Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	1	1	5	/	0	1	Signature	

Paper Reference(s)

6115/01

Edexcel GCE

Biology (Human)

Advanced

Unit 5H

Tuesday 21 June 2005 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination
Ruler

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL questions in the spaces provided in this booklet.
Show all the steps in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and parts of questions are shown in round brackets: e.g. (**2**).
The total mark for this question paper is 70.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.
The Synoptic section (Questions 4 to 7) is designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

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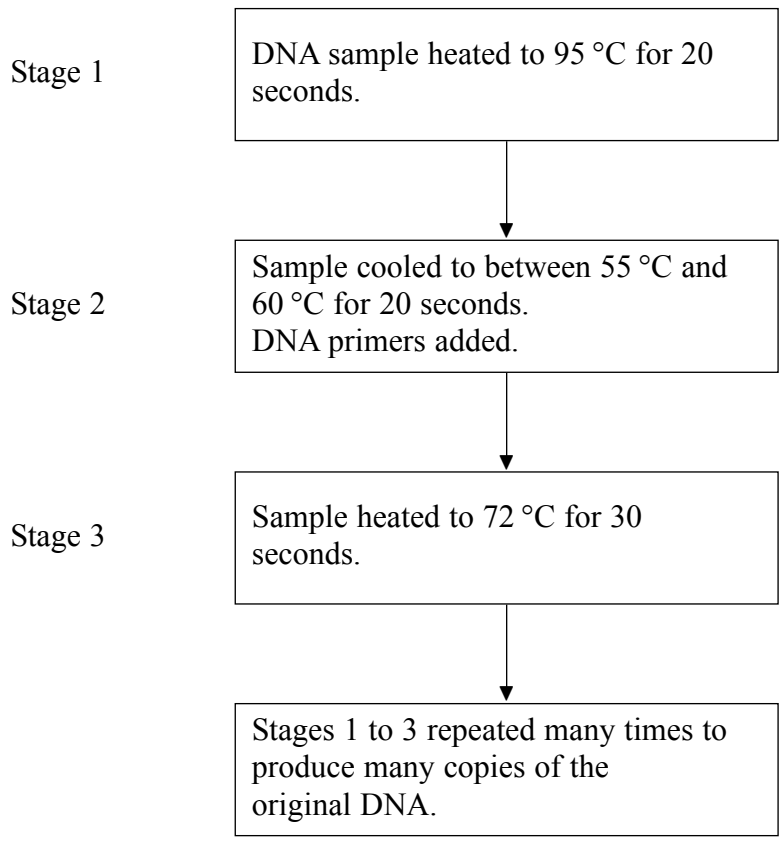
Answer ALL questions in the spaces provided.

1. The flow diagram below summarises some of the stages used to copy DNA in the polymerase chain reaction (PCR).



(a) Explain why the DNA is heated during Stage 1.

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(2)

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(b) Describe the structure of the primers used in Stage 2 and explain why they are used.

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(3)

(c) Another method of producing many copies of a DNA sample is to introduce the DNA into bacteria and allow them to reproduce. Suggest one disadvantage of this technique compared with PCR.

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(1)

(Total 6 marks)

