Centre Number						Candidate Number				
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Other Names										
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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10	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2011

Biology BIOL2

Unit 2 The variety of living organisms

Thursday 26 May 2011 1.30 pm to 3.15 pm

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

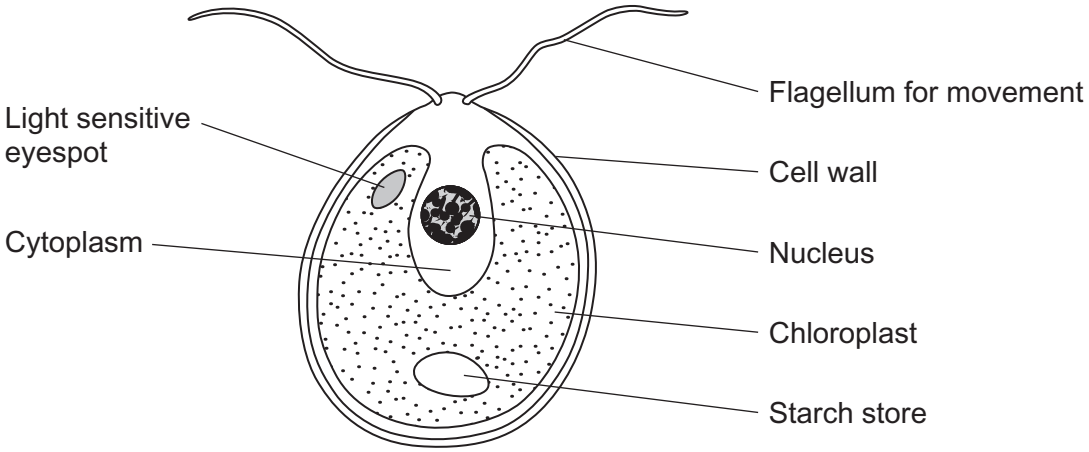
Time allowed
- 1 hour 45 minutes

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. Do not write outside the box around each page or on blank pages.
- 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 maximum mark for this paper is 85.
- The marks for questions are shown in brackets.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

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

1 The diagram shows an organism called *Chlamydomonas*.



1 (a) Name **two** structures shown in the diagram that are present in plant cells but are **not** present in animal cells.

1 .....

2 .....

(2 marks)

1 (b) *Chlamydomonas* lives in fresh water ponds. Use your knowledge of osmosis to suggest an advantage of using starch as a carbohydrate store.

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(2 marks)

1 (c) *Chlamydomonas* has adaptations that help it to maintain a high rate of photosynthesis. Use information in the diagram to explain what these adaptations are.

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(3 marks)

(Extra space) .....

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7

2 (a) Explain what is meant by genetic diversity.

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(1 mark)

2 (b) Apart from genetic factors what other type of factor causes variation within a species?

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(1 mark)

2 (c) The spotted owl is a bird. Numbers of spotted owls have decreased over the past 50 years. Explain how this decrease may affect genetic diversity.

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(2 marks)

4

3 The diagram shows a short sequence of DNA bases.

T T T G T A T A C T A G T C T A C T T C G T T A A T A

3 (a) (i) What is the maximum number of amino acids for which this sequence of DNA bases could code?

(1 mark)

3 (a) (ii) The number of amino acids coded for could be fewer than your answer to part **(a)(i)**. Give **one** reason why.

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(1 mark)

3 (b) Explain how a change in the DNA base sequence for a protein may result in a change in the structure of the protein.

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(3 marks)

(Extra space) .....

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3 (c) A piece of DNA consisted of 74 base pairs. The two strands of the DNA, strands **A** and **B**, were analysed to find the **number** of bases of each type that were present. Some of the results are shown in the table.

