General Certificate of Education
June 2008
Advanced Subsidiary Examination

HUMAN BIOLOGY (SPECIFICATION A)   **BYA3 R**
Unit 3   Pathogens and Disease

AQA
ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Tuesday 3 June 2008   9.00 am to 10.30 am

For this paper you must have:
- a ruler with millimetre measurements.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked**.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

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

1 The diagram shows a stage in protein synthesis.

Organelle **X**

tRNA

C G A U A G U A U C A U

Part of a molecule of mRNA
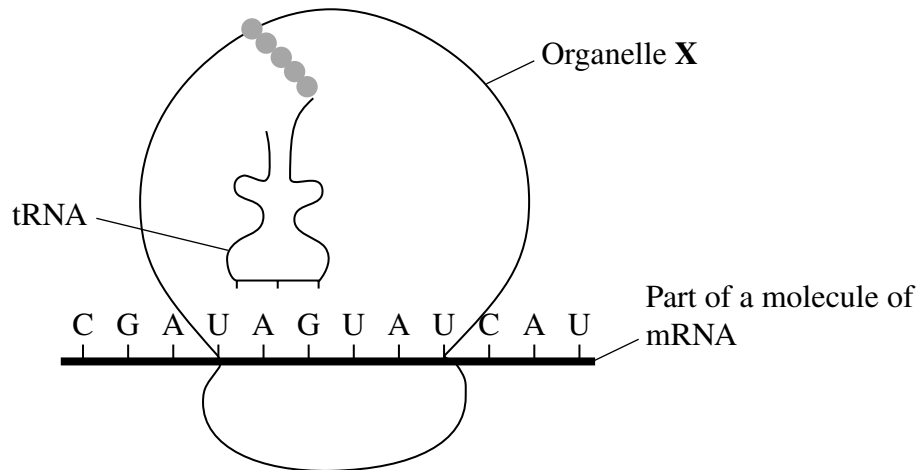
1 (a) (i) Name organelle **X**.

....
(1 mark)

1 (a) (ii) Give the anticodon of the tRNA molecule.

....
(1 mark)

1 (a) (iii) Give the DNA code that would produce the mRNA base sequence shown in the diagram.

....
(1 mark)

1 (b) Kanamycin is a drug that kills cells by interfering with translation. It binds to mRNA and causes a base to be missed out during translation.

Explain how kanamycin causes cells to produce non-functional proteins.

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(2 marks)

Turn over for the next question

Turn over ▶

2 The photographs show several stages in mitosis.

The photographs cannot be reproduced here
due to third-party copyright constraints.

2 (a) Starting with **B**, put the stages in the correct sequence.

   B
   …………   …………   …………   …………   *(1 mark)*

2 (b) Explain the arrangement of the chromosomes in stage **A**.

   ....

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                                                                                                              (2 marks)

2 (c) Photographs of all the chromosomes in a cell can be useful to see if the chromosomes of an unborn baby are normal.

Some cells are collected, usually from the fluid in which the unborn baby is growing. These cells are stimulated to divide by mitosis. Next, a substance is added which inhibits the formation of the spindle. The cells are examined using a microscope and then photographed.

Suggest why it is important

2 (c) (i) that the cells examined with the microscope are dividing by mitosis.

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....
(1 mark)

2 (c) (ii) to inhibit the formation of the spindle.

....

....
(1 mark)

5

Turn over for the next question

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*

3 (a) People with pancreatitis have high concentrations of digestive enzymes, such as amylase, in their blood. Explain why.

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(2 marks)

3 (b) Doctors investigated the effectiveness of two drugs used to treat pancreatitis. Patients with pancreatitis were divided randomly into two groups. One group was given drug **A** and the other group was given drug **B**. The concentration of amylase in the blood of each patient was then measured every day. The results are shown in the graph.