Q1

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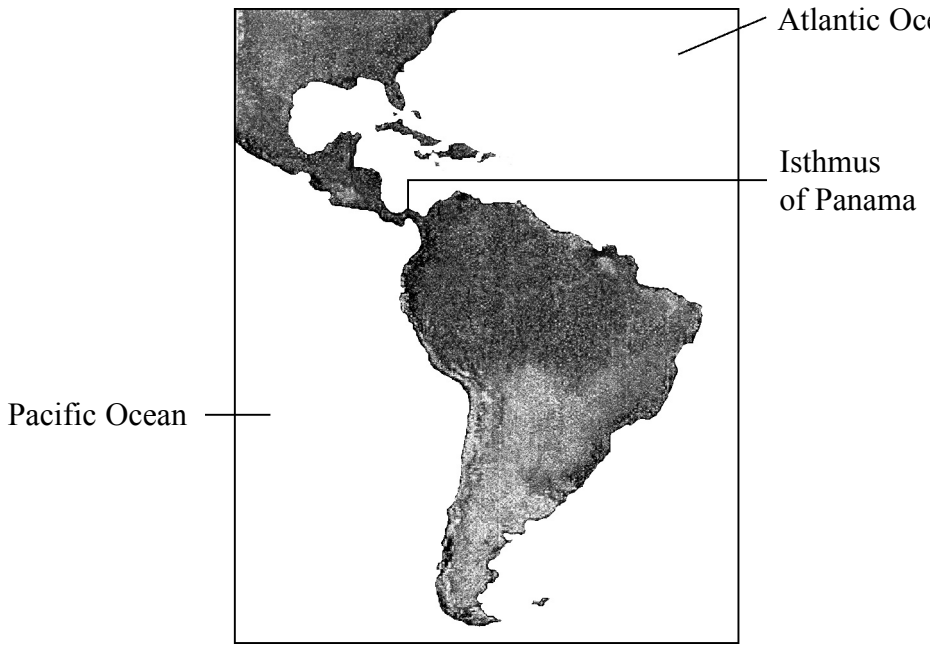
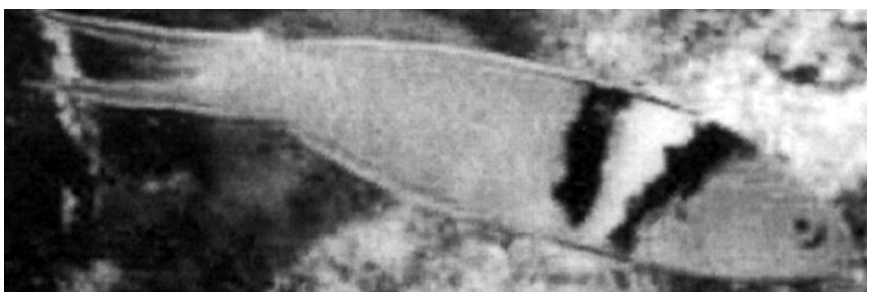
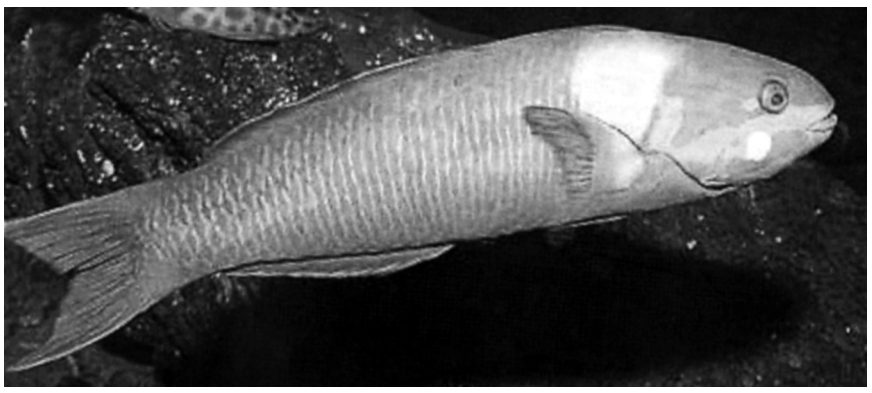
2. The Isthmus of Panama is a strip of land that separates the Pacific Ocean from the Atlantic Ocean in Central America. The map below shows the Isthmus of Panama.



The pictures below show two species of fish known as wrasse.



Blue-headed wrasse *(Thallassoma bifasciatum)*



Rainbow wrasse *(Thallassoma lucasanum)*

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The blue-headed wrasse is found in the coral reefs on the Atlantic side of the isthmus and the rainbow wrasse is found in the reefs on the Pacific side of the isthmus.

It has been shown that both of the species are descended from a common ancestral population that was split as the isthmus formed.

(a) Explain why the blue-headed wrasse and the rainbow wrasse are described as different species.

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(2)

(b) Suggest how analysis of DNA or proteins might be used to supply additional evidence that these species have descended from a common ancestor.

