

Candidate forename						Candidate surname					
Centre number						Candidate number					

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE
F224
HUMAN BIOLOGY

Energy, Reproduction and Populations

FRIDAY 22 JUNE 2012: Morning
DURATION: 1 hour 15 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- 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 60.



Where you see this icon you will be awarded marks for the quality of written communication in your answer.

- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

BLANK PAGE

QUESTION 1 STARTS ON PAGE 4

Answer ALL the questions.

- 1 (a) The world's human population has been increasing exponentially for the last 100 years.**

Fig. 1.1 shows the birth rate and death rate for the United Kingdom, Ghana and Nigeria for the year 2006.

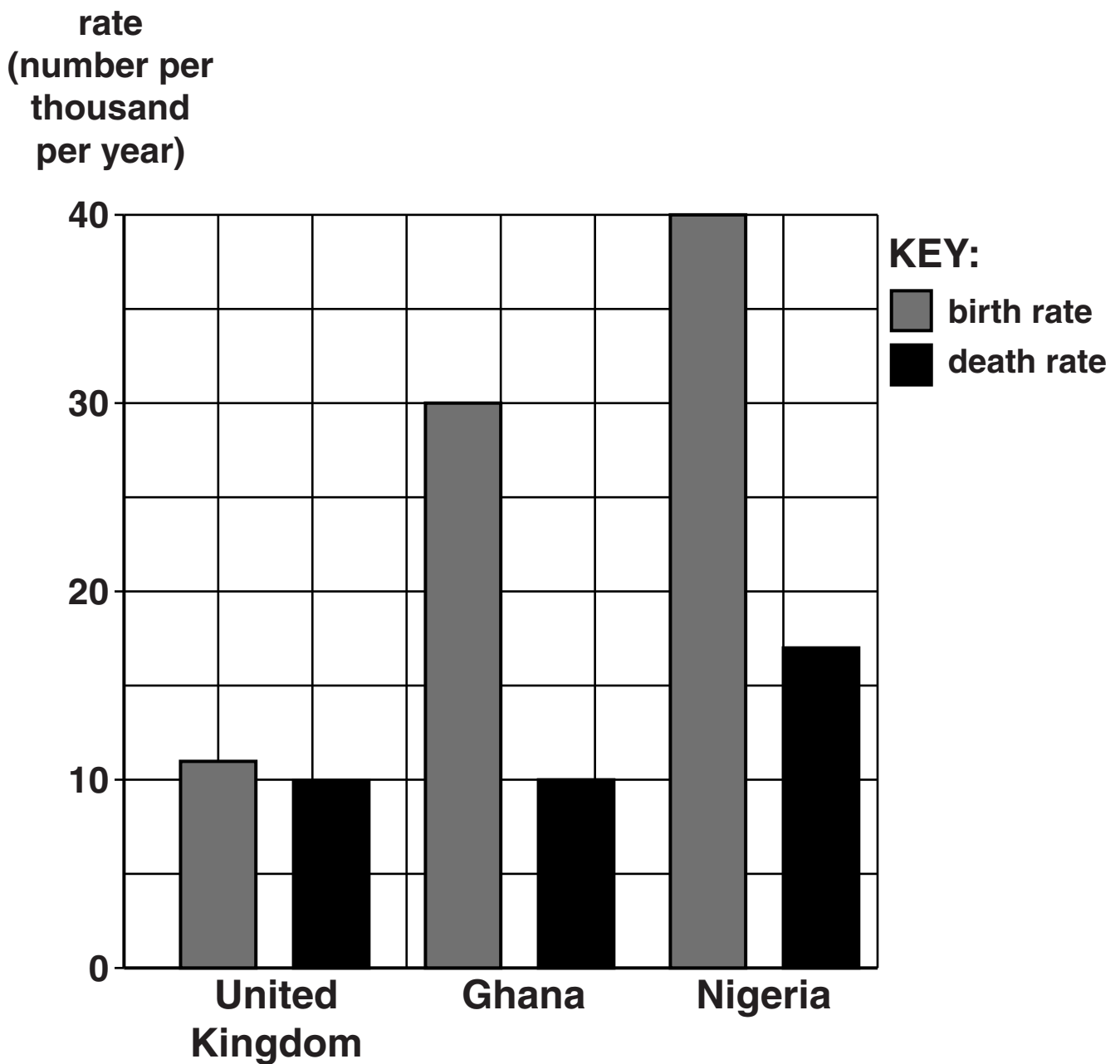


Fig. 1.1

- (i) Suggest reasons for the difference in BIRTH RATE between the United Kingdom and Nigeria.

