

**Thursday 12 January 2012 – Morning**

**GCSE TWENTY FIRST CENTURY SCIENCE  
BIOLOGY A**

**A161/02** 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



Candidate forename		Candidate surname	
--------------------	--	-------------------	--

Centre number						Candidate number				
---------------	--	--	--	--	--	------------------	--	--	--	--

**MODIFIED LANGUAGE**

**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 All humans have different phenotypes.

(a) Put a tick (✓) in the box next to the statement that best explains the word phenotype.

Phenotype describes the ...	... genes ...		... an organism has.
	... number of cells ...		
	... nuclei ...		
	... characteristics ...		
	... chromosomes ...		

[1]

(b) Genes cause genetic differences in humans.

Each gene has more than one allele.

Draw a straight line to link each **description** of alleles with its correct **definition**.

description	definition
homozygous	has more than two alleles for a gene
	the alleles for the gene are the same
	each chromosome has two alleles
heterozygous	the alleles for a gene are different
	each cell has a different allele

[2]

(c) The Punnett square shows the inheritance of a characteristic caused by a recessive allele **g**.

	<b>G</b>	<b>g</b>
<b>G</b>	<b>GG</b>	<b>Gg</b>
<b>g</b>	<b>Gg</b>	<b>gg</b>

(i) Write down the genotype of a carrier.

answer ..... [1]

(ii) Write down the genotype that will show the characteristic.

answer ..... [1]

**[Total: 5]**



(c) Different people have different opinions about genetic testing.

Write down **one** argument for and **one** argument against genetic testing.

.....

.....

.....

..... [2]

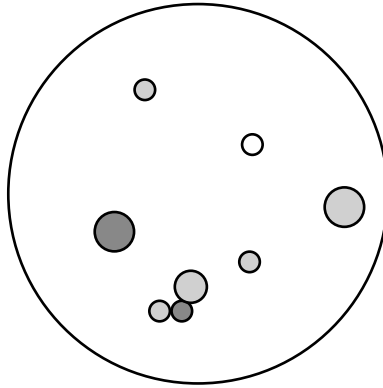
[Total: 10]

**3** Microorganisms can cause disease.

They can reproduce rapidly.

A single bacterium will divide many times to form a colony.

- (a)** Bacteria are added to a Petri dish. The dish is sealed. After 24 hours the dish contains several **colonies** of bacteria.



- (i)** What is the smallest number of bacteria that could have been present in the Petri dish at the start of the 24-hour period?

answer ..... [1]

- (ii)** A single bacterium can divide every 20 minutes.

One of the colonies has 4096 bacteria.

Calculate how long this colony has been growing.

Show your working.

answer = ..... [2]

(iii) A similar colony takes longer than expected to grow to 4096 bacteria.

Which of these statements are possible reasons why?

Put ticks (✓) in the boxes next to the possible reasons.

The Petri dish is too large.

There is a shortage of food.

They were left for too long.

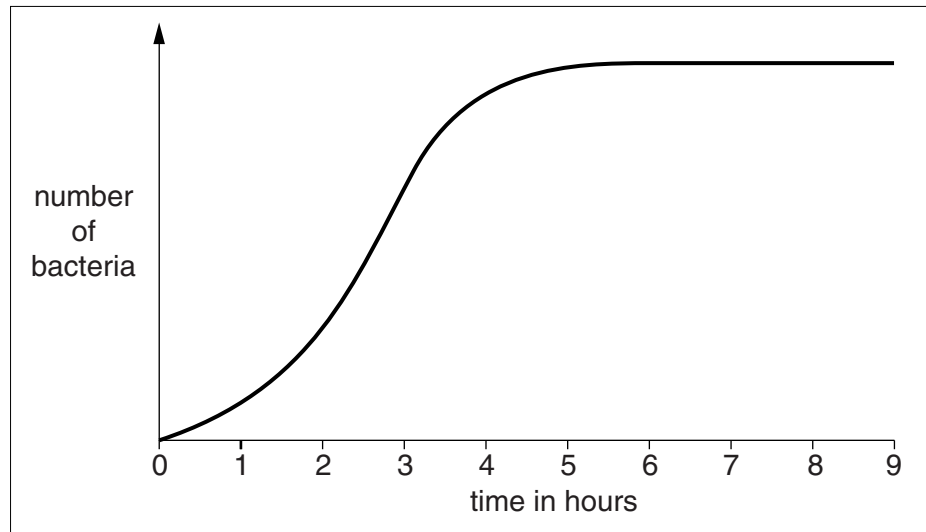
There were not enough bacteria to start with.

The temperature has been reduced.