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(2)

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(c) Explain how the splitting of the common ancestral population into an Atlantic population and a Pacific population have led to the formation of these two separate species.

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(5)

Q2

(Total 9 marks)

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3. Maple syrup urine disease (MSUD) is an inherited metabolic disorder. People with this disorder are homozygous for a defective recessive allele. One of the effects of this is that the urine has a characteristic smell of maple syrup. Progressive degeneration of the nervous system will eventually lead to death.

The disease can be detected before a child is born using tissue samples from the fetus so that treatment can be given before there is any damage to the nervous system.

(a) Explain what is meant by the term **allele**.

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(2)

(b) Describe **one** method of taking a tissue sample from a fetus which could be used to test for maple syrup urine disease (MSUD).

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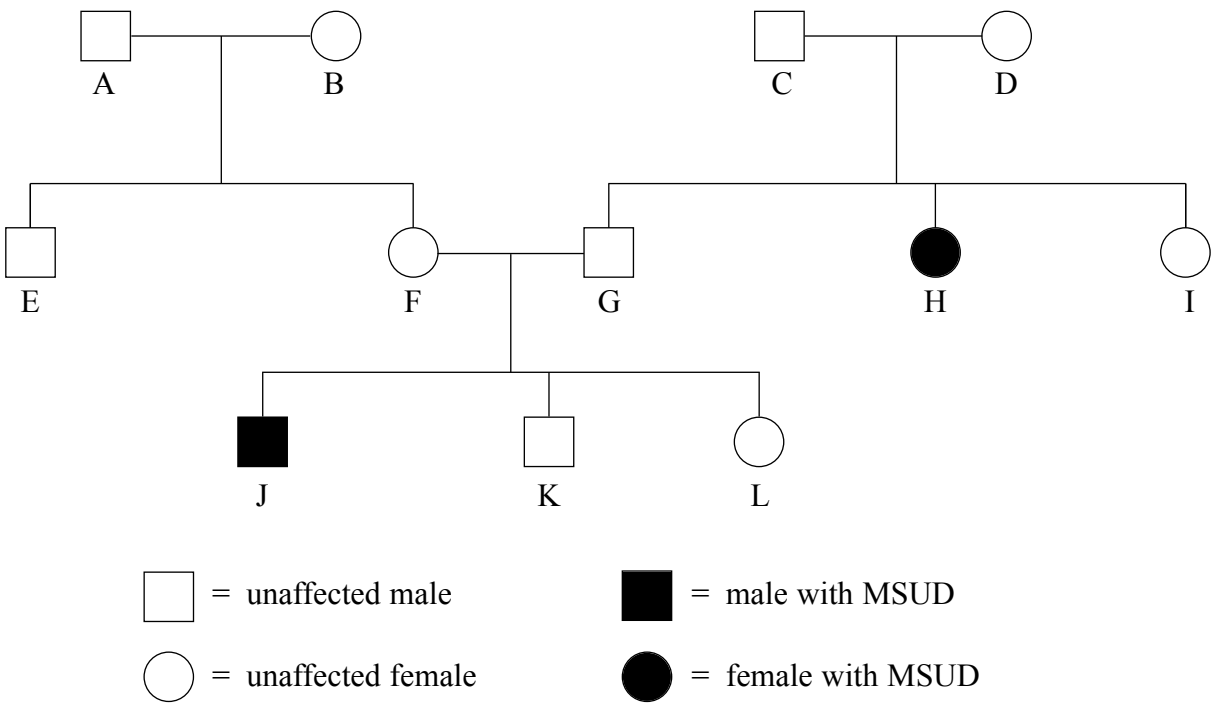
(c) The diagram below shows the occurrence of MSUD in a family.



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(i) If female F and male G were to have a fourth child, state the probability that the child would have MSUD. Explain your answer.

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(ii) What does the information in the diagram indicate about the genotypes of male A and female B? Give reasons for your answer.

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(2)

Q3

(Total 9 marks)

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Synoptic Section

The questions in this section are designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

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4. The total number of woodland and farmland birds in England decreased during the last half of the 20th century.

