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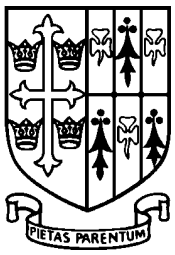

16+ ENTRANCE EXAMINATION

For entry in

September 2016

BIOLOGY

Time: 1 hour

Candidates Name: ……

Q1.

(a) Mycoprotein is one type of food produced using biotechnology.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The microorganism used in the production of mycoprotein is

(1)

☒ **A** *Agrobacterium*

☒ **B** *Bacillus*

☒ **C** *Fusarium*

☒ **D** *Saccharomyces*

(ii) The table shows the mass of different nutrients in 100 g of mycoprotein mince and 100 g of minced beef.

nutrient	mass of nutrient in 100 g of mycoprotein mince / g	mass of nutrient in 100 g of minced beef / g
protein	13.5	20.0
carbohydrates	12.0	1.0
fat	7.0	16.0
fibre	3.5	0.0
salt	1.0	0.7

Calculate the difference in the mass of protein contained in 200 g of minced beef compared with 200 g of mycoprotein mince.

(2)

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(iii) Mycoprotein mince has nutritional advantages compared with minced beef.
State **one** nutritional advantage of mycoprotein. **(1)**

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(b) Explain **one** advantage, other than a nutritional benefit, of using microorganisms to produce food.

(2)

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*(c) Fermenters are used to grow microorganisms.
Explain how optimum conditions for the growth of microorganisms are controlled in a fermenter.

(6)

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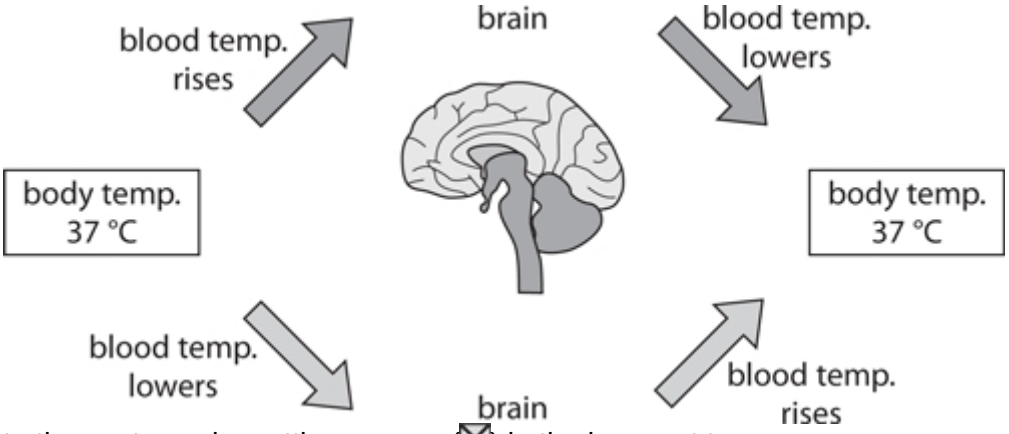
(Total for Question = 12 marks)

Q2.

(a) The diagram shows the regulation of body temperature.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.
The type of control shown in the diagram is known as

(1)

☒ **A** negative feedback

☒ **B** osmoregulation

☒ **C** positive feedback

☒ **D** variation

(ii) State the part of the brain that controls body temperature.

(1)

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(b) Describe **one** way in which the skin helps in the control of body temperature.

(2)

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(c) Explain why humans need to maintain their body temperature at 37 °C.

(2)

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*(d) Explain how changes in the volume of blood going through the skin help to maintain body temperature.

(6)

