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Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
June 2002
Advanced Subsidiary Examination



BIOLOGY (SPECIFICATION A)
Unit 2 Making Use of Biology

BYA2

Monday 27 May 2002 Morning Session

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

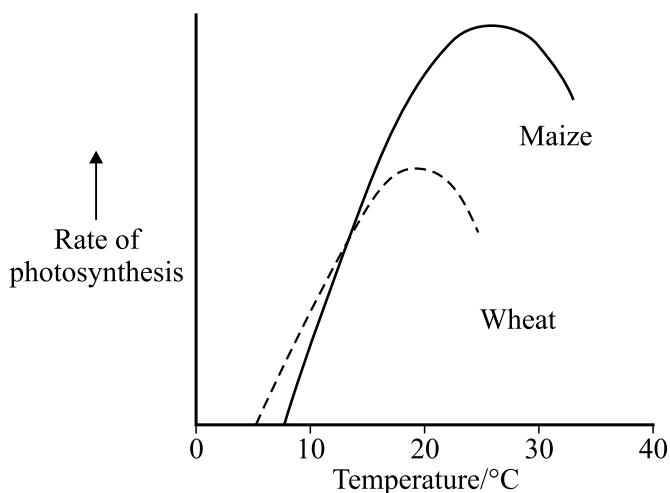
Information

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
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Total (Column 1) →			
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Examiner's Initials			

Answer **all** questions in the spaces provided.

- 1 The graph shows the effect of temperature on the rate of photosynthesis of maize and wheat.



- (a) (i) In collecting these data, light intensity was kept constant. Explain why.

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 (1 mark)

- (ii) Describe and explain the effect of temperature on the rate of photosynthesis of these two crop plants.

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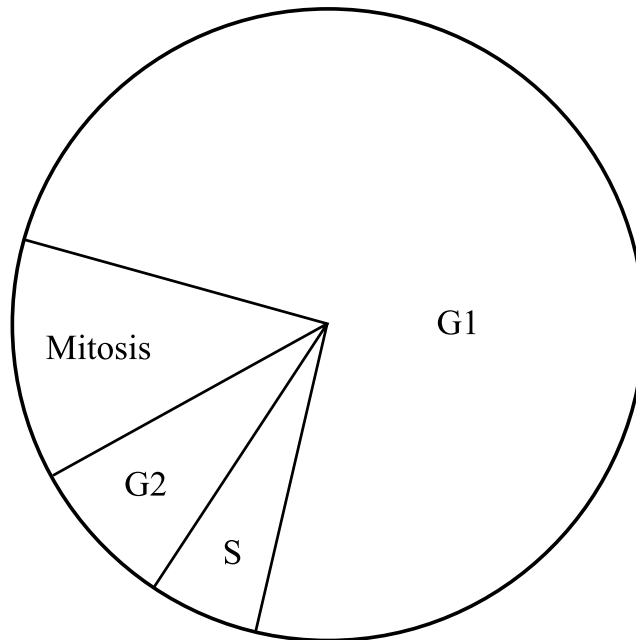
 (2 marks)

- (b) Explain why maize is grown in preference to wheat in many tropical countries.

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 (2 marks)

2 The diagram shows some of the different stages in the cell cycle.



(a) There are 20 units of DNA in a cell during stage G2. Give the number of units of DNA you would expect to find in this cell

- (i) at prophase of mitosis;
- (ii) in one of the daughter cells produced at the end of mitosis;
- (iii) during stage G1.

(3 marks)

(b) Vincristine is a drug used in the treatment of cancer. It prevents spindle formation during mitosis.

- (i) Explain how treatment with vincristine will affect the behaviour of chromosomes during mitosis.

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(2 marks)

- (ii) People who are given vincristine to treat cancer have a reduced number of red blood cells. Suggest a reason for this.

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(1 mark)

3 (a) (i) What is meant by *biological control*?

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(1 mark)

(ii) Give **two** characteristics of a successful biological control agent.

