

Tuesday 7 June 2016 – Afternoon

AS GCE HUMAN BIOLOGY

F222/01/TEST Growth, Development and Disease

Candidates answer on the Question Paper.

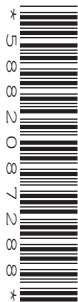
OCR supplied materials:

- 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 **28** pages. Any blank pages are indicated.

Answer **all** the questions.

1 This question is based on Case Study 1: **25 by 25**

(a) Scientists have predicted that if the non-communicable disease (NCD) framework is put into practice, by 2025 the mortality rate for cardiovascular disease (CVD) is likely to be reduced to a greater extent than the mortality rate for cancer.

(i) Suggest **two** reasons why the CVD mortality rate is likely to be reduced to a greater extent than the cancer mortality rate.

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..... [2]

(ii) Scientists predict that reducing mortality from breast cancer will be difficult. Effective screening, however, can help reduce mortality rate.

Table 1.1 shows four techniques that are used to screen for breast cancer.

Complete Table 1.1 by:

- inserting the missing terms in column 1 and column 2
- inserting a tick (✓) or a cross (✗) as appropriate in column 3 and column 4 for each technique.

Screening technique	Type of radiation detected	Produces three-dimensional image	Requires injection of radioactive substance
MRI scans	✓	✗
PET scans		
.....	Infrared radiation		
CT scan		

Table 1.1

[4]

- (iii) It is estimated that one in six cancers is associated with chronic bacterial or viral infections.

Suggest **one** way that chronic viral infections may cause cancer or increase the risk of developing cancer.

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..... [2]

- (iv) Carcinogens can affect proto-oncogenes and tumour suppressor genes.

Outline the role of proto-oncogenes and tumour suppressor genes in cells.

proto-oncogenes
.....
tumour suppressor genes
..... [2]

- (b) Scientists have estimated that the mortality rate from CVD could be reduced by up to 34% by the year 2025 if the NCD framework proposed by the World Health Organisation (WHO) is implemented.

Coronary heart disease (CHD) is an example of a CVD.

- (i) List **three** factors, other than diet and smoking, that may account for differences in CHD mortality rates between different regions of the world.

1
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2
.....
3
..... [3]

(ii) The CHD mortality rate in the UK is decreasing.

CHD morbidity, however, has been rising in the UK and this has increased the financial burden of treating the disease. Diets that are high in fat and salt have been blamed for the increase in CHD morbidity.

Suggest **two** reasons why CHD mortality is decreasing in the UK even though CHD morbidity is increasing.

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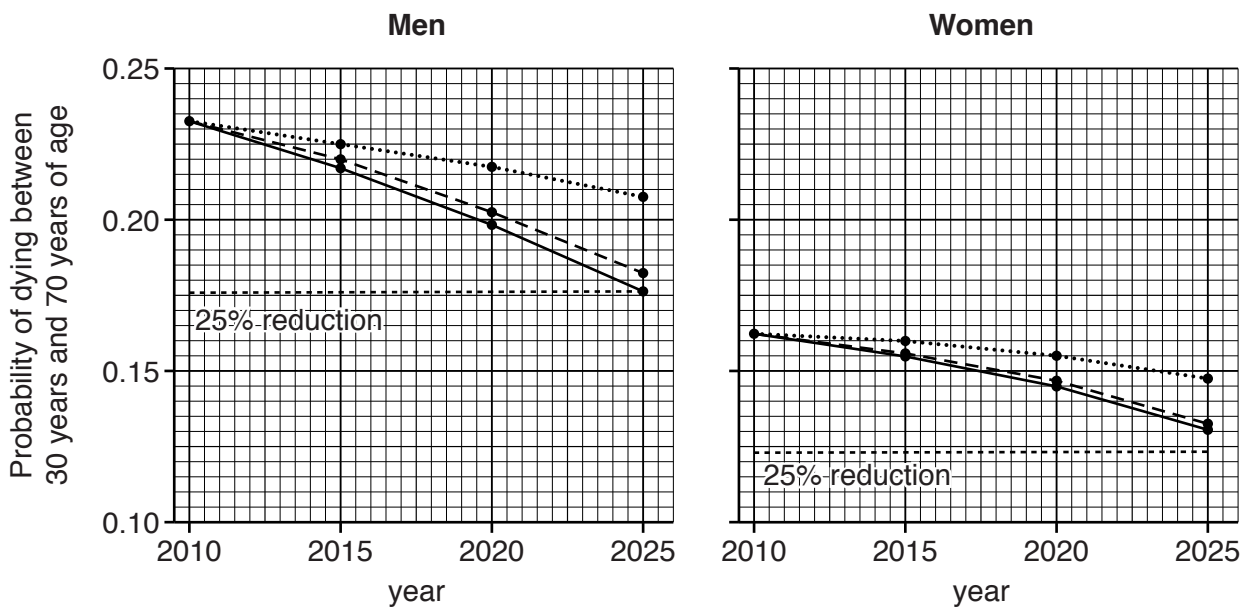
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..... [2]