[2]

- (ii) Suggest why Ghana has the same DEATH RATE as the United Kingdom despite being a less economically developed country.

[2]

- (b) Factors that affect the size of human populations are termed density-dependent (DD) factors and density-independent (DI) factors.**

Table 1.1 below shows three factors which caused changes in human population size in different parts of the world.

Suggest whether each factor is density-dependent (DD) or density-independent (DI) and write DD or DI in the right-hand column of the table.

Table 1.1

factor	DD or DI
many people died due to an increase in malaria in Western Africa	<hr/>
drought caused famine in parts of the Sudan	<hr/>
a tsunami destroyed fishing villages on the east coast of India	<hr/>

[2]

[Total: 6]

BLANK PAGE

QUESTION 2 STARTS ON PAGE 8

2 The male and female reproductive systems are regulated by hormones.

(a) The male reproductive and urinary systems are connected.

Fig. 2.1 is a diagram of the male reproductive system and part of the urinary system.

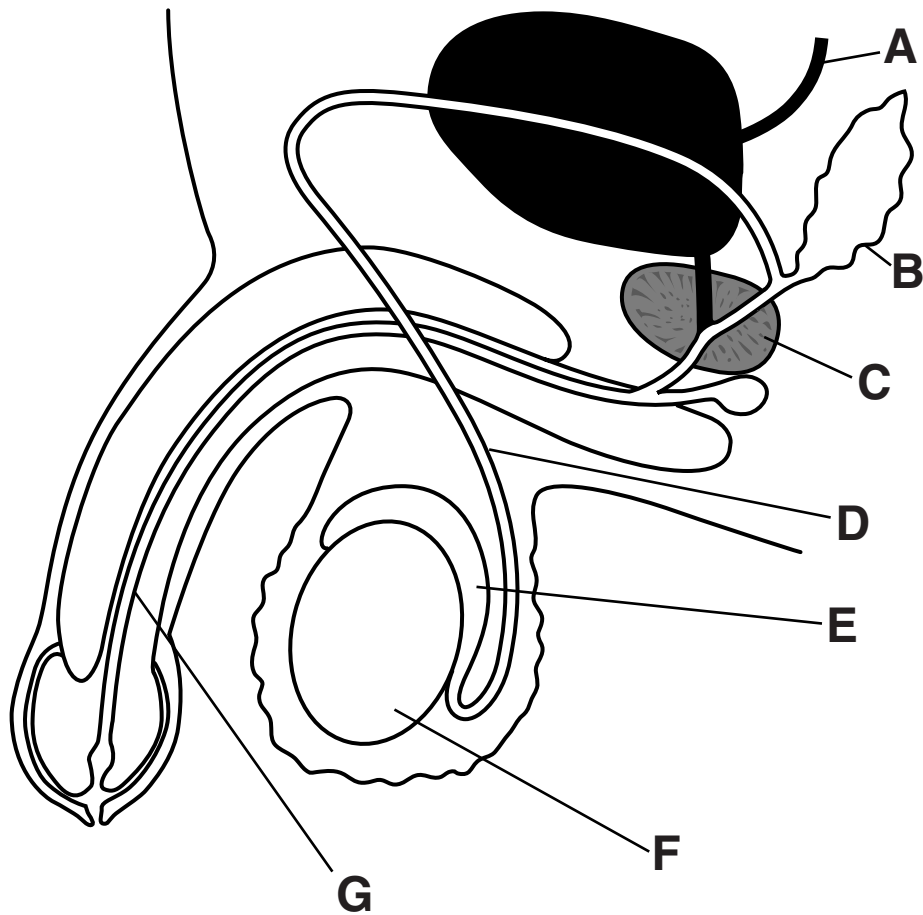


Fig. 2.1

Table 2.1 is a list of functions carried out by different structures in the male reproductive system and urinary system.

Identify the structure on Fig. 2.1 which matches the function given in Table 2.1.

Write the correct letter in Table 2.1.

Table 2.1

function	structure
stores mature spermatozoa	_____
produces testosterone	_____
produces alkaline fluid	_____

[3]

- (b) The events of the menstrual cycle are controlled by the interaction of hormones produced by the brain and the female reproductive system.**

GnRH is released by the hypothalamus and stimulates the anterior pituitary gland.

