

**Thursday 12 January 2012 – Morning**

**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



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- Your 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 **20** pages. Any blank pages are indicated.

Answer **all** the questions.

**Section A – Module B1**

1 Simon is going sledging with his friends.



(a) Simon’s body needs to keep warm in the snow.

Why is it important that Simon’s body temperature does **not** fall too low?

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

(b) To stop him losing too much heat, **vasoconstriction** takes place.

Explain how vasoconstriction reduces heat loss.

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

(c) After sledging, Simon and his friends decide to get some food.

Simon has Type 1 diabetes.

Simon needs to take insulin before he can eat.

Insulin will control Simon’s blood sugar level.

Explain how insulin controls blood sugar levels.

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

**[Total: 5]**



3 Rafik plays rugby.



Rafik thinks he needs a special diet.

He finds out about diets for rugby players.

Read the information Rafik finds.

The training diet of a rugby player should

- **be high in carbohydrate-rich foods** eg cereal, bread, rice, pasta, potato, fruit
- **be moderate in protein-rich foods** eg meat, chicken, fish, milk and cheese
- **be low in fat** eg avoid too much butter, fatty meats, high fat snacks and fried food
- **include fruit & vegetables** to help prevent illness.

(a) Rugby players need a diet low in fat.

Fats are made up of fatty acids and one other chemical.

Write down the name of this chemical.

..... [1]

(b) The proteins mentioned in the diet are all **first class proteins**.

What is meant by first class proteins?

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

(c) Rafik is concerned that he might be too overweight to play rugby.

Read the information in the box.

<p>Body Mass Index (BMI)</p> <ul style="list-style-type: none"> <li>• underweight &lt; 18.5</li> <li>• normal weight = 18.5–24.9</li> <li>• overweight = 25–29.9</li> <li>• obese = 30 or more.</li> </ul>	$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$
--	---

(i) Rafik is 180 cm tall and has a mass of 85 kg.

Calculate Rafik’s BMI.

Show your working.

BMI = ..... [2]

(ii) Is Rafik overweight? .....

Use the information in the box to explain your answer.

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

(iii) Rafik finds out about the BMI of other rugby players.

He finds out that most of the England rugby team have a BMI greater than 30.

Rafik’s friend tells him that a high BMI does not mean you are unfit **and** unhealthy.

Is Rafik’s friend correct? .....

Suggest reasons for your answer.

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

[Total: 7]

4 Mady is investigating how light affects seedlings.

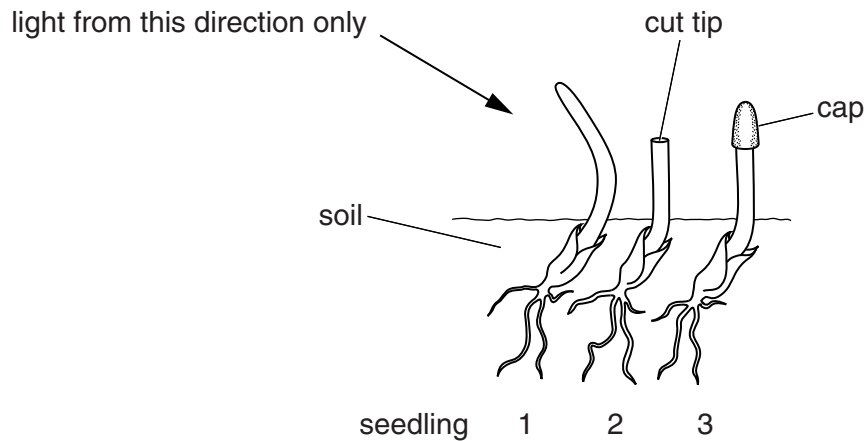
She allows the first seedling to grow normally.

She cuts off the tip of the second seedling.

She puts a light-proof cap over the tip of the third seedling.

Mady then leaves all three seedlings to grow with light shining from one direction only.

Look at the picture showing her results.



(a) Mady writes down some statements about her results.

