OCR

Monday 2 June 2014 – Afternoon

AS GCE HUMAN BIOLOGY

F222/01/TEST Growth, Development and Disease

Candidates answer on the Question Paper.

OCR supplied materials:
- Advance Notice (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 45 minutes

* F 2 2 2 0 1 *

* 3 1 1 3 4 3 3 8 9 6 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- An Advance Notice is enclosed for use with this examination.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question is based on the case study **'TB: STILL HITTING THE HEADLINES' (Case Study 1).**

(a) You were told in the case study that Robert Koch discovered the cause of tuberculosis (TB) in 1882.

This discovery led to diagnostic skin tests for TB being developed.

Describe how individuals in the UK are tested for TB today.

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..... **[3]**

(b) TB is sometimes described as a social disease because it can spread easily among people living in deprived communities.

TB is found mainly in deprived communities in developing countries, where the disease can be endemic.

(i) Distinguish between the terms *endemic* and *epidemic*.

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..... **[2]**

(ii) State **two** reasons why TB spreads easily in deprived communities.

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[2]

(c) TB is caused by the bacterium *Mycobacterium tuberculosis*.

Populations of bacteria may become resistant to antibiotics.

Stages in the development of antibiotic-resistant bacteria are listed in Table 1.1.

A	random mutations in some bacterial cells make them resistant to antibiotics
B	the next generation of bacteria are resistant to antibiotics
C	the surviving bacteria reproduce and pass on alleles for resistance to their offspring
D	bacterial populations show genetic variation
E	when antibiotics are used inappropriately, the resistant bacteria survive and the non-resistant bacteria are killed

Table 1.1

Place the stages in the correct order to describe how populations of bacteria become resistant to antibiotics. The first stage has been done for you.

D .... **[2]**

(d) In the case study you were told that TB claims the lives of many people infected with Human Immunodeficiency Virus (HIV).

Explain why people who test positive for HIV are at a much greater risk of developing TB than people who test negative for HIV.

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(e) The protective effect of the current TB vaccine is approximately 80%. This means only 80% of those vaccinated against TB are protected from the disease. The protective effect of the vaccine varies between different populations and can be much lower than 80%.

Epidemics of TB are more likely to occur when only a low percentage of the population has been protected by the TB vaccine.

Explain why.

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(f) A vaccine against HIV has yet to be developed.

Suggest why developing a vaccine for HIV has proved difficult.

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(g) Table 1.2 lists some structural features that can be seen in HIV, or in *Mycobacterium tuberculosis*, or in both.

Complete Table 1.2 by placing ticks or crosses in the boxes.

✓ = feature present

✗ = feature absent

Structural feature	**HIV**	***Mycobacterium tuberculosis***
Genetic material is RNA only		
Membrane present		
Cell wall present		

Table 1.2 **[3]**

[Total: 19]

2 This question is based on the case study **'SOWING THE SEEDS OF HEALTH' (Case Study 2)**.

In the case study, Jamie and Mr Rose discuss Kew Gardens. Kew Gardens is home to the Millennium Seed Bank.

(a) (i) State why seed banks, such as the one at Kew Gardens, are examples of *ex situ* conservation.

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(ii) Many of the seeds stored in seed banks are given a DNA barcode.

Suggest what is meant by a DNA barcode **and** how a DNA barcode could be used to identify plants with potential medicinal properties.

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(b) Aspirin is derived from a compound known as salicylic acid, which is found in a variety of plants.

Aspirin can be prescribed for people who are recovering from myocardial infarction.

Explain how aspirin benefits people who are recovering from myocardial infarction.

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..... **[2]**

(c) (i) Essential oils from plants can be used in aromatherapy as part of a treatment plan for cancer.

What is the term given to treatments such as aromatherapy?

..... **[1]**

(ii) Evidence for the effectiveness of medical treatments is obtained from clinical trials.

Suggest **one** ethical issue that a medical practitioner might discuss with a patient who is requesting aromatherapy as a cancer treatment.