The table below shows the changes in the number of woodland and farmland birds in England between 1970 and 2000.

The number of birds is shown as a percentage of the total in 1970.

Year	Number of woodland birds as percentage of 1970 total	Number of farmland birds as percentage of 1970 total
1970	100.0	100.0
1975	109.2	109.4
1980	102.9	99.6
1985	100.9	76.1
1990	94.7	70.7
1995	85.4	62.3
2000	89.5	58.6

[Data adapted from *e-Digest of Environmental Statistics*, DEFRA 2003]

(a) Compare the changes in the number of woodland birds with those of farmland birds from 1970 to 2000.

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(2)

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(b) Many of the woodland and farmland birds are secondary consumers feeding on insects. Most of these insects are primary consumers. Explain what effect the decrease in the numbers of birds might have upon the populations of other species in the food webs.

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(c) The following passage describes some of the changes that have taken place in farmland management in England during the last half of the 20th century.

> At the same time that farmland bird populations were in decline, unprecedented changes were taking place in the way farmland was managed. Pesticide and fertiliser usage increased, hedges were lost, wetter areas were drained, hay meadows were replaced with silage grass, new crop varieties were introduced, field size increased and habitat diversity declined.
>
> [Donald P F & Gregory R D – *Biologist* (2002), 49 (3)]

Explain how the changes in farmland management, described in the passage, might have contributed towards the decline in farmland bird populations between 1975 and 2000.

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(6)

Q4

(Total 12 marks)

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5. Denim, the fabric of jeans, is made from cotton. Cotton is almost entirely cellulose. The faded look of denim, known as 'stonewashed', was originally achieved by washing denim with stones in large industrial washing machines. Now the manufacturers use a type of cellulase enzyme. The enzyme digests the outer surface of the cotton fibres creating a look that is indistinguishable from the stonewashing method.

(a) Describe the structure of a cellulose molecule.

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(3)

(b) There are a number of different types of cellulases. The graph opposite shows the activity of two types, acid-cellulase and neutral-cellulase, at different pH values.

(i) Compare the activity of the two enzymes across the range of pH values.

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(ii) After the enzyme treatment has been carried out, the reaction has to be stopped to prevent further damage to the fabric. Suggest how the reaction could be stopped.

