Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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7	
8	
9	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2013

Biology BIOL1

Unit 1 Biology and disease

Wednesday 9 January 2013 9.00 am to 10.15 am

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

Time allowed
- 1 hour 15 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 60.
- You are expected to use a calculator, where appropriate.
- 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.

There are no questions printed on this page

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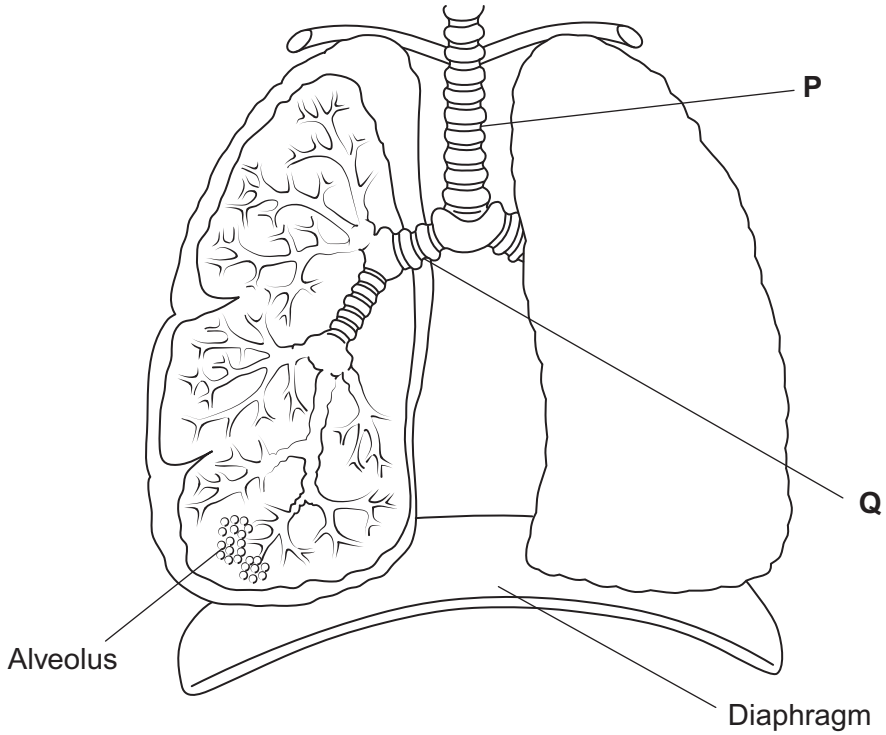
ANSWER IN THE SPACES PROVIDED

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

1 (a) The diagram shows the structure of the human gas exchange system.



Name organs

P .....

Q .....

(1 mark)

1 (b) Explain how downward movement of the diaphragm leads to air entering the lungs.

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(2 marks)

1 (c) Complete the equation.

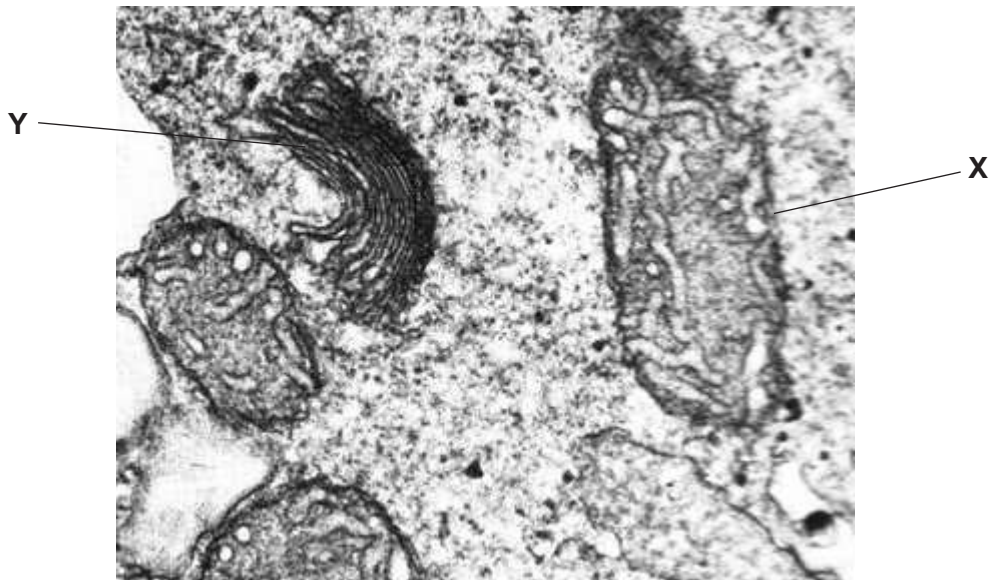
Pulmonary ventilation = ... × .....