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..... **[1]**

(d) Jamie and Mr Rose talk about how smoking tobacco can damage human health.

Women are advised not to smoke during pregnancy.

Explain how smoking cigarettes during pregnancy can have a negative effect on the baby.

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..... **[5]**

(e) Certain plants are good sources of the minerals required for healthy infant growth.

Table 2.1 lists three plant sources of minerals.

Complete Table 2.1 by writing either the name of the correct mineral or the correct function in the boxes provided.

Source	Mineral	Function
Spinach		Formation of haemoglobin
Broccoli		The development of teeth and bones and blood clotting
Soya Beans	Phosphate	

Table 2.1 **[3]**

(f) Plants are used in traditional medicine in many countries.

The Hausa and Fulani tribes of West Africa use the leaves of the shrub *Vismia guianensis* in their traditional folk medicine. Recent research indicates that *Vismia guianensis* may have antimicrobial properties.

Suggest **two** advantages of researching plants already known to work in traditional folk medicine when attempting to find sources of medicinal drugs.

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..... **[2]**

[Total: 18]

3 Tobacco smoking is the cause of approximately 25% of all deaths from cancer in the UK and has killed millions of people over the last 50 years.

Table 3.1 shows the relative risk of lung cancer based on two variables:

- the number of years a person has smoked cigarettes
- the number of cigarettes smoked per day.

Number of years smoking	Relative risk of lung cancer		
	<10 cigarettes smoked	10–19 cigarettes smoked	20+ cigarettes smoked
<20	0.9	2.6	1.3
20–29	1.4	2.3	2.8
30–39	4.3	6.0	10.9
40–49	5.7	16.2	12.6
50+	17.6	22.6	41.0

Table 3.1

(a) (i) Using the information in Table 3.1, calculate the percentage increase in relative risk of lung cancer when smoking 20+ cigarettes per day for 30–39 years compared to smoking fewer than 10 cigarettes per day for 30–39 years.

Show your working.

Answer = ... % **[2]**

(ii) Suggest an explanation for the trends shown in Table 3.1.

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..... **[3]**

(iii) A student examining the data in Table 3.1 made the following statement:

"The number of cigarettes you smoke per day doesn't affect your risk of developing lung cancer."

Suggest one piece of evidence that supports the statement **and** one piece of evidence that does not support the statement.

evidence supporting the statement .....

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evidence not supporting the statement .....

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[2]

(b) Chronic bronchitis is another lung disease that can be caused by smoking cigarettes.

Describe how cigarette smoke leads to the development of chronic bronchitis **and** how this reduces the rate of gas exchange in the lungs.

In your answer you should give a balanced account of the development of bronchitis and its effect on gas exchange.

[8]

[Total: 15]

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QUESTION 4 STARTS ON PAGE 12

4 Cell division by meiosis is essential for sexual reproduction in eukaryotes.

(a) Explain the importance of meiosis in sexual reproduction.

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..... **[3]**

(b) Turner's syndrome is a genetic disorder that may be detected during fetal development.

Turner's syndrome is caused by a chromosomal mutation that results from the non-disjunction of chromosomes during meiosis.

State a stage in meiosis when non-disjunction can occur.

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(c) Fig. 4.1 shows the growth rate curve between the ages of 0 and 18 for females without Turner's syndrome and for females with Turner's syndrome.

