OCR
Oxford Cambridge and RSA

H

Wednesday 25 May 2016 – Afternoon

GCSE GATEWAY SCIENCE
BIOLOGY B

B731/02 Biology modules B1, B2, B3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

* B 7 3 1 0 2 *

* 3 0 6 0 5 6 3 2 2 6 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

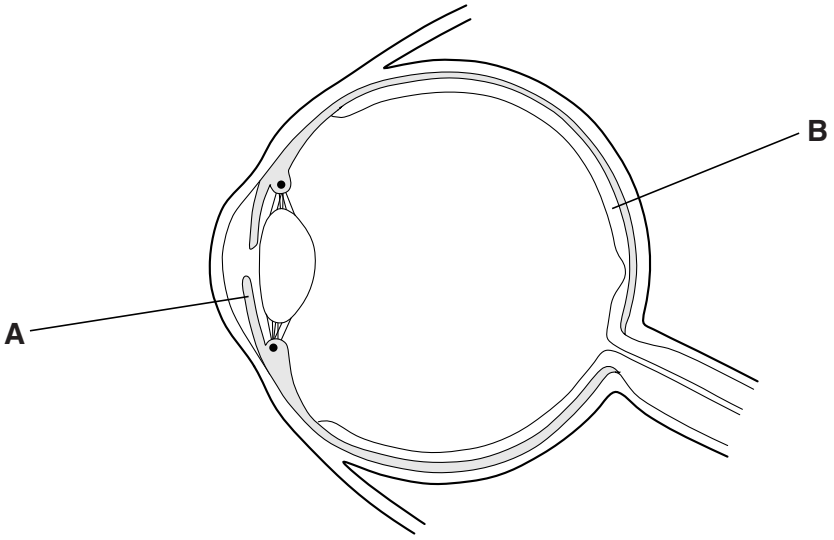
INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

SECTION A – Module B1

1 The diagram shows a section of a human eye.



(a) Describe the jobs of parts **A** and **B**.

Part **A** .....

Part **B** .....

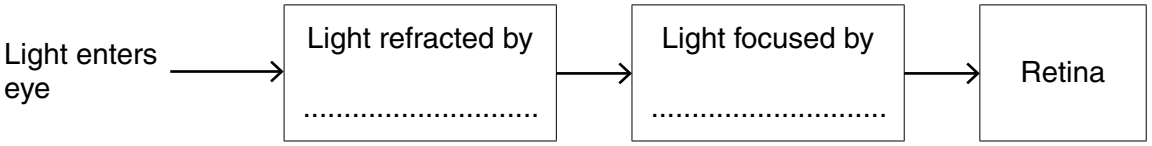
[2]

(b) Light enters the eye.

The flowchart shows what happens to the light as it travels through to the back of the eye.

What are the parts of the eye that the light is travelling through?

Write the names in the boxes.



[2]

(c) The iris is the coloured part of the eye.

The colour is controlled by genes on chromosomes inside cells.

Non-identical twins can have different coloured eyes from each other.

Describe what causes this variation in eye colour.

.....

.....

.....

..... **[2]**

(d) Binocular vision helps people judge distances.

Explain how.

.....

.....

.....

..... **[2]**

[Total: 8]

2 **(a)** Alan and Charlotte are investigating plant growth.

They know that plants respond to changes in their environment.

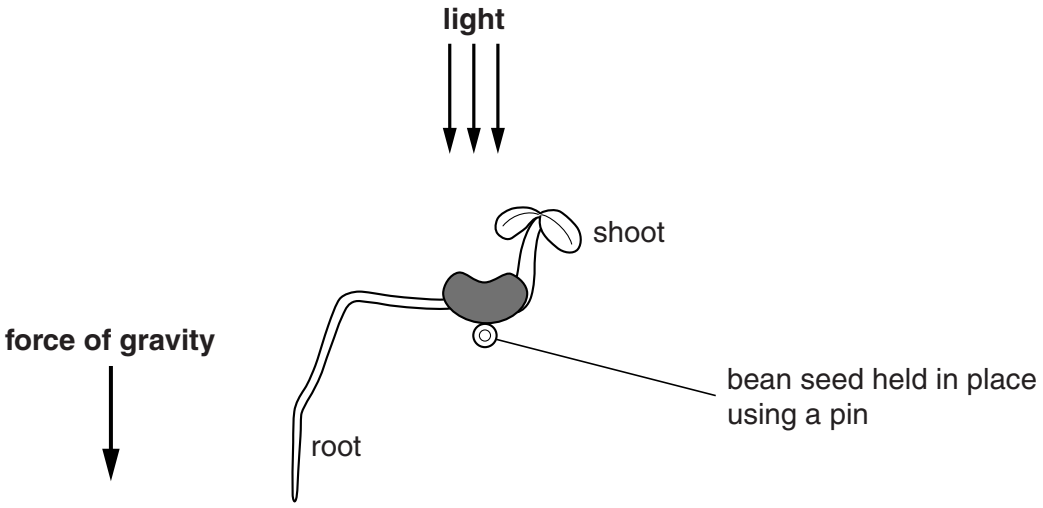
Plant growth is controlled by hormones.

