

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
AS GCE  
F222/01/TEST  
HUMAN BIOLOGY  
Growth, Development and Disease  
MONDAY 1 JUNE 2015: Afternoon  
DURATION: 1 hour 45 minutes  
plus your additional time allowance  
MODIFIED ENLARGED 24pt**

<b>Candidate forename</b>						<b>Candidate surname</b>				
<b>Centre number</b>						<b>Candidate number</b>				

**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**Advance Notice (inserted)**

**OTHER MATERIALS REQUIRED:**

**Electronic calculator**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**An Advance Notice is enclosed for use with this examination.**

**Write your name, centre number and candidate number in the boxes on the first page. 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.**

## **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.**

**Any blank pages are indicated.**

**BLANK PAGE**

**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.**

**TABLE 1.1**

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

**(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]



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**(ii) CHD can result in a heart attack, which may cause cardiac arrest.**

**Distinguish between heart attack and cardiac arrest.**

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[2]



(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.

**TABLE 1.2**

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

[4]

(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]

**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’.**

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**[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.**

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**[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** \_\_\_\_\_

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**2** \_\_\_\_\_

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**[2]**



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

**Tear ducts secrete fluid containing lysozyme.**

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**Agglutination of pathogens by antibodies.**

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**Macrophages release chemicals that cause inflammation.**

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

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**[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.

**TABLE 2.1**

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

**[5]**

**(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?**

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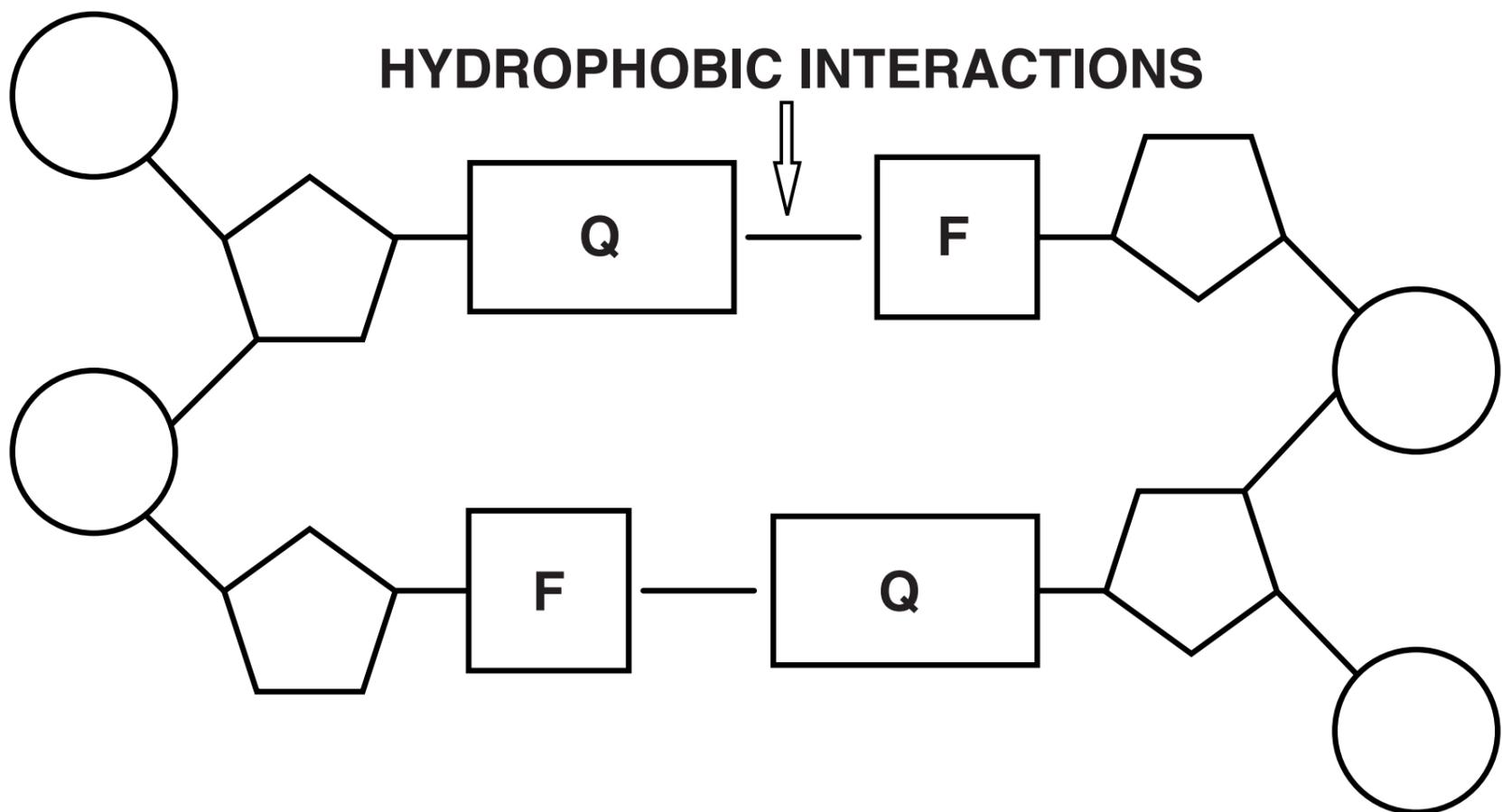
**[1]**