(1 mark)

4

Turn over ▶

2 The photograph shows part of the cytoplasm of a cell.



2 (a) (i) Organelle **X** is a mitochondrion.

What is the function of this organelle?

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(1 mark)

2 (a) (ii) Name organelle **Y**.

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(1 mark)

2 (b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical (light) microscope. Explain why.

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(2 marks)

4

3 (a) Name the monosaccharides of which the following disaccharides are composed.

3 (a) (i) Sucrose

monosaccharides ..... and .....

(1 mark)

3 (a) (ii) Lactose

monosaccharides ..... and .....

(1 mark)

3 (b) Amylase and maltase are involved in the digestion of starch in the small intestine.

Complete the table by identifying where these enzymes are produced and the product of the reaction they catalyse.

Name of enzyme	Where the enzyme is produced	Product of the reaction catalysed by the enzyme
Amylase		
Maltase		

(2 marks)

4

Turn over for the next question

4 (a) Cholera bacteria produce toxins which increase secretion of chloride ions into the lumen of the intestine.

Explain why this results in severe diarrhoea (watery faeces).

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(3 marks)

(Extra space) .....

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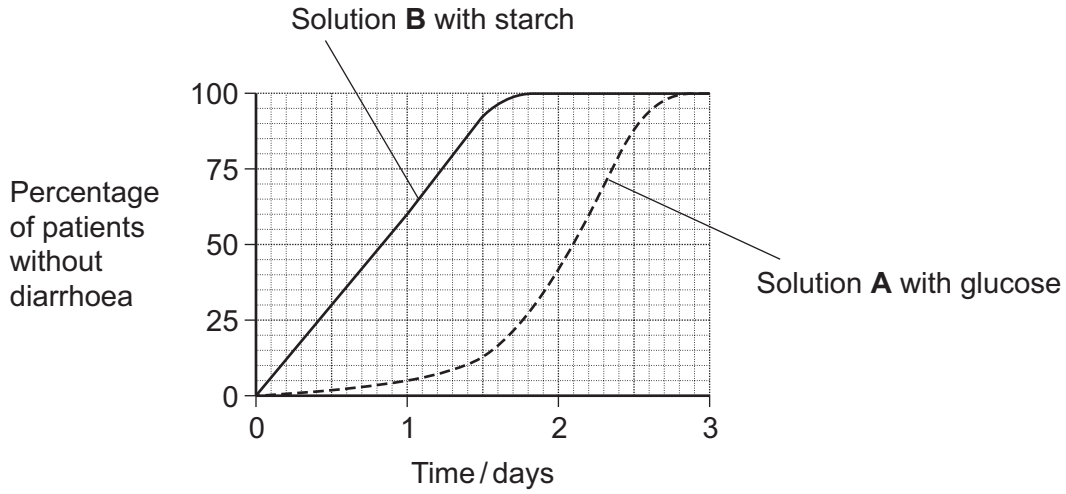
4 (b) Scientists investigated how effective two oral rehydration solutions, **A** and **B**, were in treating patients with diarrhoea caused by cholera.

- Solution **A** contained glucose.
- Solution **B** was identical to **A**, except that glucose was replaced by starch.

The graph shows their results.



4 (b) (i) The water potential of solution **B** was higher (less negative) than the water potential of solution **A**.

Explain why.

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(1 mark)

4 (b) (ii) 100 patients were treated with solution **A** and 100 patients were treated with solution **B**.