(c) Scientists predict three possible trends for the global reduction in NCD mortality by the year 2025. Fig. 1.1 shows these trends and the estimated reductions in NCD mortality.



Key:

- trend without the NCD framework
- - - trend if risk factor targets achieved
- trend if tobacco use is reduced to levels lower than the target

Fig. 1.1

2 This question is based on Case Study 2: **The Thrifty Phenotype**

(a) In the UK, fetal growth measurements are taken during pregnancy and nutritional advice is given to mothers by medical professionals.

(i) Outline the antenatal care offered to mothers **other than** nutritional advice and fetal growth measurements.

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[5]

(ii) Suggest how the oxygen and nutrient supply to a fetus could be monitored during pregnancy.

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[2]

(iii) A baby's development is also monitored after birth.
Describe how a newborn baby's head circumference is measured.

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.....
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[1]

(iv) An infant's organ systems develop at different rates.

The letters **A** to **D** below correspond to different developmental periods during the human life cycle:

- A 0–5 years
- B 5–10 years
- C 10–15 years
- D 15–20 years

Select the letter that corresponds to the fastest period of development in males of:

the nervous system

the reproductive system

[2]

(b) An individual who experiences poor nutrition as a fetus has a higher probability of developing diabetes in **adulthood**.

Suggest the type of diabetes that is likely to develop in adults as a result of fetal under-nutrition.

Explain your choice.

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..... [3]

- (d) You were told in the case study that early life conditions can influence the probability of developing coronary heart disease (CHD) in adulthood.

Behaviours in adulthood, such as smoking cigarettes, can also increase the risk of developing CHD.

Explain why regular smoking increases the risk of developing CHD.

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..... [3]

[Total: 19]

3 Vaccination can be used to reduce the spread of human papilloma virus (HPV) in human populations.

(a) (i) Outline **one** ethical argument against the use of the HPV vaccine in the UK.

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..... [1]

(ii) Explain how the HPV vaccine leads to the development of long-term immunity against HPV in a person receiving the vaccine.

