

**Tuesday 18 June 2013 – Morning**

**GCSE TWENTY FIRST CENTURY SCIENCE  
BIOLOGY A**

**A163/02** Module B7 (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**



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 **60**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Jason is concerned that he may be overweight.

- (a) He wants to calculate his Body Mass Index (BMI).  
He knows that his mass is 86.0 kg and his height is 1.70 m.

The formula used to calculate BMI is

$$\text{BMI} = \frac{\text{mass (kg)}}{[\text{height (m)}]^2}$$

Use the formula to calculate Jason's BMI to three significant figures.  
Show your working.

BMI = ..... [2]

- (b) Use the result of your calculation and the table below to determine Jason's condition.

BMI reading	Condition
< 18.5	underweight
18.5–24.9	healthy weight
25.0–29.9	overweight
≥ 30.0	obese

Jason's condition ..... [1]

- (c) Jason is concerned about the repeatability of the data he has collected and the accuracy of the equipment that he has used.  
Explain what is meant by **repeatability** and **accuracy** in this case.

.....

.....

.....

..... [2]

(d) Jason knows that the greater his BMI, the greater his risk of having heart disease.

(i) Jason looks at this table of data that he sees on the internet.

BMI	Increased risk of heart disease
23–25	50%
26–29	72%

He concludes that the increased risk is reduced from 72% to 50% if the BMI is reduced from 26 to 25.

What is the problem with Jason’s interpretation of the data?  
Explain your answer.

.....

.....

.....

..... [2]

(ii) Jason loses weight.  
His doctor tells him that his probability of having a heart attack within the next ten years is 0.3%.  
Use this example to discuss the risk to Jason, by referring to probability and consequence.

.....

.....

.....

..... [2]

[Total: 9]

2 Blood consists of many different components.

(a) The table shows the normal level of three different blood components. It also shows the level in three different people, **A**, **B** and **C**.

	Red blood cell haemoglobin g per 100 cm <sup>3</sup>	White blood cells per mm <sup>3</sup>	Platelets per mm <sup>3</sup>
normal level	15	8500	250 000
person <b>A</b>	15	3000	255 000
person <b>B</b>	9	9000	245 000
person <b>C</b>	15	8000	130 000

What is the consequence of this data for the health of each person? Explain your answer.

person **A** .....

.....

person **B** .....

.....

person **C** .....

..... [3]

- (b) Red blood cells are adapted to the job that they do.  
Draw one straight line from each **feature** to the correct **description of its function**.

feature	description of function
contains haemoglobin	only survives for six weeks
no nucleus	smaller volume to hold oxygen
biconcave shape	to bind with oxygen
	able to divide to produce new cells
	more space for haemoglobin
	hinders the red blood cells movement through the blood
	increased surface area for oxygen exchange

[3]

[Total: 6]



- 4 In 1774 a scientist called Sir Charles Blagden designed an experiment to test the effect of high temperatures on the human body.  
The temperature of the human body is 37 °C.  
Blood boils just above 100 °C.

He entered a room where the air temperature was above 127 °C.

He placed an egg and a piece of meat in the room.  
The egg was cooked in 15 minutes and the meat in 35 minutes.

A student predicted that Sir Charles Blagden’s body temperature would rise and he would die very quickly.

Do you think the student’s prediction is correct?  
Justify your answer.

.....

.....

.....

..... [3]

[Total: 3]

5 Jenny has type 2 diabetes.

- (a) Which of the following dietary factors can help Jenny to control her diabetes?  
Put ticks (✓) in the boxes next to the correct answers.

take vitamin supplements	<input type="checkbox"/>
have a high fibre diet	<input type="checkbox"/>
eat more protein	<input type="checkbox"/>
increase energy (food) intake	<input type="checkbox"/>
eat more complex carbohydrates	<input type="checkbox"/>
take mineral supplements	<input type="checkbox"/>

[2]

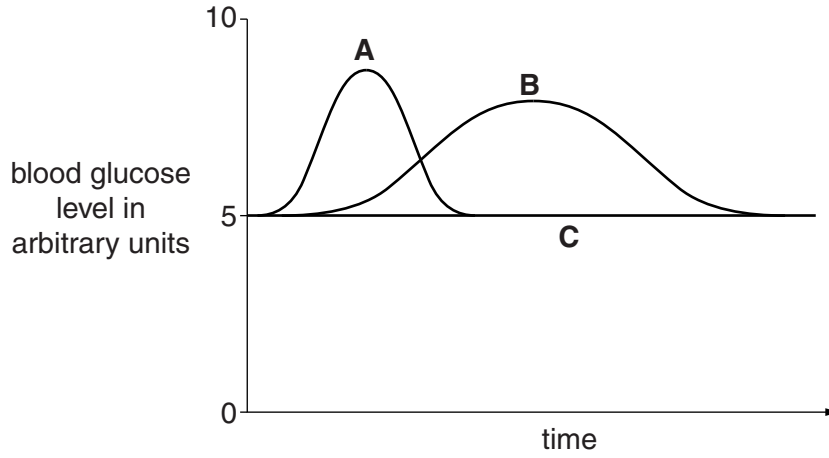
- (b) Having an unhealthy lifestyle can increase the risk of some conditions.  
Which of the following conditions are most likely caused by lifestyle factors?  
Put ticks (✓) in the boxes next to the **three** correct answers.