**[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?**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[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.

Replication happens in the S-phase of mitosis.

The DNA molecule unwinds.

Free DNA nucleotides are activated.

Thymine pairs with adenosine.

The nucleotides are joined by DNA helicase.

Cytosine pairs with guanine.

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.**

**$G_1$**  \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**$G_2$**  \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

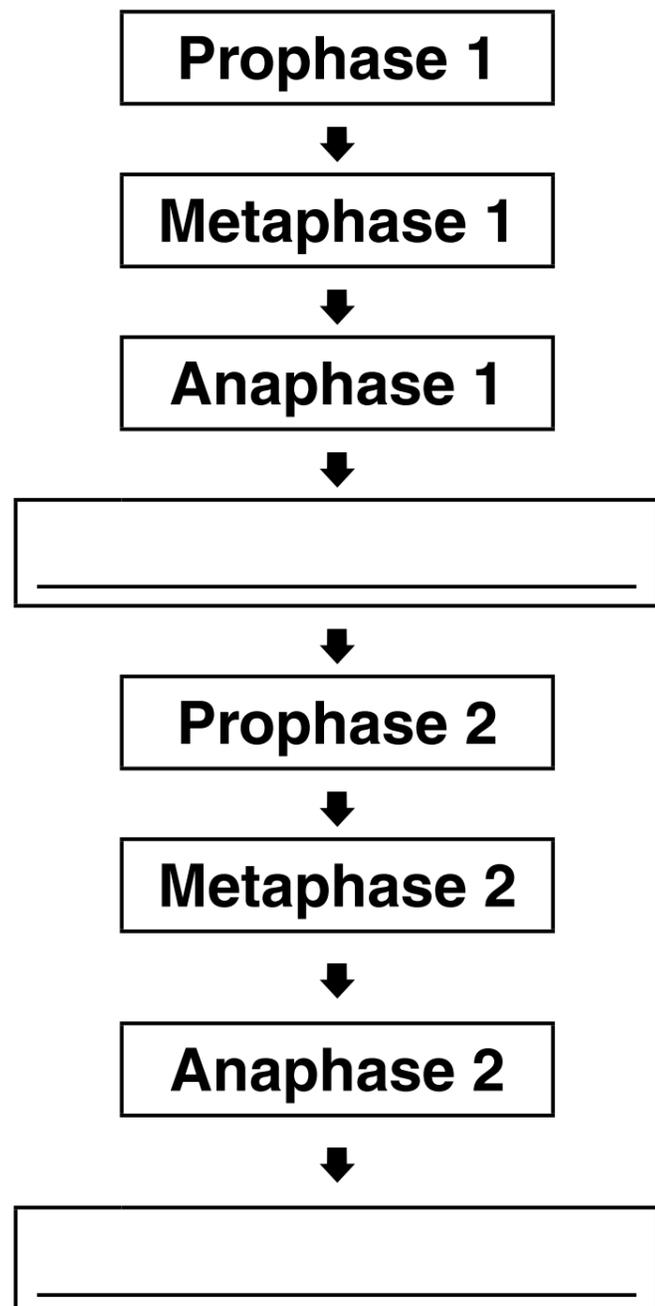
\_\_\_\_\_

**[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** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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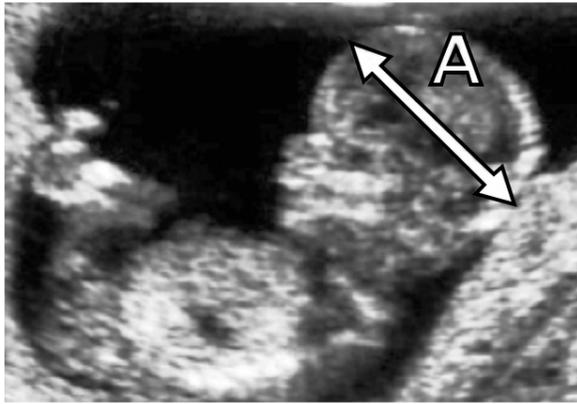
\_\_\_\_\_ [4]

**[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.

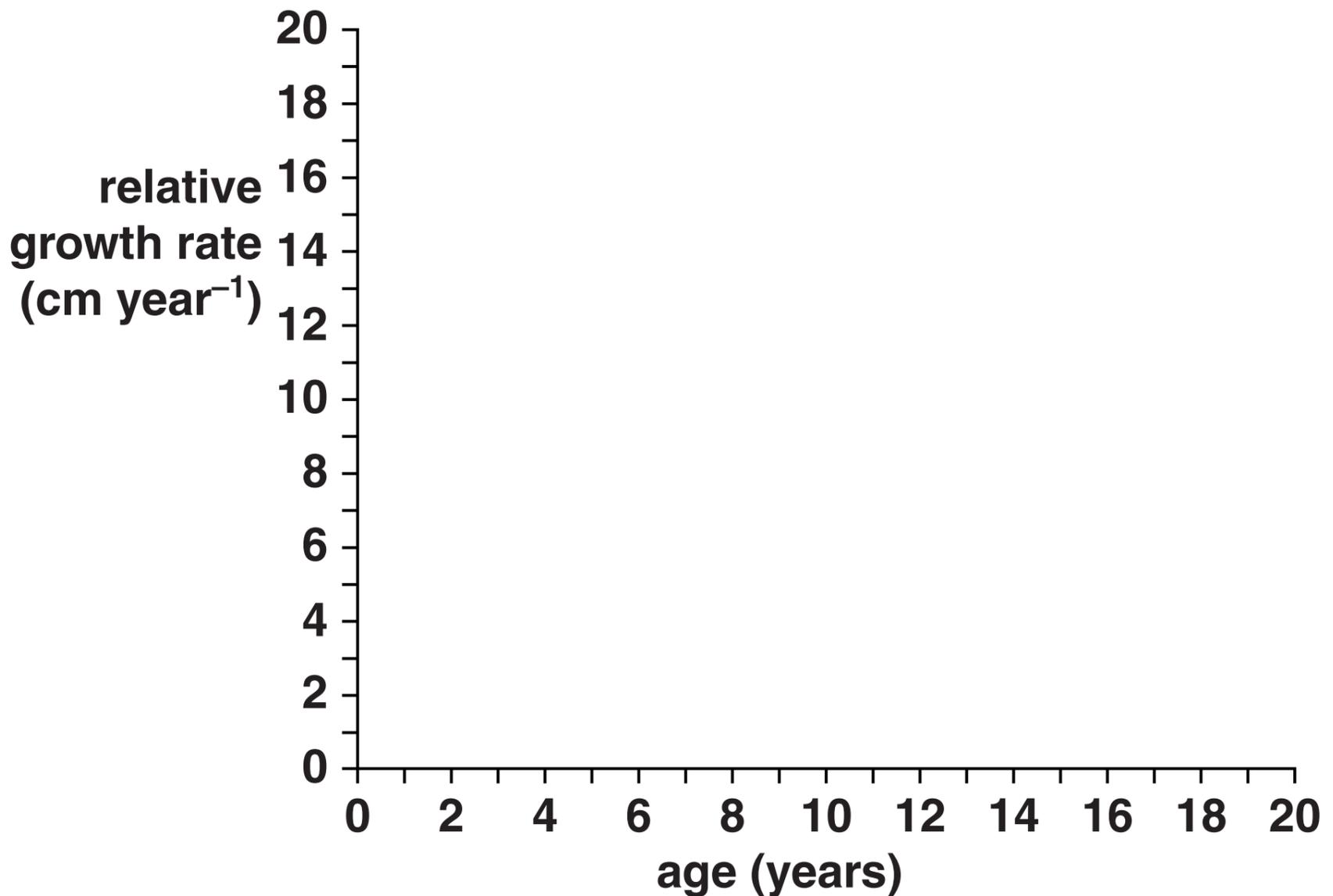
\_\_\_\_\_ [1]



