



88126005

**BIOLOGY**  
**STANDARD LEVEL**  
**PAPER 2**

Friday 16 November 2012 (afternoon)

1 hour 15 minutes

Candidate session number

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Examination code

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**INSTRUCTIONS TO CANDIDATES**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[50 marks]*.



0116

**SECTION A**

Answer **all** questions. Write your answers in the boxes provided.

- 1. Cells in the alveolus wall produce a surfactant. Its function is to prevent alveoli collapse at the end of expiration. Surfactants are used in the treatment of respiratory system disease in premature babies.

The table shows some of the components of different surfactant preparations.

Component	Percentage composition by mass			
	Synthetic surfactant A	Synthetic surfactant B	Natural human surfactant	Modified human surfactant
Phospholipids	99	84	81	100
Cholesterol	0	not stated	5 to 10	0
Fatty acids	<0.5	6	1.5	0
Proteins	1	0.5 to 1	5 to 10	0

[Source: *Clinical and Diagnostic Laboratory Immunology*, 2000, 7(5), pp. 817–822, 2012, January 9, 2013]

- (a) State the surfactant that contains the least amount of phospholipids. [1]

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- (b) Compare the composition of natural human surfactant with synthetic surfactants. [2]

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*(Question 1 continued)*

- (c) State **one** feature of the alveoli, other than the presence of a film of moisture, that adapts them to gas exchange. [1]

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- (d) Phospholipids found in the surfactants form a surface film on the moist lining of the alveoli. Outline how the hydrophilic and hydrophobic parts of the phospholipids in the surfactants are aligned on the alveolar surface. [1]

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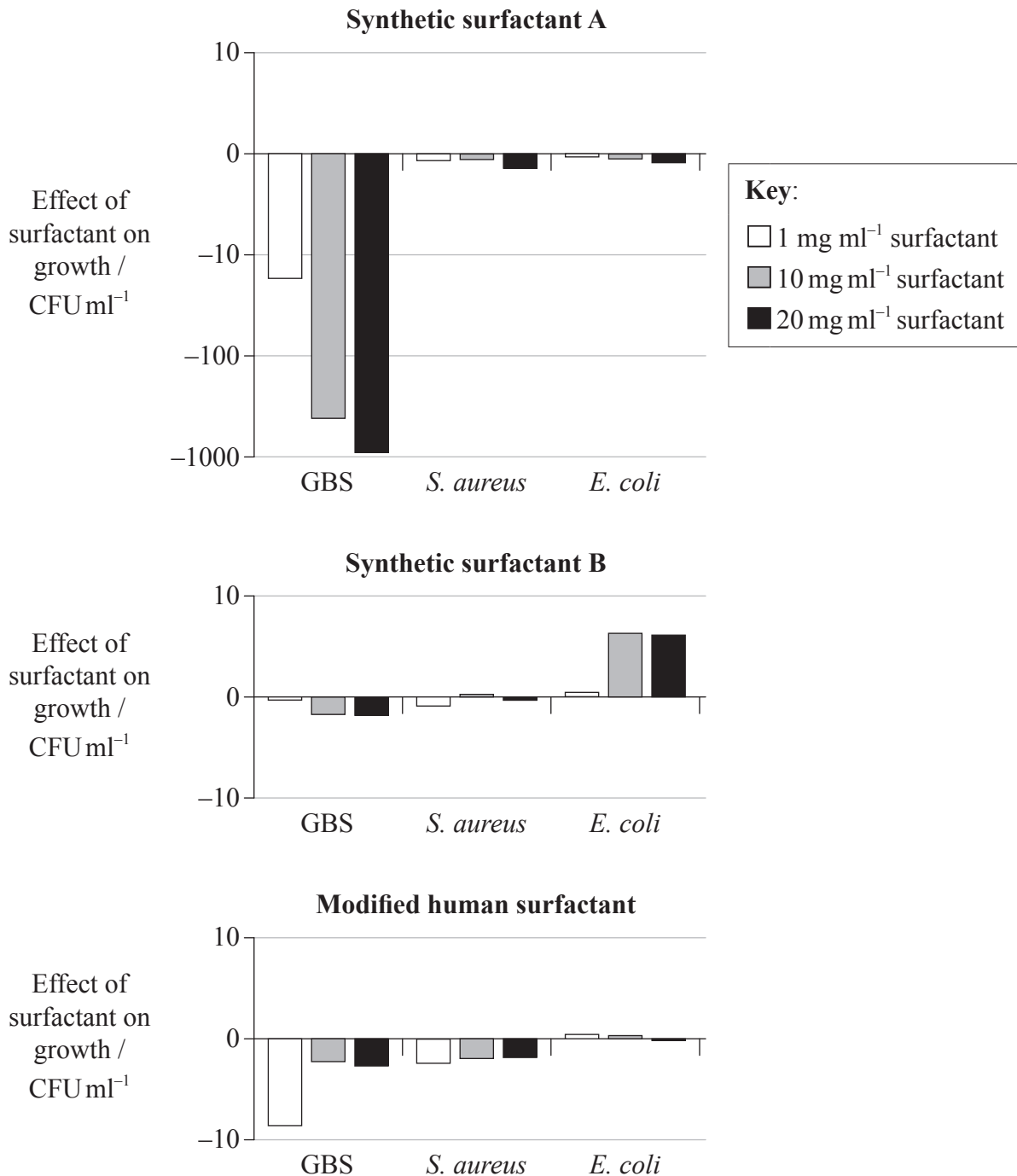
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(Question 1 continued)

