

Monday 1 June 2015 – Afternoon

AS GCE HUMAN BIOLOGY

F222/01/TEST

Growth, Development and Disease

Candidates answer on the Question Paper.

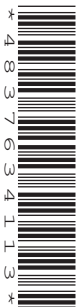
OCR supplied materials:

- Advance Notice (inserted)

Other materials required:

- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 45 minutes




Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 ‘**INTERVIEW WITH A PHLEBOTOMIST**’ (**Case Study 1**).

(a) You were told in the case study that blood samples can be tested for the presence of tumour markers. High levels of tumour markers may indicate that a person has cancer.

(i) Explain what is meant by cancer.

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

(ii) What type of proteins could be used to confirm the presence of tumour markers in a blood sample?

..... [1]

(b) The Polymerase Chain Reaction (PCR) can be used to test a blood sample for the presence of Human Immunodeficiency Virus (HIV).

Stages in the PCR test are listed in Table 1.1.

A	The beta haemoglobin gene is used as a positive control.
B	Viral RNA is converted into DNA.
C	The presence of both viral DNA and beta haemoglobin DNA indicates a positive test result.
D	HIV RNA is extracted from the person’s blood.
E	DNA is amplified in a PCR machine.

Table 1.1

(i) Place the stages **B to E in the correct order** to describe the PCR test for HIV.

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

(ii) State **one** other test for HIV that could be performed on a sample of blood.

..... [1]

(d) The phlebotomist said that a blood sample can be taken to test for diabetes.

In an oral glucose tolerance test for diabetes, a blood sample is taken after a period of fasting. Then, further blood samples are taken at regular intervals after the glucose drink has been consumed.

(i) Explain why sampling before and after the consumption of the glucose drink helps to determine whether a person has diabetes.

.....

.....

.....

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.....

.....

..... [2]

(ii) Suggest why a high glucose level in the final blood sample of the glucose tolerance test might not necessarily confirm that a person has diabetes.

.....

.....

..... [1]

(e) In the case study you were told that a person’s blood group can be determined by testing a sample of their blood.

(i) Complete Table 1.2 below to show the blood groups, antigens and antibodies of patients 1, 2, 3 and 4.

Patient	ABO blood group	Rhesus blood group	Blood group antigen(s) on erythrocytes	Blood group antibodies produced in plasma
1		Rh+	A and D	Anti-B
2	AB		A and B and D	
3	O	Rh-		Anti-A and Anti-B and Anti-D
4	B	Rh-		

[4]

Table 1.2

- (ii) A universal donor can donate blood to anyone who needs a blood transfusion. A universal recipient can receive blood from anyone.

Choose one **patient number** from Table 1.2 that represents a universal donor and one **patient number** that represents a universal recipient.

Universal donor

Universal recipient

[1]

[Total: 23]

Question 2 begins on page 6

2 This question is based on the case study ‘**VACCINATING THE YOUNG**’ (Case Study 2).

(a) You were told in the case study that the NHS now recommends that pregnant women should be given vaccinations against whooping cough.

(i) Explain what is meant by the term *vaccine*.

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

(ii) When a pregnant woman is vaccinated against whooping cough, both she and her baby gain immunity.

Choose **two** words from the list below to describe the type of immunity gained by the mother, and **two** words to describe the immunity gained by the baby.

NATURAL ARTIFICIAL ACTIVE PASSIVE

Immunity gained by mother and

Immunity gained by baby and [1]

(iii) The programme of vaccination used in the United Kingdom (UK) requires booster vaccinations to be given against some diseases, including whooping cough.

Explain why booster vaccinations are necessary.

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

- (b) In the case study you were told that potential replacements for the BCG vaccine for TB are being researched.

Two of the potential replacement vaccines are MVA85A and MTBVAC.

- (i) In clinical trials, a group given the MVA85A vaccine was compared with a group given a placebo.

State **two** essential properties of placebos.

1

.....

2

.....

[2]

- (ii) Suggest why it might be thought unethical to use placebos in some clinical trials.

.....

.....

..... [1]

- (iii) The MTBVAC vaccine increases the production of a particular type of T helper lymphocyte.

T helper lymphocytes coordinate the specific and the non-specific immune responses to infection.