Write down the name of one type of hormone that controls plant growth.

..... **[1]**

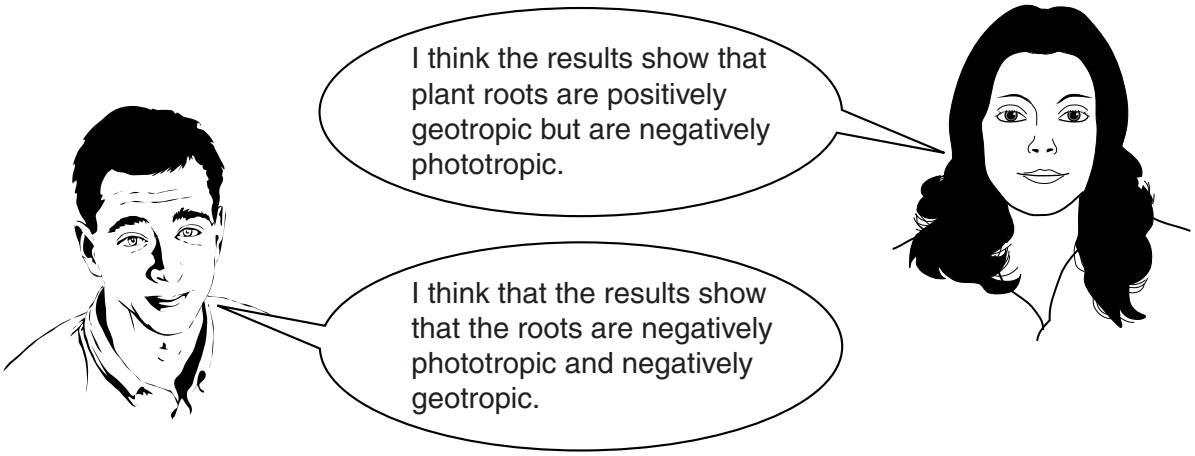
(b) Alan and Charlotte investigate how plant roots grow.

Alan and Charlotte find a diagram showing the results of an investigation into the growth of roots.



5

Alan and Charlotte make different conclusions about the results.



Explain whose conclusion **best** matches the results in the diagram.

.....

.....

.....

..... **[2]**

[Total: 3]

Question 3 begins on page 6

3 **(a)** Nicola is a vegetarian.

She must make sure she eats enough protein to stay healthy.

The estimated average daily requirement (EAR) for protein that Nicola needs can be calculated using the formula:

$$\text{EAR in g} = 0.6 \times \text{body mass in kg}$$

(i) Nicola has a mass of 55 kg.

Calculate Nicola's EAR.

..... **[1]**

(ii) Nicola's sister Janice is pregnant.

Janice's EAR was 36 before she became pregnant.

Suggest how her EAR changes during pregnancy.

Explain your answer.

.....

..... **[1]**

(b) Janice has cystic fibrosis.

Cystic fibrosis is caused by a recessive allele (**f**).

What is the probability of her baby having cystic fibrosis?

The baby's father is heterozygous for cystic fibrosis.

Use a labelled genetic diagram to explain your answer.

..... **[2]**

(c) Club thumb is another inherited condition.

It is caused by a **dominant** allele (**T**).

Janice has normal thumbs.

The father is heterozygous.

What is the probability of the baby having club thumbs?

Explain your answer.

.....

