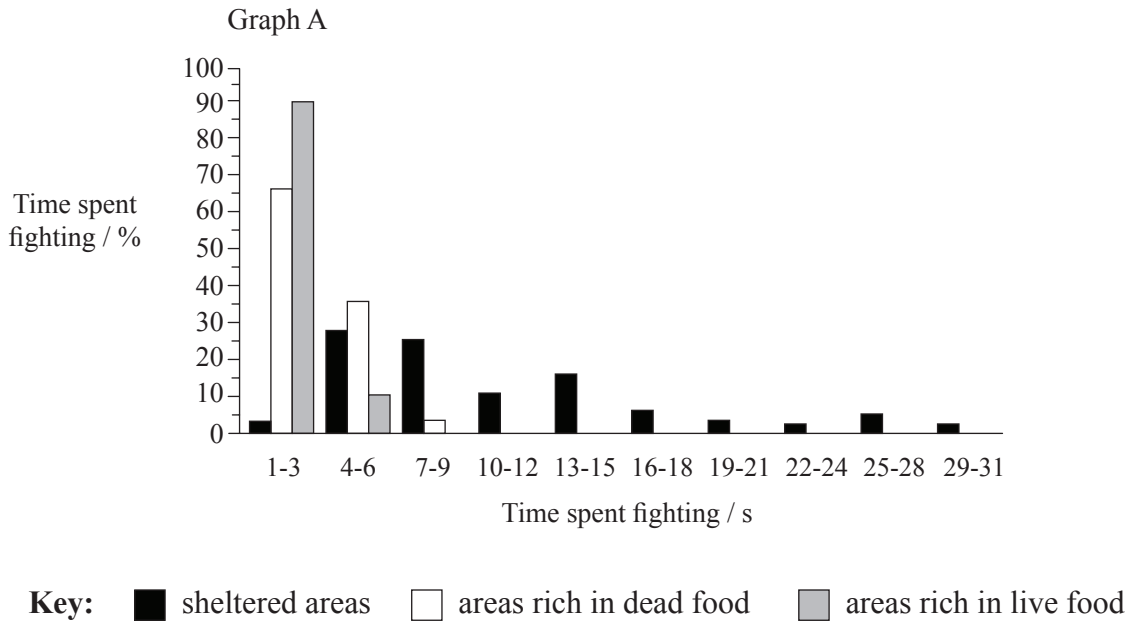
Graph A

Key: ■ sheltered areas   □ areas rich in dead food   ▨ areas rich in live food

Graph B

(a)   Using the data in graph A, compare the percentage of time the crayfish spent fighting in sheltered areas and areas rich in live food.   *[2]*

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(This question continues on the following page)

(Question E1 continued)

    (b)   (i)   Identify the average length of a fight in sheltered areas and areas rich in dead food. *[1]*

                  sheltered: . . . .

                  rich in dead food: . . . .

           (ii)   Calculate the ratio of the average fight length in areas rich in dead food to the average fight length in sheltered areas. *[1]*

                  Answer: . . . .

    (c)   Discuss which areas are preferred by the crayfish. *[3]*

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E2.   (a)   Define the term *imprinting*. *[1]*

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    (b)   Outline Lorenz's experiments on imprinting in geese. *[2]*

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E3. (a)   Annotate the diagram below of the human eye.   *[4]*
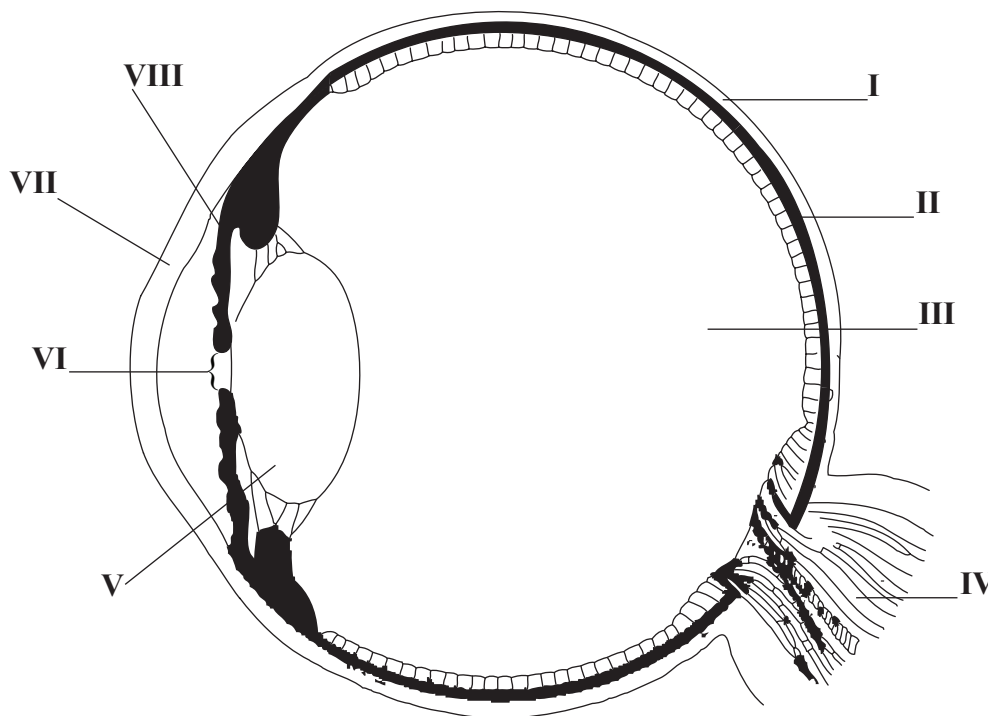
I: . . . .   II: . . . .

