Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8793885303

BIOLOGY **9700/22**

Paper 2 Structured Questions AS **October/November 2014**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

DC (LK/SW) 79830/4

Answer **all** the questions

1 Fig. 1.1 is a light micrograph of a section through part of the gas exchange system.

A, **B** and **C** are three different types of tissue.

Fig. 1.1

(a) The cell types in tissue **A** have different functions.

Describe how the cell types work together to maintain the health of the gas exchange system.

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(b) Suggest why the cells in tissue **B** have many mitochondria.

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(c) Name the parts of the gas exchange system where tissue **C** is distributed.

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[Total: 5]

2 Fig. 2.1 shows one section of the nitrogen (N) cycle. Some details of the water cycle are also included.

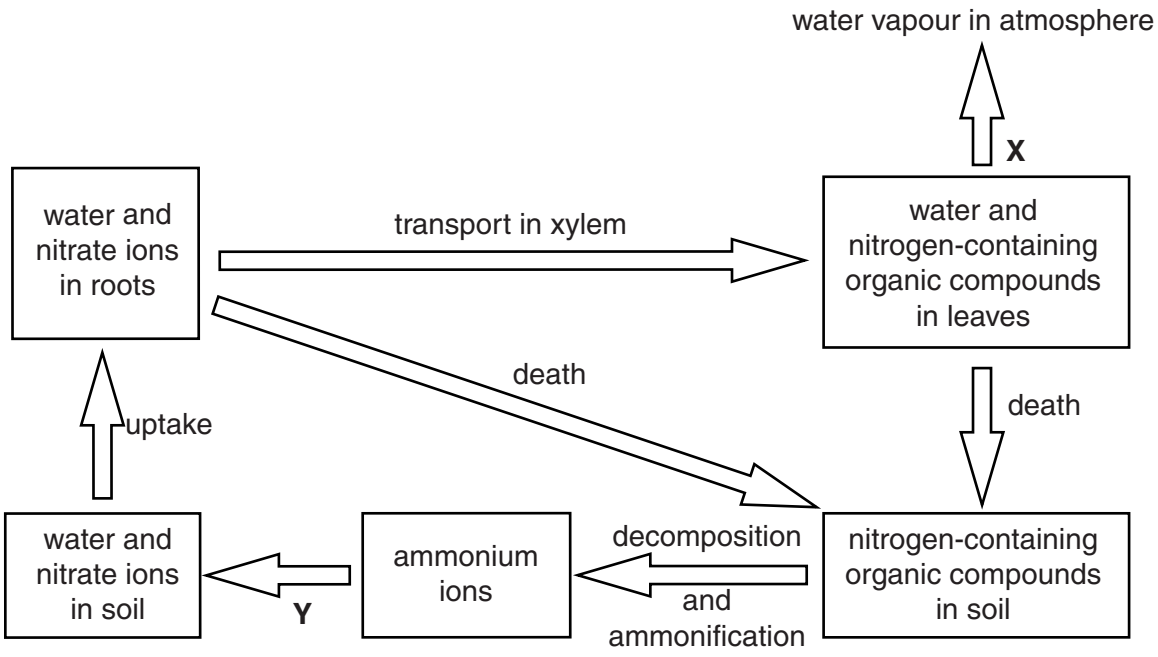

Fig. 2.1

(a) Name processes **X** and **Y**.

X .....

Y .....[2]

(b) Name **one** organism involved in process **Y**.

.....[1]

(c) Explain why process **X** occurs, even if it is a disadvantage to a plant.

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(d) State two examples of how the leaves of xerophytic plants are adapted to reduce the loss of water vapour to the atmosphere.

1. .....

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2. .....

.....[2]

(e) Nitrate ions are taken up by root hair cells.

Outline the role of the cell surface membrane of root hair cells in the uptake of nitrate ions.

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(f) Describe **and** explain how water and nitrate ions are transported in the xylem from roots to leaves.

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(g) One use of the nitrogen in the nitrate ions is for the synthesis of organic molecules such as RNA.