..... **[2]**

[Total: 6]

Question 4 begins on page 8

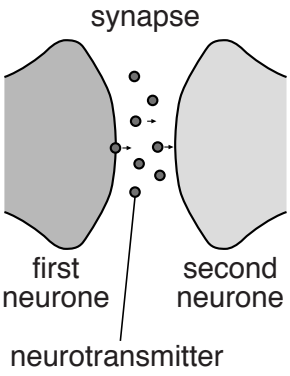
4 **(a)** High energy drinks often contain a legal drug.

This drug affects the transmission of impulses at nerve synapses.

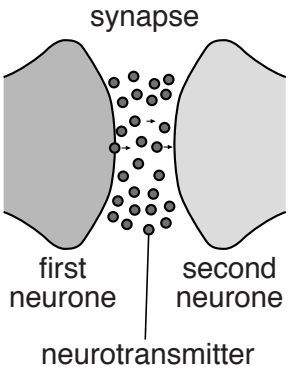
Look at the diagrams.

They show the activity at the synapse before and after having the high energy drink.

activity before drink



activity after drink



What type of drug is in the drink?

Explain how you can tell from the diagrams.

.....

.....

..... **[2]**

(b) Nicotine is a drug found in cigarettes.

Nicotine can affect reaction times.

There are some diseases of the nervous system that slow down reaction times.

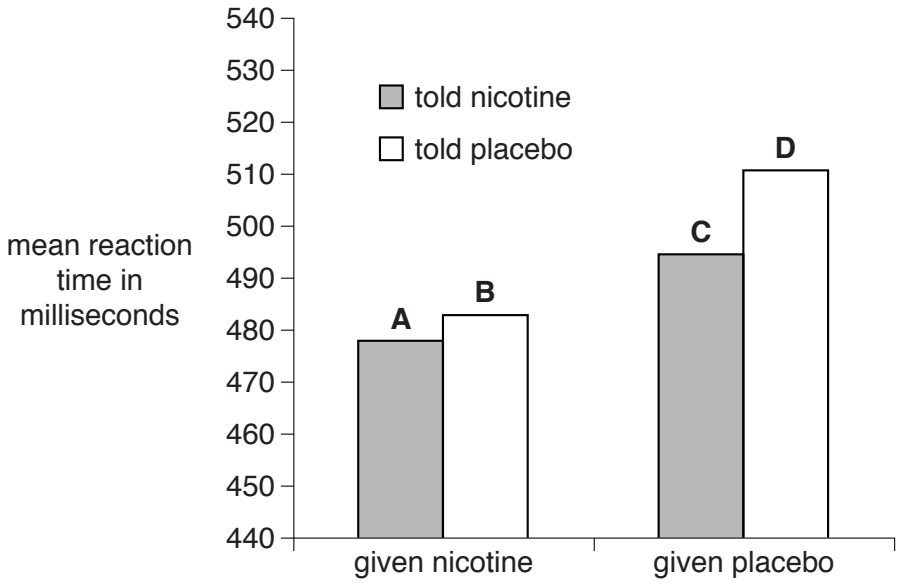
Doctors have investigated the use of nicotine to treat people with these diseases.

Look at the graph.

It shows the results from a trial where four groups of people were tested.

- Group **A** was given nicotine and told it was nicotine
- Group **B** was given nicotine and told it was a placebo
- Group **C** was given a placebo and told it was nicotine
- Group **D** was given a placebo and told it was a placebo

Each group's mean (average) reaction time was then recorded.



Suggest why the trial was designed in this way, and explain what the results show.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