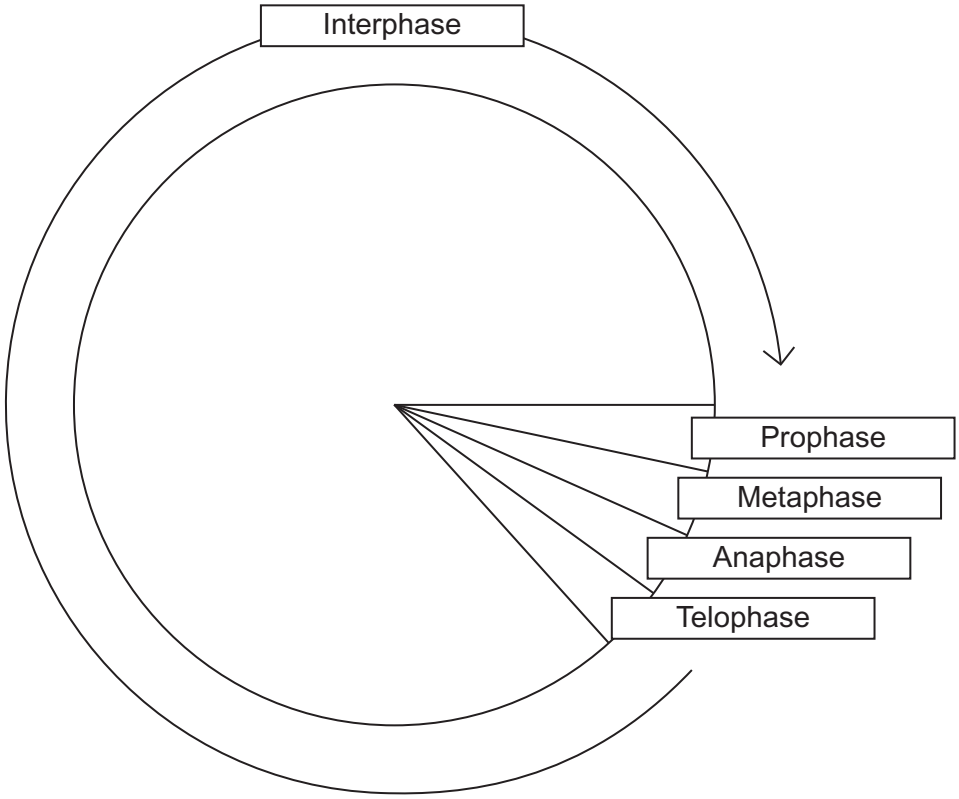
	Number of bases			
	C	G	A	T
Strand **A**	26			
Strand **B**	19		9	

Complete the table by writing in the missing values. *(2 marks)*

7

Turn over ▶

4 The diagram shows a cell cycle.



4 (a) In prophase of mitosis, the chromosomes become visible. Describe what happens in

4 (a) (i) metaphase

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(2 marks)

4 (a) (ii) anaphase.

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(2 marks)

4 (b) (i) Cells lining the human intestine complete the cell cycle in a short time. Explain the advantage of these cells completing the cell cycle in a short time.

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(1 mark)

4 (b) (ii) The time required for a cell to complete the cell cycle was 4 hours 18 minutes. Calculate the time required in minutes for this cell to multiply to produce eight cells. Show your working.

Answer .....

(2 marks)

4 (c) Mikanolide is a drug that inhibits the enzyme DNA polymerase. Explain why this drug may be effective against some types of cancer.

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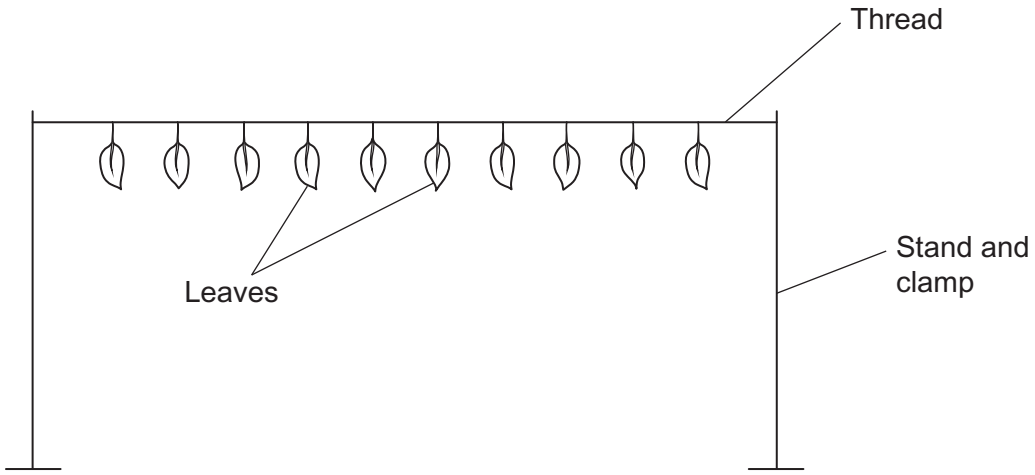
(2 marks)