Calculate the difference in the number of patients without diarrhoea after 1 day's treatment with solution **A** and those without diarrhoea after 1 day's treatment with solution **B**.

Show your working.

Difference in number of patients .....

(2 marks)

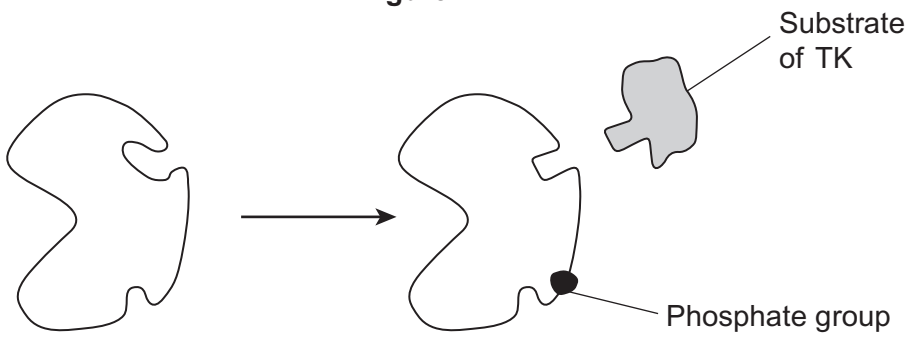
6

Turn over for the next question

5 The enzyme tyrosine kinase (TK) is found in human cells. TK can exist in a non-functional and a functional form. The functional form of TK is only produced when a phosphate group is added to TK.

This is shown in **Figure 1**.

Figure 1



Non-functional form of TK Functional form of TK

5 (a) Addition of a phosphate group to the non-functional form of TK leads to production of the functional form of TK.

Explain how.

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(2 marks)

5 (b) The binding of the functional form of TK to its substrate leads to cell division. Chronic myeloid leukaemia is a cancer caused by a faulty form of TK. Cancer involves uncontrolled cell division.

Figure 2 shows the faulty form of TK.

Figure 2

Faulty form of TK

Suggest how faulty TK leads to chronic myeloid leukaemia.

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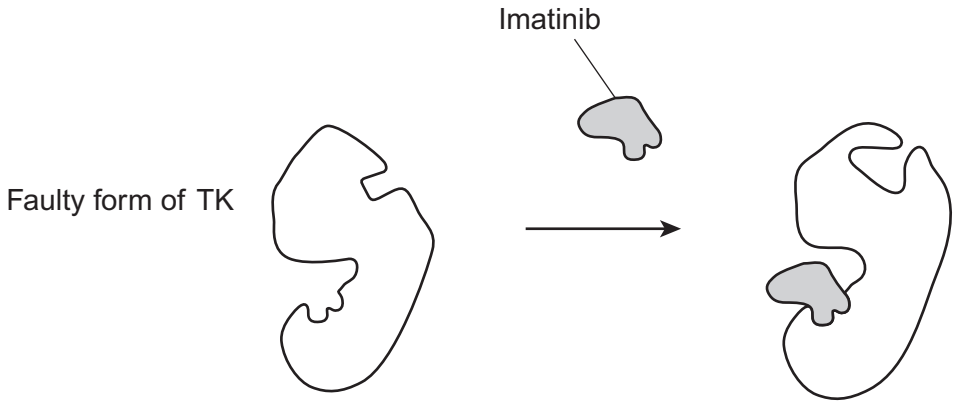
(2 marks)

5 (c) Imatinib is a drug used to treat chronic myeloid leukaemia.
Figure 3 shows how imatinib inhibits faulty TK.

Figure 3



Using all of the information, describe how imatinib stops the development of chronic myeloid leukaemia.