- (i) Give the full name of GnRH.**

_____ **[1]**

- (ii) Oestrogen concentration rises between day 4 and day 14 of the menstrual cycle.**

This rise in oestrogen concentration initially inhibits LH and FSH secretion. However, on day 13, the rise in oestrogen concentration stimulates a surge in the secretion of these hormones, particularly LH.

Explain the significance of this surge in LH secretion.

_____ **[2]**

(iii) Progesterone is a steroid hormone.

- **Steroids are synthesised from cholesterol.**
- **Progesterone receptors are found INSIDE endometrial cells.**

Suggest how progesterone molecules reach the receptors AND how they are able to trigger changes in endometrial cells.

[2]

- (iv) Describe what happens to the endometrium as a result of stimulation by progesterone.**

[2]

- (v) Menstruation begins on day 28 of the menstrual cycle.**

During this time, cells in the endometrium are deleted, leading to a breakdown in endometrial tissues.

Suggest what process causes this cell deletion in endometrial tissues.

_____ [1]

[Total: 11]

BLANK PAGE

QUESTION 3 STARTS ON PAGE 14

- 3 (a) During exercise, muscle cells require more energy than when they are at rest. This means that enzyme controlled reactions in glycolysis, the link reaction and the Krebs cycle will need to happen at an increased rate.

Glycolysis takes place in the cytoplasm of muscle cells to provide energy to these cells and to produce pyruvate.

Letters P and Q in Fig. 3.1 indicate what can happen to the pyruvate produced by glycolysis in a muscle cell.