State where nitrogen is found within an RNA molecule.

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.....[1]

[Total: 13]

3 In mammals, oxygen is transported by red blood cells in a system that is described as a closed double circulation. The majority of oxygen molecules are transported as oxyhaemoglobin. At the respiring tissues, oxygen dissociates from haemoglobin and diffuses to the surrounding cells.

(a) Explain what is meant by a *closed double circulation*.

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(b) Fig. 3.1 is a diagram that highlights the tertiary and quaternary structure of a haemoglobin molecule.

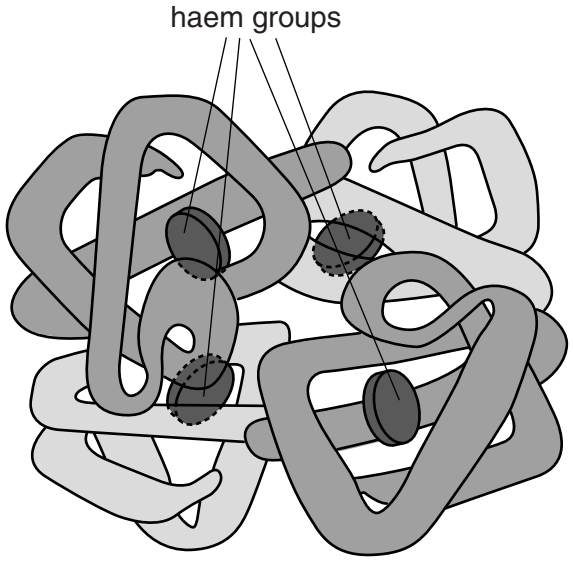

Fig. 3.1

Explain how the tertiary and quaternary levels of protein structure of the haemoglobin molecule contribute to its role in the transport of oxygen.

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(c) At high altitudes, the partial pressure of inspired oxygen is considerably lower than at sea level. This means that the partial pressure of oxygen in the blood is also much lower at high altitudes than at sea level.

Fig. 3.2 is an oxygen dissociation curve of adult oxyhaemoglobin.

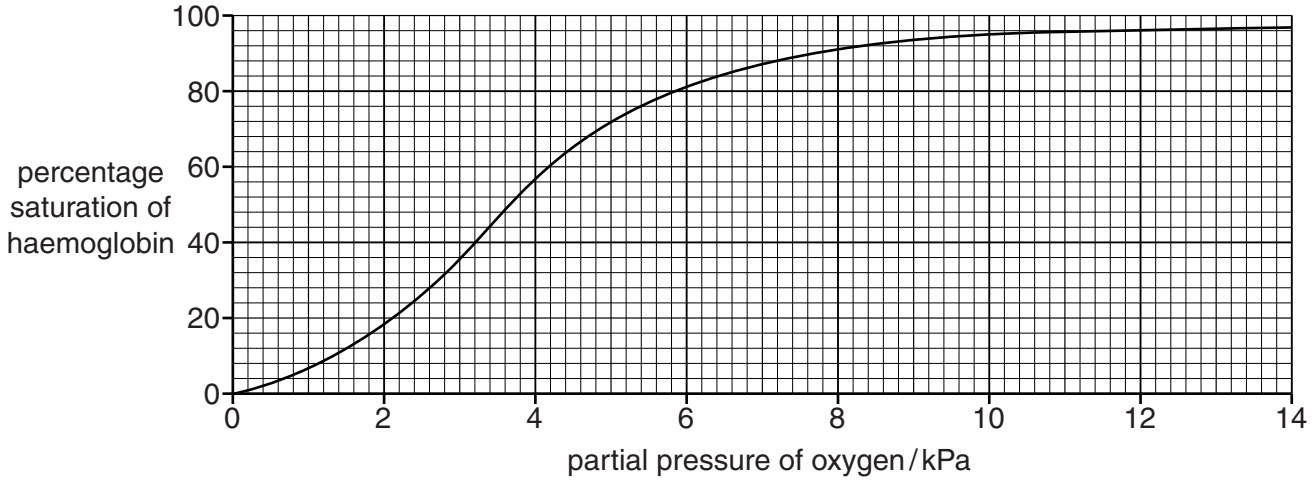

Fig. 3.2

With reference to Fig. 3.2, calculate the difference in percentage saturation of haemoglobin at sea level, where the partial pressure of oxygen is 13.0 kPa, and at a higher altitude, where the partial pressure of oxygen is 6.2 kPa.