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(2 marks)

6

Turn over ▶

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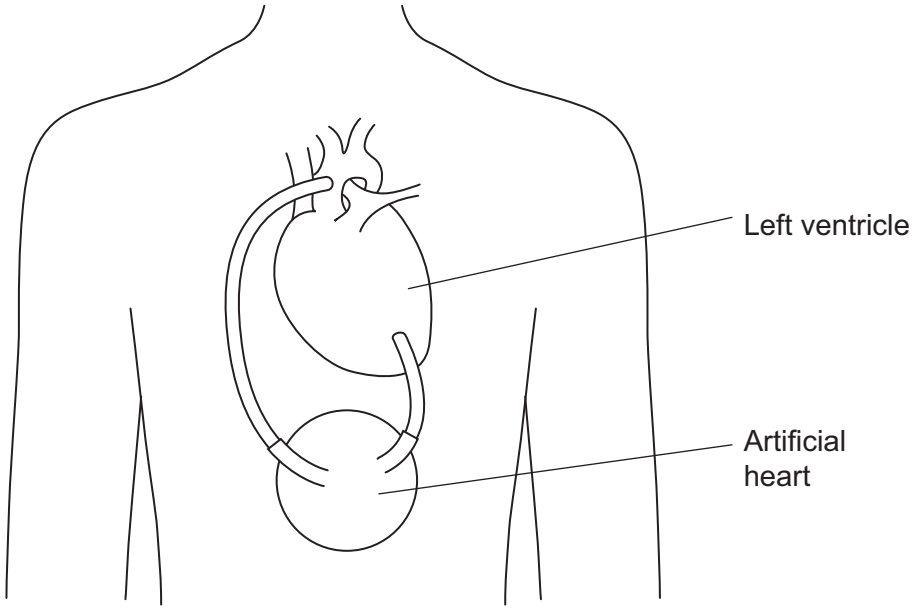
6 Some people have a form of *heart failure* where their heart is not pumping blood as well as it used to. Some people with heart failure are given an artificial heart to improve circulation of blood from the left ventricle.
Figure 4 shows where this type of artificial heart is connected.

Figure 4



6 (a) Name the blood vessel to which the artificial heart is connected.

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(1 mark)

6 (b) In these patients, the right ventricle still produces sufficient blood flow to keep the patient alive.

Suggest why the left ventricle requires the help of the artificial heart but the right ventricle does not.

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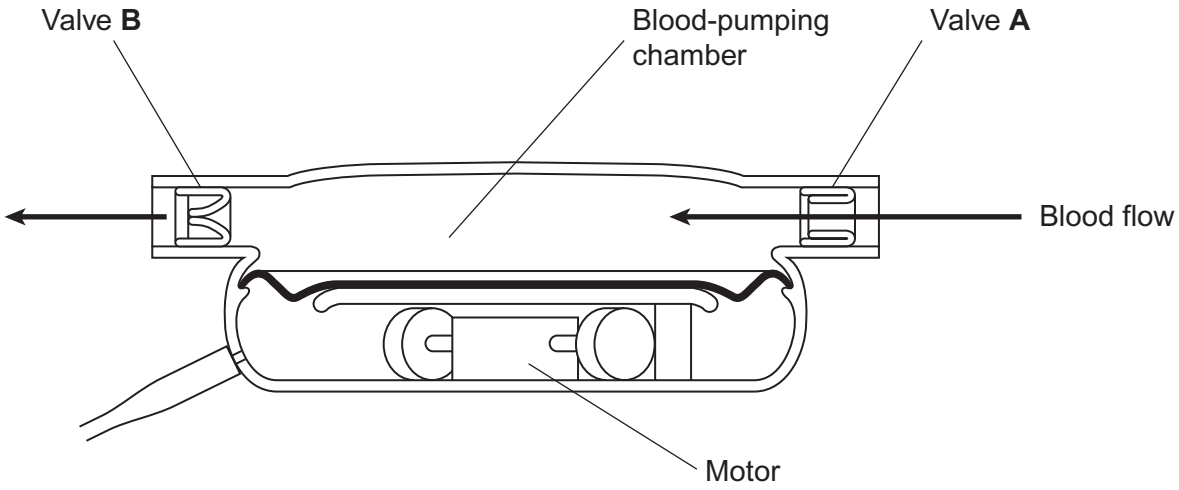
(2 marks)

Question 6 continues on the next page

6 (c) **Figure 5** shows the internal structure of this type of artificial heart.

Figure 5



Valves **A** and **B** have the same functions as heart valves involved in the cardiac cycle. Name the heart valve that has the same function as:

valve **A** .....

valve **B** .....