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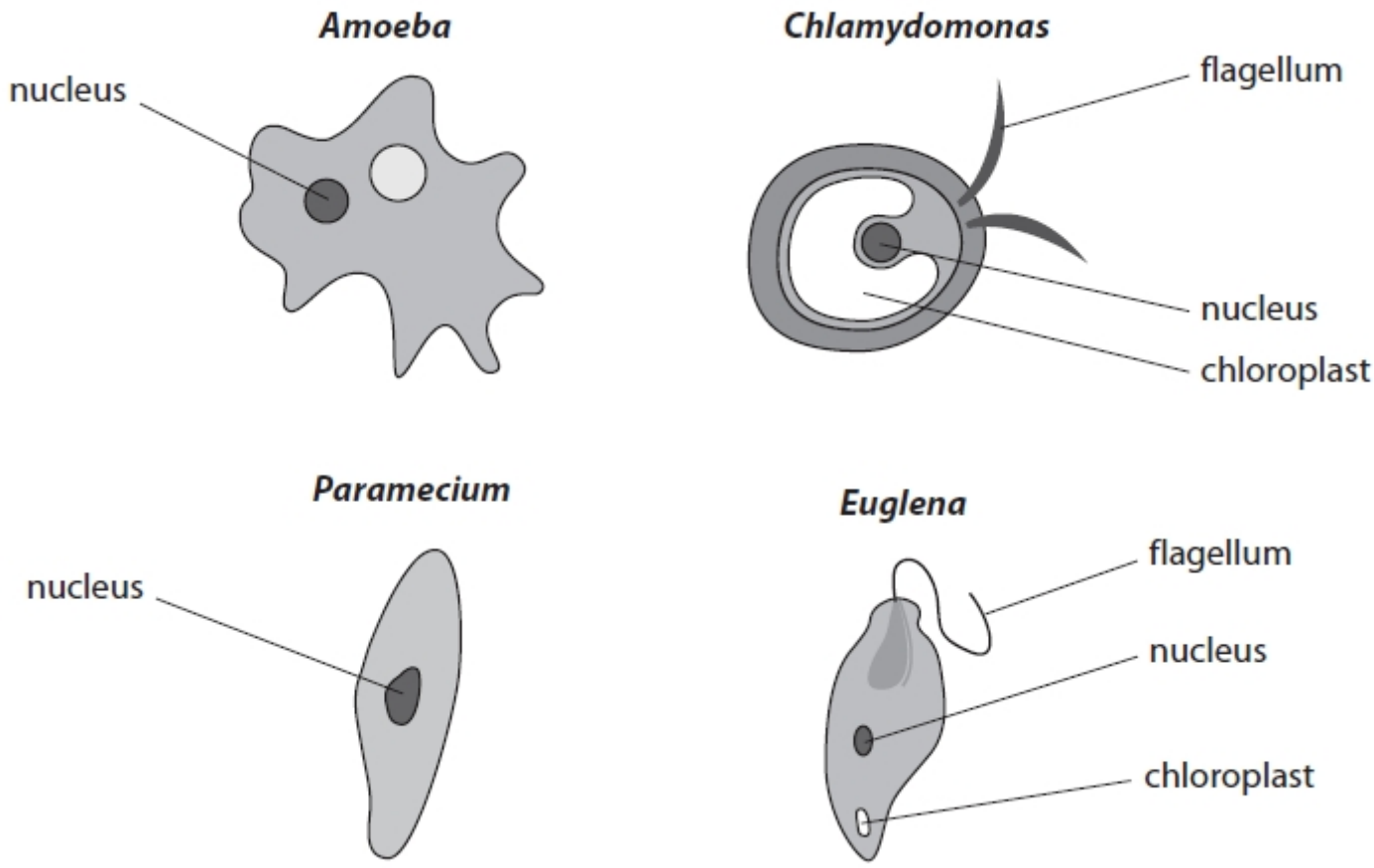
(Total for Question = 12 marks)

Q3.

(a) All the organisms in the diagram belong to one Kingdom.



(i) Which Kingdom do these organisms belong to?
Place a cross (☒) in the box next to your answer.

(1)

- ☒ **A** Animalia
- ☒ **B** Fungi
- ☒ **C** Protoctista
- ☒ **D** Prokaryotes

(ii) In which structure are the chromosomes of these organisms found?
Place a cross (☒) in the box next to your answer.

(1)

- ☒ **A** cilia
- ☒ **B** chloroplast
- ☒ **C** flagellum
- ☒ **D** nucleus

(iii) Suggest **one** reason why both *Euglena* and *Chlamydomonas* could be placed into the Kingdom Plantae.

(1)

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(b) (i) *Euglena* is unusual because it is both heterotrophic and autotrophic.

Explain how this helps *Euglena* to survive.

(3)

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(ii) A scientist discovered a new species of *Euglena* in boiling acidic mud in Costa Rica.
Explain how this discovery could be validated by the scientific community.