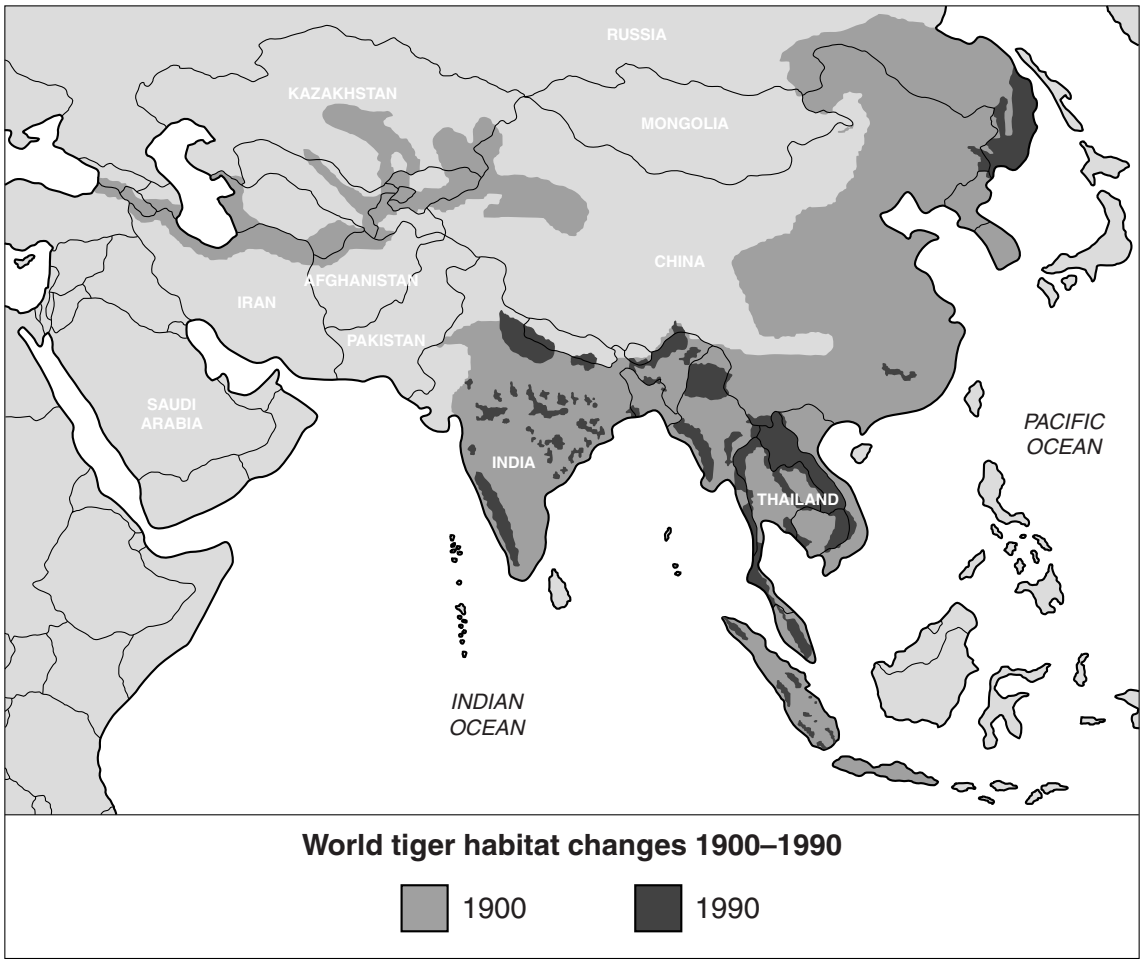
..... **[6]**

[Total: 8]

SECTION B – Module B2

5 Look at the picture.

It shows tiger habitats in the year 1900 and again in 1990.



(a) The changes in tiger habitats have increased the risk of the extinction of tigers.

Explain why.

.....

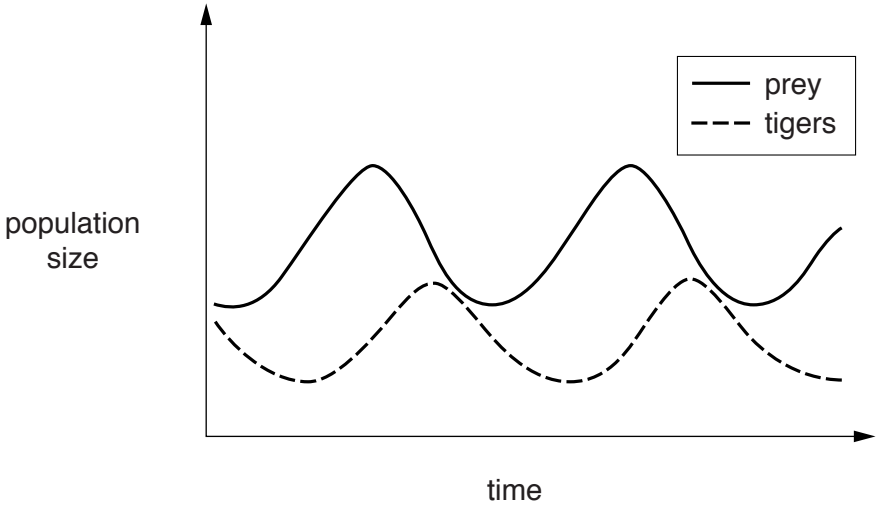
.....