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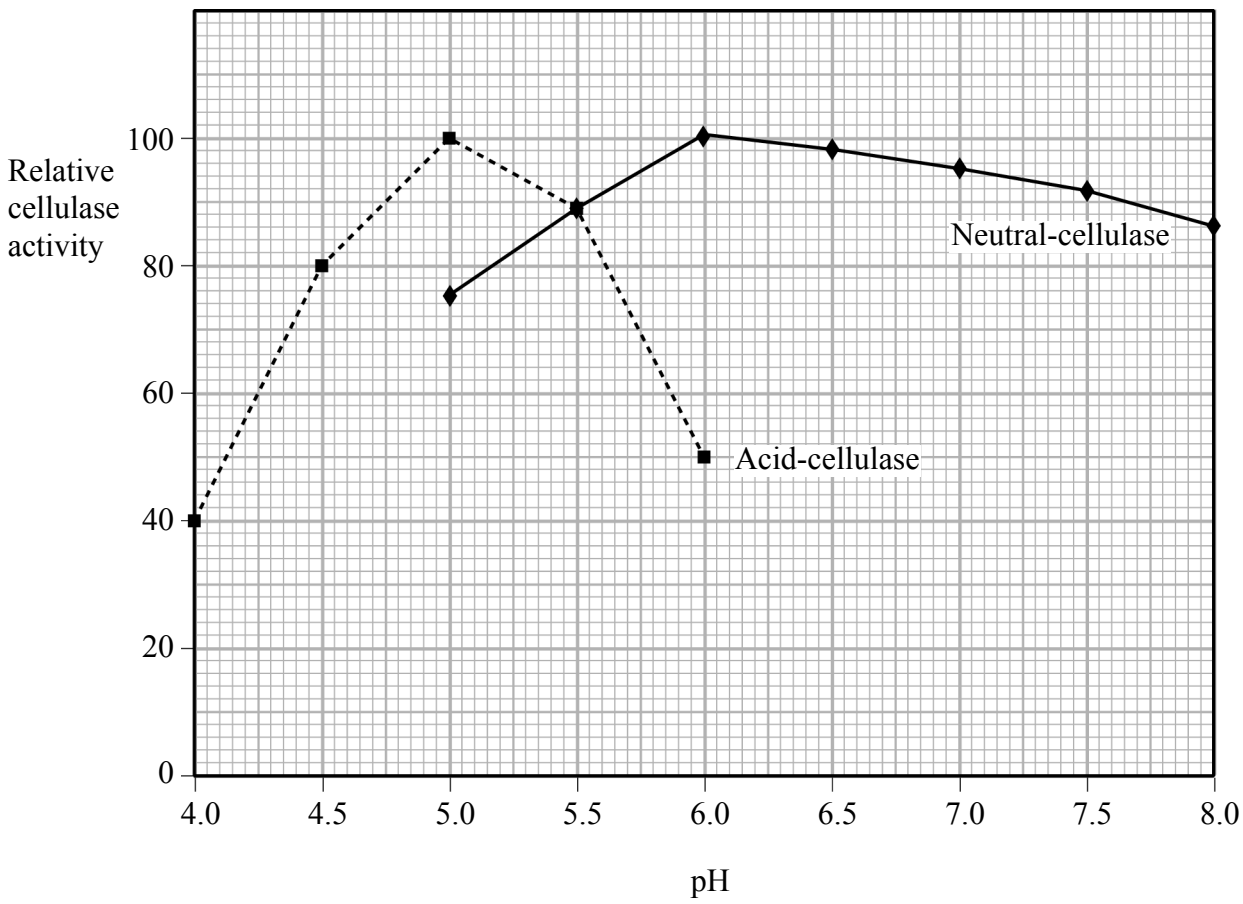
Relative cellulase activity
100
80
60
40
20
0
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
pH
Neutral-cellulase
Acid-cellulase

Leave blank

(c) Cellulase is made by many species of fungi. However, a greater yield of cellulase can be obtained using bacteria genetically modified to produce cellulase.

Describe how the cellulase gene could be transferred into a bacterium.

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(d) Explain the role of cellulase-producing bacteria in a ruminant mammal.

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(2)

Q5

(Total 13 marks)

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6. Phenylketonuria (PKU) is an inherited disease in which the concentration of the amino acid phenylalanine in the blood increases to harmful levels. If PKU is not treated, excess phenylalanine can harm nerve cells and cause brain damage.

PKU is caused by a point mutation. The mutation reduces the activity of the enzyme phenylalanine hydroxylase. This enzyme converts the amino acid phenylalanine to other essential compounds in the body.

(a) Phenylalanine is an amino acid. In the space below, draw the structure of an amino acid molecule.

(2)

(b) Explain how a point mutation, such as the one that causes PKU, can lead to reduced enzyme activity.

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(c) Phenylalanine is used for the synthesis of transmitter substances. Describe the role of a transmitter substance at a synapse.

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Q6

(Total 9 marks)

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7. (a) Explain how the structure of an alveolus is adapted for gas exchange.

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(3)

(b) The table below shows the percentages of oxygen and carbon dioxide in inspired air, expired air and alveolar air.

Gas	Percentage of gas in air		
	Inspired air	Alveolar air	Expired air
Oxygen	20.8	13.1	15.3
Carbon dioxide	0.04	5.2	4.2

(i) Explain why the percentage of oxygen in expired air is higher than in alveolar air.

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(2)

(ii) The diffusion gradients of the gases between the alveolar air and blood in the capillaries need to be steep. Explain how these diffusion gradients are maintained.

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(c) Explain why pregnant women are advised not to smoke during their pregnancy.

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(3)

(d) The number of smokers is increasing rapidly in China. Suggest how this rise in the number of smokers could affect the population structure of China in the future, giving reasons for your suggestions.

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(2)

Q7

(Total 12 marks)

TOTAL FOR PAPER: 70 MARKS

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