Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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4	
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8	
9	
10	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2009

Human Biology HBIO2

Unit 2 Humans – their origins and adaptations

Thursday 4 June 2009 1.30 pm to 3.00 pm

For paper you must have:
- a ruler with millimetre measurements.

You may use a calculator.

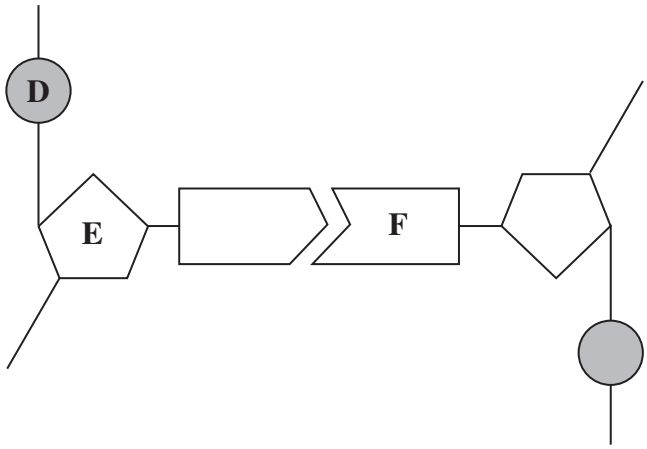
Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**
- You may ask for extra paper Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.

Answer **all** questions in the spaces provided.

1 (a) The diagram shows one pair of nucleotides of a DNA molecule.



1 (a) Name

D .....

E .....

F .....

(3 marks)

1 (b) Complete the table to give **two** differences between the structure of DNA and the structure of RNA.

	DNA	**RNA**
1		
2		

(2 marks)

5

2 (a) What is meant by a hierarchical classification?

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(2 marks)

2 (b) Complete the table showing the classification of the domestic dog, *Canis familiaris*.

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
	Carnivora
	Canidae
Genus	
Species	

(2 marks)

2 (c) The domestic dog was produced by selective breeding. What is selective breeding?

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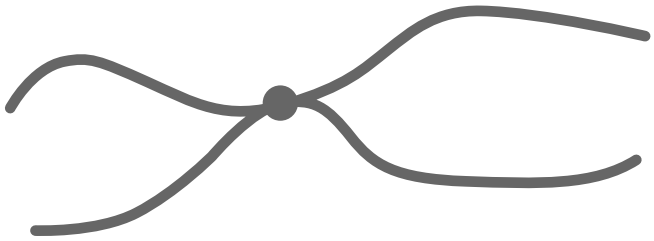
(2 marks)

6

3 (a) The diagram shows a chromosome at the start of mitosis.



Describe and explain the appearance of the chromosome.

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(2 marks)

3 (b) The photographs show two stages in mitosis.

Stage **A**

Stage **B**

Name stages **A** and **B**. Describe what is happening to the chromosomes in each stage.

3 (b) (i) Stage **A** .....

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(2 marks)

3 (b) (ii) Stage **B** .....

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(2 marks)

6

Turn over for the next question

4 During gamete formation in humans, diploid (2n) cells undergo meiosis to produce haploid (n) gametes.

4 (a) Explain why it is important that gametes are haploid.

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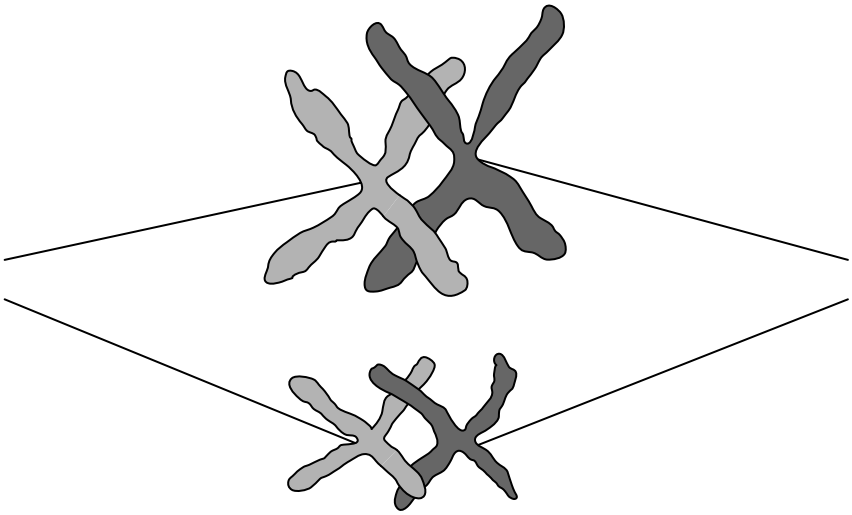
(2 marks)