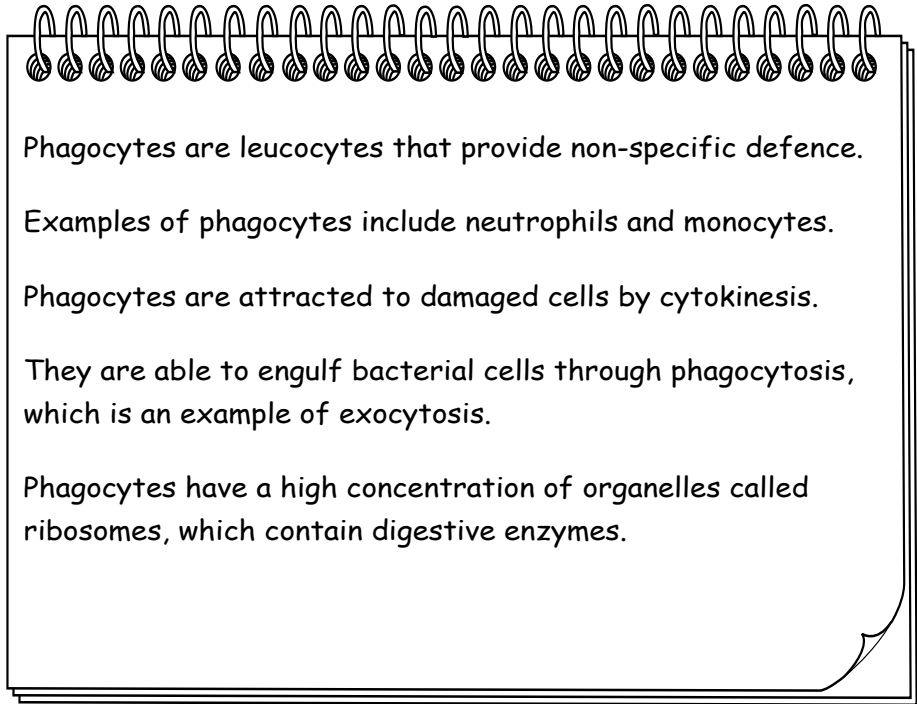


In your answer you should make clear the order in which the events occur.

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..... [8]

(b) A student is revising the structure and functions of phagocytes with a friend.

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



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

- 1. error
- replacement word

- 2. error
- replacement word

- 3. error
- replacement word

[3]

[Total: 12]

4 Conditions such as Turner syndrome and Klinefelter syndrome can be detected by a laboratory technique called karyotyping.

(a) Complete the following passage, which describes how a karyotype is produced.

A sample of fetal cells is taken from the placenta or amniotic fluid. These cells are then cultured in an incubator. Two chemicals are added to the culture. One chemical stimulates cell division by mitosis and the other chemical, called , prevents spindle formation. This halts mitosis at the start of The fetal cells swell up when they are added to a salt solution. A third chemical, a , is added to make the visible so that they can be photographed and analysed.

[4]

(b) (i) A friend suggests to a woman who is 10 weeks pregnant that she could have her baby tested for conditions such as Turner syndrome using amniocentesis and karyotyping.

Evaluate the suitability of the procedure suggested by the friend.

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..... [2]

- (ii) Fetal DNA, originating from the placenta, is present in a mother’s blood after 7 weeks of pregnancy.

This fetal DNA can be sampled from the mother’s blood in a new procedure known as cell-free fetal DNA (cffDNA) sampling. This represents an alternative to the traditional methods of obtaining fetal DNA, such as amniocentesis.

Suggest **two** advantages of cffDNA sampling over traditional methods, such as amniocentesis.

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..... [2]

- (c) (i) Table 4.1 below lists three conditions diagnosed by karyotyping.

Complete Table 4.1 by indicating the sex chromosomes present in each of the three conditions and the total number of chromosomes in each body cell.

Condition diagnosed	Sex chromosomes present	Total number of chromosomes in each body cell
Turner syndrome		
Klinefelter syndrome		
Normal male		

Table 4.1

[3]

- (ii) Individuals identified as having Turner or Klinefelter syndrome develop physical characteristics associated with their condition.

State **one** example of a typical characteristic found in people with Turner syndrome and **one** example of a typical characteristic found in people with Klinefelter syndrome.

Turner

Klinefelter

[1]

[Total: 12]

5 Ebola is a viral disease that was first described in human populations in 1976.

Several thousand cases of the disease were recorded in 2014.

Table 5.1 shows the estimated number of Ebola cases and deaths that resulted from the disease. Figures are shown for the world population and for nations located in West Africa.

Number of Ebola cases		Number of deaths from Ebola	
World	West Africa	World	West Africa
21 364	21 358	8 459	8 458

Table 5.1

(a) Use the data to evaluate the validity of the following statements:

- the Ebola outbreak was a pandemic
- Ebola was more likely to result in deaths in West Africa than the rest of the world.

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..... [3]

(b) (i) In 2014, the world's population was estimated to be 7.2 billion.