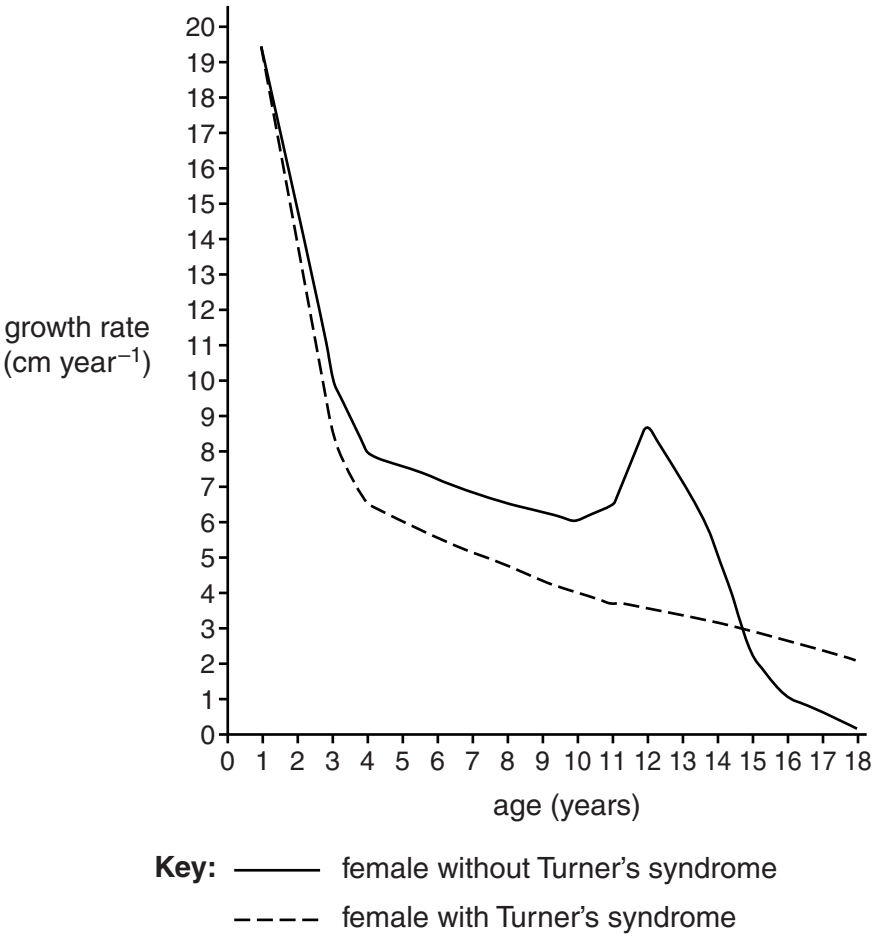

Fig. 4.1

Use the information in Fig. 4.1 to answer to following questions:

(i) Describe **one** similarity between the growth rate of females without Turner's syndrome and the growth rate of females with Turner's syndrome.

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(ii) Describe **two** differences between the growth rate of females without Turner's syndrome and the growth rate of females with Turner's syndrome.

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(iii) Predict the effect of Turner's syndrome on the adult height of females with this condition.

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(d) Ultrasound, amniocentesis and karyotyping are all techniques used in the diagnosis of fetal disorders such as Turner's syndrome.

Outline how each of the following techniques is used in the diagnosis of Turner's syndrome during pregnancy.

ultrasound .....

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amniocentesis .....

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karyotyping .....

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[3]

[Total: 11]

5 Erythrocytes have short lifespans and are constantly produced by the bone marrow stem cells.

Fig. 5.1 is a scanning electron micrograph of a bone marrow stem cell.

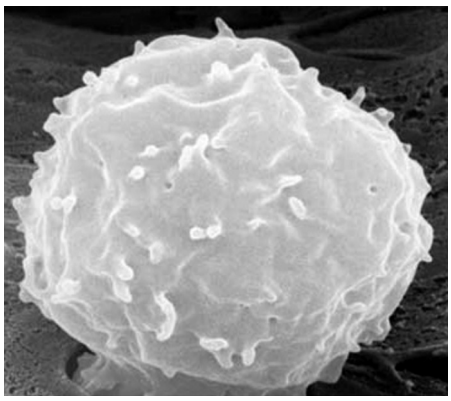

Fig. 5.1

(a) Describe how a mature erythrocyte would differ in appearance from a bone marrow stem cell, such as the one in Fig. 5.1.

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(b) Pluripotent stem cells are found in embryos and can differentiate into any type of cell.

Bone marrow stem cells are described as multipotent.

Suggest what is meant by *multipotent*.

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(c) At the eight cell stage of development, all the cells in an embryo are identical. These cells are capable of dividing to form any cell type in a fetus.