4 (b) The diagram shows some of the chromosomes in a human cell during one stage of meiosis.



Describe what happens to these chromosomes in the next stage of meiosis.

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(2 marks)

4 (c) Describe an error during meiosis that can lead to Down's syndrome.

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(2 marks)

6

Turn over for the next question

5 Humans originating from hot parts of the world have different adaptations from those originating from cold parts of the world.

5 (a) Explain the advantage of a small surface area to volume ratio in cold parts of the world.

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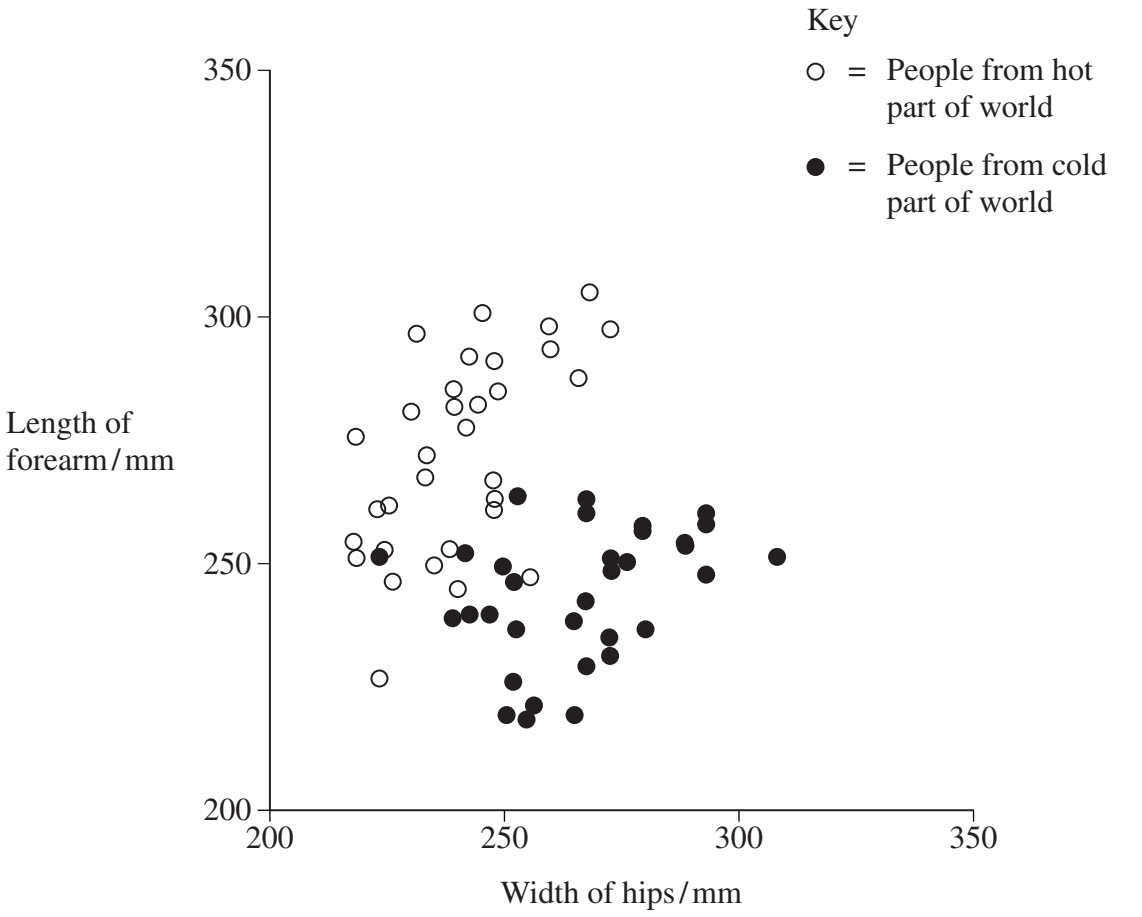
(2 marks)

