Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Centre Number

Candidate Number

Biology

Assessment Unit AS 2
assessing
Organisms and Biodiversity

AB121

[AB121]
WEDNESDAY 17 JUNE, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
There is an extra lined page at the end of the paper if required.
Answer **all eight** questions.
You are provided with **Photographs 2.6A** and **2.6B** for use with **Question 6** in this paper. Do not write your answers on these photographs.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
Section A carries 60 marks. Section B carries 15 marks.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers.
Use accurate scientific terminology in all answers.
You should spend approximately **20 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in Section B, and awarded a maximum of 2 marks.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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Section A

Examiner Only	
Marks	Remark

1 Identify the word or phrase described by each of the following statements, which relate to the mammalian heart.

- The ability of cardiac muscle to contract without stimulation from an external source

_____

- The specialised muscle fibres which convey an impulse down the septum from the atrio-ventricular node

_____

- The structures which prevent the atrio-ventricular valves from turning inside out during ventricular systole

_____

- The valves which close when arterial pressure exceeds ventricular pressure

_____

- The arteries which carry oxygenated blood to the heart muscle itself

_____

[5]

Examiner Only	
Marks	Remark

2 Red blood cells contain a pigment called haemoglobin which is responsible for the transport of oxygen in the blood.

(a) Describe concisely the structure of a molecule of haemoglobin.

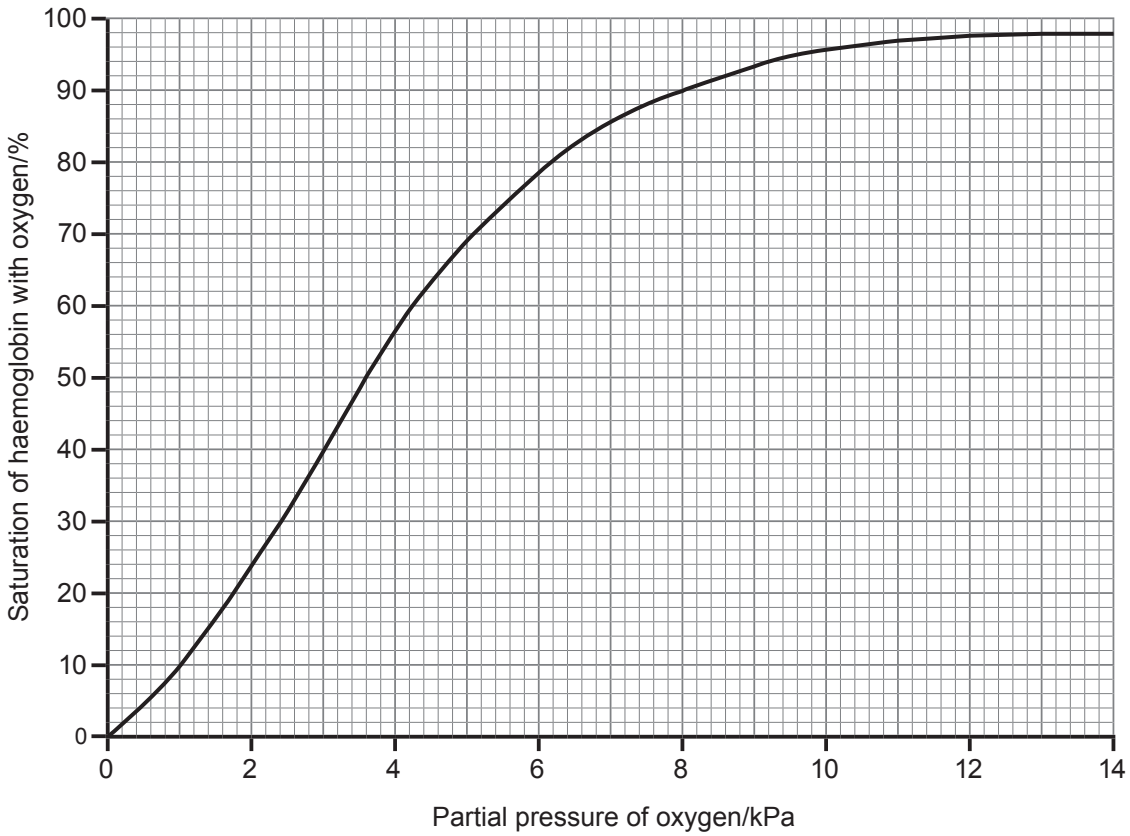
_____

_____

_____

_____ [2]

The oxygen dissociation curve for human haemoglobin is shown in the graph below.