III: . . . .   IV: . . . .

V: . . . .   VI: . . . .

VII: . . . .   VIII: . . . .

(b)   Explain the role of the sympathetic and parasympathetic systems in the body, using the control of the eye to illustrate your answer.   *[6]*

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Option F — Applied Plant and Animal Science

F1. The reduction of plowing (the preparation of soil) ahead of planting crops reduces production costs and improves soil productivity. Scientists investigated the effect of different plowing methods on cotton production. The results below show the impact of deep, surface and no plowing methods on cotton yield and plant population numbers.

Key: ☐ deep plowing   ■ surface plowing   ▨ no plowing
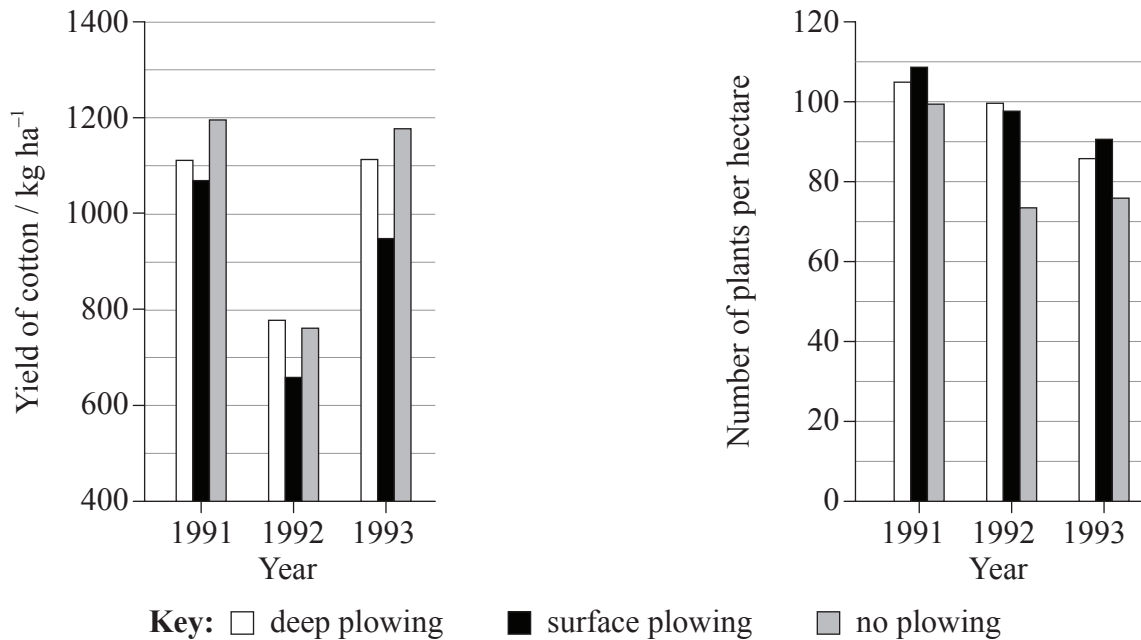
[Source: Charles W Kennedy and Robert L Hutchinson, *Crop Science*, (2001) page 1162. Figures used with permission.]