The effect of three different surfactants on the growth of three types of bacteria was assessed. Group B streptococci (GBS), *Staphylococcus aureus*, and *Escherichia coli* were incubated with three different concentrations of surfactant (1, 10 and 20 mg ml<sup>-1</sup>).

The bar charts show whether each concentration of surfactant increased or decreased bacterial growth, compared with the growth without surfactant. The difference in growth is shown as colony forming units (CFU) per millilitre.



[Source: *Clinical and Diagnostic Laboratory Immunology*, 2000, 7(5), pp. 817–822, 2012, January 9, 2013

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(Question 1 continued)

- (e) Identify the effect of increasing the concentration of synthetic surfactant A on the growth of GBS. [1]

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- (f) Compare the effect of the three surfactants, synthetic surfactants A and B and the modified human surfactant, on the growth of the different bacteria at a concentration of 20 mgml<sup>-1</sup>. [3]

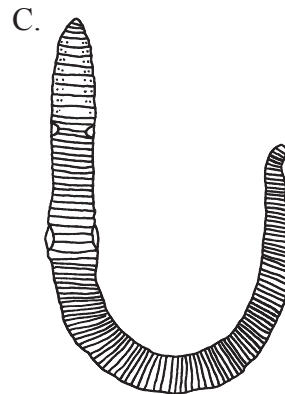
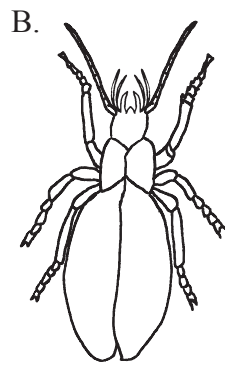
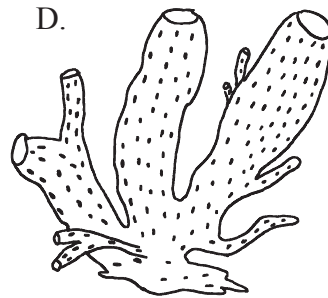
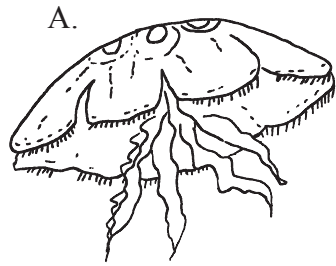
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- (g) Using all the data provided, evaluate the hypothesis that the presence of proteins in surfactants can decrease bacterial growth. [3]

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2. (a) Parts of a dichotomous key to organisms A, B, C and D are shown. Design missing parts of the key using features visible in the following diagrams. [2]



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1.	Body with tentacles .....	A
	Body without tentacles .....	go to 2
2.	.....	B
	.....	go to 3
3.	.....	C
	.....	D

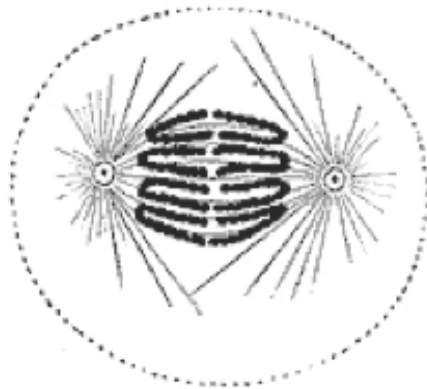
- (b) All of these organisms belong to the animal kingdom. State **two** structural differences between animal cells and plant cells. [2]

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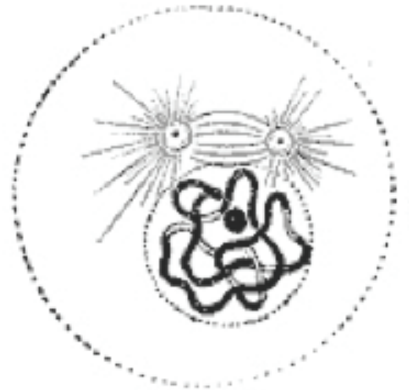
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3. The electron micrographs show mitosis in a cell at an early stage and an intermediate stage.