5 (b) Scientists measured the length of the forearm and the width of the hips in two groups of people. One group was from a hot part of the world and the other group was from a cold part of the world. The graph shows the results.



Describe and explain the results.

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(3 marks)

(Extra space).....

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5 (c) Humans originating from very sunny parts of the world have a dark skin.
Explain the advantage of this.

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(2 marks)

7

Turn over for the next question

6 Muscle contraction requires energy from ATP. Phosphocreatine is a substance found in low concentrations in muscle cells. It can be used to release energy very quickly to make ATP.

6 (a) Other than ATP and phosphocreatine, name **two** substances used as energy sources by muscles.

1 .....

2 .....

(2 marks)

6 (b) During running races, the main source of ATP used by muscles changes as the length of the race increases.

The table gives information about the ways in which ATP is produced in races of different lengths.

Length of race / m	**Way in which ATP is produced**
100	From phosphocreatine
200	From phosphocreatine
400	From phosphocreatine and anaerobic respiration
800	Anaerobic respiration
1500	Anaerobic respiration and aerobic respiration
5000	Aerobic respiration
10 000	Aerobic respiration

Explain the changes in the way ATP is produced in muscle cells as the length of a race increases.

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(4 marks)

(Extra space).....

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6 (c) Muscle fatigue is associated with a fall in pH. Explain how a fall in pH can affect the activity of enzymes in muscles.

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(2 marks)

8

7 Radon is a radioactive gas that can get into some houses from the ground. Scientists investigated the effect of exposure to different amounts of radiation from radon on the percentage risk of developing lung cancer for smokers and non-smokers.

The table shows the results.

Exposure to radiation from radon / Bq m^{-3}	**Percentage risk of developing lung cancer**	
	Non-smoker	**Smoker**
0	0.4	10.1
100	0.5	11.6
400	0.7	16.0
800	0.9	21.6

7 (a) How many times greater is the risk of developing lung cancer for smokers exposed to 800 Bq m^{-3} compared to smokers exposed to 0 Bq m^{-3}?
Show your working.

Answer..... times greater *(2 marks)*

7 (b) Using these data, describe the effects of exposure to different amounts of radiation from radon on the percentage risk of developing lung cancer.

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(3 marks)

(Extra space).....

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7 (c) New houses are built with *radon traps* to remove any radon gas. Some experts have suggested putting *radon traps* into all older houses as well. This would cost several hundred pounds for each house.

Does the evidence from this study support spending large amounts of public funds on *radon traps*?

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(3 marks)

(Extra space).....