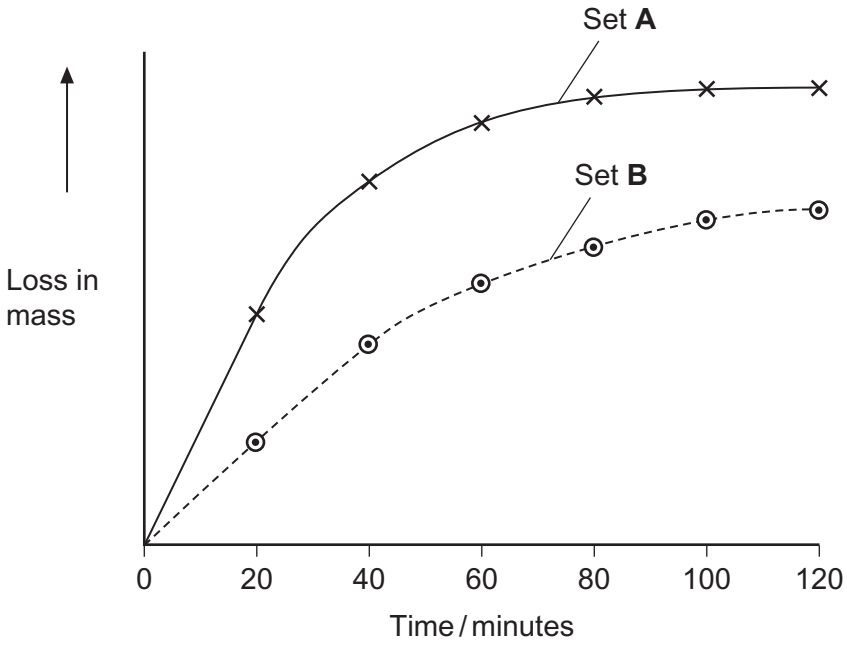
9

5 A student investigated the rate of transpiration from privet leaves.

- She obtained two sets of ten privet leaves.
- She left the ten leaves in set **A** untreated. She covered the upper surfaces of the ten leaves in set **B** with grease.
- She weighed each set of leaves and then tied all the leaves in each set to a separate length of thread. This is shown in the diagram.



- She then weighed each set of leaves every 20 minutes over a period of 2 hours and plotted a graph of her results.



5 (a) Give **two** environmental conditions that the student should have kept constant during this investigation.

1 .....

2 .....

(2 marks)

5 (b) The student measured the water loss in milligrams. Explain the advantage of using ten leaves when taking measurements in milligrams.

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(1 mark)

5 (c) Explain the change in mass of untreated leaves in set **A** shown in the graph.

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(3 marks)

(Extra space) .....

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5 (d) The results that the student obtained for the leaves in set **B** were different from those for set **A**. Suggest an explanation for this difference.

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(2 marks)

8

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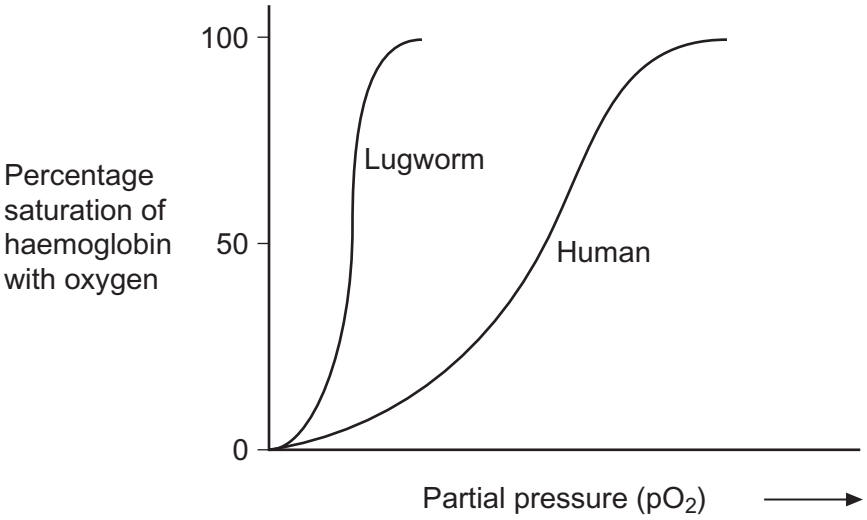
6 Lugworms live in mud where the partial pressure of oxygen is low. The graph shows oxygen dissociation curves for a lugworm and for a human.