The total population of the West African nations that experienced Ebola was 231.4 million.

Using the information in Table 5.1, calculate the Ebola mortality rate (deaths per 100 000) for the world and for the West African nations.

World =

West Africa =

[2]

(ii) Suggest **one** reason for the difference in mortality rates calculated in (b)(i).

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

(c) (i) What problems will medical professionals need to overcome when treating diseases caused by pathogens such as the Ebola virus, which has only recently evolved to infect humans?

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..... [2]

- (ii) A patient diagnosed with Ebola in the UK was treated with blood plasma from a person who had recently recovered from the disease.

This is known as convalescent plasma therapy (CPT).

Suggest why CPT can be effective in the treatment of patients with Ebola.

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..... [2]

- (iii) Suggest **one** precaution that must be taken when using CPT.

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..... [1]

- (d) Ebola is an example of a notifiable disease.

What is meant by a *notifiable disease*?

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..... [1]

[Total: 12]

17
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6 Mitosis results in the production of diploid cells.

Fig. 6.1 represents one cell cycle, of which mitosis is part.

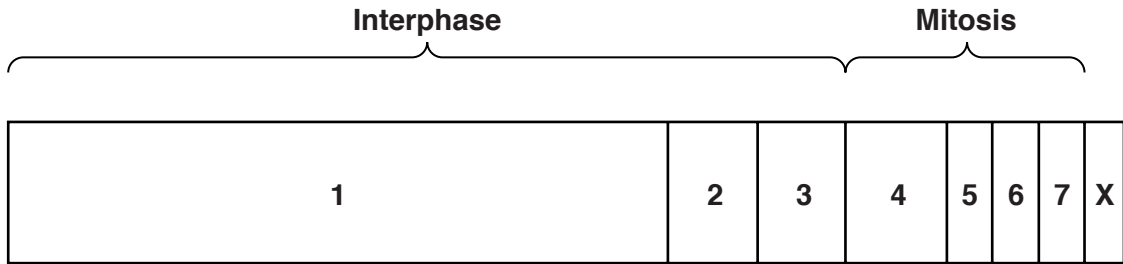


Fig. 6.1

(a) (i) Describe what occurs in the stage labelled X.

.....
 [1]

(ii) Name the stage of the cell cycle labelled 1 and explain why this stage takes up more than 50% of the cell cycle.

name of stage

explanation

.....
 [2]

(iii) Chromosomes become visible in stage 4 in Fig. 6.1.

Describe **two** further changes that occur in the cell in stage 4.

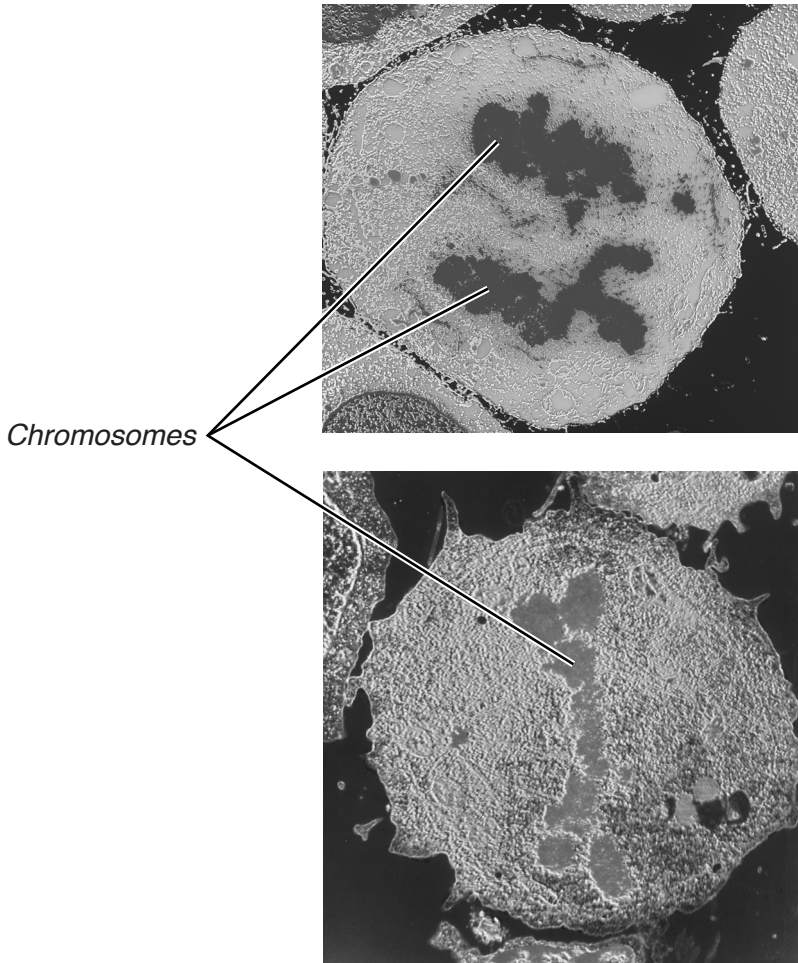
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 [2]