Describe how T helper lymphocytes coordinate these responses.

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..... [3]

- (iv) State whether each of the following immune responses to infection is **specific** or **non-specific**.

Tear ducts secrete fluid containing lysozyme.

.....

Agglutination of pathogens by antibodies.

.....

Macrophages release chemicals that cause inflammation.

.....

Monocytes in plasma leave the capillaries and move to damaged tissue.

.....

[2]

- (v) Both T lymphocytes and B lymphocytes are classed as white blood cells. Although they have some features in common, there are many differences between the two types of lymphocyte.

Table 2.1 below lists statements that apply to either T lymphocytes, to B lymphocytes or to both types of lymphocyte.

Complete each row by adding a tick (✓) to show whether each statement applies to T lymphocytes, to B lymphocytes or to both T and B lymphocytes.

Statement	T lymphocyte	B lymphocyte	Both T and B lymphocytes
Produced in bone marrow			
Mature in thymus gland			
Undergo clonal expansion			
Some cells can secrete hydrogen peroxide to destroy infected cells			
Can produce antibodies			

[5]

Table 2.1

- (c) The NHS now offers the HPV vaccination to girls aged 12 and 13 years in order to reduce the spread of HPV infection.

Why are HPV infections **not** treated with a course of antibiotics?

.....

.....

..... [1]

[Total: 18]

- 3 Some scientists think that the structure of DNA can be improved. Scientists in Florida have been attempting to re-design DNA.

Fig. 3.1 shows a section of one of their designs.

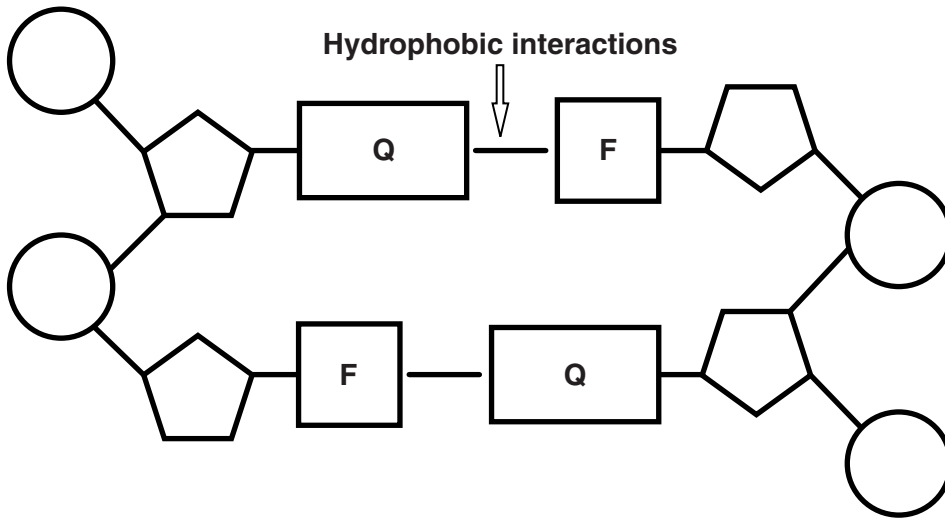


Fig. 3.1

- (a) State **two** differences and **one** similarity between natural DNA and the re-designed DNA shown in Fig. 3.1.

Differences

1

.....

.....

2

.....

.....

Similarity

.....

.....

[3]