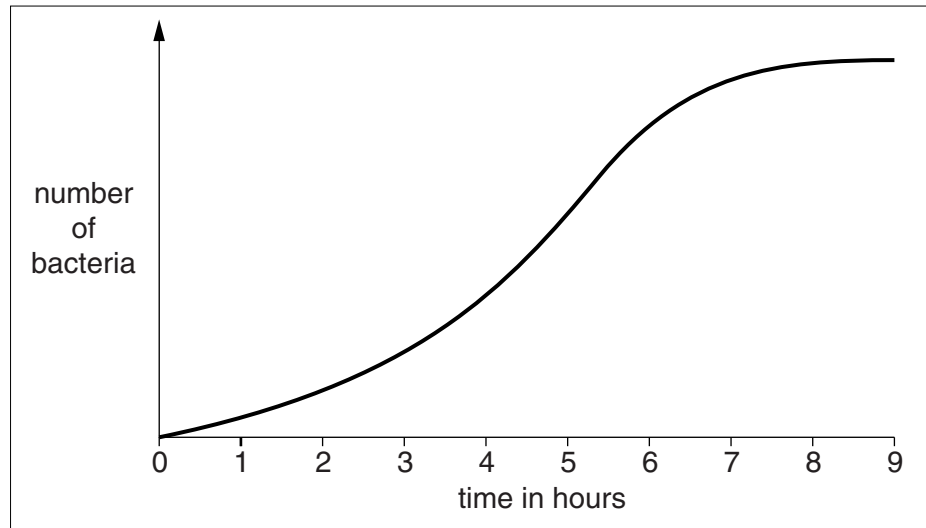
[2]

- (b) A student studies two strains of bacteria. The graphs show the number of bacteria in three flasks over a period of time.

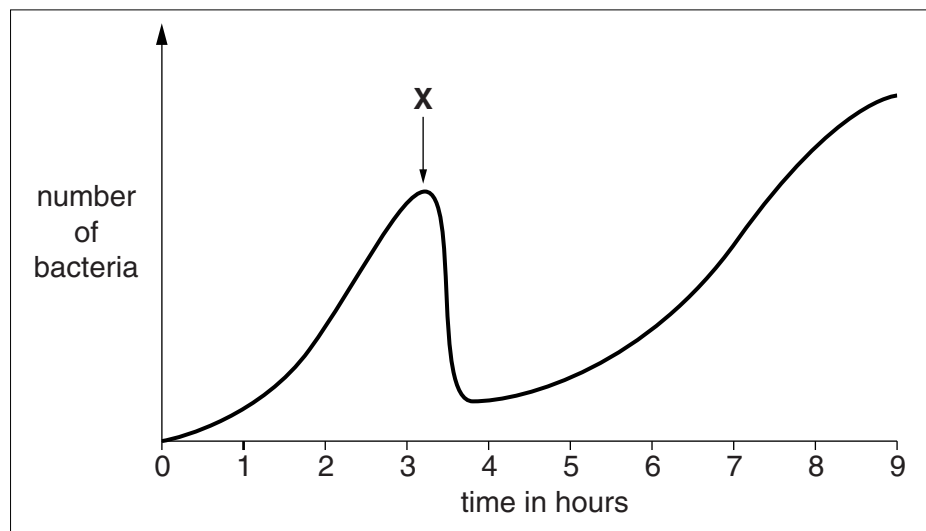
flask A



flask B



flask C





**Flask A** only contains a strain of bacteria (R-) that is not resistant to penicillin.

**Flask B** only contains a strain of bacteria (R+) that is resistant to penicillin.

**Flask C** contains a mixture of both strains of bacteria (R- and R+).

Penicillin was introduced to **flask C** at point **X** on the graph.

(i) Describe the effect on the number of bacteria after adding penicillin to **flask C**.

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

(ii) The student only looked at the information in the three graphs. The student drew the following five conclusions.

Assume the vertical axis of each graph has the same scale.

- 1 After 2 hours there were more bacteria in **flask B** than in **flask A**.
- 2 The growth rate of bacteria in **flask A** was greatest at about 3 hours.
- 3 Resistant bacteria grew slower than non-resistant bacteria because they had less food.
- 4 After six hours, **flask C** mostly contained resistant bacteria.
- 5 The growth rate of bacteria in **flask C** increased after 5 hours because strain R- had become resistant to the penicillin.

Which of the student's conclusions could be correctly drawn from the graphs?

Choose from **1, 2, 3, 4** and **5**.

answer ..... [2]

(iii) Another student said that the results for **flask C** clearly show why patients should complete a course of antibiotics.

State whether the student was correct. Explain your answer.

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

[Total: 12]

4 Vaccinations help prevent disease.

(a) Edward Jenner discovered the first vaccine.