(2)

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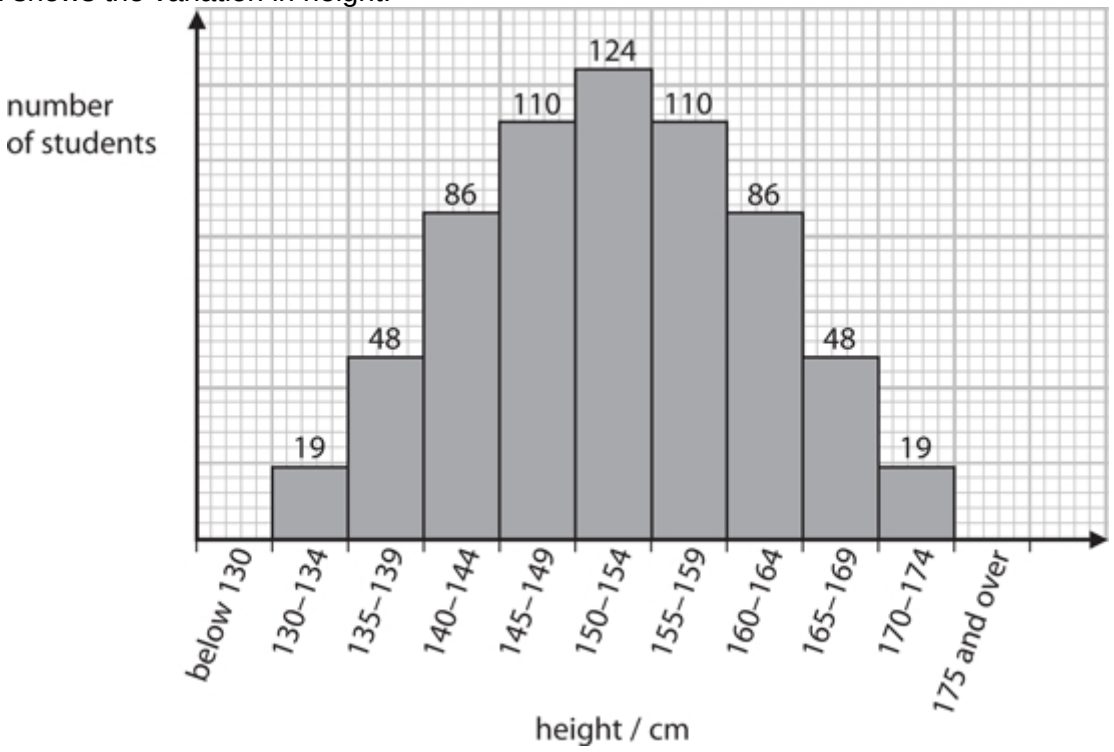
(Total for question = 8 marks)

Q4.

The graph shows the variation in height.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The range in heights of the students is due to

(1)

☒ **A** environmental influences only

☒ **B** genetic influences only

☒ **C** environmental and genetic influences

☒ **D** neither environmental nor genetic influences

(ii) Describe the variation in height of these students, as shown in the graph.

(3)

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(Total for Question = 4 marks)

Q5.

Taller animals may have an evolutionary advantage.

Explain how evolution by natural selection brings about changes in a species.

(3)

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(Total for Question = 3 marks)

Q6.

The table shows some of the enzymes involved in the digestion of starch, protein and fat, in three parts of the digestive system.

part of digestive system	substance digested	enzyme	products of digestion
mouth	starch	P	simple sugars
stomach	protein	R	molecule W
small intestine	fat	S	molecules Y and Z
	starch	Q	simple sugars

(a) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) Enzyme Q is produced by the

(1)

☒ **A** large intestine

☒ **B** liver

☒ **C** oesophagus

☒ **D** pancreas

(ii) Molecules Y and Z are **(1)**

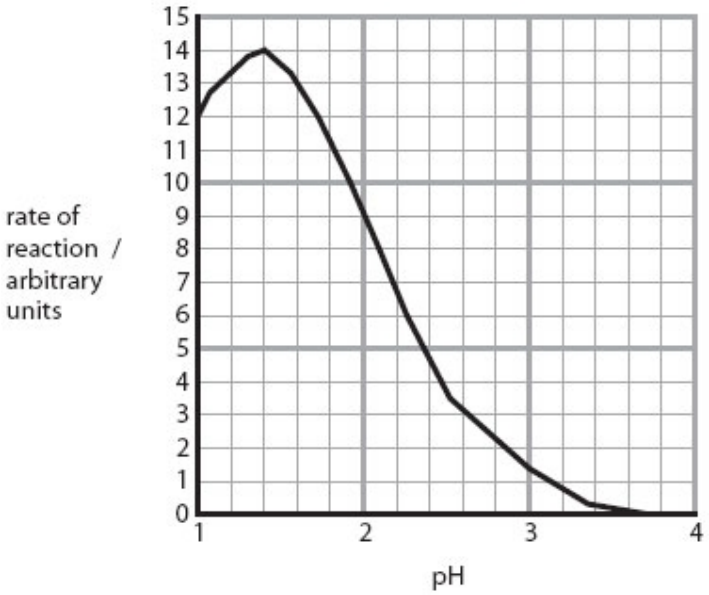
☒ **A** fatty acids and glucose

☒ **B** fatty acids and glycerol

☒ **C** lactic acid and glucose

☒ **D** lactic acid and glycerol

(b) The graph shows how pH affects the rate of the reaction catalysed by enzyme R.