(a) (i) Calculate the average number of cotton plants per hectare in 1992 regardless of the plowing method used.   *[1]*

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(ii) Suggest a reason why cotton yield was lower in 1992 than in 1991 or 1993.   *[1]*

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(b) Compare the yield of cotton with the number of plants during the study period.   *[2]*

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(This question continues on the following page)

(Question F1 continued)

(c)   Using the data, discuss what advice should be given to farmers regarding plowing methods.   *[2]*

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F2.   (a)   Explain the role of auxin in phototropism.   *[2]*

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(b)   Describe the commercial use of plant growth regulators.   *[2]*

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F3. (a)   Describe **two** examples of transgenic techniques in agriculture. One example must be in
plants and the other in animals.   *[6]*

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(b)   Discuss the ethical issues arising from the use of transgenic techniques in agriculture.   *[4]*

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Option G — Ecology and Conservation

G1. The Southern Oscillation Index (SOI) is an indicator of global climate cycle changes. Large negative values indicate warmer than normal weather (El Niño), whereas large positive values suggest colder than normal weather (La Niña).

Between 1988 and 1998, scientists studied the effect of changes in the SOI on *Dendroica caerulescens*, the black-throated blue warbler, a migratory songbird. Each dot in the diagrams represents the mean value calculated for that year.
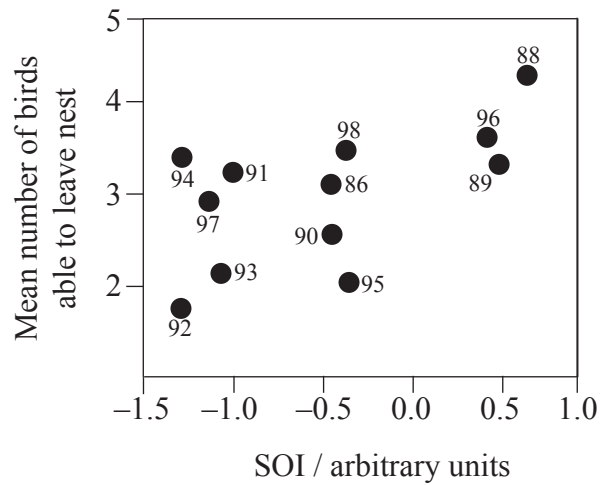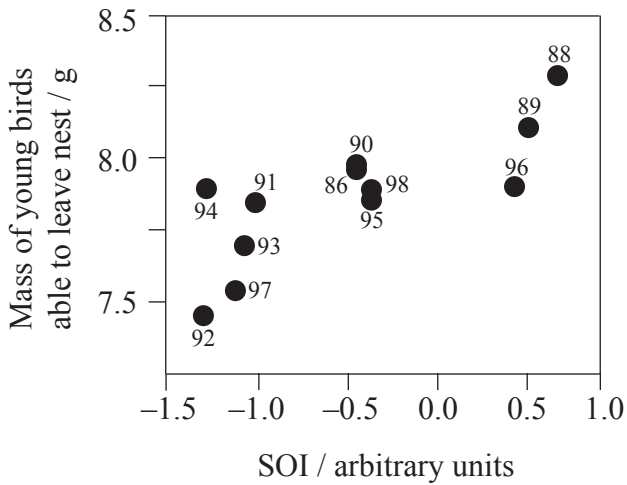
[Source: T. Scott Sillett et al., 'Impacts of a Global Climate Cycle on Population Dynamics of a Migratory Songbird', Science, (16 June 2000), vol. 288, issue 5473, pp. 2040 – 2042. Reprinted with permission from AAAS.]

(a) State the average mass of juvenile birds leaving their nest in 1989. *[1]*

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(b) Compare the relationship between young birds' mass and mean number of birds able to leave the nest. *[2]*

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(c) Discuss the implications of global climate changes for the warblers. *[3]*

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G2. Describe the principle of competitive exclusion. *[3]*

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G3. (a)   Outline the factors that caused the recent extinction of a named animal.   *[4]*

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(b)   Discuss reasons for the conservation of biodiversity using rainforests as your example.   *[7]*