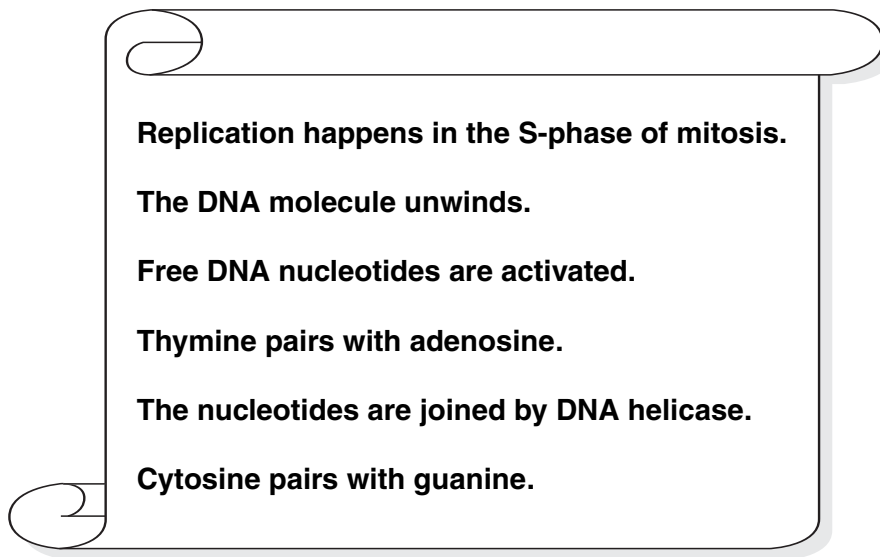
(b) During the cell cycle, DNA is replicated.

(i) Why is DNA replication a semi-conservative process?

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

(ii) A student attempted to describe the process of DNA replication to a friend.

The student wrote the following description, but the friend noticed three errors in the description.



Choose **three words** from the description that are errors **and** write a suitable word or term to replace each one.

1. *Error*
Replacement

2. *Error*
Replacement

3. *Error*
Replacement

[3]

- (iii) In addition to DNA replication, other events also take place in the cell cycle. Two phases of the cell cycle are G_1 and G_2 .

Outline the processes that take place in these two phases.

G_1

.....

.....

.....

G_2

.....

.....

.....

[4]

- (c) Once DNA has been replicated, cell division can occur.

Fig. 3.2 shows the stages of meiosis, a type of cell division. Two stages are missing.

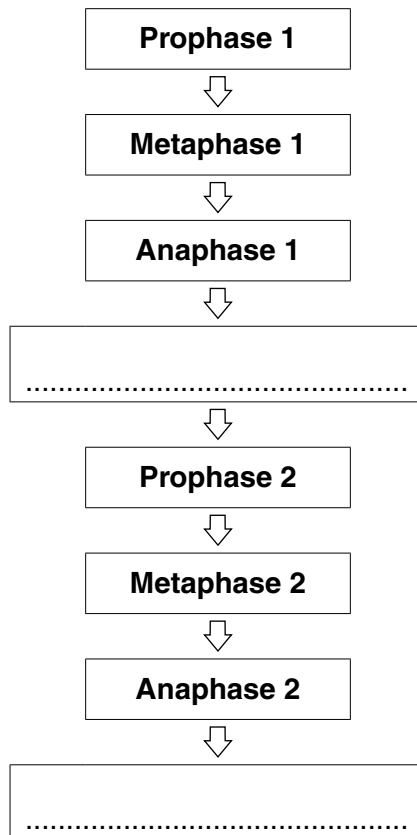


Fig. 3.2

- (i) Write the names of the two missing stages in the empty boxes in Fig. 3.2.

[1]

- (ii) Processes during metaphase 1 and metaphase 2 contribute to genetic variation of the gametes formed in meiosis.

Name the processes that contribute to genetic variation in metaphase 1 and metaphase 2.

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

- (iii) Genetic variation is generated in metaphase 1, metaphase 2 and in one other stage of meiosis.

Name this stage and explain how it contributes to genetic variation.

stage

explanation

.....
.....
.....
.....
..... [4]

[Total: 18]

4 Fetal growth is measured during pregnancy to check that the baby is developing as expected.

Fig. 4.1 shows one of the measurements that can be made. This measurement is labelled **A**.



Fig. 4.1

(a) (i) Name the measurement shown at **A** in Fig. 4.1.
..... [1]

(ii) State the method used to obtain this image from which the measurement can be made.
..... [1]

(b) (i) After birth, growth continues to be monitored to make sure that infants are growing at normal rates.

Outline the different methods that may be used to measure an **infant's** growth.

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[5]

- (ii) Infant growth can be recorded as an absolute rate or a relative rate.

On Fig. 4.2 below, sketch a typical **relative** growth rate curve for the height of a human from birth to 20 years.