Examiner Only	
Marks	Remark

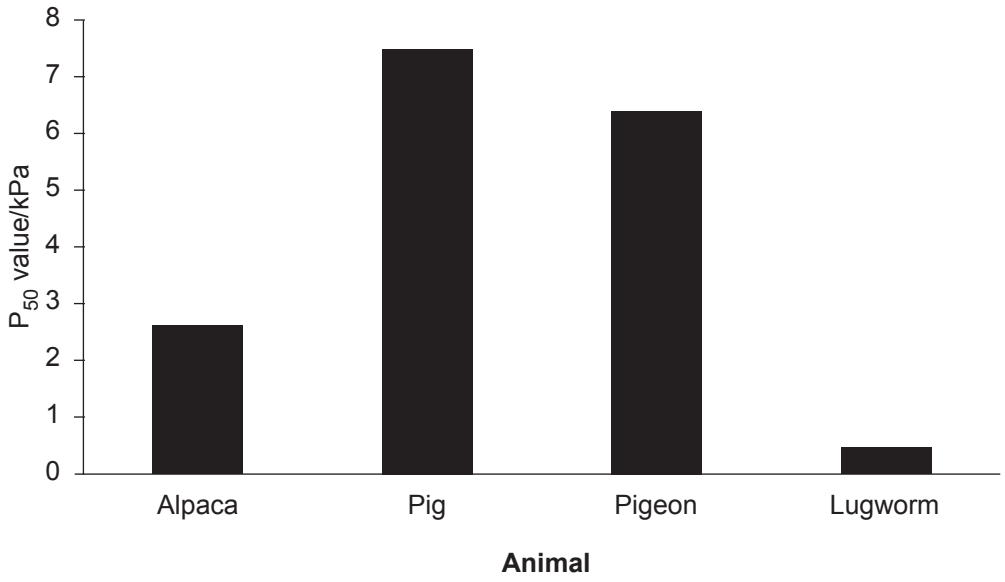
(b) **(i)** On the **horizontal axis** of the graph, indicate with an **X** the approximate partial pressure of oxygen in the alveoli. [1]

(ii) Determine the partial pressure of oxygen which results in 50% saturation of haemoglobin with oxygen.

_____ kPa [1]

The partial pressure of oxygen which results in 50% saturation of haemoglobin in an animal is termed the P_{50} value.

The graph below shows P_{50} values for haemoglobin in a number of different animals.



(c) **(i)** From the graph, identify which animal's haemoglobin has the lowest affinity for oxygen.

_____ [1]

(ii) Suggest how the low P_{50} value of haemoglobin in the lugworm enables it to live in muddy habitats.

_____

_____

_____ [1]

(d) Describe **two** factors which promote the dissociation of oxygen from haemoglobin in heavily respiring muscle tissue.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 The Common Scoter duck *(Melanitta nigra)* was first found breeding in Lower Lough Erne in 1905. Its numbers increased until the late 1970s but it is now extinct in the lough. The Common Scoter nests close to the lough shore, usually under dense cover. The female incubates the eggs alone for between 27 and 31 days. The ducks feed on small invertebrates.

In the 1960s, roach *(Rutilus rutilus)* was introduced to the lough. The population of this fish increased rapidly so that it currently represents more than 60% of all fish biomass in the lough. Roach also feed on small invertebrates.

Farming of mink *(Neovison vison)* began in the area in the late 1950s. Escaped mink are known to have established wild populations around the lough. Mink are carnivorous mammals which feed on ground-nesting birds and their eggs.

Pollution of the lough increased in the 1970s, causing a reduction in the invertebrate biomass.

Using the information provided and your knowledge, answer the following questions.

(a) State the genus of the Common Scoter.