Describe how an embryonic cell gives rise to tissues and organs as a fetus develops **and** how the growth patterns of tissues differ.

In your answer you should include differences in the growth patterns of both reproductive and nervous tissue.

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(d) Cancer may develop as a result of mutations in stem cells.

Describe how a mutation of a proto-oncogene in a stem cell may give rise to cancer.

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..... **[3]**

(e) Apoptosis is the process that destroys cancerous cells, but it is also essential in the normal development of an embryo.

(i) Define *apoptosis*.

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..... **[1]**

(ii) Give **one** example of apoptosis in the normal development of an embryo.

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..... **[1]**

[Total: 15]

6 Heart attacks can be recognised by a number of symptoms, including sweating and pale skin. Prompt action by trained first-aiders increases a person's chances of survival.

(a) State **two** actions that can be taken when a **conscious** person is recognised as having a heart attack.

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..... **[2]**

(b) Cardiopulmonary resuscitation (CPR) is performed on people who have suffered cardiac arrest and are no longer conscious.

A Japanese study compared the effectiveness of two forms of CPR:

- CPR with chest compressions only
- conventional CPR (with chest compressions and rescue breaths).

Patients who had suffered cardiac arrest were given one of the two treatments.

Successful outcomes were judged as the percentage of patients who survived for one month and did not have brain damage.

Fig. 6.1 shows the results.

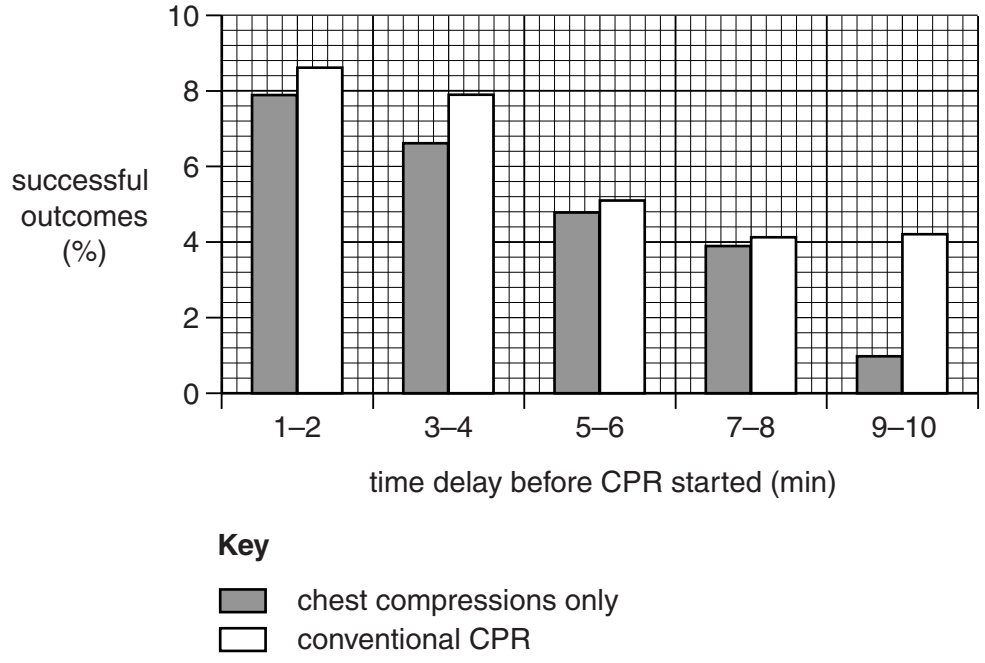

Fig. 6.1

(i) Using the information in Fig. 6.1, compare the effect on successful outcomes of 'CPR with chest compressions only' and 'conventional CPR'.

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(ii) The British Heart Foundation encourages untrained individuals to use 'CPR with chest compressions only'.

Use the information in Fig. 6.1 to suggest why the British Heart Foundation promotes this form of CPR as a first aid treatment to be used by untrained individuals.

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..... **[1]**

(c) A person who is recovering from cardiac arrest may be given coronary bypass surgery.