Put ticks (✓) in the boxes next to the **two** correct statements.

- Only seedlings 1 and 2 are showing positive geotropism.
- Only seedling 1 is showing positive phototropism.
- All the seedlings are responding to gravity.
- Only seedling 3 is showing negative phototropism.
- None of the seedlings are responding to light.
- None of the seedlings are showing negative phototropism.

[2]

(b) The differences between seedlings 1 and 2 are due to a plant hormone.

Explain why they grew differently.

.....

.....

.....

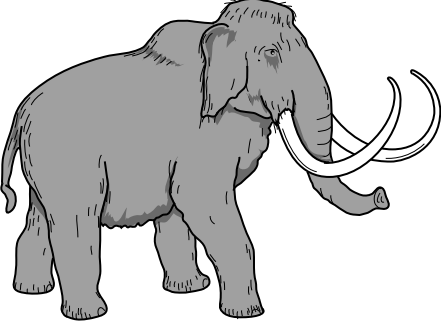
.....

..... [3]

[Total: 5]

Section B – Module B2

5 Read this article about mammoths.



Mammoths were large elephant-like animals that are now extinct. The bodies of more and more mammoths are being found preserved in ice. This is because the global temperature is increasing. This is melting the ice caps.

Some people suggest using mammoth tusks instead of elephant tusks as a source of ivory. They hope that this will stop elephants from becoming extinct. However, they know that this is not a long term solution because this source of ivory is not sustainable.

(a) Mammoths are now extinct.

Some people are worried that elephants in Africa might become extinct.

(i) Suggest **one** way that preventing the extinction of elephants could **benefit** people that live in Africa.

..... [1]

(ii) Some scientists say that the idea of using mammoth ivory instead of elephant ivory may help elephant conservation.

Suggest why this idea may help.

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

(b) The increase in global temperature is melting ice and exposing the dead mammoths.

Many people think that the increase in global temperature is due to increased carbon dioxide levels in the atmosphere.

Explain how increased carbon dioxide levels could lead to global warming.

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



(c) Mammoths and elephants are thought to have descended from common ancestors.

Elephants have much less hair on their bodies than mammoths did.

A scientist called Lamarck had a theory that could explain why mammoths had long hair.

Lamarck's explanation: Mammoths lived in cold climates.

This made their hair grow longer to keep them warm.

This characteristic was passed on to their offspring.

Over many generations the mammoths developed long hair.

(i) Lamarck's explanation is now thought to be **incorrect**.

Explain why it is thought to be incorrect.

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

(ii) About fifty years after Lamarck put forward his theory, Charles Darwin suggested an alternative theory called natural selection.

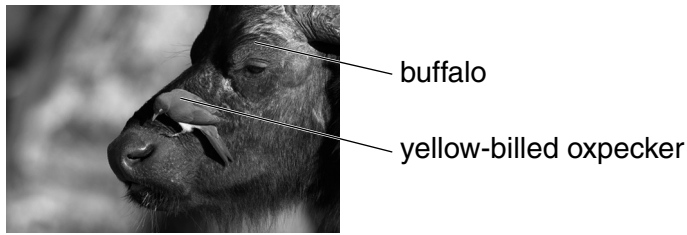
How would Charles Darwin's theory explain the long hair of mammoths?

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

[Total: 9]



7 (a) Buffalo are herbivores that live in Africa.



Buffalo feed on grass.

Yellow-billed oxpeckers are small birds that live on buffalo.

Yellow-billed oxpeckers hunt for live ticks that feed on buffalo.

The ticks feed on buffalo blood.

(i) Write down **one** reason why a pyramid of biomass for this food chain may look different from a pyramid of numbers.

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

(ii) The ticks are **parasites** of the buffalo.

What does the word parasite mean?

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

(b) A different species of oxpecker lives in another part of Africa.

This is the red-billed oxpecker. It also lives on buffalo.

A scientist wants to investigate whether buffalo also benefit from the red-billed oxpecker.

He counts the number of ticks on six buffalo.