**Phase A**



**Phase B**



[Source: Phase A from: <http://upload.wikimedia.org/wikipedia/commons/f/f5/Anaphase.jpg>  
 Phase B from: <http://upload.wikimedia.org/wikipedia/commons/d/db/Prophase.jpg>]

(a) (i) State the name of each phase shown, recording whether each phase has taken place at an early or intermediate stage of mitosis. [2]

Phase A: ..... occurs at an ..... stage  Phase B: ..... occurs at an ..... stage
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(ii) Outline the events occurring in phase A. [2]

..... ..... .....
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*(Question 3 continued)*

- (b) State what results when there is an uncontrolled division of cells in living organisms. [1]

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- (c) DNA in chromosomes undergoes replication before mitosis. Outline how complementary base pairing is important in this process. [2]

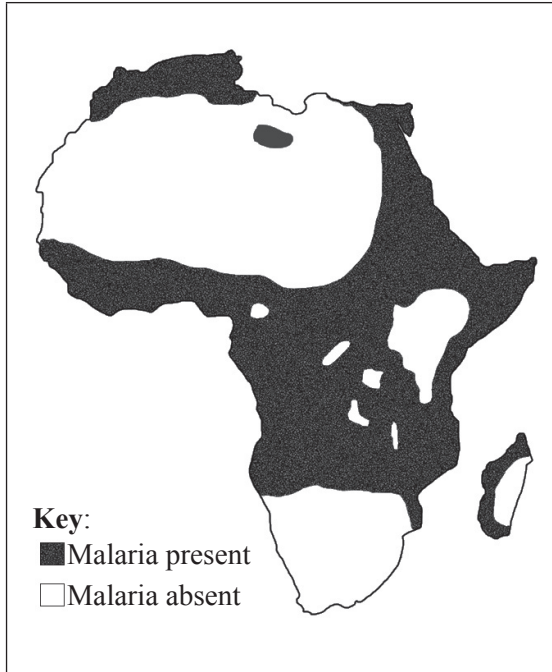
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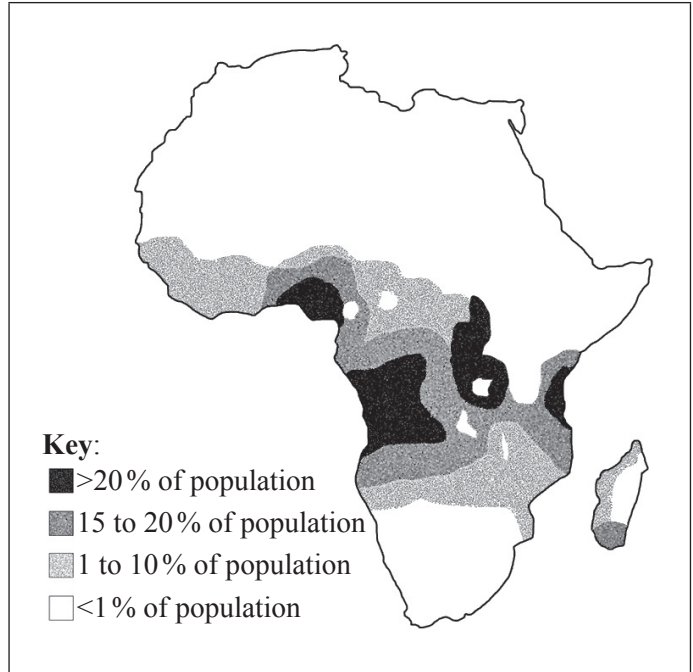


4. Sickle-cell anemia is a disease caused by a base substitution mutation, where GAG has changed to GTG. The distribution of the sickle-cell allele is correlated with the incidence of malaria in many places, as shown by the map of Africa.

**Malaria incidence**



**Sickle-cell allele distribution**



[Source: Image courtesy of Anthony Allison; image source: Wikimedia Commons]

- (a) The correlation shown in the data above can be explained by natural selection. Outline how the process of natural selection can lead to evolution. [3]

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(Question 4 continued)

- (b) Explain how a base substitution mutation, such as GAG to GTG, can lead to a disease like sickle-cell anemia. [2]

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- (c) Using a Punnett grid, determine the possible genotypes and phenotypes of a cross between a man and a woman who are both carriers of the sickle-cell allele. Use the symbol Hb<sup>S</sup> for the sickle-cell allele and Hb<sup>A</sup> for the normal allele. [2]

Phenotypes:

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**SECTION B**

Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers in the boxes provided.

5. (a) Outline the role of condensation and hydrolysis in metabolic reactions involving carbohydrates. [4]
- (b) Metabolic reactions are catalysed by enzymes. Explain how enzymes catalyse reactions and how a change in pH could affect this. [8]
- (c) Describe the digestion of food in the human digestive system. [6]
6. (a) Define *habitat*, *population*, *community* and *ecosystem*. [4]
- (b) Outline how energy flows through an ecosystem. [6]
- (c) Discuss the benefits and possible harmful effects of altering species by **one** example of genetic modification. [8]
7. (a) Draw a labelled diagram of the structure of a motor neuron. [4]
- (b) Outline the control of the heartbeat by the nervous and endocrine systems. [6]
- (c) Explain the principles of synaptic transmission. [8]









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