1

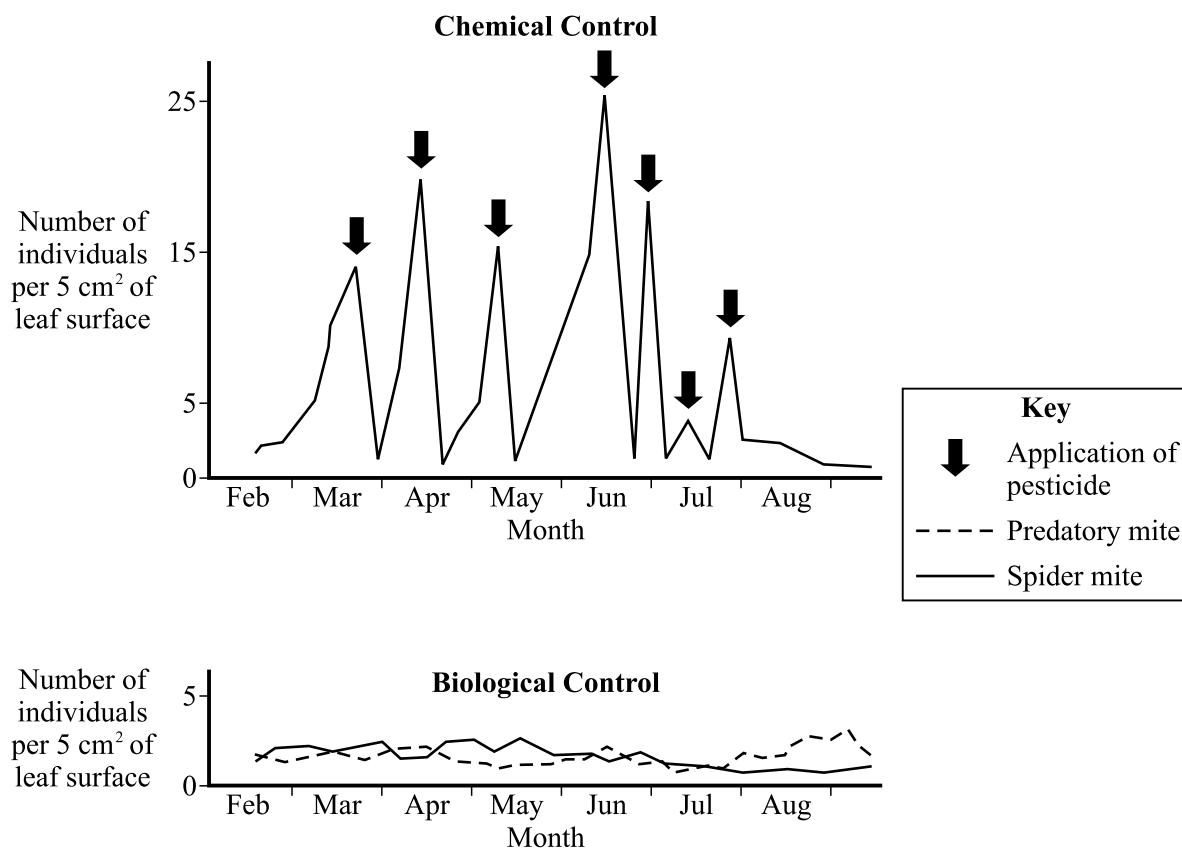
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2

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(2 marks)

Spider mites are pests which cause damage to cucumbers that are grown in glasshouses. The graphs show the results of an investigation into different ways of controlling spider mites. In one glasshouse, spider mites were treated with pesticides. In another glasshouse, a predatory mite was used as a biological control agent.



- (b) Which method of controlling spider mites was more effective? Give evidence from the graphs to support your answer.

Method:

Evidence:

.....

.....

(2 marks)

- (c) Neither method gets rid of the spider mites completely. Explain the reason for this for:

(i) chemical control;

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(ii) biological control.....

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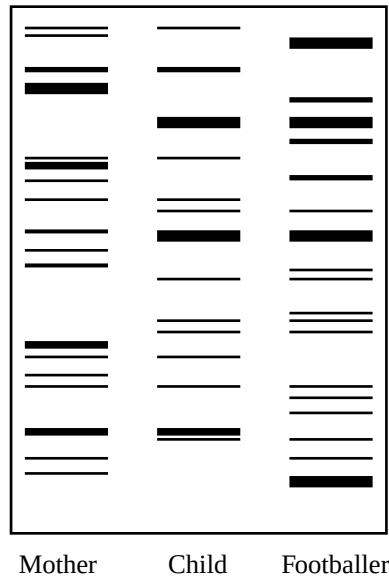
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(3 marks)

8

TURN OVER FOR THE NEXT QUESTION

- 4 A woman accused a wealthy footballer of being the father of her child. He said that he was not. To settle the issue, genetic fingerprinting was carried out on DNA from the mother, the child and the footballer. The genetic fingerprints from this test are shown in the diagram.



