

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Education
 June 2007
 Advanced Subsidiary Examination



SCIENCE FOR PUBLIC UNDERSTANDING
Unit 1 Issues in the Life Sciences

SPU1

Friday 8 June 2007 9.00 am to 10.15 am

You will need no other materials.
 You may use a calculator.

Time allowed: 1 hour 15 minutes

Instructions

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

Information

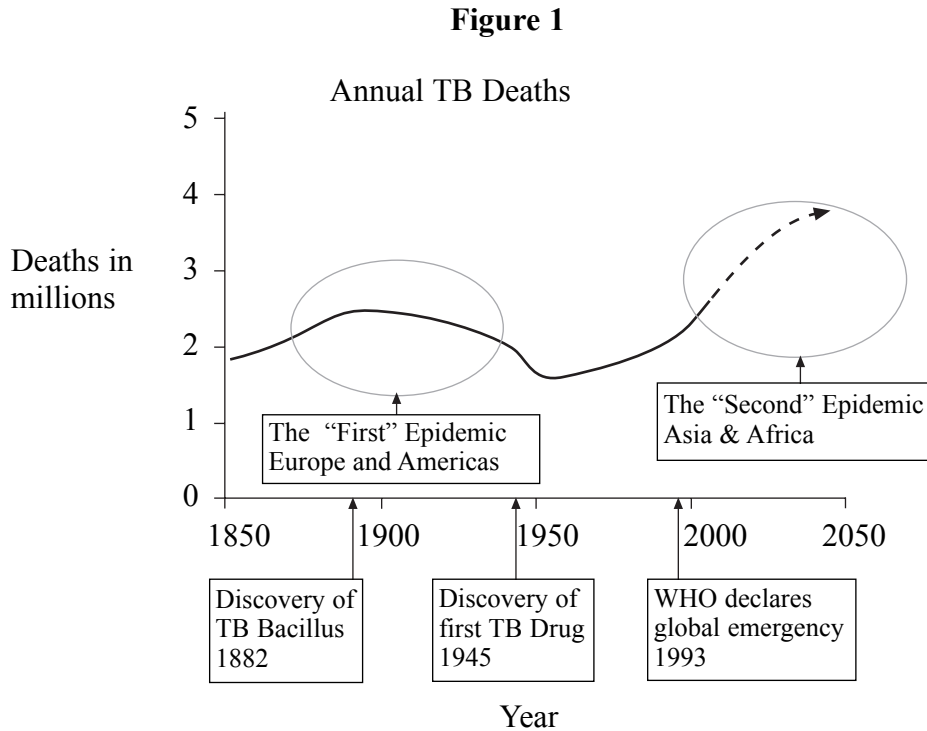
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- Questions 1(c)(ii) and 4(d) should be answered in continuous prose. In these questions you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
4			
5			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



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

- 1 Tuberculosis, TB, is an infectious disease caused by bacteria. TB is mainly transmitted in droplets by coughing and spitting. **Figure 1** shows one estimate of the number of deaths from TB worldwide over the 200 years from 1850 to 2050.



- (a) (i) Suggest **one** reason for the rise in TB deaths in Europe and the Americas between 1850 and 1890.

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 (1 mark)

- (ii) Deaths from TB started to fall soon after the discovery of the TB bacterium in 1882. Suggest **one** way in which this discovery may have contributed to the fall.

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 (1 mark)

- (iii) Drugs that cure TB have been available since 1945. Suggest **one** reason why deaths from TB in Asia and Africa continue to rise despite this.

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 (1 mark)



(b) TB can be treated by antibiotics. These must be taken for about 6 months to cure completely the TB but patients feel better long before this. Between 1% and 10% of new TB cases are resistant to at least one of the commonly used antibiotics.

(i) One commentator wrote, "From a public health perspective, incomplete treatment of TB is worse than no treatment at all." Why might she write that?

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(2 marks)

(ii) Explain why resistance is less likely to develop if a combination of different antibiotics is taken.

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(2 marks)

(c) There is a vaccine against TB, known as BCG.

(i) Explain how a vaccine works to prevent infection.

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(2 marks)

Question 1 continues on the next page



(ii) The BCG vaccine is not very effective, particularly in regions of the world where the incidence of TB is growing fastest.

Recently there has been research to develop a better vaccine. Several vaccines have been tested on animals and are now undergoing trials in healthy volunteers.

If a friend was thinking of volunteering for a trial of a new TB vaccine as a healthy volunteer would you encourage or discourage them?

Present the arguments you would use.

Two of the 6 marks in this question are available for the quality of your written communication.