(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<sup>-1</sup>. Show your working.

relative growth rate = \_\_\_\_\_ kg year<sup>-1</sup> [2]

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

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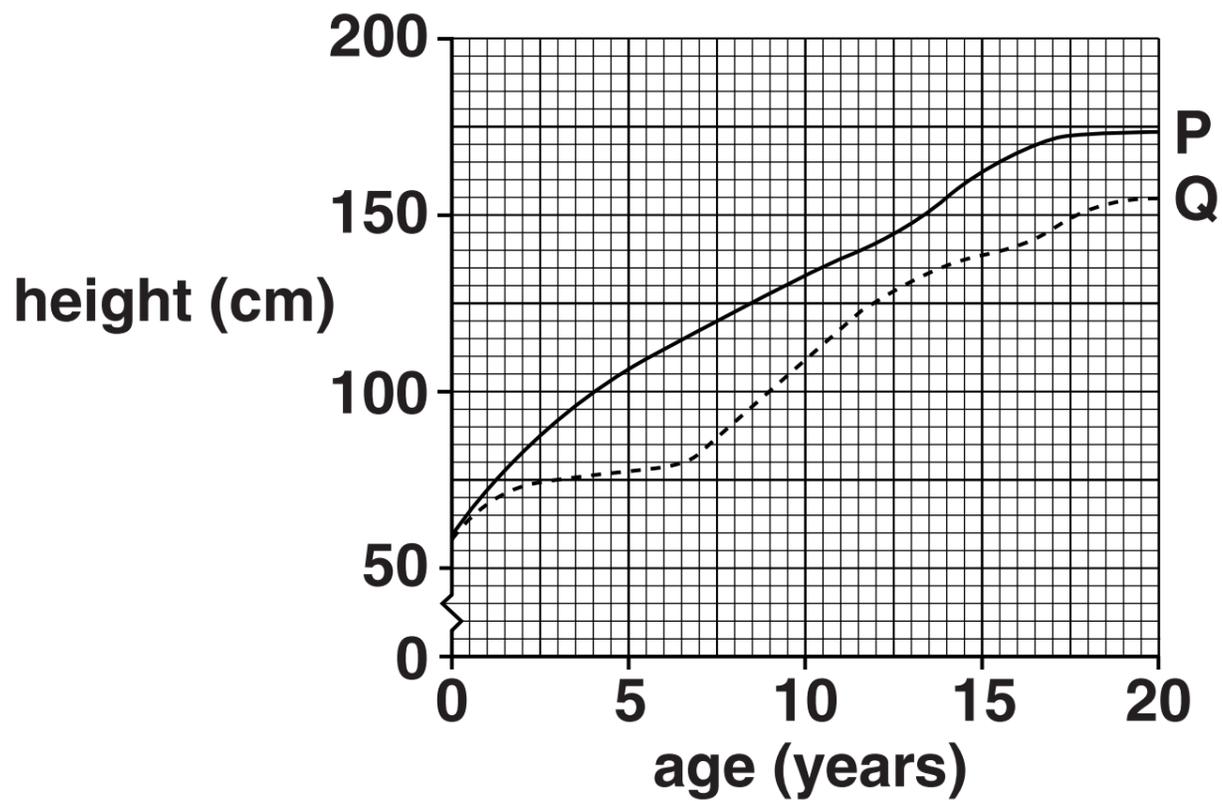
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[1]

(c) Children show different patterns of growth. This may be due to different factors.

Fig. 4.3 shows the growth patterns for two different boys, P and Q.

FIG. 4.3





**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'?**

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**[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.