- (a) Do the results indicate that the footballer is the father of the child? Explain your answer.

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 (1 mark)

- (b) Explain why all the DNA samples are cut using the same restriction enzyme.

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 (1 mark)

- (c) A probe is used to locate the bands of DNA. Explain why the probe must be radioactive.

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 (2 marks)

- (d) Some animals are known as endangered species because there is only a small number of individuals left in the wild. Zoos may try to increase the number of these animals by breeding them in captivity. For greater success, a breeding pair should be unrelated. Explain how genetic fingerprints can be useful in selecting animals for breeding.

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(1 mark)

- 5 Fruit juices, such as apple juice, contain pectin. Pectin is a complex carbohydrate which can cause fruit juice to thicken and appear cloudy. Manufacturers of fruit juices often use the enzyme pectinase to overcome these problems. The fruit juice is passed through a column packed with immobilised pectinase and the pectin is broken down to smaller, soluble molecules.

- (a) Pectinase is an extracellular enzyme secreted by a fungus. Describe how pectinase could be produced industrially, starting with a pure culture of the fungus.

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(3 marks)

- (b) Give **two** advantages of immobilising the pectinase used in this process.

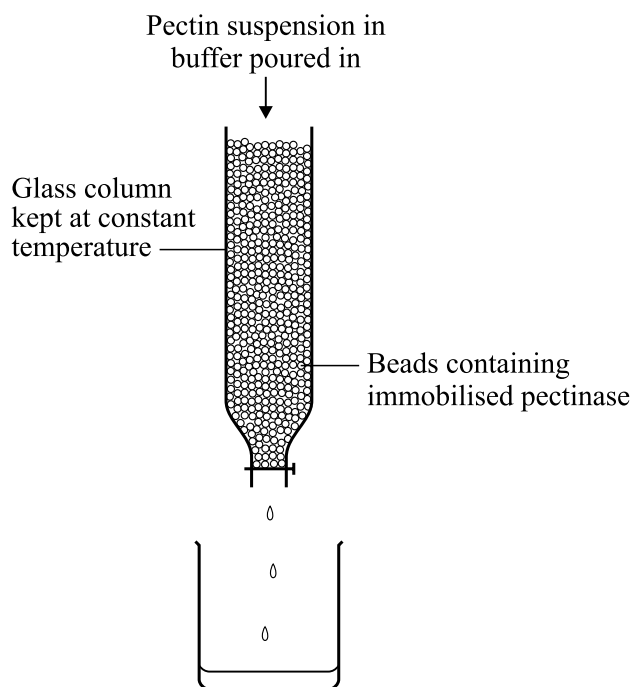
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 2

(2 marks)

QUESTION 5 CONTINUES ON THE NEXT PAGE

- (c) In an investigation, immobilised pectinase was placed in a glass column. A pectin suspension was passed through it.

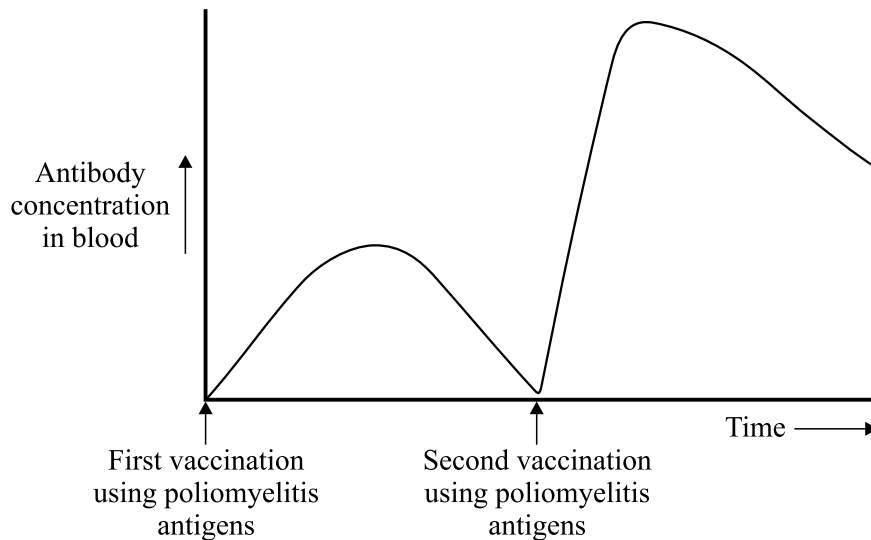


Give **three** factors, other than temperature and pH, which would affect the rate of pectin breakdown in this investigation.