6 (a) Explain the advantage to the lugworm of having haemoglobin with a dissociation curve in the position shown.

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(2 marks)

6 (b) In humans, substances move out of the capillaries to form tissue fluid. Describe how this tissue fluid is returned to the circulatory system.

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(3 marks)

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5

Turn over ▶

7 Cranes are large birds. One of the earliest methods of classifying cranes was based on the calls they make during the breeding season.

7 (a) Explain why biologists could use calls to investigate relationships between different species of crane.

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(2 marks)

7 (b) More recently, biologists have used DNA hybridisation to confirm the relationships between different species of crane. They made samples of hybrid DNA from the same and from different species. They measured the percentage of hybridisation of each sample. The results are shown in the table.

Species of crane from which hybrid DNA was made			**Percentage DNA hybridisation**
Grus americana	and	*Grus monachus*	97.4
Grus monachus	and	*Grus rubicunda*	95.7
Grus americana	and	*Grus rubicunda*	95.5
Grus rubicunda	and	*Grus rubicunda*	99.9
Grus americana	and	*Grus americana*	99.9
Grus monachus	and	*Grus monachus*	99.8

7 (b) (i) Which **two** species seem to be the most closely related? Explain your answer.

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(2 marks)

7 (b) (ii) The biologists measured the temperatures at which the samples of hybrid DNA separated into single strands. Explain why these temperatures could be used to find the percentage of DNA hybridisation.

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(2 marks)

7 (c) Biologists can also use protein structure to investigate the relationship between different species of crane. Explain why.

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(2 marks)

8

Turn over for the next question

8 Costa Rica is a Central American country. It has a high level of species diversity.

8 (a) There are over 12 000 species of plants in Costa Rica. Explain how this has resulted in a high species diversity of animals.

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(2 marks)

8 (b) The number of species present is one way to measure biodiversity. Explain why an index of diversity may be a more useful measure of biodiversity.

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(2 marks)

8 (c) Crops grown in Costa Rica are sprayed with pesticides. Pesticides are substances that kill pests. Scientists think that pollution of water by pesticides has reduced the number of species of frog.

8 (c) (i) Frogs lay their eggs in pools of water. These eggs are small. Use this information to explain why frogs' eggs are very likely to be affected by pesticides in the water.

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(2 marks)

8 (c) (ii) An increase in temperature leads to evaporation of water. Suggest how evaporation may increase the effect of pesticides on frogs' eggs.

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(1 mark)

7

Turn over for the next question

9 Erythropoietin (EPO) is a substance produced in the body. It increases the production of red blood cells. Synthetic EPO is made artificially. It is used to treat patients who have a form of anaemia in which there is a reduced number of red blood cells. Scientists investigated the effect of synthetic EPO on volunteers with this form of anaemia.

- The scientists injected synthetic EPO in a salt solution into patients in the experimental groups. They also set up control groups.
- They gave the different experimental groups different doses of synthetic EPO and different lengths of treatment.
- At the beginning and end of the treatment, the scientists measured each patient's haemoglobin concentration. From these measurements, they calculated the mean increase in haemoglobin concentration.

Some of the results are shown in the table.

Number of volunteers	Length of treatment / weeks	Dose of synthetic EPO / units per kilogram per week	Mean increase in haemoglobin concentration / arbitrary units
58	8	85	19.0
18	8	170	26.0
40	12	150	12.5
82	12	450	34.2
46	24	120	23.0
53	24	240	31.0

9 (a) Explain why treatment with synthetic EPO affects the haemoglobin concentration in these volunteers.

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(2 marks)

9 (b) Suggest how the control groups should have been treated in this investigation.

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(2 marks)

9 (c) The scientists measured the dose of synthetic EPO per kilogram per week. Explain why they measured the dose per unit mass and per unit time.

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(2 marks)

9 (d) Explain how the information that the scientists collected might be useful in treating patients with anaemia.

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(2 marks)

Question 9 continues on the next page

9 (e) Some athletes have used synthetic EPO as a performance enhancer. Explain how synthetic EPO may improve performance in long-distance events.

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(4 marks)

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9 (f) Athletes may be tested to see if the concentration of EPO in their blood is above normal. Suggest how scientists determine the normal concentration of EPO in blood.