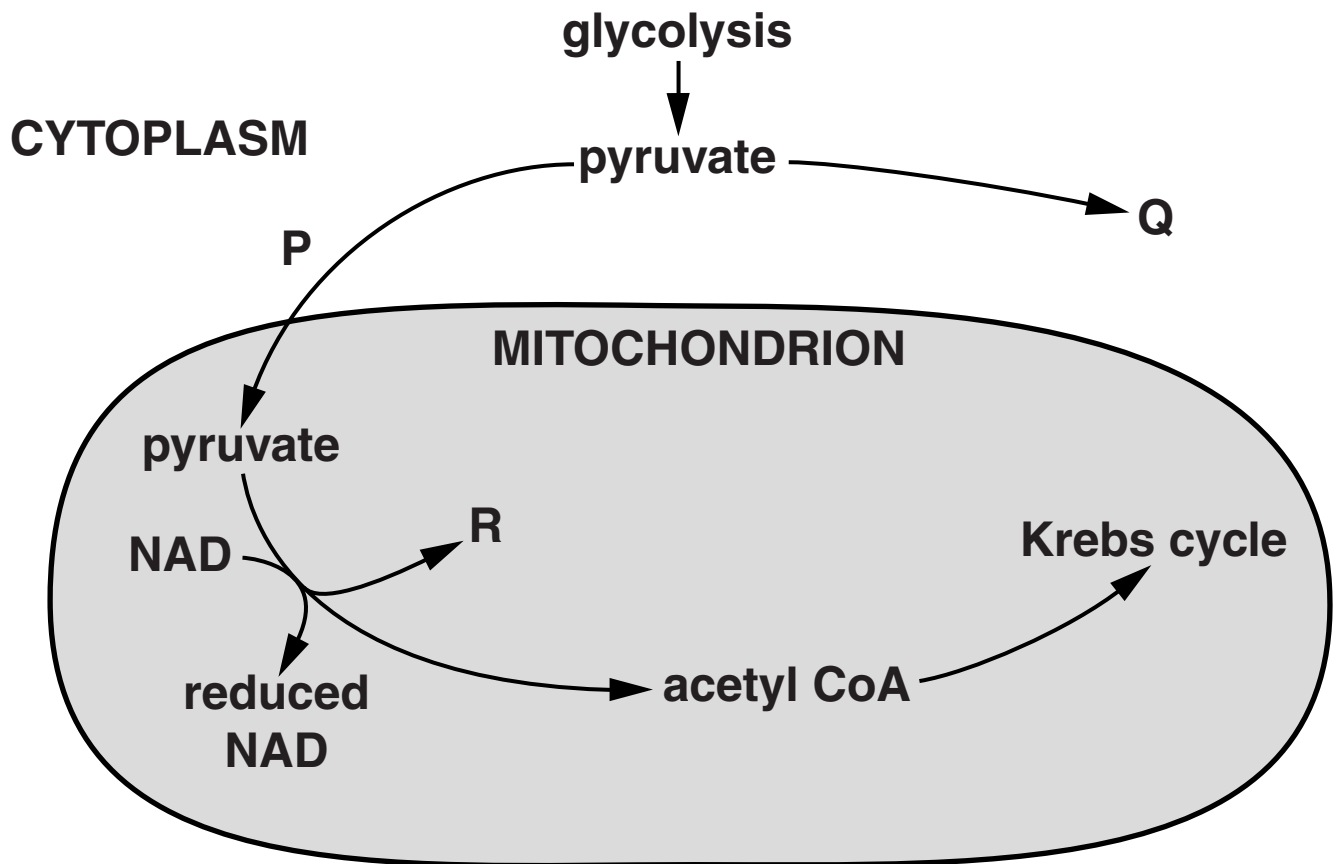


Fig. 3.1

(i) Under what conditions would Q be formed?

_____ [1]

(ii) Identify the final product of Q.

_____ [1]

(iii) Identify substance R.

_____ [1]

(iv) The conversion of pyruvate to acetyl CoA involves the use of two types of enzyme.

Name both TYPES of enzyme.

_____ [2]

(v) Suggest why the link reaction does not take place in red blood cells (erythrocytes).

_____ [1]

- (b) The sequence of biochemical processes in the cell, called the Krebs cycle, was demonstrated in 1957 at Oxford University by Sir Hans Krebs.**

Outline the sequence of events in the Krebs cycle.



In your answer you should use the appropriate technical terms, spelt correctly.

[illegible]

[6]

[Total: 12]

4 Humans can act as consumers in many food chains.

Fig. 4.1, opposite, shows the energy flow through the following food chain.

maize crop → cattle → human

The numbers represent energy in $\text{kJ m}^{-2} \text{ day}^{-1}$.

- (a) (i) Calculate the percentage of light energy available to plants that is fixed in photosynthesis by the maize crop.**

Show your working. GIVE YOUR ANSWER TO TWO DECIMAL PLACES.

Answer = _____ % [2]

- (ii) Explain why all of the energy fixed in photosynthesis by the maize crop is not passed on to the cattle.**