.....

.....

..... **[3]**

(b) The graph shows the relationship between populations of tigers and their prey.



What conclusions can you make from the graph about the relationship between tigers and their prey?

.....

.....

.....

..... **[2]**

[Total: 5]

6 **(a)** Organisms are classified in different levels, from kingdom to species.

Between kingdom and species there are five levels of classification.

Complete the missing levels in this list to give the correct sequence for classification.

kingdom
.....
class
.....
family
.....
species

[2]

(b) If populations of organisms become isolated, new species are more likely to develop.

Explain why.

.....

.....

.....

..... **[2]**

(c) The picture shows three species of butterfly on a buddleia bush.

Buddleia are found in open shrub land.

These butterflies feed on nectar from flowers.

(i) These butterflies are involved in **interspecific** competition. Explain why.

..... **[1]**

(ii) These different species of butterfly each occupy a similar ecological niche.

Explain why.

.....

..... **[1]**

(iii) A different species of butterfly lives in oak woodland.

This butterfly is closely related to the other three butterflies but has different mouthparts.

Suggest why it needs different mouthparts.

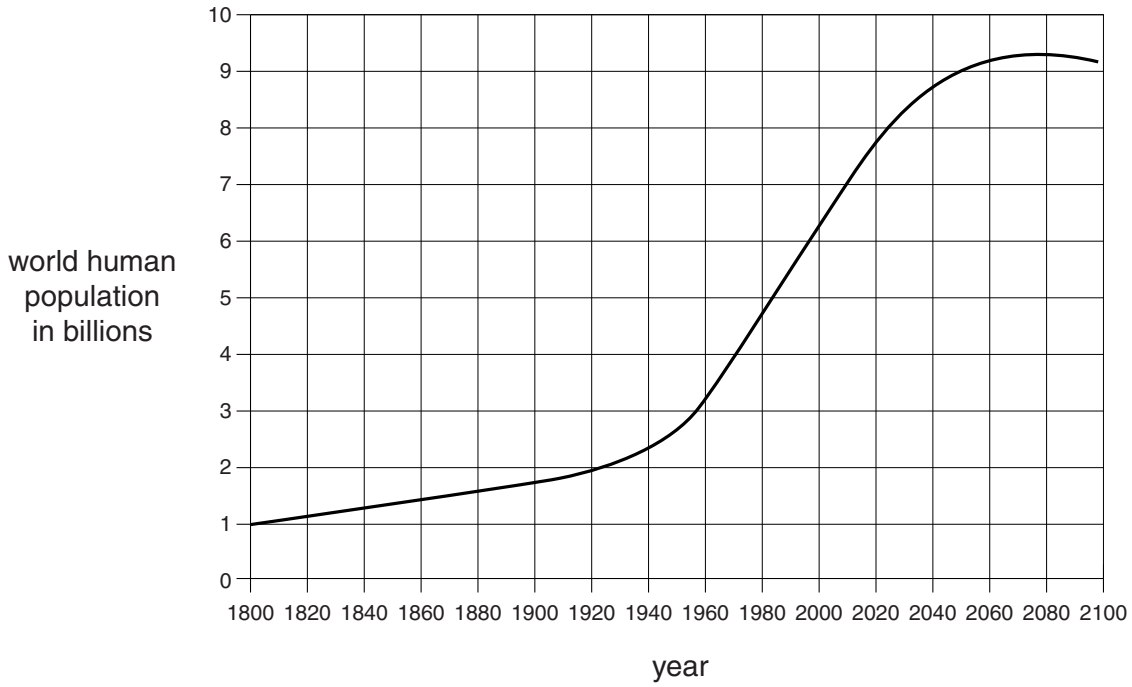
.....

..... **[1]**

[Total: 7]

7 Look at the graph.

It shows the world human population and how some scientists think it could change in the future.



(a) (i) Which **time period** shows the human population increasing exponentially?

Put a (ring) around the correct answer.

1800 to 1860 **1940 to 1980** **2000 to 2040** **2040 to 2100**

[1]

(ii) What are the possible consequences of exponential growth for the human population?