Read the article about Edward Jenner then answer the following questions.

**Edward Jenner 1749 – 1823**

Edward Jenner discovered the first vaccine in 1796. He noticed that milk maids who caught the mild disease of cowpox never caught the deadly disease of smallpox. He thought that cowpox must give protection against smallpox. To test his idea he injected a small boy called James Phipps with pus from a milk maid who had cowpox. James caught cowpox. When James had recovered, Jenner injected James with pus from a person who had smallpox. This would normally have resulted in James getting smallpox, but he did not. Edward Jenner had used cowpox pus to invent the first vaccine.



- (i) Using ideas about vaccines, explain how Jenner’s treatment prevented James Phipps from getting smallpox.



*The quality of written communication will be assessed in your answer.*

..... [6]

- (ii) Use the example above to describe a correlation between a factor and an outcome.

..... [1]

(iii) Explain the ethical issue that was involved in the article about Edward Jenner.

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

(iv) People often say that the right decision is the one that leads to the best outcome for the greatest number of people involved.

Explain why Jenner's work is an example of this.

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

(v) If scientists were developing this vaccine today, how would their methods be different from Jenner's?

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

(b) To prevent epidemics of infectious disease it is necessary to vaccinate a high percentage of the population.

The more infectious the disease, the greater the percentage of the population that needs to be vaccinated.

Explain why.

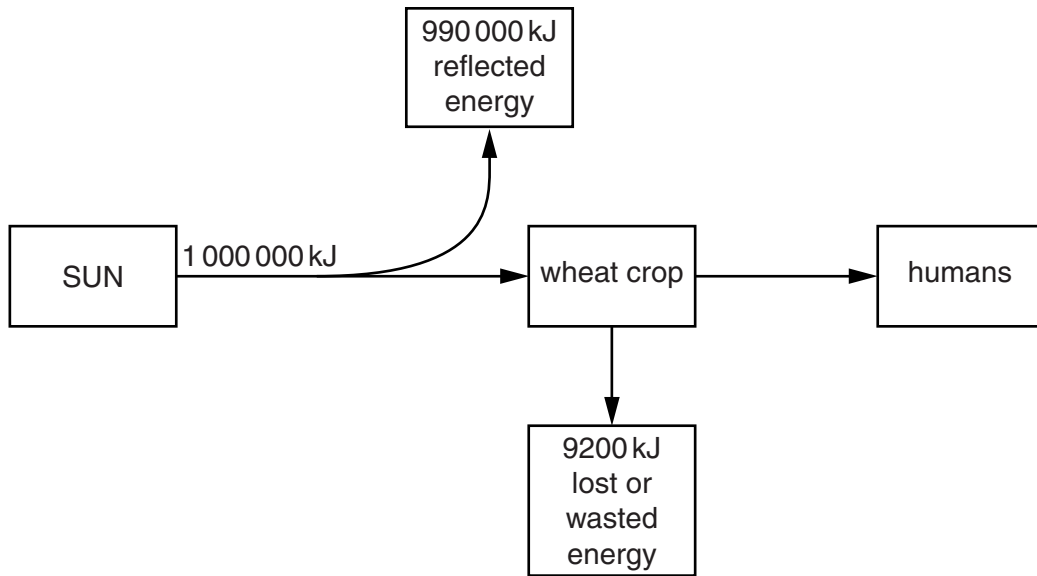
.....  
.....  
.....  
.....  
..... [2]

(c) Explain why vaccinations can never be completely risk free.

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

[Total: 14]

5 Energy flows through food chains.



(a) Look at the energy flow chart.

(i) Calculate how much energy in the wheat is passed to humans.

Show your working.

answer = .....kJ [2]

(ii) Calculate the percentage efficiency of the energy transfer from the wheat crop to humans.

Show your working.

answer = .....% [2]

(b) Vegetarians do not eat meat. Use your answers to part (a) and your knowledge of food chains to help you to evaluate the sustainability of vegetarianism compared to eating meat.

.....

.....

.....

.....

..... [3]

[Total: 7]

6 Nitrogen is recycled through the environment.

Explain the process.

A space has been left for you to draw a diagram as part of your explanation.



*The quality of written communication will be assessed in your answer.*

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

7 Biodiversity and sustainability are important for life on Earth.

(a) Explain what is meant by **biodiversity**.

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

(b) Write down **two** reasons why biodiversity is important.

1 .....  
.....  
2 .....  
..... [2]

(c) Explain what is meant by **sustainability**.

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

[Total: 6]

END OF QUESTION PAPER

15  
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

**PLEASE DO NOT WRITE ON THIS PAGE**



**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.