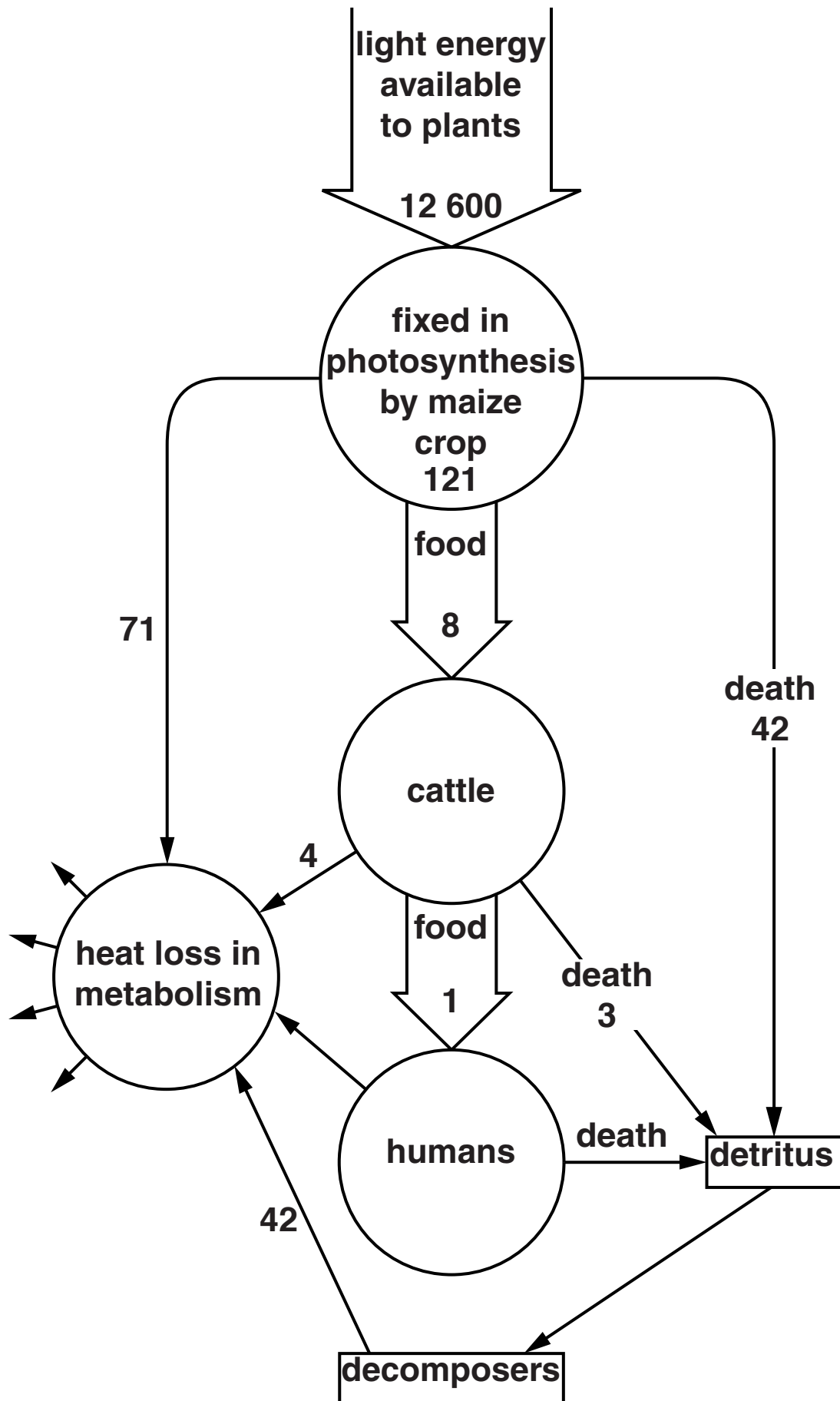


Fig. 4.1

(b) All organisms that are not eaten will eventually die of other causes and form part of the detritus, as shown in Fig. 4.1. The detritus will be decomposed by microorganisms allowing nitrogen to be recycled.

(i) Name ONE compound containing nitrogen that is present in bodies of dead organisms.

_____ [1]

(ii) Nitrogenous compounds from dead organisms are converted into ammonium ions. These ions can then be converted by bacteria into nitrite and then nitrate ions. Nitrate ions can be absorbed, in solution, by plants such as maize.

State what TYPE of bacteria convert nitrite into nitrate ions.

_____ [1]

(iii) Nitrate fertilisers are applied to soil, either as a solid powder or as granules. These fertilisers dissolve in ground water to form a solution.

State ONE property of water that enables it to act as a solvent for nitrate fertilisers.

_____ [1]

[Total: 8]

BLANK PAGE

QUESTION 5 STARTS ON PAGE 22

- (a) Some cells die as a result of damaged DNA molecules.**

Explain how DNA molecules can be damaged and how this damage can be repaired in cells.



In your answer you should use the appropriate technical terms, spelt correctly.

[illegible]

[6]

(b) At the ends of each chromosome are structures called telomeres.

Most human body cells can only divide up to 50 times before they die. This is due to the reduction in the length of the telomeres during each cell division.

Suggest why a reduction in the length of the telomeres could result in the ageing and eventual death of a cell.

[3]

- (c) An enzyme called telomerase is produced by some cells in the human body. Telomerase adds nucleotides to the ends of chromosomes.

Table 5.1 shows the telomerase activity and telomere length of some types of cell after cell division.

Table 5.1

type of cell	number of cell divisions	telomerase activity	telomere length
embryonic stem cell	unlimited	high	maintained
bone cell	limited	absent	shortened
epidermis cell	limited	absent	shortened
liver cell	partially limited	low	slightly shortened
cancer cell	unlimited	high	maintained
neurone	limited	absent	shortened

Using the information in Table 5.1:

- (i) suggest ONE consequence of high telomerase activity in a cell;

_____ [1]

- (ii) suggest why, unlike some other organs in the human body, the liver is able to repair itself.

[1]

- (d) A new drug is being trialled in the USA as a treatment for breast cancer. This drug acts as an inhibitor of the enzyme telomerase.

Fig. 5.1 shows the effects of telomerase inhibitor and conventional chemotherapy on the size of the breast tumour.