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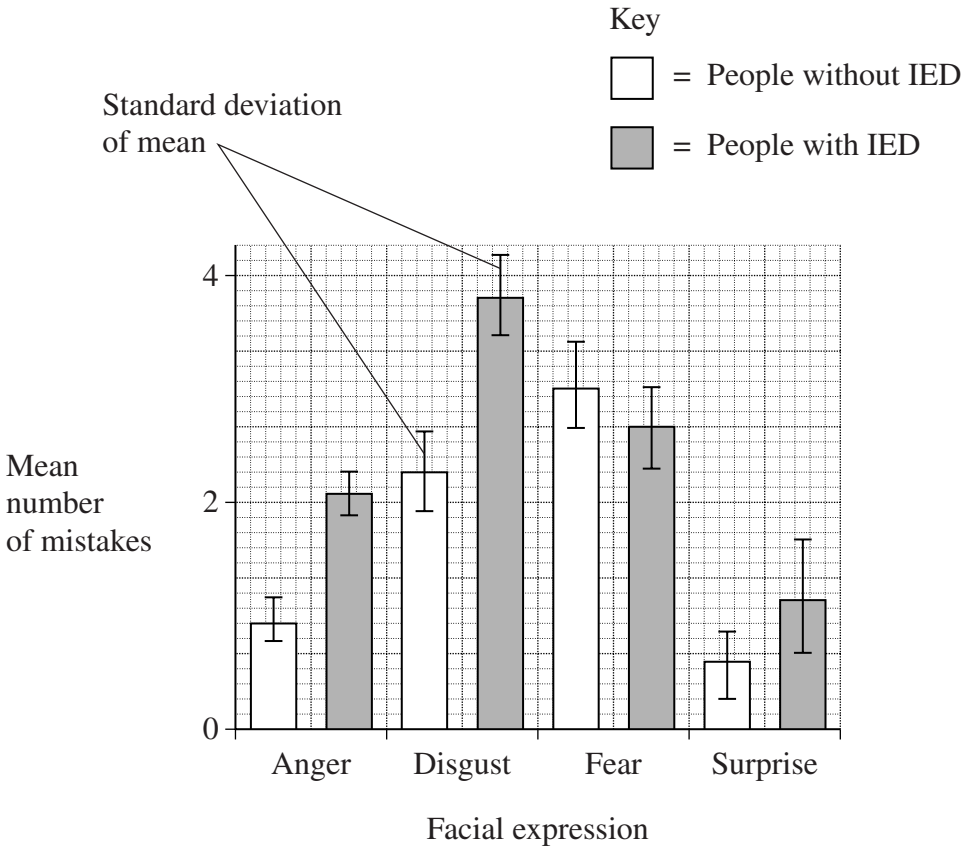
8

8 Intermittent Explosive Disorder (IED) is a condition in which people show very aggressive behaviour for no obvious reason.

Doctors showed two groups of people photographs of facial expressions of anger, disgust, fear and surprise. One of the groups had IED and the other did not. The doctors recorded the number of mistakes the people in each group made in identifying these expressions.

The chart shows the mean number of mistakes the people in each group made for each expression and the standard deviation.



8 (a) What do these data show about the ability of people with and without IED to identify these facial expressions?

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(4 marks)

(Extra space).....

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8 (b) Using this information, suggest why people with IED may show very aggressive behaviour for no obvious reason.

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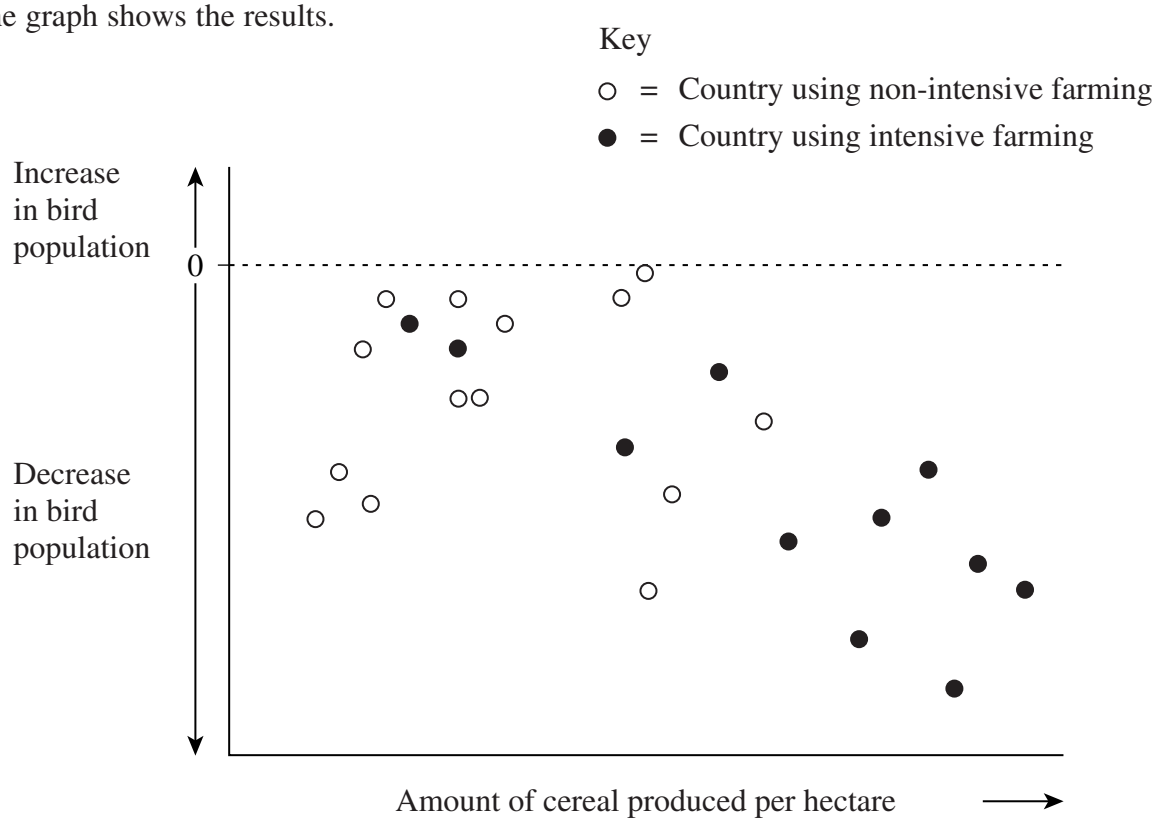
(2 marks)