- 1
- 2
- 3

(3 marks)

- 6 A child was given two vaccinations consisting of antigens from the virus which causes poliomyelitis. The graph shows the concentration of antibodies resulting from these vaccinations.



- (a) What is a poliomyelitis antigen?

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(2 marks)

- (b) Describe and explain the difference in the child's response to the two vaccinations shown in the graph.

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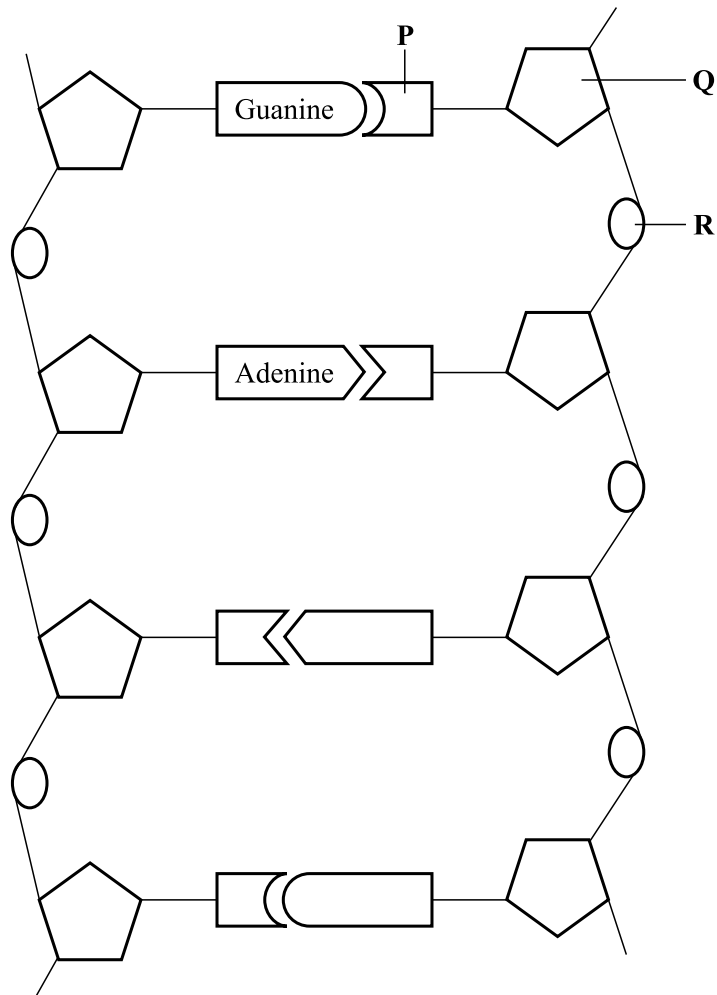
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(3 marks)

7 The diagram shows a section of a DNA molecule.



(a) Name parts **P**, **Q** and **R**.

P

Q

R

(2 marks)

(b) Explain why DNA replication is described as *semi-conservative*.

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(2 marks)

- (c) Complete the table to give **two** ways in which the structure of DNA differs from the structure of mRNA.

DNA	mRNA

(2 marks)

- (d) A piece of DNA was analysed. 15% of its nucleotides were found to contain guanine. What percentage of its nucleotides would you expect to contain adenine? Show your working.

Answer

(2 marks)

- 8 Some snakes produce poisonous venom. Different poisonous snakes produce different types of venom. A person who has been bitten by a particular species of poisonous snake may be treated with the appropriate antivenom. Antivenoms consist of antibodies against venom. They are made by injecting an animal such as a horse with increasing doses of snake venom.
- 5 The antibodies the horse produces are then extracted and purified.

The Brazilian pit-viper is an extremely poisonous snake. The main component of its venom is jararhagin. Jararhagin is a protein which breaks down tissues, rapidly causing the death of any animal which has been bitten.