He stops red-billed oxpeckers from sitting on three of the buffalo.

Red-billed oxpeckers are allowed to sit on the other three buffalo.

After several days he works out the change in the number of ticks on each buffalo.

His results are in the table.

	change in the number of ticks on each buffalo after the experiment		
buffalo with red-billed oxpeckers	+3	+7	-4
buffalo without red-billed oxpeckers	+4	-4	+6

Discuss what the data show about any possible benefit gained by the buffalo.

.....

.....

..... [2]

(c) Buffalo often have small wounds and sores on their bodies.

The scientist also looks at the effect that red-billed oxpeckers have on these wounds.

	number of wounds that DO NOT heal	number of wounds that heal	number of wounds that heal in %
buffalo with red-billed oxpeckers	49	55	
buffalo without red-billed oxpeckers	3	24	88.9

(i) Work out the missing percentage in the table.

answer.....%

[1]

(ii) Describe the results of this experiment and suggest possible explanations.

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

(d) Explain why the two species of oxpecker **do not** occupy the same ecological niche.

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

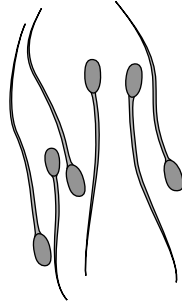
[Total: 10]

Section C – Module B3

8 Look at the picture of bull sperm cells.

Bull sperm cells contain a different number of chromosomes to the number in body cells.

Bull **skin** cells contain 60 chromosomes.



(a) What is the **haploid** number of chromosomes for a bull?

.....

[1]

(b) The Holstein breed of cattle has been bred especially for milk production.

Many Holstein cattle frequently suffer lameness and diarrhoea.

This is because of the way they are bred.

Explain why the method of breeding can increase the risk of lameness and diarrhoea.

.....  
.....  
.....  
.....  
.....

[3]

(c) Cattle can also be cloned for increased milk production.

(i) Cloning animals is more difficult than cloning plants.

Explain why.

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

(ii) Cloning is possible because of pioneering scientific research.

Scientists now understand a lot about how cells are controlled.

This is due to work done by several scientists.

Read the following information about some scientific work.

Watson and Crick worked at Cambridge University. Together they were studying the structure of deoxyribonucleic acid (DNA), the molecule that contains the hereditary information for cells.

At the same time, Maurice Wilkins and Rosalind Franklin were using X-ray diffraction to study DNA at King's College London. Watson and Crick used information from the X-ray studies to further their research and in April 1953 published the structure of DNA.

Watson, Crick and Wilkins received the Nobel Prize for Medicine in 1962. Rosalind Franklin had died in 1958 and, despite her key experimental work, received no prize. The Nobel Prize is not awarded to someone after they have died.

Explain the advantages of using teams of scientists to investigate scientific problems.

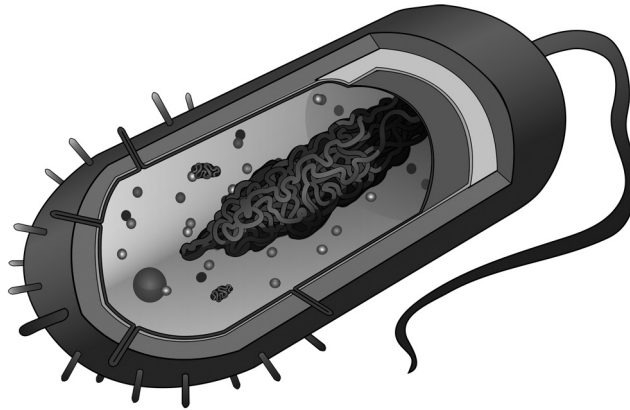
.....  
.....  
.....  
..... [3]

[Total: 8]

9 Scientists have discovered a new cell.

They need to decide if the new cell is an animal, plant or bacterial cell.

Look at the diagram.



Use the diagram to decide whether the cell is animal, plant or bacterial.

The cell is .....

Give reasons for your answer.