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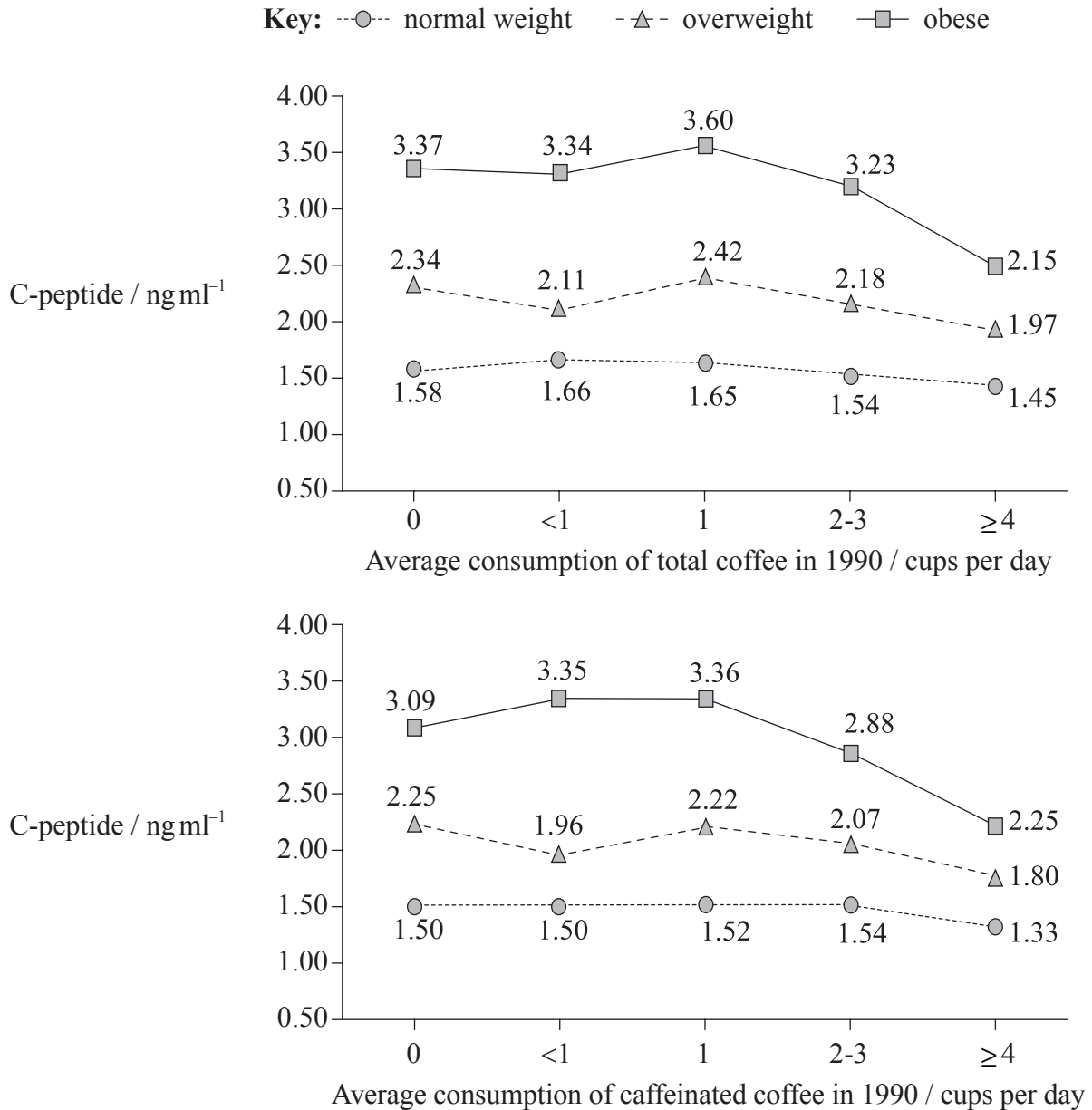
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Option H — Further Human Physiology

H1. Reduced risk of Type 2 diabetes has been associated with coffee consumption. A compound called C-peptide is found in the bloodstream when insulin is released. Increased C-peptide levels are associated with Type 2 diabetes.

The following study investigated the effect of coffee consumption on blood plasma concentration of C-peptide in women. The subjects were grouped according to their weight and their level of coffee consumption. The study investigated both total coffee consumption (caffeinated and decaffeinated coffee) and consumption of caffeinated coffee.

Key: ···◯··· normal weight   - △ - overweight   ─■─ obese

(This question continues on the following page)

(Question H1 continued)

    (a)   Describe the relationship between C-peptide concentration and total coffee consumption.   *[2]*

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    (b)   Compare the effect on C-peptide concentrations in women who drink more than 4 cups of caffeinated coffee per day with those who drink no caffeinated coffee.   *[2]*

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    (c)   Using the data provided, suggest advice that could be given to women in order to reduce the incidence of Type 2 diabetes.   *[2]*

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H2. (a)   Define the term *partial pressure*.   *[1]*

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    (b)   Outline how the body acclimatizes to high altitudes.   *[3]*

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H3. (a) Draw a labelled diagram of the structural features of exocrine glands. *[3]*

(b) Explain the control of thyroxine by negative feedback. *[7]*

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