(2 marks)

6 (d) There are different designs of artificial heart. Doctors compared results for patients who received two different types of artificial heart, **X** and **Y**.

They recorded information 2 years after the artificial hearts were implanted. Their results are shown in **Figure 6**.

Figure 6

	Information recorded 2 years after artificial heart implanted		
Type of artificial heart	**Number of patients surviving without replacement of artificial heart**	**Number of patients surviving but who required repair or replacement of artificial heart**	**Number of patients who died**
X (119 patients)	62	13	44
Y (58 patients)	7	24	27

Which type of artificial heart was the more successful? Use calculations to support your answer.

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(3 marks)

(Extra space) .....

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8

Turn over ▶

7 Some people have a condition called *white-coat hypertension*. People with this condition develop a higher than normal heart rate and blood pressure when they are in a doctor's surgery. High heart rate is correlated with high blood pressure.

Doctors investigated differences in heart rate between men with *white-coat hypertension* and those without the condition. They measured the men's mean heart rates:

- in the doctor's surgery, by recording the pulse in the wrist for 1 minute, when the men were lying down
- at home, using a portable heart rate monitor when the men were walking around
- at home, using a portable heart rate monitor when the men were sleeping.

7 (a) The groups of men selected for this investigation were matched.
Other than being men, suggest **one** factor for which they should have been matched.

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(1 mark)

7 (b) Explain why the pulse recordings in the doctor's surgery were taken when the men were lying down.

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(1 mark)

7 (c) The pulse felt in the artery in the wrist can be recorded and used to measure heart rate.

Suggest why the pulse felt can be used to measure heart rate.

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(2 marks)

7 (d) The portable heart rate monitor recorded the men's heart rates continuously. This gave more reliable mean heart rates than those obtained by recording the pulse in the wrist for 1 minute.

Suggest why it is more reliable.

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(2 marks)

7 (e) The table shows the doctors' results.

Where and how heart rate was measured	Mean heart rate / beats per minute	
	Men with white-coat hypertension	Men without white-coat hypertension
Doctor's surgery, recording pulse when lying down	67	63
At home, walking around, using heart monitor	76	73
At home, sleeping, using heart monitor	63	60

A journalist, who saw these results, stated that they showed there is no such thing as *white-coat hypertension*.

Do these data support this statement? Give reasons for your answer.

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(2 marks)

8

8 The human immunodeficiency virus (HIV) leads to the development of acquired immunodeficiency syndrome (AIDS). Eventually, people with AIDS die because they are unable to produce an immune response to pathogens.

Scientists are trying to develop an effective vaccine to protect people against HIV. There are three main problems. HIV rapidly enters host cells. HIV causes the death of T cells that activate B cells. HIV shows a lot of antigenic variability.

Scientists have experimented with different types of vaccine for HIV. One type contains HIV in an inactivated form. A second type contains attenuated HIV which replicates in the body but does not kill host cells. A third type uses a different, non-pathogenic virus to carry genetic information from HIV into the person's cells. This makes the person's cells produce HIV proteins. So far, these types of vaccine have not been considered safe to use in a mass vaccination programme.

Use the information in the passage and your own knowledge to answer the following questions.

8 (a) People with AIDS die because they are unable to produce an immune response to pathogens (lines 2–4).

Explain why this leads to death.

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(3 marks)

(Extra space) .....

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8 (b) Explain why each of the following means that a vaccine might **not** be effective against HIV.

8 (b) (i) HIV rapidly enters host cells (lines 6 –7).

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(2 marks)

8 (b) (ii) HIV shows a lot of antigenic variability (lines 7– 8).

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(2 marks)

8 (c) So far, these types of vaccine have not been considered safe to use in a mass vaccination programme (lines 14 – 15).

Suggest why they have **not** been considered safe.

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(3 marks)

(Extra space) .....

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10

9 (a) Some substances can cross the cell-surface membrane of a cell by simple diffusion through the phospholipid bilayer.
Describe other ways by which substances cross this membrane.

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(5 marks)

(Extra space) .....

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9 (b) Atheroma formation increases a person's risk of dying.

Explain how.

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

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