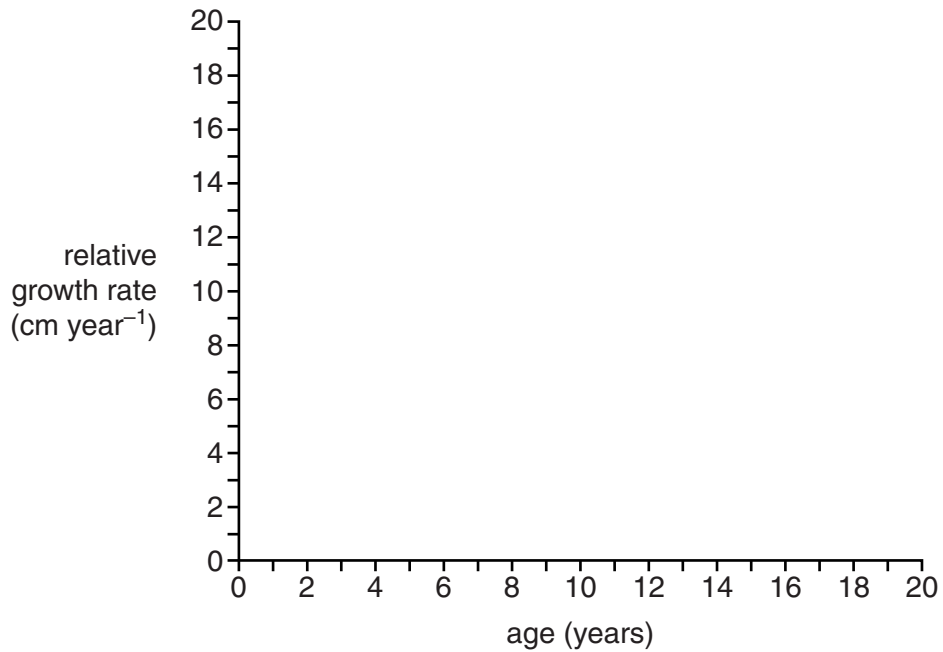


Fig. 4.2

This question should be answered on Fig. 4.2.

[2]

- (iii) An infant weighed 12.0 kg at 2 years of age and 15.3 kg at 3 years of age.

Calculate the relative growth rate of this infant in kg year^{-1} . Show your working.

relative growth rate = kg year^{-1} **[2]**

- (iv) Suggest why the relative growth rate and not the absolute growth rate is sometimes used to monitor growth after birth.

.....

 **[1]**

17
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Question 5 begins on page 18
PLEASE DO NOT WRITE ON THIS PAGE

5 Tuberculosis (TB) and Coronary Heart Disease (CHD) cause millions of deaths each year.

(a) TB is described as an infectious disease, whereas CHD is described as a non-infectious disease.

(i) What is meant by the term *infectious disease*?

.....

 [1]

(ii) Give **one** other example of an infectious disease and **one** other example of a non-infectious disease.

Infectious disease
 Non-infectious disease [1]

(b) Table 5.1 below shows the 2013 global mortality rates for the two diseases and the mortality rates in two countries: the United Kingdom (UK) and The Gambia, in Africa.

In 2013, the United Nations (UN) ranked the UK 26th and The Gambia 165th in the Human Development Index. This Index is a measure of standards of living and levels of poverty.

Disease	Mortality (per 100 000)		
	Global	UK	The Gambia
TB	24.0	0.5	48.0
CHD	138.6	122.0	108.5

Table 5.1

6 The prevalence of bowel cancer has increased in the UK over the last 40 years.

Benzopyrene is a molecule that has been linked to an increased risk of bowel cancer. It can be produced in cigarette smoke and burned food. Research indicates that benzopyrene may affect the p53 gene.

(a) (i) Define the term *prevalence*.

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..... [1]

(ii) Suggest how benzopyrene may affect the p53 gene, leading to an increased risk of cancer.

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..... [3]

(iii) Benzopyrene is a chemical carcinogen. Exposure to chemical carcinogens increases the risk of developing cancer.

State **two** other factors that increase the risk of developing cancer.

1
.....
2
..... [2]

(iv) Some forms of cancer are described as acute.

State what is meant by *acute*.

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

- (b) The presence of blood in a person’s faeces can be an early sign of bowel cancer.