_____ [1]

(b) **(i)** The death rate was particularly high in **female** Scoter ducks. Explain why.

_____

_____

_____

_____ [2]

(ii) Explain **two** reasons why the Scoter duck population has declined and become extinct.

1. _____

_____

_____

2. _____

_____

_____ [2]

(c) Much of the land around Lower Lough Erne has been subjected to drainage, ploughing and reseeding. Explain how these practices lead to reduced biodiversity on land.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The metabolic activity of an organism can be indicated by the cell respiration rate. One way of investigating the cell respiration rate is to measure the oxygen consumed by an organism over a period of time.

The table below shows the cell respiration rates of mammals of different body masses. The cell respiration rate is given as mm^3 of oxygen consumed per gram of body mass per hour.

Mammal	Typical body mass/kg	Cell respiration rate/ $mm^3\ O_2\ g^{-1}\ hr^{-1}$
Mouse	0.03	1518
Rabbit	2.2	466
Dog	12	318
Human	70	202
Horse	700	106
Elephant	3800	67

(a) Using the information in the table, describe the relationship between body mass and cell respiration rate.

_____

_____

_____ [1]

(b) Calculate the oxygen consumed in 1 hour by the mouse. (Show your working.)

Answer _____ mm^3 [2]

The metabolic activity of an organism is influenced both by its surface area and its volume.

Examiner Only	
Marks	Remark

(c) **(i)** State how the surface area to volume ratio would differ between the dog and the mouse.

_____

_____

_____ [1]

(ii) Suggest the relationship between the surface area to volume ratio and cell metabolic activity.

_____

_____

_____ [1]

(d) In mammals, the uptake of oxygen from the atmosphere and its subsequent delivery to the respiring tissues is facilitated by structures with a large surface area.

Identify **three** ways in which a large surface area is achieved in mammals to enable a high uptake and delivery of oxygen.

1. _____

_____

2. _____

_____

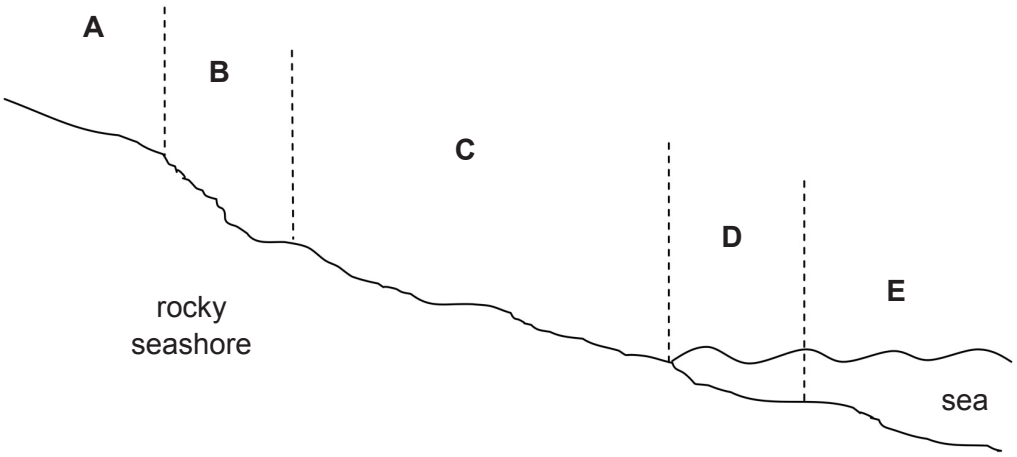
3. _____

_____ [3]

Examiner Only	
Marks	Remark

5 Sheltered rocky seashores have distinct zones which result from the extent to which water covers the area during high and low tides.

Zones on a rocky seashore are indicated in the diagram below.



Details of each of the zones **A** to **E** are given in the table below.

Zone	Tidal coverage details	Dominant seaweed species
A	never covered in water but sprayed or splashed with saltwater	no seaweed present
B	only covered in water during the highest tides	channelled wrack, spiral wrack
C	covered in water during most high tides and exposed to air during most low tides	bladder wrack, egg wrack
D	only exposed to air during the lowest tides	saw wrack, thongweed
E	never exposed to air	sugar kelp, oarweed

(a) (i) A student proposes the hypothesis that seaweeds can only obtain their required minerals when covered in seawater. Identify the evidence from the table which supports this hypothesis.