- 10 DNA technology may soon provide a better way of making antivenom. Instead of injecting animals with venom, they are injected with DNA. In one trial antivenom was produced by injecting DNA, coding for jararhagin, into cells in mice. The mice responded by producing antibodies to the jararhagin.

- (a) (i) Describe how an animal, such as a horse, makes antibodies when it has been injected with snake venom (lines 4–5).

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(3 marks)

- (ii) When a person is bitten by a poisonous snake, doctors try to identify the snake so that the correct type of antivenom can be used. Explain why the bite of a particular species of poisonous snake must be treated with the correct type of antivenom.

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(2 marks)

- (b) (i) The amino acid sequence of jararhagin is known. Explain how this information would enable a biologist to make an artificial gene which coded for jararhagin.

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(2 marks)

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[illegible]

15

- 9 (a) Describe how hormones are involved in the development and release of egg cells from the ovary of a mammal.

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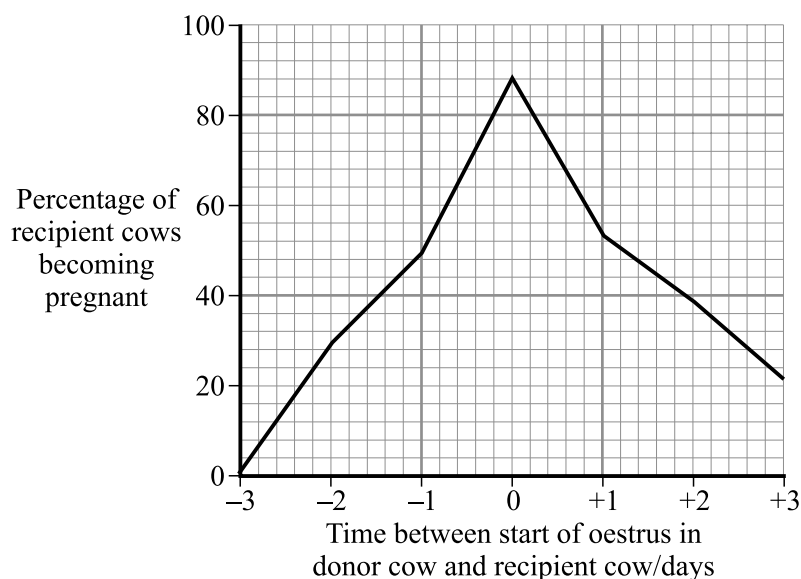
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(6 marks)

- (b) Cattle breeders use hormones to produce a large number of embryos from a donor cow. The embryos are collected from this donor cow and inserted into the uteruses of recipient cows. For this technique to be successful, the oestrous cycle of the donor cow must be synchronised with the oestrous cycles of the recipient cows. The graph shows the results of an investigation into the effect of synchronising oestrous cycles on the percentage of successful pregnancies in the recipient cows.



On the graph, a figure of 0 on the x-axis indicates that the recipient cow and the donor cow begin oestrus on the same day. A value of -2 indicates that the recipient cow began oestrus two days after the donor cow.

- (i) In a group of 7 cows, what number would you expect to become pregnant if their cycles were synchronised with the donor cow? Show your working.

Answer
(2 marks)

- (ii) The percentage of successful pregnancies was low when the recipient cow started oestrous three days after the donor cow. Explain why.

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(2 marks)

QUESTION 9 CONTINUES ON THE NEXT PAGE

- (c) In another investigation, a group of female pigs was given hormone injections as soon as they had stopped feeding their piglets. A control group was not given hormone injections. Some of the results of this investigation are shown in the table.

	Hormone-treated group	Control group
Mean number of days between stopping feeding their piglets and oestrus	4.8	5.4
Mean number of embryos produced in the next pregnancy	15.5	10.1
Mean number of piglets born	11.3	9.3

- (i) Name **one** hormone which could have been used to inject the hormone-treated group. Explain the evidence from the table which supports your answer.

Hormone

Evidence

.....
(2 marks)

- (ii) Use the information in the table to explain **two** reasons why this hormone treatment may be profitable for farmers.

Reason 1

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Reason 2

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(2 marks)

- (iii) Suggest and explain **one** possible disadvantage of giving this hormone treatment to pigs.

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(1 mark)

END OF QUESTIONS