Show your working.

answer ..... % [2]

(d) After spending time at altitude, a person can become acclimatised. One feature of acclimatisation is an increase in the red blood cell count.

Explain the importance of the increase in the red blood cell count.

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..... [2]

(e) Before acclimatisation can occur, some people develop a condition known as acute mountain sickness when they travel to high altitude areas.
Acetazolamide is a non-competitive enzyme inhibitor that is used as a drug to prevent and treat acute mountain sickness.

Explain the effects of a non-competitive inhibitor on the rate of enzyme activity.

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(f) Tobacco smoking can have an effect on the transport of oxygen by haemoglobin.
Fig. 3.3 shows oxygen dissociation curves with and without the presence of carbon monoxide (CO).

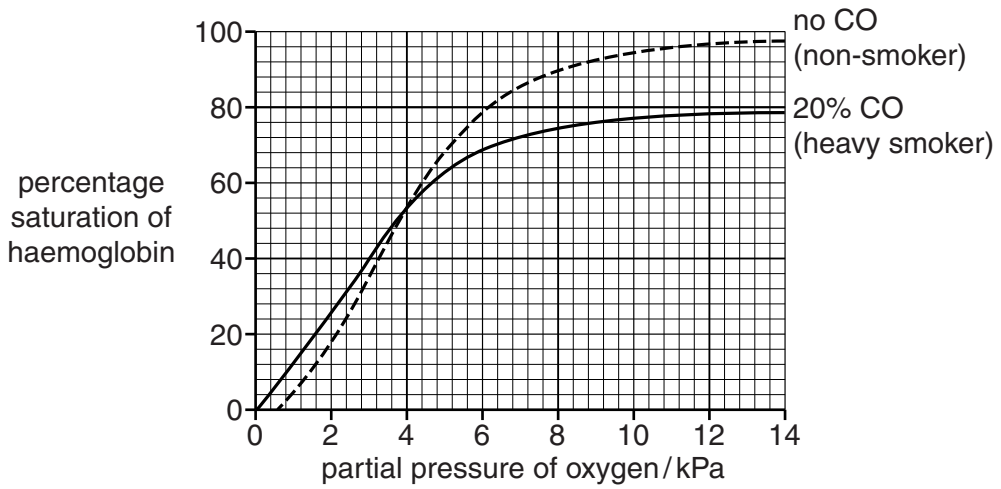

Fig. 3.3

With reference to Fig. 3.3, describe the effect of carbon monoxide on the cardiovascular system.

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[Total: 16]

4 Cholera is an infectious disease that can affect children and adults. Symptoms of the disease can occur very quickly, from a few hours to a few days.

Table 4.1 shows:

- the economic status of each of five countries
- the number of cases of cholera reported to the World Health Organization (WHO) over a five year period for each country
- the population in 2006 and in 2010 of each country.

Table 4.1

country	economic status	number of cholera cases reported			population / millions	
		2006	2008	2010	2006	2010
Zimbabwe	low	789	60055	951	12.5297	12.5715
Uganda	low	5194	3726	2341	29.3703	33.4247
Angola	middle	67257	10511	1484	17.0104	19.0819
Cameroon	middle	922	0	10759	17.9484	19.5989
Canada	high	2	1	2	32.6490	34.1088

(a) (i) Table 4.1 shows that there are differences in the number of cholera cases reported between the high economic status country and the low economic status countries.

Suggest three reasons to explain these differences.

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2. .....

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3. .....

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(ii) With reference to Table 4.1, suggest reasons for the differences in the number of cases of cholera reported over the five year period for Angola and Cameroon.