When coronary bypass surgery is ineffective, however, a heart transplant may be carried out.

Suggest **one** potential **disadvantage** for a patient who receives a heart transplant rather than coronary bypass surgery.

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[Total: 7]

Question 7 begins on page 20

7 A study published in *The Lancet* in 2011 revealed that more than 350 million people in the world have some form of diabetes. Type 2 diabetes is often linked to obesity.

(a) Explain how an unbalanced diet may lead to obesity.

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(b) In a study funded by Diabetes UK, eleven healthy volunteers were given a special diet which reduced their food intake to 2.5 kJ per day for two months.

Fig. 7.1 shows the effect of reducing food intake to 2.5 kJ per day on the fasting blood glucose concentration of the volunteers.

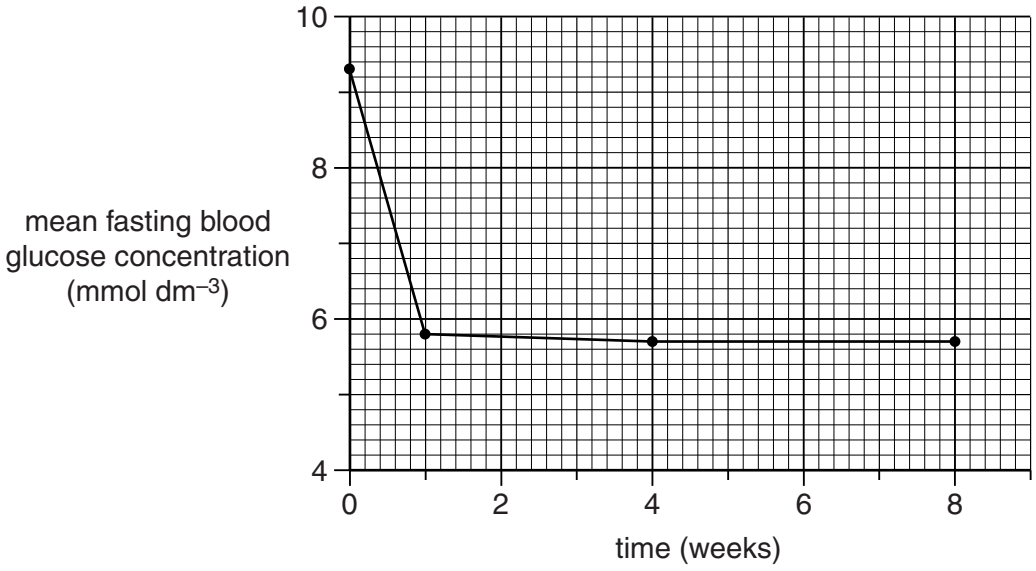

Fig. 7.1

(i) Using the information in Fig. 7.1, describe the effect on the fasting blood glucose concentration of reducing food intake to 2.5 kJ per day.

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(ii) The eleven volunteers were closely supervised by a medical team and matched with an equal number of diabetic volunteers who did not get the special diet.

Suggest why the researchers used only a small number of volunteers in this study.

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..... **[1]**

(iii) After finishing the reduced-energy diet, the volunteers returned to a normal eating pattern but were given advice on eating a balanced diet.

This advice was based on the NICE public health guidelines.

Suggest **three** different strategies that the volunteers should be advised to adopt to maintain a balanced diet.

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(c) People with diabetes can use biosensors to monitor their blood glucose concentration.

(i) Explain why it is important for diabetics to monitor their blood glucose concentration.

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(ii) Complete the following passage by inserting the **most appropriate word** into each gap to explain how a biosensor works.

A person's blood is placed on a test strip on the biosensor. The test strip contains a molecule called glucose ..... . This molecule is an ..... that converts glucose in the blood into ..... . An electrode detects the small electric current generated by this chemical reaction. The current is converted by a ..... into a digital reading of the person's blood glucose concentration.

[4]

[Total: 15]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined pages. The question number(s) must be clearly shown in the margins.

ADDITIONAL ANSWER SPACE