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

[Total: 2]

10 (a) (i) Cell division occurs during growth.

Write down the name of the type of cell division used for growth.

..... [1]

(ii) Explain why DNA replicates **before** cells divide.

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





11 Carl is an athlete.

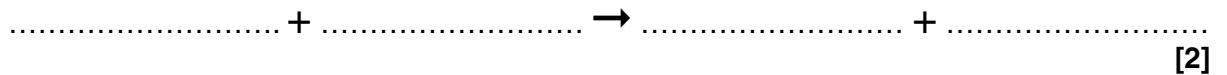
He competes in the 200m sprint.



(a) Muscle contraction during the sprint needs energy.

**Aerobic respiration** is a process that occurs in living cells.

Complete the symbol equation for aerobic respiration.



(b) The circulatory system has parts that help transport substances around the body.

Arteries are part of the circulatory system.

How do arteries help transport substances around the body?

Put a tick (✓) in the box next to the correct statement.

- arteries carry blood at low pressure away from the heart
- arteries carry blood at high pressure away from the heart
- arteries carry blood at low pressure and have valves to prevent backflow
- arteries carry blood at high pressure back to the heart
- arteries join veins to capillaries

[1]

(c) (i) Look at the table of data.

It shows the maximum oxygen consumption for males of different fitness levels.

The males are aged between 13 and 29 years old.

maximum oxygen consumption in cm <sup>3</sup> per kg per minute						
age in years	fitness levels					
	very poor	poor	fair	good	excellent	superior
13–19	less than 35	35–38	39–45	46–50	51–55	more than 55
20–29	less than 33	33–35	36–42	43–46	47–52	more than 52

Carl is **25** years old.

He has a maximum oxygen consumption of 44 cm<sup>3</sup> per kg per minute.

Carl wants to improve his fitness level to **excellent**.

Look at the table.

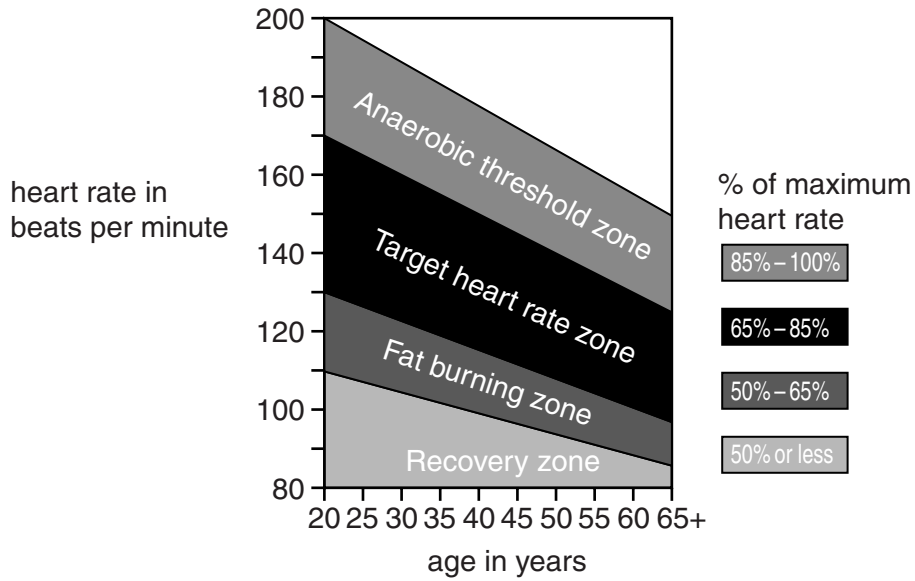
Calculate Carl’s maximum oxygen consumption as a percentage of the **lowest excellent** value.

answer .....%

[1]

(ii) Carl needs to exercise to further improve his fitness level.

Look at the Exercise Target Zone Chart.



Carl’s heart rate reaches 180 beats per minute during exercise.

Is Carl training efficiently? .....

Justify your answer.

.....

.....

.....

..... [3]

[Total: 7]

**END OF QUESTION PAPER**



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