The Faecal Occult Blood Test (FOBT) is a method of screening populations for bowel cancer. The test detects blood in faeces.

Fig. 6.1 shows the results of a study that compared the bowel cancer mortality rates of two groups. One group was screened for bowel cancer every two years using the FOBT. Members of the control group were not screened.

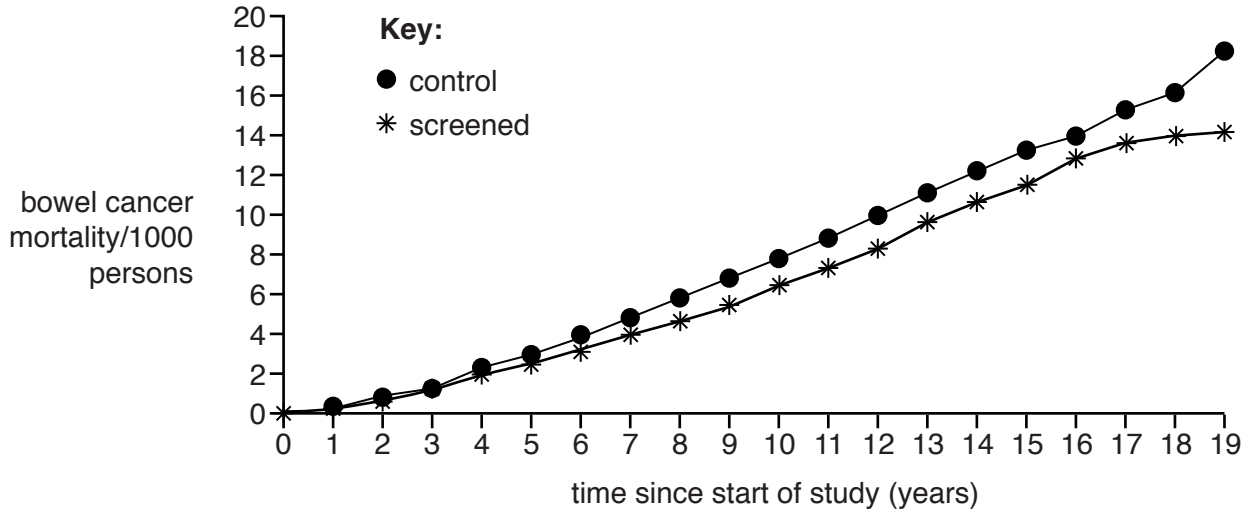


Fig. 6.1

A student looking at the data in Fig. 6.1 made the following statement:

“FOBT screening improves the chances of surviving bowel cancer.”

- (i) Using the information in Fig. 6.1, suggest **one** piece of evidence that supports the student’s statement.

.....

.....

..... [1]

- (ii) What further information would be needed to assess the **validity** of the student’s statement?

1

.....

2

..... [2]

- (iii) If blood is found in faeces using the FOBT, additional tests are needed to confirm the presence of bowel cancer.

Suggest why additional tests are needed if blood is found in the faeces.

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

- (c) TIC10 is a promising anti-cancer drug that has been tested on mice.

It may be years before TIC10 can be used to treat cancer in humans.
The drug will first need to undergo clinical trials.

- (i) Outline the role of NICE (National Institute for Health and Clinical Excellence) after a drug has undergone clinical trials.

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

- (ii) TIC10 causes apoptosis in cancerous cells but not in healthy cells.

Complete the following passage, which describes how apoptosis works.

Apoptosis is triggered by extracellular and intracellular signals. Enzymes break down the cell's cytoskeleton. The condenses in a process known as pyknosis and then it fragments. The forms bulges called blebs. The cell breaks into vesicles. Macrophages recognise and engulf the vesicles by

[3]

[Total: 16]

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.

This section of the page is a large, empty area for writing answers. It consists of a vertical solid line on the left side, creating a margin, and a series of horizontal dotted lines extending across the page to the right. The dotted lines are spaced evenly, providing a guide for writing.

ADDITIONAL ANSWER SPACE

A large rectangular area for writing, bounded by a solid vertical line on the left and a solid horizontal line at the top. The interior is filled with horizontal dotted lines, providing a guide for handwriting.



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