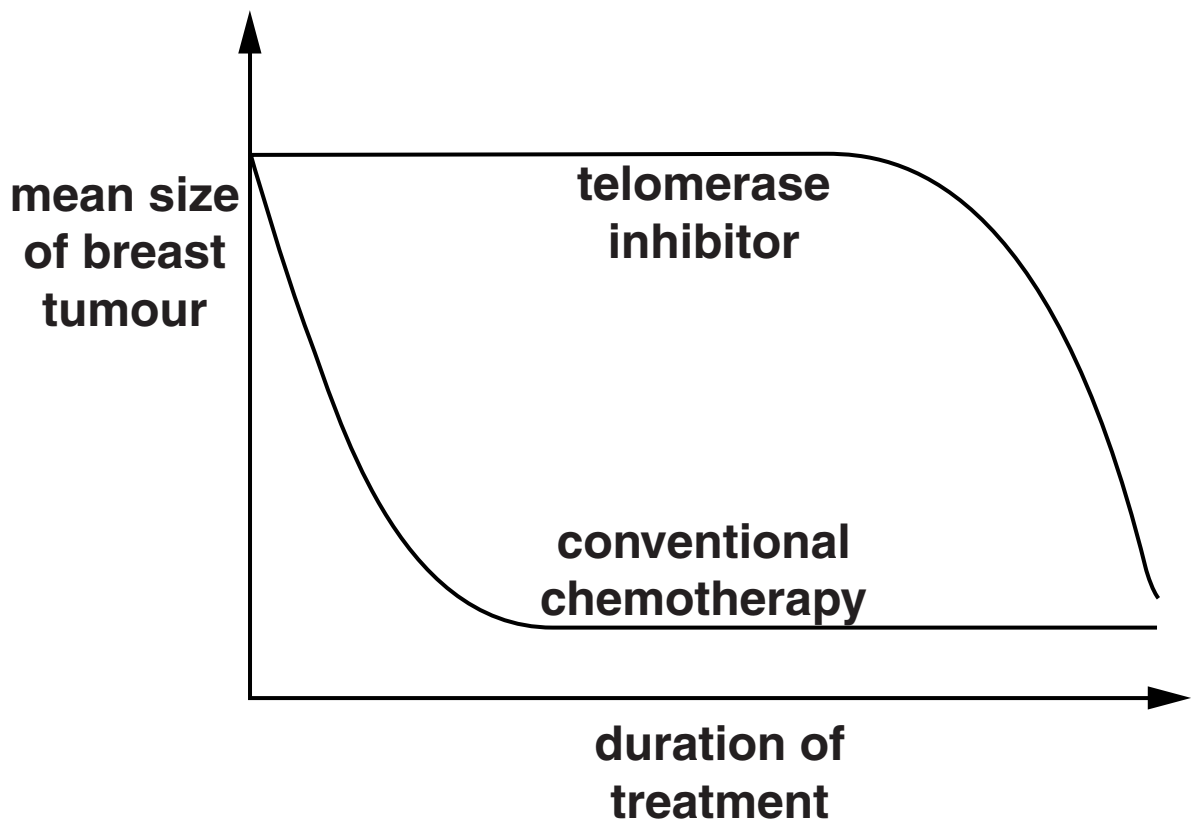


Fig. 5.1

- (i) Suggest how the activity of telomerase enzyme might be slowed down by this new drug.**

[2]

- (ii) The data in Fig. 5.1 suggest that the mean size of breast tumours decreases more quickly with conventional chemotherapy than with telomerase inhibitor.**

Suggest the advantages of using telomerase inhibitor treatment compared to conventional chemotherapy.

[2]

[Total: 15]

BLANK PAGE

- 6 (a) Multiple pregnancies in humans can occur for a number of reasons. Twins are the most common example of a multiple pregnancy.**

Describe how dizygotic (fraternal) and monozygotic (identical) twins are formed.

dizygotic _____

monozygotic _____

_____ **[2]**

- (b) Occasionally, a twin detected by an ultrasound scan early in pregnancy is not detected by subsequent scans.**

State the term used to describe this situation.

_____ **[1]**

(c) Table 6.1 shows the incidence of twins in the USA in the year 2000.

Table 6.1

age of mother (years)	fertility treatment	family history of twins	fraternal (fr) or identical (id)	number of pairs of twins (% of total live births)
25–29	x	✓	fr	3.0
30–34	x	✓	fr	4.0
35–39	x	✓	fr	5.0
25–39	x	x	fr	1.7
25–39	✓	x	fr	20.0
25–39	x	x	id	0.4

Using the information in Table 6.1, what conclusions can be made regarding the incidence of twins in the USA in the year 2000?

[3]

(d) State the possible consequences to the BABIES of a multiple pregnancy.

[2]

[Total: 8]

END OF QUESTION PAPER

ADDITIONAL PAGE

IF ADDITIONAL SPACE IS REQUIRED, YOU SHOULD USE THE LINED PAGE(S) BELOW. THE QUESTION NUMBER(S) MUST BE CLEARLY SHOWN.

[illegible]

ADDITIONAL PAGE

[illegible]

[illegible]

ADDITIONAL PAGE

[illegible]

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.