6

9 Intensive farming involves high inputs of fertilisers and pesticides to produce large surpluses of food. Intensive farming has been linked to decreases in biodiversity.

Ecologists investigated decreases in populations of wild birds in Europe. Decreases in bird populations were recorded in some European countries between 1970 and 1990. The amount of cereal produced per hectare for each country was also recorded. Each country was described as using either intensive or non-intensive farming.

The graph shows the results.



9 (a) Describe the results.

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(3 marks)

(Extra space).....

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9 (b) Do these data support the hypothesis that intensive farming is causing decreases in populations of wild birds in Europe? Explain your answer.

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(3 marks)

(Extra space).....

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9 (c) Other than intensive farming, suggest **one** other way in which human activity could reduce the size of bird populations.

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(2 marks)

8

Turn over for the next question

10 Read the passage.

DNA was taken from the bones of neanderthals. Scientists used this DNA to test the hypothesis that some neanderthals had pale skin and red hair. The scientists thought this because neanderthals lived in Europe.

The scientists extracted the MC1R gene from this DNA. This gene codes for a protein found in plasma membranes. The protein is a receptor that controls the production of a brown pigment called eumelanin. Modern humans with mutations that cause loss of MC1R function tend to have pale skin and red hair.

The MC1R gene from the neanderthals had a mutation not reported in modern humans. To ensure that the mutated MC1R gene was not from contaminating DNA from modern humans, the scientists checked the DNA base sequences of everyone involved in processing the neanderthals' DNA. None showed the mutation.

This evidence suggests that although neanderthals and modern humans evolved from a common ancestor, they followed different evolutionary paths to pale skin and red hair.

10 (a) Suggest how scientists developed the hypothesis that some neanderthals had pale skin and red hair (line 2).

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(2 marks)

10 (b) How might the scientists have dated the bones?

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(2 marks)

10 (c) Receptor proteins such as MC1R form part of the structure of the plasma membrane (lines 4 and 5). Describe how.

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(2 marks)

10 (d) Explain how a gene mutation that changes DNA causes loss of MC1R function resulting in people with pale skin and red hair (lines 6 and 7).

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(4 marks)

(Extra space).....

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Question 10 continues on the next page

10 (e) Explain how modern humans and neanderthals may have evolved from a common ancestor (lines 12 and 13).

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(6 marks)

(Extra space).....

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10 (f) Some scientists have suggested that the conclusions that neanderthals had pale skin and red hair are not reliable. Suggest reasons why these conclusions may not be reliable.

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(4 marks)

(Extra space).....

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END OF QUESTIONS

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