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(2 marks)

9 (g) Synthetic EPO can increase blood pressure. Suggest why.

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(1 mark)

15

10 (a) *Clostridium difficile* is a bacterium that is present in the gut of up to 3% of healthy adults and 66% of healthy infants.

10 (a) (i) *C. difficile* rarely causes problems, either in healthy adults or in infants. This is because its numbers are kept low by competition with harmless bacteria that normally live in the intestine.

Use this information to explain why some patients treated with antibiotics can be affected by *C. difficile*.

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(2 marks)

10 (a) (ii) Suggest why older people are more likely to be affected by *C. difficile*.

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(1 mark)

10 (b) The antibiotic methicillin inhibits the enzyme transpeptidase. This enzyme is used by some bacteria to join monomers together during cell wall formation. Methicillin has a similar structure to these monomers. Use this information to explain how methicillin inhibits the enzyme transpeptidase.

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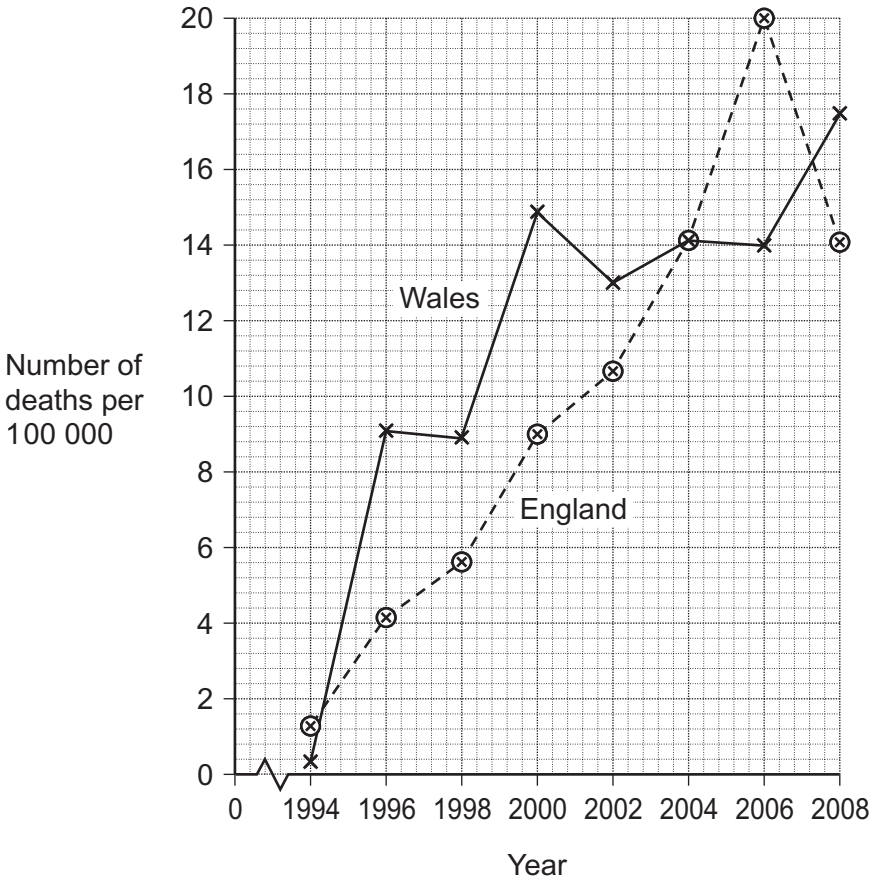
(2 marks)

10 (c) MRSA is a variety of *Staphylococcus aureus*. It is difficult to treat infections caused by this bacterium because it is resistant to methicillin and to some other antibiotics. As a result, some patients who are already very ill may die if they become infected with MRSA. The graph shows the number of deaths in England and Wales between 1994 and 2008 caused by MRSA.



10 (c) (i) It may be difficult to identify MRSA as the actual cause of death. Explain why.

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(1 mark)

10 (c) (ii) Describe the change in the number of deaths caused by MRSA in England in the period shown in the graph.

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(1 mark)

10 (c) (iii) Calculate the percentage increase in the number of deaths caused by MRSA in Wales from 1996 to 2006. Show your working.

Answer ..... *(2 marks)*

10 (d) Describe how gene transmission and selection have increased the difficulty of treating bacterial infections with antibiotics.

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(6 marks)

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END OF QUESTIONS

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