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(b) Vaccination helps to prevent the spread of infectious diseases by stimulating an immune response in individuals against specific pathogens, such as Morbillivirus, the virus that causes measles.

(i) Suggest two reasons why measles vaccination programmes may fail to prevent epidemics.

1. .....

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2. .....

..... [2]

(ii) Outline the response produced by **B-lymphocytes** on exposure to Morbillivirus in an individual **who already has immunity** to measles.

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[Total: 12]

5 **(a)** Complete Table 5.1 by numbering each event to show the sequence occurring in the initiation and control of one heart beat.

Use **1** as the first event in the sequence.

Table 5.1

event	sequence
impulses pass down septum through conducting fibres known as the bundle of His	
atrioventricular node sends out impulses	
impulses travel across atrial walls	
impulses reach base of ventricles (apex of heart)	
impulses pass up through Purkyne fibres in ventricle walls	
sinoatrial node sends out impulses	

[3]

(b) Explain the circumstances that cause the closing of the semi-lunar valves during the cardiac cycle.

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.....[2]

(c) At the arterial end of a capillary bed in muscle tissue, the hydrostatic pressure is high enough to cause the formation of tissue fluid.

Explain the differences between the composition of blood and the composition of tissue fluid at the arterial end of a capillary bed.

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[Total: 7]

[Turn over

6 *Agrobacterium tumefaciens* is a bacterium that can enter plants through wounds and cause a disease known as crown gall disease.

The bacterium attaches to the surface of cells and inserts a small circular DNA molecule, known as a plasmid, into the cell. Some of the genes on the plasmid code for proteins that cause changes in the plant cell and result in the formation of a plant tumour, or gall.

(a) Outline the changes that occur during tumour formation.

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(b) Bacteria that enter the stem through a wound can reach the root of the plant to cause damage.

Suggest how the bacteria are able to reach the root of the plant.

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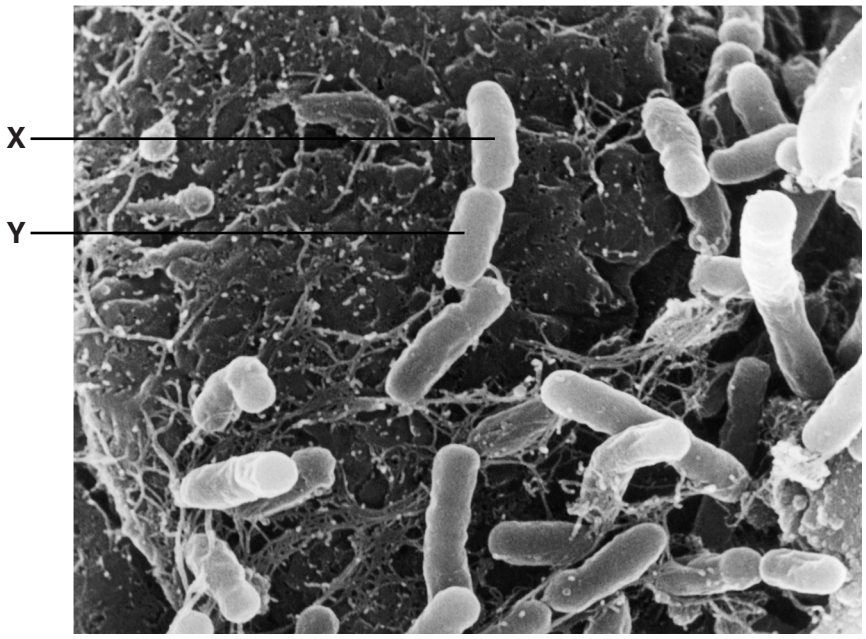
(c) Fig. 6.1 shows *A. tumefaciens* on the surface of cells of a tobacco plant, *Nicotiana plumbaginifolia*.

The cells **X** and **Y** are newly formed cells.



magnification ×11500

Fig. 6.1

Calculate the actual length of cell **X** in micrometres.

Show your working.

answer ..... μm [2]

[Total: 7]

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