(iv) Fig. 6.2 is a photomicrograph showing two stages of mitosis in human cells.

In the box next to each image, state:

- the number of the stage (using the information in Fig. 6.1)
- the name of the stage shown.



Number of stage (see Fig. 6.1)
.....
Name of stage
.....

Number of stage (see Fig. 6.1)
.....
Name of stage
.....

Fig. 6.2

[2]

(b) Meiosis is a type of nuclear division that produces haploid daughter cells (gametes). It also results in genetic variation in gametes.

Crossing-over introduces genetic variation during prophase I of meiosis. Further genetic variation is introduced during metaphase I and metaphase II of meiosis.

Explain why the genetic variation produced in **meiosis II** is dependent on crossing-over.

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..... [2]

[Total: 9]

21
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(b) Fig. 7.1 shows an electron micrograph of *M. tuberculosis* bacteria.

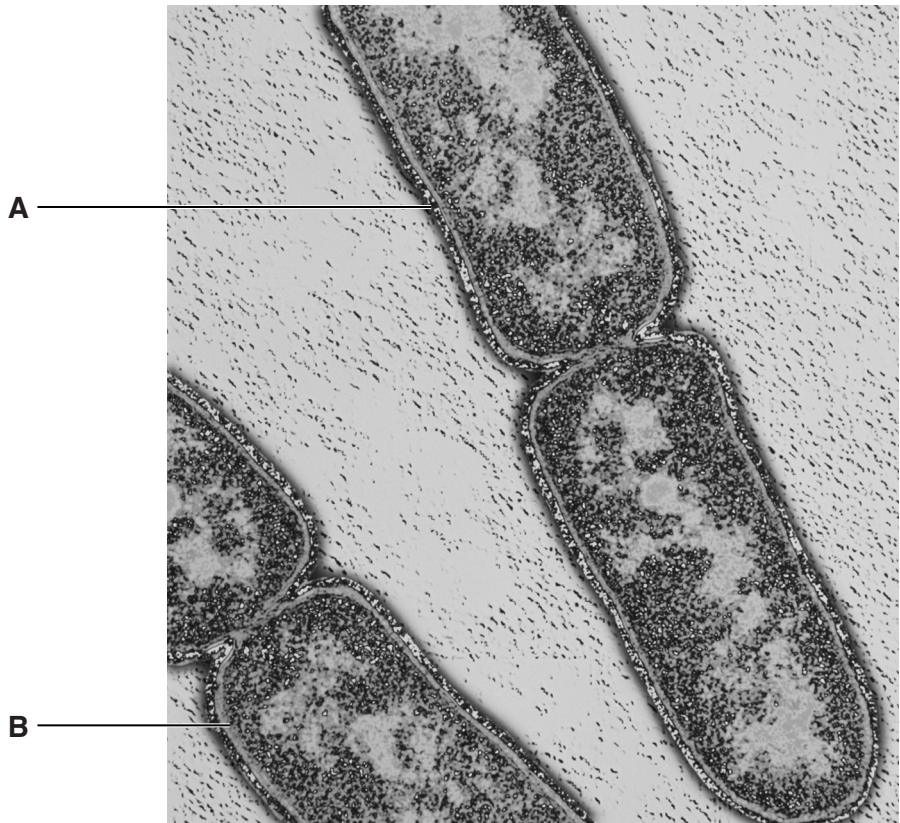


Fig. 7.1

The structure labelled **B** (pale layer) is a cell wall.