.....

..... **[2]**

(iii) The rate of growth of the human population can be calculated by finding the gradient of the graph.

Calculate the rate of population growth from 1800 to 1880 by finding the gradient of the graph.

rate of population growth = ... billion per year **[2]**

(b) Sustainable development is one way of meeting the needs of an increasing population.

Explain how exponential growth may make sustainable development very difficult.

.....

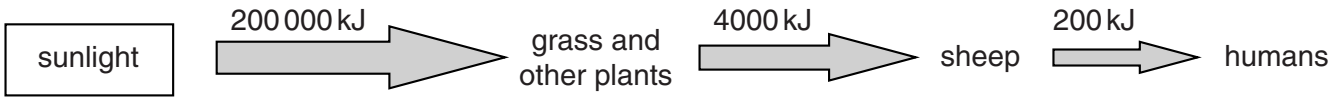
.....

..... **[2]**

[Total: 7]

Question 8 begins on page 16

8 Look at the energy flow through the food chain.



Calculate the efficiency of energy transfer from the plants to the sheep.

Explain how energy is lost from this food chain, and why this limits the length of the food chain.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

[Total: 6]

BLANK PAGE

Question 9 begins on page 18

PLEASE DO NOT WRITE ON THIS PAGE

SECTION C – Module B3

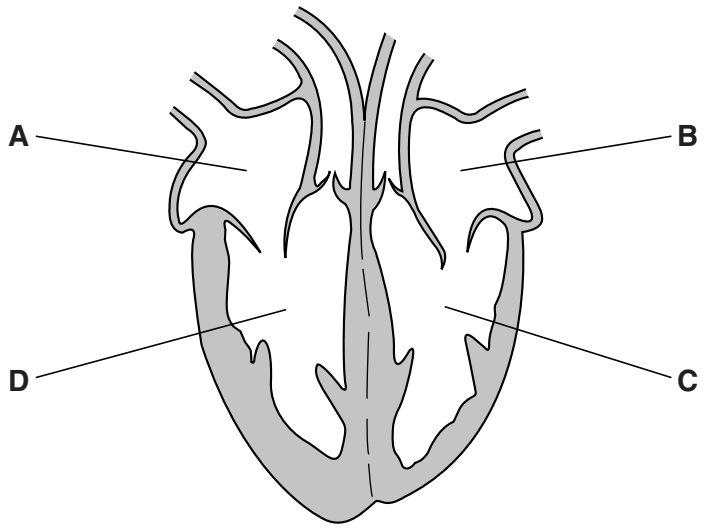
9 About 1 in 10 000 people has a condition called situs inversus.

People with this condition have **their organs reversed** so they are a '**mirror image**' of the usual arrangement.

For most people with situs inversus, there are no harmful effects on their health.

However, doctors need to know if someone has the condition if they are going to successfully treat them if they are ill or injured.

(a) The diagram shows the heart from someone with situs inversus, viewed from the front.



(i) Look at the diagram of the heart. Which part pumps blood **around the body**?

Choose from **A**, **B**, **C** or **D**, and explain your choice.

.....

.....

..... **[2]**

(ii) If someone with situs inversus needs a heart transplant, then a normal heart can be used.

The procedure will be very similar to a normal heart transplant but there will need to be some differences.

Suggest how the procedure will be different.

Explain your answer.

.....

.....

.....

..... **[2]**

(b) (i) The population of the UK is about 63 million (63 000 000).

If 1 in 10 000 people has situs inversus, then approximately how many people in the UK have situs inversus?

answer ..... **[1]**

(ii) All babies in the UK could be x-rayed to test if they have situs inversus.

This information could be kept in their medical records and be available to doctors if they needed it.

Discuss whether all babies in the UK **should** be x-rayed to see if they have situs inversus.

Use information from part **(i)**, and other parts of the question, to help you answer.

.....

.....

.....

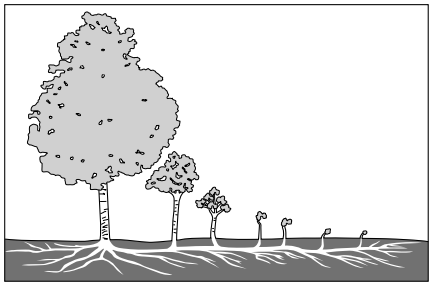
..... **[2]**

[Total: 7]

10 Read the newspaper article.

Pando, the World's Largest Organism

Pando is a forest of 47 000 aspen trees in Utah, USA. All the trees are connected by one underground root system. This means they can all be thought of as part of one massive organism. Scientists have estimated the total mass of Pando to be about 6 000 000 kg, making it the heaviest known single organism in the world.