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(6 marks)

15



- 2 Cardiovascular disease, CVD, includes heart attacks and strokes. CVD is the largest single cause of death in the UK. Statins are medicines that, when taken regularly over a long period of time, reduce the risk of CVD. Statins work by reducing the level of cholesterol in the blood.

In 2006 the UK Government decided that all those who had a risk of 20% or more of developing CVD within the next 10 years should be prescribed statins on the NHS.

- (a) Name **two** risk factors, other than cholesterol levels, that affect the risk of CVD.

.....

.....

(1 mark)

- (b) (i) For a particular group of men, the risk of developing CVD over the next ten years is estimated to be 20%. Of a sample of 1000 men in this group, how many would you expect to develop CVD within a ten year period?

.....

(1 mark)

- (ii) If all these 1000 men take statins their risk is reduced by 21%. How many of the men on statins would you expect to develop CVD?

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(1 mark)

- (iii) What percentage of the sample of 1000 men would you therefore expect to be saved from CVD by taking statins?

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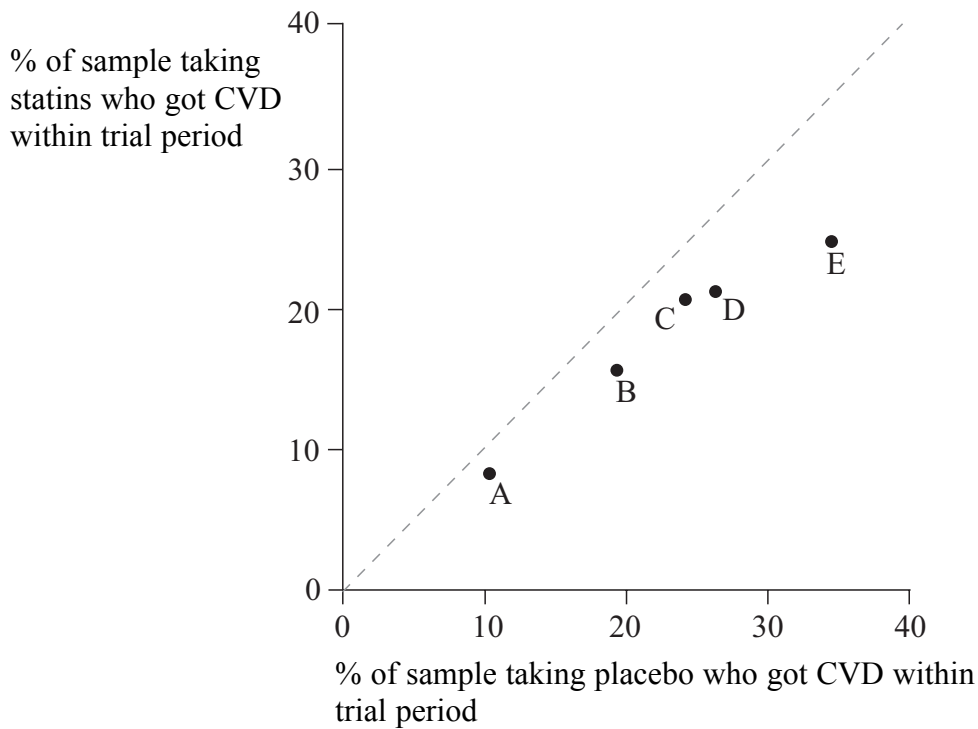
(1 mark)

Question 2 continues on the next page



(c) **Figure 2** shows the outcome of five randomised controlled trials of statins.

Figure 2



(i) What is meant by a randomised controlled trial?

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.....

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(2 marks)

(ii) Which of the trials was done on the population with the greatest risk?

.....

(1 mark)

(iii) Which of the trials shows the greatest benefit from statins?

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(1 mark)



(d) The cost of extending a person’s life by one year through prescribing statins has been estimated for groups of people with different levels of risk. For someone with a 30% risk of CVD over 10 years it is £10 000. For someone of the same age with a 5% risk the cost rises to £31 000.

(i) Explain why it costs so much more to extend life amongst the group with a lower risk of CVD.

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(2 marks)

(ii) Statins reduce the risk of dying from CVD even for those with risks as low as 5%. Why do you think the UK government has decided that it will not pay for treatment below a risk of 20%?

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(1 mark)

(e) If the government changed this policy and decided to pay for the treatment of everyone whose risk of CVD is greater than 5% over 10 years, it would involve giving statins to about 40% of those over 40 years of age.

Suggest **two** reasons why this might **not** be a good decision for the overall health of the UK population.

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(2 marks)



- 3 Many people believe that food additives (colourings and preservatives) affect children's behaviour but evidence has been contradictory. A research study was carried out on 227 three-year-old children. About 40% of parents who were approached consented to the complete study.