**TABLE 5.1**

<b>DISEASE</b>	<b>MORTALITY (PER 100 000)</b>		
	<b>Global</b>	<b>UK</b>	<b>The Gambia</b>
<b>TB</b>	<b>24.0</b>	<b>0.5</b>	<b>48.0</b>
<b>CHD</b>	<b>138.6</b>	<b>122.0</b>	<b>108.5</b>

**For TB AND CHD:**

**compare the mortality rates of the UK and The Gambia**

**compare the mortality rates of the UK and of The Gambia with the global mean averages.**

**Suggest reasons for the differences in mortality rates. [8]**



**Your answer should contain a balance of descriptions of the data and explanations of the data.**

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**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 opposite 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.**

**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.**

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**[1]**

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

**1** \_\_\_\_\_

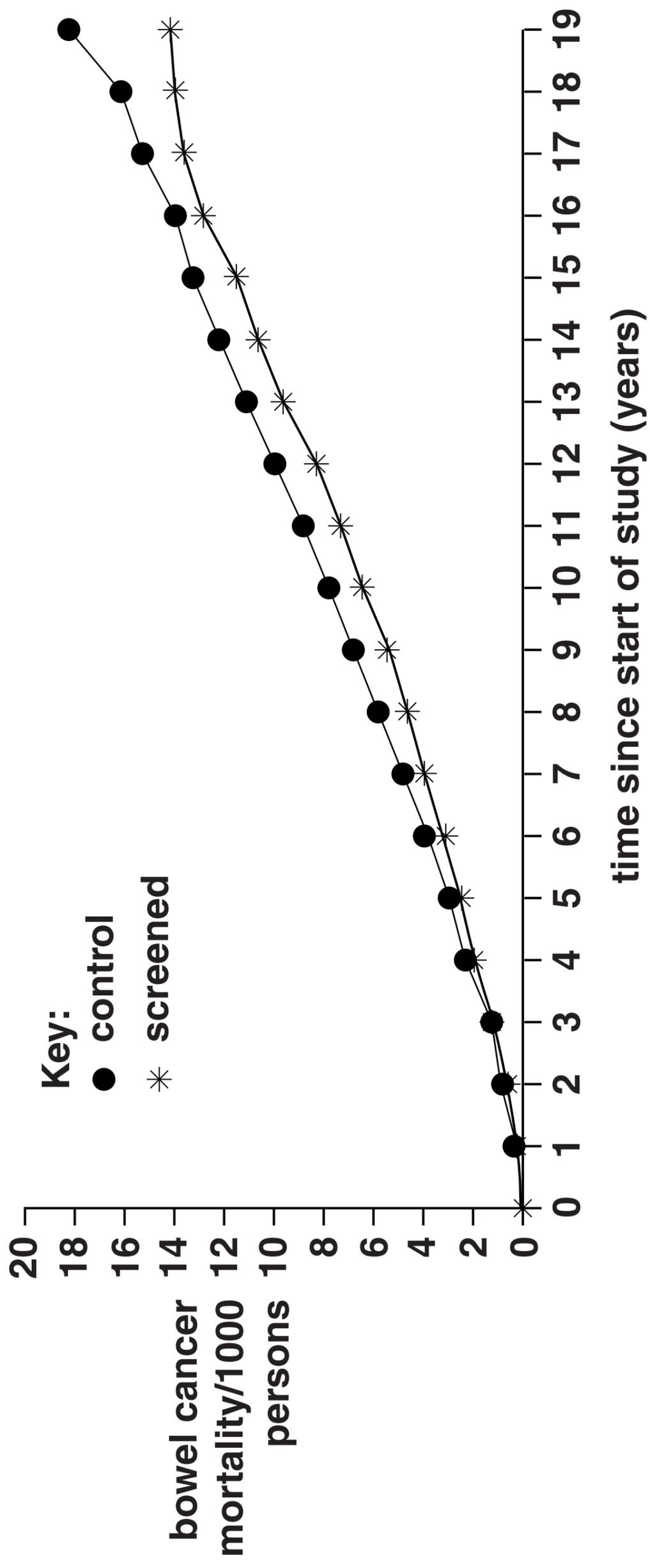
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**2** \_\_\_\_\_

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**[2]**

**FIG. 6.1**



**(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.**

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**[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


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