Mean concentration of amylase in blood/units per dm^3

Key
- - - - - Drug **A**
———— Drug **B**

Time/days
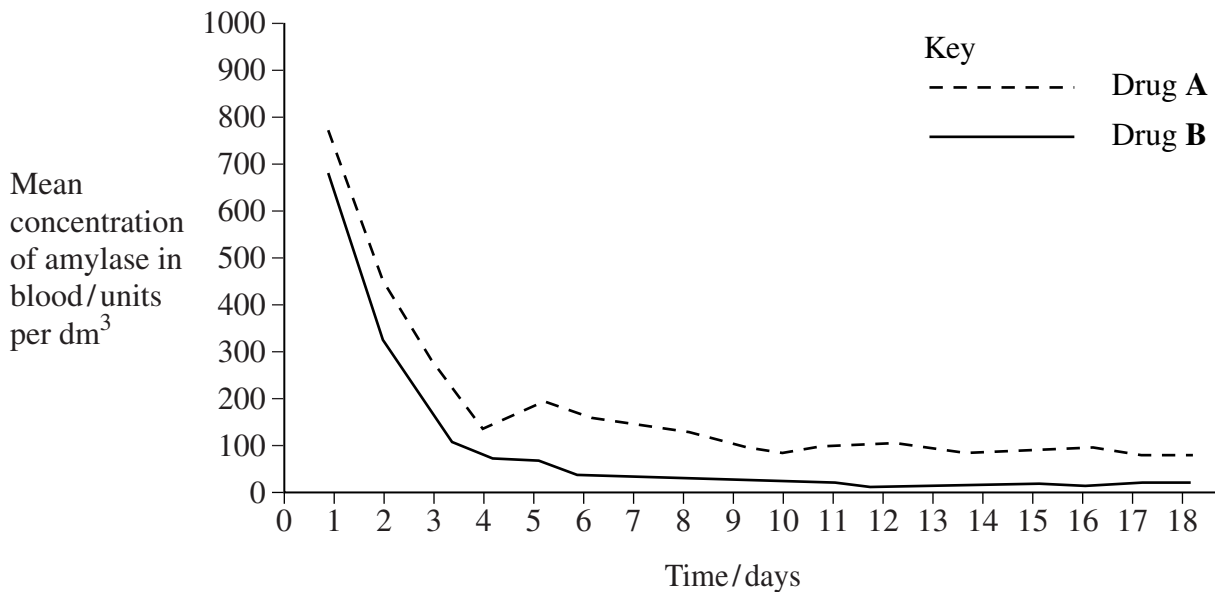
3 (b) (i) It was important that the patients were placed into the groups at random. Explain why.

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(1 mark)

3 (b) (ii) The doctors did not know which of the drugs each patient was given. Suggest why this was important.

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(1 mark)

3 (b) (iii) In many drug investigations, a control group is given a placebo (dummy pill). In this investigation, the control group was **not** given a placebo. Suggest why.

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(1 mark)

3 (b) (iv) The doctors concluded that drug **B** was more effective than drug **A**. Use the graph to explain why.

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(2 marks)

7

Turn over for the next question

Turn over ▶

4 Cervical cancer is cancer of the cervix (the neck of the uterus).

A study showed that the incidence of cervical cancer in the UK fell between 1993 and 2004.

Regular cervical smear tests are one reason for a fall in the number of cases of cervical cancer in the UK. In this test, a sample of cells is taken from the cervix and examined under a microscope. Pre-cancerous cells can be detected at an early stage. These are abnormal cells which may develop into cervical cancer cells.

4 (a) Explain why cancer is more likely to be treated successfully if it is diagnosed at an early stage.

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(2 marks)

4 (b) Most cases of cervical cancer are caused by strains of the Human Papilloma Virus (HPV). The virus is spread through sexual intercourse.

A vaccine has been produced that protects women from some strains of HPV. It is being offered to girls in their early teens. Scientists hope that it will reduce the incidence of cervical cancer.

4 (b) (i) The vaccine may not be effective against every strain of HPV. Explain why.

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....
(2 marks)

4 (b) (ii) Some people think that the vaccine should be offered to boys as well as girls, even though boys cannot develop cervical cancer.

Suggest **one** advantage of giving the vaccine to boys.

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(1 mark)

5

5 Anthrax is a disease that affects both humans and cows. Anthrax antibodies can be used to treat anthrax.

Scientists get anthrax antibodies from cows that have been vaccinated against anthrax.

5 (a) Cows that have been given anthrax vaccine produce antibodies against the disease. Explain how.

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(3 marks)

(Extra space) ....

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5 (b) Cows produce more antibodies if they have been vaccinated against anthrax several times. Explain why.

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(2 marks)

Turn over ▶

6 Some students used a haemocytometer to count the number of cells in a sample from a yeast culture. The diagram shows the yeast cells in a typical triple-lined square.
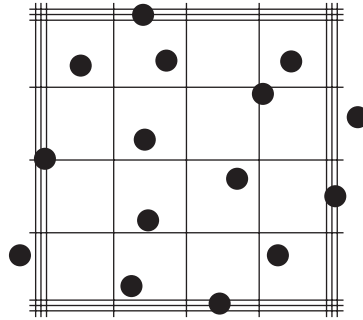
The triple-lined square measures 0.2 mm by 0.2 mm and the haemocytometer is 0.1 mm deep.