The study was organised as shown in **Figure 3**.

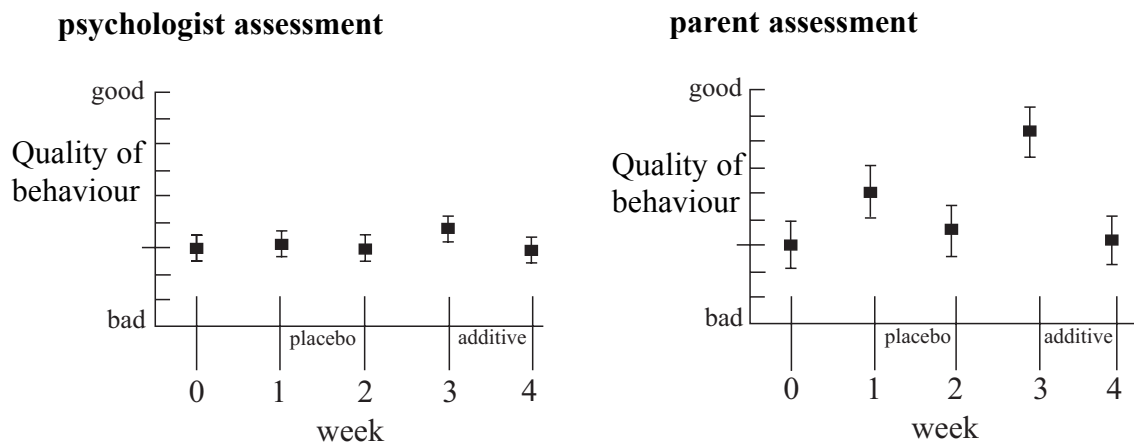
Figure 3

	Week 1	Week 2	Week 3	Week 4
Normal diet	no additives in normal diet	no additives in normal diet	no additives in normal diet	no additives in normal diet
Drinks given as part of study		fruit drinks with no additives		fruit drinks with 5 additives

- The children's behaviour was assessed, before the study started (week 0) and at the end of each week, by their parents and by psychologists.
- Parents, children and psychologists did not know whether the fruit drinks given in week 2 and week 4 contained additives or not.

Some of the results are shown in **Figure 4**.

Figure 4



- (a) What was used as a placebo, to compare the effects of additives and no additives on children's behaviour?

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(1 mark)



(b) The assessments by the psychologists and the parents were very different.

(i) Discuss which is likely to be the more accurate assessment.

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(2 marks)

(ii) There is a danger in studies of this kind that people's expectations can affect their assessments. Is there any evidence of this in the data in **Figure 4**? Explain your answer.

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(2 marks)

(iii) Does the data in **Figure 4** suggest that additives have an effect on children's behaviour? Justify your answer.

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(2 marks)

(iv) The uncertainty in the data in **Figure 4** is indicated by the length of the vertical bars. Suggest **one** change to the study that might have reduced the uncertainty.

.....

(1 mark)

Question 3 continues on the next page



(c) A newspaper reported the results of this research as shown in **Figure 5**.

Figure 5

Additives ‘make children behave badly’

Additives used in hundreds of children’s foods and drinks can cause temper tantrums and disruptive behaviour, researchers found. The government-funded study confirms what many parents have long suspected. Colourings could spark behaviour changes in many toddlers.

Is the newspaper article a fair reflection of the findings of this study? Explain your answer.

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(2 marks)

(d) What do you think would be a sensible reaction to this study

(i) by the Food Standards Agency who paid for it,

.....

.....

(1 mark)

(ii) by parents?

.....