(i) Identify structure **A** (dark layer).

..... [1]

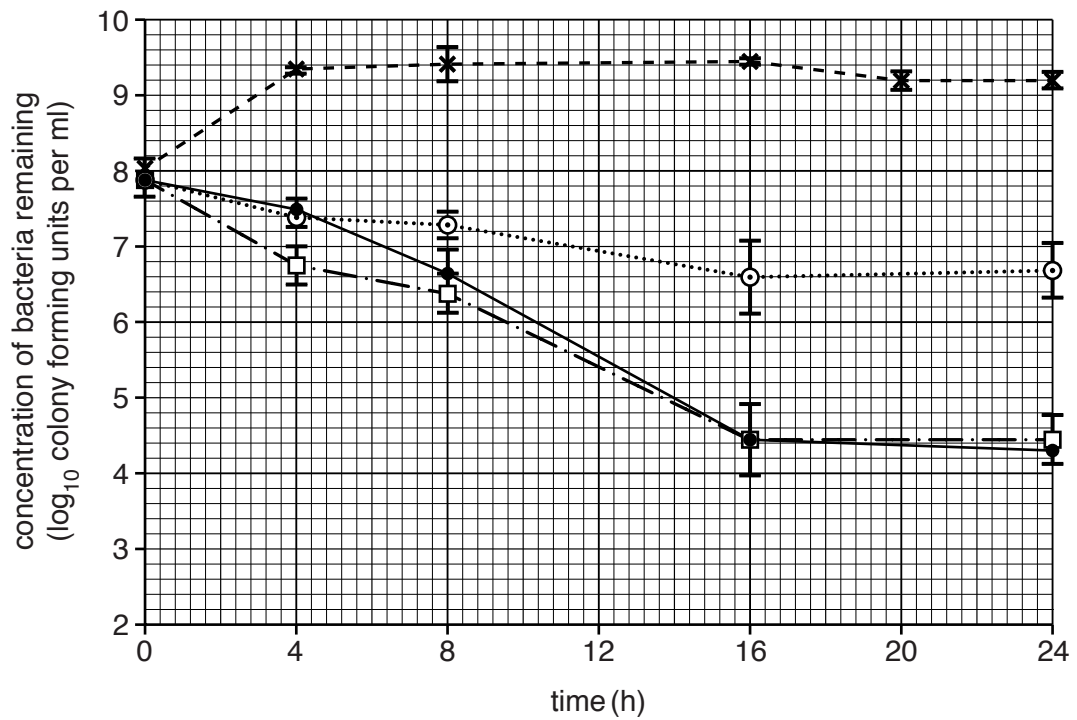
(ii) Name the substance from which structure **B** is made [1]

(iii) State **one** difference between the DNA in cells such as those shown in Fig. 7.1 and the DNA present in lymphocytes.

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

(c) In 2014, scientists discovered a new antibiotic called teixobactin.

The effectiveness of teixobactin in controlling bacterial growth was compared with that of two established antibiotics in a series of tests. Some of the test results are shown in Fig. 7.2.



Key:

- x-- Control
-○..... Vancomycin
- Oxacillin
- Teixobactin

Fig. 7.2

Using the information in Fig. 7.2, discuss the relative effectiveness of antibiotics in controlling bacterial growth.

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..... [3]

[Total: 14]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.



A vertical form designed for data entry or record-keeping. It features a solid vertical line on the left side that defines a narrow column. The rest of the page is filled with horizontal dotted lines, creating a series of rows for text. There are 30 rows in total, each starting with the solid left border and extending across the page with dotted lines.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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