(i) Name enzyme R.

(1)

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(ii) The rate of reaction can be determined by measuring how quickly molecule W is formed. Name molecule W.

(1)

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(iii) Calculate the difference in the rate of the reaction between pH 1 and pH 2.

(2)

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(iv) Suggest why this enzyme works better at pH 1 than at pH 2.

(2)

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(c) Explain the roles of bile in digestion.

(2)

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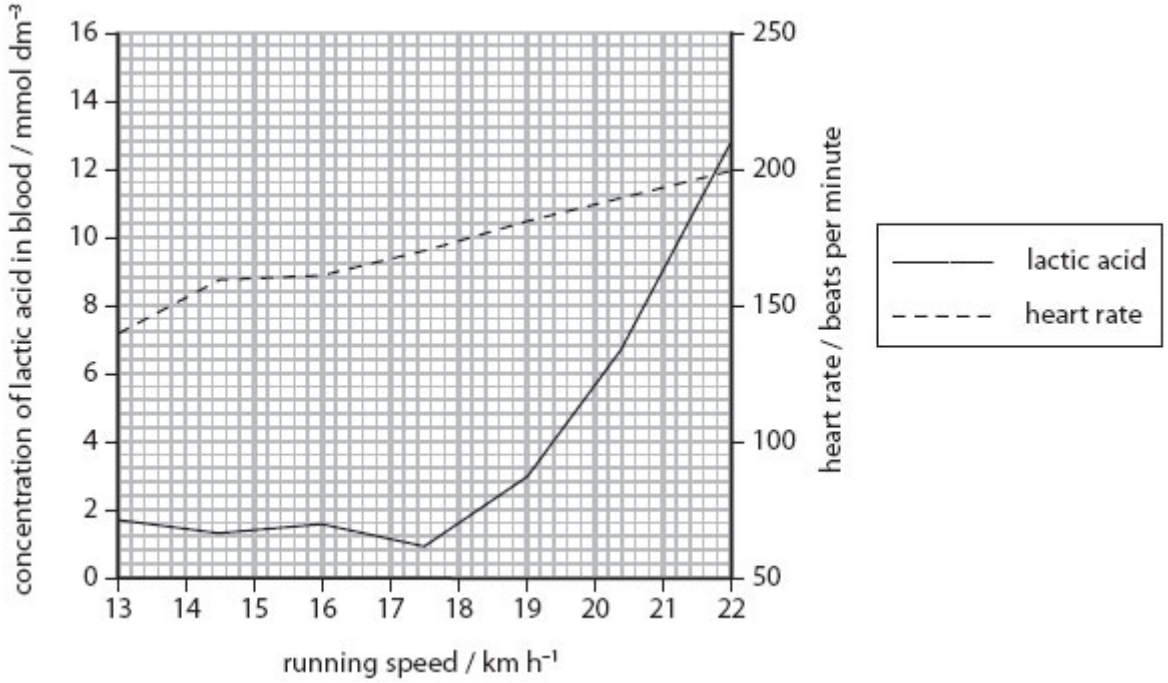
(Total for Question is 10 marks)

Q7.

In an investigation, a person ran at different speeds.

(a) The graph shows the concentration of lactic acid in the blood and the heart rate of this person while running.



(i) When the running speed is 22 km h^{-1}, the stroke volume of the runner is 0.18 dm^3.

Calculate the cardiac output of the runner using the equation.

cardiac output = stroke volume × heart rate

(2)

answer = ... dm^3 per minute

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the heart rate is at its maximum the concentration of lactic acid in the blood is

(1)

☒ **A** 11.2 mmol dm^{-3}

☒ **B** 12.8 mmol dm^{-3}

☒ **C** 200.0 mmol dm^{-3}

☒ **D** 210.0 mmol dm^{-3}

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The graph shows that

☒ **A** as the heart rate increases the concentration of lactic acid increases

☒ **B** as the concentration of lactic acid increases the heart rate decreases

☒ **C** the concentration of lactic acid increases as running speed increases

☒ **D** the concentration of lactic acid is not dependent on heart rate

(iv) Explain why the concentration of lactic acid changes at running speeds greater than 18 km h^{-1}.

(3)

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(b) After running the person rested.
Explain why the concentration of lactic acid in the blood changes whilst resting.

(3)

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(Total for Question is 10 marks)