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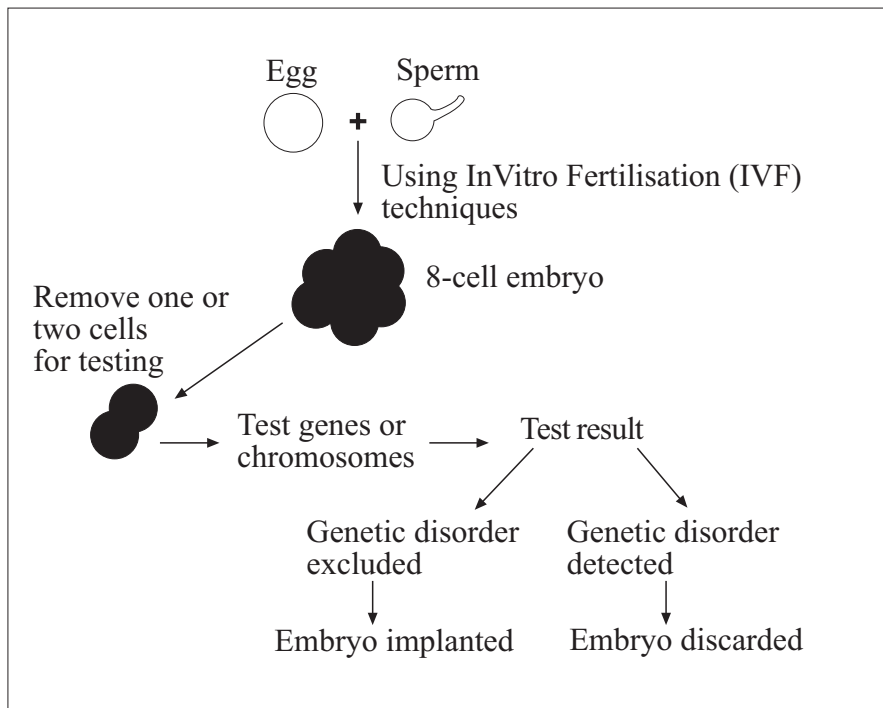
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(2 marks)



- 4 **Figure 6** shows the process of Preimplantation Genetic Diagnosis, PGD, which can be used to prevent the birth of babies carrying serious genetic diseases such as cystic fibrosis or sickle cell anaemia.

Figure 6



- (a) A child has about 10 000 billion cells. Explain how a single cell removed from the 8-cell embryo can contain information relevant to the future health of the whole child.

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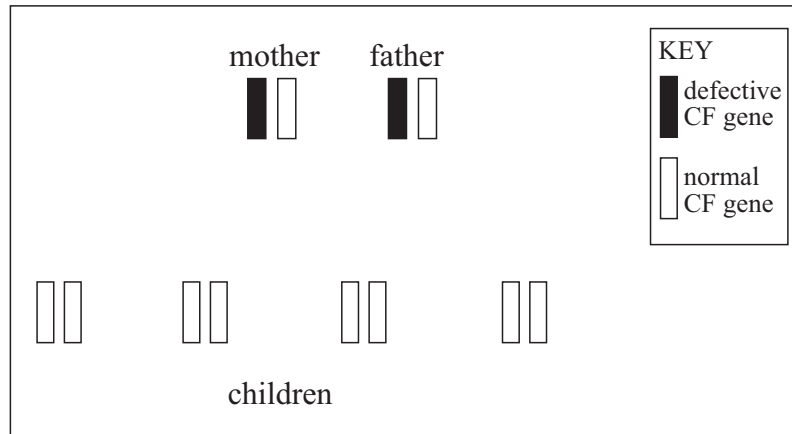
(1 mark)

Question 4 continues on the next page



- (b) **Figure 7** represents the genes for cystic fibrosis in a healthy couple who are both carriers of the defective CF gene. A person with two defective CF genes will develop the disease.

Figure 7



- (i) Complete **Figure 7** to show **all** the possible combinations of CF genes in their 4 children. (2 marks)
- (ii) Identify on **Figure 7** which of these children will develop cystic fibrosis. (1 mark)
- (c) Doctors normally test the genes of the developing fetus again during the early part of the pregnancy.

- (i) Name or describe a technique they would use to do this.

.....

(1 mark)

- (ii) Why would they need to do this further test?

.....

(1 mark)



5 Kenya is short of food. Its population is growing at about 3.5% a year whilst food production is only growing at 2.5%.

The main reasons for low crop yields are:

- lack of water
- plant and insect pests and expensive pesticides
- poor soil and the high cost of fertiliser.

There is some hope that the technology of genetic modification, GM, could increase food production.

- Insect Resistant Maize for Africa, IRMA, is a research project based in Kenya.
- The researchers have genetically modified maize so that the plants produce a natural insecticide normally found in a bacterium. This maize is known as ‘Bt maize’.

(a) Explain the process of GM by which the insecticide-producing gene is introduced into the maize to create ‘Bt maize’.

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(2 marks)

(b) How would this ‘Bt maize’ benefit poor farmers?

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(2 marks)

(c) The researchers grew the maize in a special bio-safety greenhouse to test its effectiveness before they were allowed to plant it in an open field.

Give **one** risk they were avoiding by confining the maize to a greenhouse.

.....

.....

(1 mark)



- (d) A recent United Nations report warned that GM crops may not be a ‘technological quick fix’ for Africa’s hunger and poverty problems.

Give **two** reasons why GM crops might **not** be able to make a large contribution to reducing food shortages in Kenya.

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(2 marks)

7

END OF QUESTIONS



There are no questions printed on this page