Although aspens can grow from seeds, in this forest all new trees have grown from the underground roots. This means that they are clones of each other. They are all male because the first tree that this forest grew from was male.

(a) Discuss the advantages and disadvantages to this aspen forest of reproducing by cloning.

Use information from the newspaper article, as well as your own knowledge, to help you answer.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(b) Why is cloning more common in plants than animals?

.....

..... **[1]**

(c) When scientists try to estimate the total mass of plants like Pando they can either measure dry mass or wet mass.

(i) Write down **one advantage** of measuring dry mass compared with measuring wet mass.

.....

..... **[1]**

(ii) Write down **one disadvantage** of measuring dry mass compared with measuring wet mass.

.....

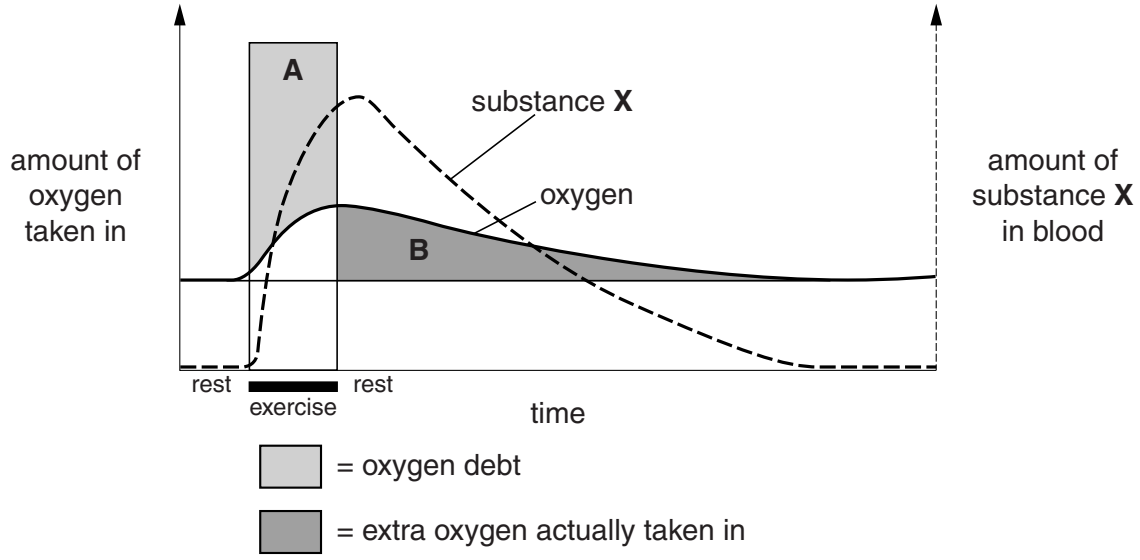
..... **[1]**

[Total: 9]

Question 11 begins on page 22

11 The graph shows the effect exercise has on the amount of oxygen taken in by the body.

It also shows how the amount of another chemical in the blood, called substance **X**, changes.



(a) Area **A** on the graph represents the oxygen debt.

What is **oxygen debt**?

.....

.....

..... **[1]**

(b) Area **B** is equal in size to area **A**.

Explain why.

.....

.....

..... **[1]**

(c) Explain the shape of the graph for substance **X**.

In your answer include what substance **X** is.

.....

.....

.....

..... **[2]**

[Total: 4]

12 DNA polymerases are enzymes that are involved in controlling DNA replication.

(a) One DNA polymerase enzyme is 928 amino acids long.

Calculate the total number of bases in the gene that codes for this enzyme.

Explain your answer.

.....

..... **[1]**

(b) Humans have 16 different DNA polymerase enzymes.

The enzymes differ in their amino acid sequence.

Explain why.

.....

..... **[1]**

(c) Describe the changes that happen to DNA when it replicates.

You may use labelled diagrams to help you answer.

.....

.....

.....

..... **[3]**

[Total: 5]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.