_____

_____

_____ [1]

(ii) Name **one** seaweed species from the table which would be expected to have highly developed adaptations to prevent desiccation (drying out).

_____ [1]

(b) Explain **one** biotic and **one** abiotic factor which may prevent sugar kelp and oarweed from growing further up the shore than zone **E**.

Biotic _____

_____

_____

Abiotic _____

_____

_____ [2]

(c) Describe a method which could be used to sample a rocky shore in order to determine how the distribution of seaweed species changes from zone **A** to zone **D**. Your answer should include one safety precaution.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [5]

Examiner Only	
Marks	Remark

6 (a) **Photograph 2.6A** shows a transverse section through an artery.

(i) Draw a block diagram of this artery in the box below. Label your diagram to show the tissues found in the wall of the artery.

[4]

Examiner Only	
Marks	Remark

(ii) State the function of **one** of the tissues you have labelled in the block diagram.

_____

_____ [1]

(b) **Photograph 2.6B** shows another artery. The structure labelled **X** is an atheroma.

Examiner Only	
Marks	Remark

(i) Suggest the effect of the atheroma on the rate of blood flow in this blood vessel.

_____

_____ [1]

(ii) Describe precisely the sequence of events resulting in the formation of an atheroma.

_____

_____

_____

_____

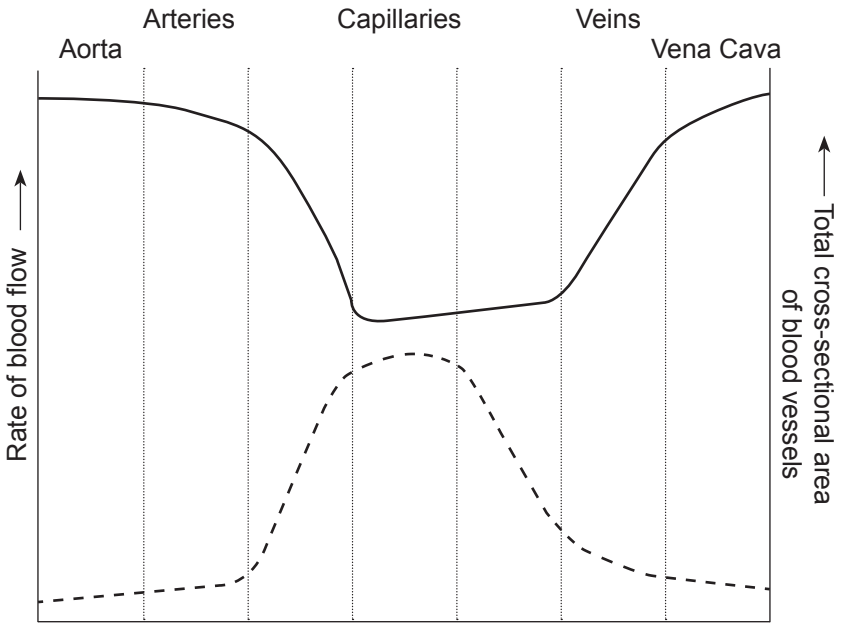
_____

_____

_____

_____ [3]

(c) The relationship between the total cross-sectional area of blood vessels and the rate of blood flow is represented in the chart below.



Examiner Only	
Marks	Remark

(i) Describe the relationship between rate of blood flow and the total cross-sectional area of blood vessels.

_____

_____ [1]

(ii) Explain **two** reasons why the rate of blood flow decreases from the aorta to the capillaries.

1. _____

_____

2. _____

_____ [2]

(iii) Explain the advantage of this decrease in flow rate with regard to capillary function.

_____

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

7 The stomatal density (number of stomata per unit area) found on leaves may be influenced by the plant's habitat.

An investigation was carried out to determine the stomatal density in four different plant species. The number of stomata on 4.5 mm^2 of leaf lower epidermis was counted.

The table below shows the results.