6 (a) (i) How many yeast cells are there in this triple-lined square?

....
(1 mark)

6 (a) (ii) Calculate the number of yeast cells in 1 mm^3 of this culture. Show your working.

Answer .... cells mm^{-3}
(3 marks)

6 (b) Sterile techniques must be used when using a haemocytometer with bacteria instead of yeast. Give **two** examples of these sterile techniques.

1 ....

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2 ....

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(2 marks)

6

Turn over for the next question

Turn over ▶

7 (a) The table has some information about pathogens that cause disease.

Complete the table.

Name of pathogen	Type of pathogen	Disease caused	How pathogen enters body
	Bacterium	Tuberculosis	
		AIDS	By having unprotected sex with an infected partner
Salmonella		Food poisoning	
	Protoctist	Malaria	

(4 marks)

7 (b) (i) Give **two** symptoms of *Salmonella* food poisoning.

1 ....

2 ....

(1 mark)

7 (b) (ii) A person is more likely to develop *Salmonella* food poisoning from food that has been left in a warm room for a few hours, than from food that has been refrigerated. Explain why.

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(2 marks)

7

8 (a) (i) What is atheroma?

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(2 marks)

8 (a) (ii) Atheroma can lead to the formation of a blood clot. Explain how a blood clot may lead to a myocardial infarction.

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(2 marks)

8 (b) A diet that is high in saturated fats can increase the risk of atheroma development. Give **two** other factors that increase the risk of atheroma development.

1 ....

2 ....
(1 mark)

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Turn over for the next question

Turn over ▶

*Areas outside
the box will
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9 Read the following passage.

Scientists discovered a protein in milk. This protein had antibacterial properties.
They extracted the protein and determined its amino acid sequence. This information
allowed them to make the gene for the protein. A vector was used to insert this gene
into rice cells, together with a marker gene.

The scientists hope to use the genetically modified rice to make drinks that would   5
combat diarrhoea. Diarrhoea is often caused by bacterial infections, and is a major
killer of children worldwide. Many tests, however, would need to be carried out
before the rice drinks could be sold to consumers.

The scientists have been given permission to plant a trial field of the genetically
modified rice. They were told, however, that the trial field had to be a long way   10
from any commercial rice farm.

Use information from the passage and your own knowledge to answer the following
questions.

9 (a) Scientists know the order of amino acids in the milk protein (line 2).
Explain how they can use this information to obtain a gene that codes for this protein.

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(2 marks)

9 (b) (i) A vector was used to insert the new genes into rice cells (lines 3 and 4). Explain
what is meant by a *vector*.

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(1 mark)

9 (b) (ii) A marker gene was used in genetically modifying the rice (line 4). Explain why.

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(2 marks)

9 (c) Many tests would be needed before the rice drinks could be sold to consumers (lines 7 and 8). Give **two** reasons why these tests would be needed.

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2 ....

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(2 marks)

9 (d) The genetically modified rice will be grown a long way from any commercial rice farms (lines 10 and 11). Explain why this is important.

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(2 marks)

Question 9 continues on the next page

Turn over ▶

9 (e) Describe how the rice cells produce the milk protein from the inserted gene.

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(6 marks)

(Extra space) ....

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15

10   (a)   Describe the adaptations of *Schistosoma* to its parasitic way of life.

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(6 marks)

(Extra space) ....

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Question 10 continues on the next page

Turn over ▶

10 (b) Scientists investigated the effect of praziquantel on reducing schistosomiasis in children. They tested 800 children to see if their urine contained *Schistosoma* eggs. They then gave each child 40 mg per kg of body mass of praziquantel. Over the next year, the scientists examined the children's urine for *Schistosoma* eggs.

10 (b) (i) Children are more likely than adults to become infected with schistosomiasis. Explain why.

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(1 mark)

10 (b) (ii) Explain why the scientists chose to examine a sample of urine for the presence of eggs.

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(2 marks)

10 (b) (iii) Suggest why the scientists calculated the dose of praziquantel per kilogram of body mass.

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(2 marks)

10 (c) The table shows some data from this investigation.

Time after treatment/ weeks	0	3	16	41	52	61
Percentage of children infected	68	28	18	13	20	35
Mean reduction in number of eggs in urine of infected children/%	–	95.3	97.5	97.9	96.0	89.4

10 (c) (i) Calculate the number of children who were uninfected at the start of the investigation. Show your working.

Number of children .... *(2 marks)*

10 (c) (ii) Use the data to suggest how often children should be given praziquantel to treat schistosomiasis. Explain your answer.

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(2 marks)

15

END OF QUESTIONS

There are no questions printed on this page

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