Huntington's disease inherited from mother	<input type="checkbox"/>
obesity	<input type="checkbox"/>
sore throat caused by bacterial infection	<input type="checkbox"/>
heart disease	<input type="checkbox"/>
skin cancer	<input type="checkbox"/>
common cold caused by a virus	<input type="checkbox"/>
cystic fibrosis inherited from both parents	<input type="checkbox"/>
colour blindness inherited from father	<input type="checkbox"/>

[1]



- (c) Controlling glucose level in the blood is important. After eating a meal, the blood glucose level may rise and then fall back to normal. The graph shows changes in blood glucose level after eating meals containing three different foods, **A**, **B** and **C**.



Write the correct letter, **A**, **B** or **C** next to the most likely food in each meal.

type of food	letter
fibre	
glucose drink	
complex carbohydrate (starch)	

[2]

- (d) Protein in food has to be processed by the digestive system in the same way as complex carbohydrates, before entering the blood stream.

Some people with type 1 diabetes do not produce enough of the hormone insulin.

These people inject themselves with insulin.

Insulin is a protein.

Why is insulin usually injected rather than taken as a tablet?

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

Insulin in tablets enters the blood stream too quickly.

Tablets are more likely to cause infection.

Insulin in tablets is more likely to cause an overdose.

Insulin in injections will work faster.

Insulin needs to be injected straight into the pancreas.

Insulin in tablets is likely to be digested and broken down.

[2]

[Total: 7]

Turn over



7 It is very important that the use of natural resources by humans is sustainable.

(a) What is meant by the sustainable use of natural resources?  
Put a tick (✓) in the box next to the correct description.

Resources are not taken from the environment.

Resources are used faster than they are replaced.

Resources are only used if they are urgently needed.

Resources are used at the rate at which they are replaced.

Resources are looked for in new areas.

[1]

(b) Suggest **two** ways that North Sea fish stocks could be managed in a sustainable way.

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

(c) Tensions sometimes exist between conserving a natural ecosystem and the needs of local people.  
Suggest why this tension may exist.

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

[Total: 4]

8 This question is about genetic modification.

(a) There are many examples of genetic modification.  
Which of the following can be achieved by genetic modification?  
Put ticks (✓) in the boxes next to the **two** correct answers.

- sexual reproduction in plants
- bacterial synthesis of medicines
- testing for genetic disorders
- selective breeding
- asexual reproduction in animals
- herbicide resistance in crop plants

[2]

(b) One example of genetic modification is the production of golden rice.  
Golden rice has a gene inserted that produces vitamin A.  
White rice does not contain vitamin A.  
Countries with people who eat mainly white rice have high levels of blindness due to a lack of vitamin A.

Suggest why people in these countries may be more in favour of the genetic modification of organisms than people who live in the United Kingdom.

.....

.....

.....

..... [2]



9 It is important in science to understand scale. Nanotechnology involves using structures that are about the same size as small molecules.

(a) Look at the list.

- 1 cells
- 2 DNA
- 3 nucleus
- 4 nanotechnology structures
- 5 human
- 6 heart

Write the list in the correct order starting with the smallest structure and ending with the largest structure.

The first one has been done for you.

4 ..... [2]

(b) The structures used in nanotechnology are smaller than 100 nanometres in size. A nanometre is one thousand millionth of a metre. Put a ring around the correct size for a nanometre.

0.001 m

0.000 001 m

0.000 000 001 m

0.000 000 000 001 m

0.000 000 000 000 001 m

[1]

(c) It is possible to see structures as small as 100 000 nm with the naked eye. A light microscope can be used to see structures as small as 2000 nm. To see structures smaller than that, an electron microscope is used.

A typical human cheek cell is 20 000 nm in diameter.

A virus is about 20 times smaller.

What device could be used to see a virus?

Explain your answer.

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

(d) Read the article about 'smelly socks' and nanoparticles.

**No more smelly socks**

Scientists have developed socks that no longer smell after they have been worn. The socks are impregnated with silver nanoparticles that kill the bacteria that cause socks to smell.

A scientist said "One problem is that silver nanoparticles may be dangerous if released into the environment. We just do not know enough yet about nanoparticles."

When the socks are washed, 10% of the silver nanoparticles are released into the washing water.

(i) Explain, using the example of the 'smelly socks', why this use of nanotechnology may not be completely safe.

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

(ii) Using the example of the 'smelly socks', suggest how scientists could reduce the risk in this case.

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

(e) Some people think that goods containing nanoparticles should be labelled. This could help people decide whether or not to buy the goods. A nanoparticle is defined as a particle smaller than 100 nm in size. Suggest why this definition may not be very useful when deciding whether or not to label goods containing nanoparticles.

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

[Total: 9]

**END OF QUESTION PAPER**

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