Species	Number of stomata	Stomatal density/ stomata mm^{-2}
A	26	5.78
B	40	8.89
C	37	
D	20	4.44

(a) (i) Calculate the stomatal density for species **C**.

_____ stomata mm^{-2} [1]

(ii) Identify which of the species investigated is most likely to grow in a dry environment. Explain your answer.

_____

_____

_____

_____ [2]

(b) (i) Define the term transpiration.

_____

_____

_____

_____ [2]

The leaves of plants growing in dry environments often have microscopic leaf hairs extending from their lower epidermis.

(ii) Explain the advantage of this.

_____

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Section B

Examiner Only	
Marks	Remark

Quality of written communication is awarded a maximum of 2 marks in this section.

8 Directional selection is one of the processes which accounts for the large diversity of organisms on our planet.

Taxonomy is the study of this diversity with the aim of analysing the similarities and differences between organisms, so that they can be classified. Currently, the five kingdom system is the most widely accepted model for classification of organisms.

(a) Describe the process of directional selection. [5]

(b) Describe the main features of organisms in each of the five kingdoms. [8]

Quality of written communication [2]

(a) Describe the process of directional selection.

Examiner Only	
Marks	Remark

(b) Describe the main features of organisms in each of the five kingdoms.

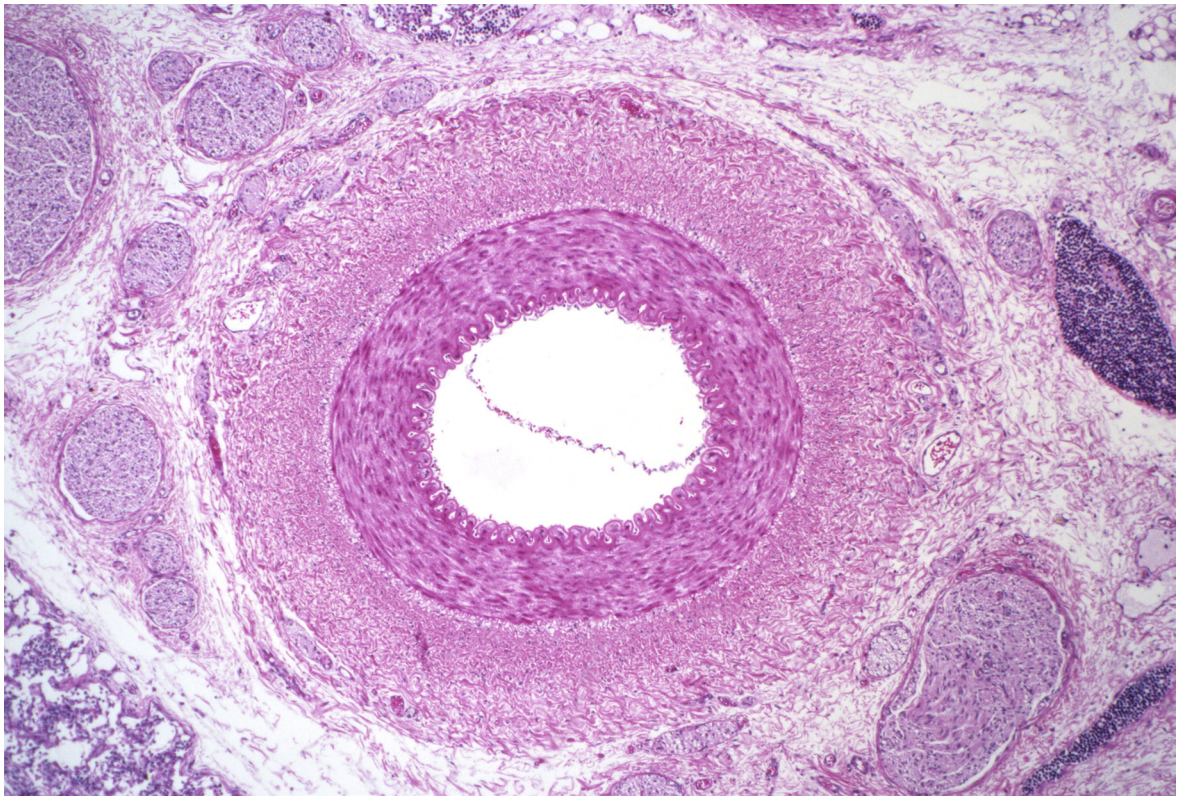
Examiner Only	
Marks	Remark

Extra lined page

Examiner Only	
Marks	Remark

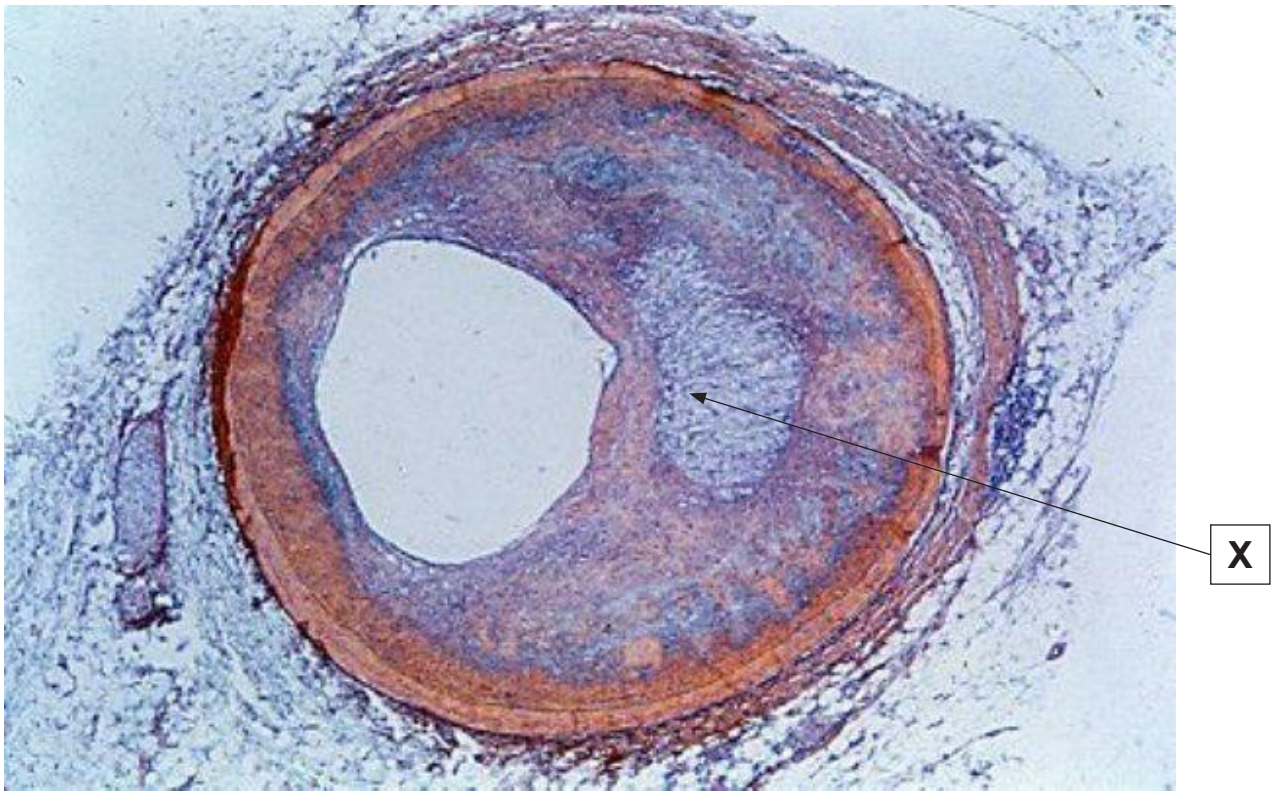
THIS IS THE END OF THE QUESTION PAPER

Photograph 2.6A
(for use with Question 6(a))



(C005/1121)

Photograph 2.6B
(for use with Question 6(b))



Source: National Human Genome Research Institute
http://www.genome.gov/dmd/img.cfm?node=Photos/Technology/Cells%20and%20biological%20pathways&id=63763