

Friday 22 June 2012 – Morning

A2 GCE HUMAN BIOLOGY

F224 Energy, Reproduction and Populations

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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Centre number							Candidate number				
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INSTRUCTIONS TO CANDIDATES

- 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 **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.
- This document consists of **20** pages. Any blank pages are indicated.

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.

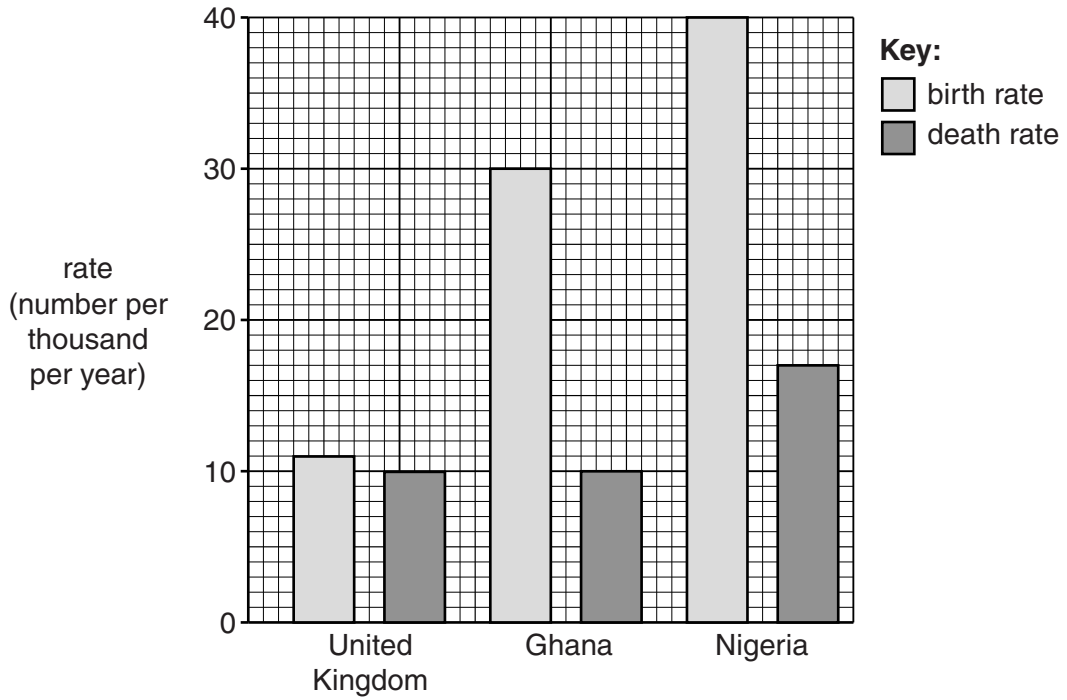


Fig. 1.1

- (i) Suggest reasons for the difference in **birth rate** between the United Kingdom and Nigeria.

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..... [2]

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.

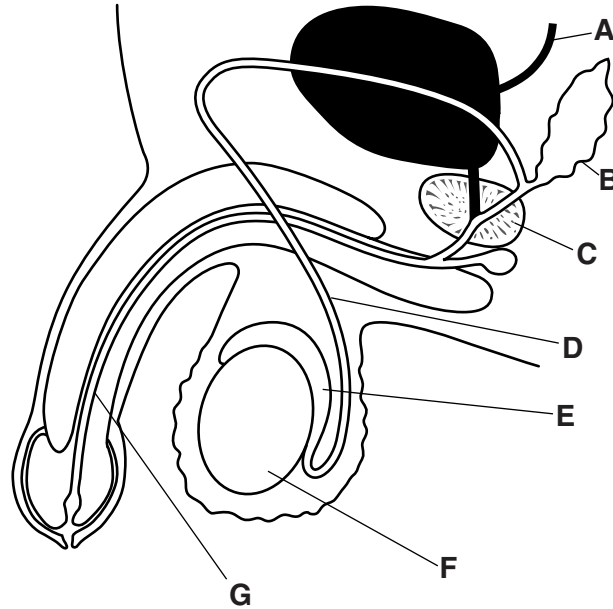


Fig. 2.1

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.

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..... [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.

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..... [2]

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

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..... [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]

PLEASE DO NOT WRITE ON THIS PAGE

QUESTION 3 STARTS ON PAGE 8

- 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.

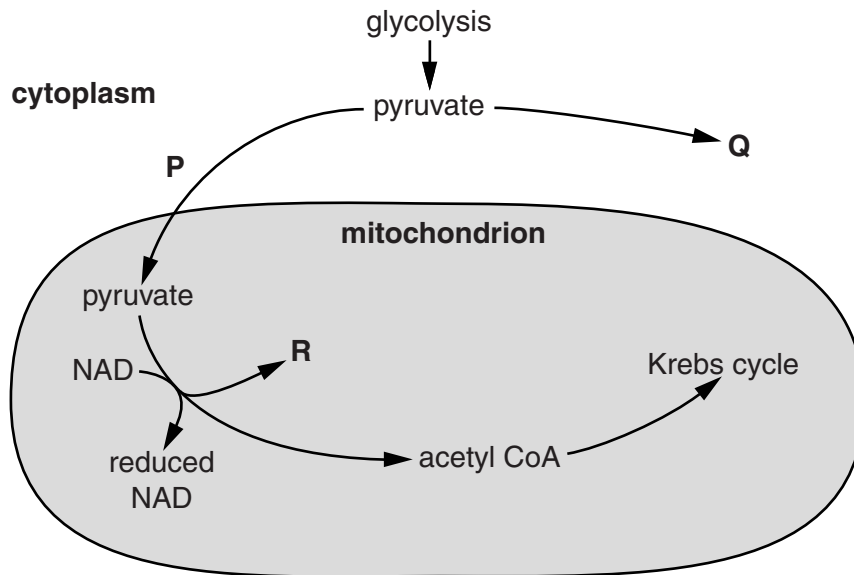


Fig. 3.1

- (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]

4 Humans can act as consumers in many food chains.

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

maize crop → cattle → human

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

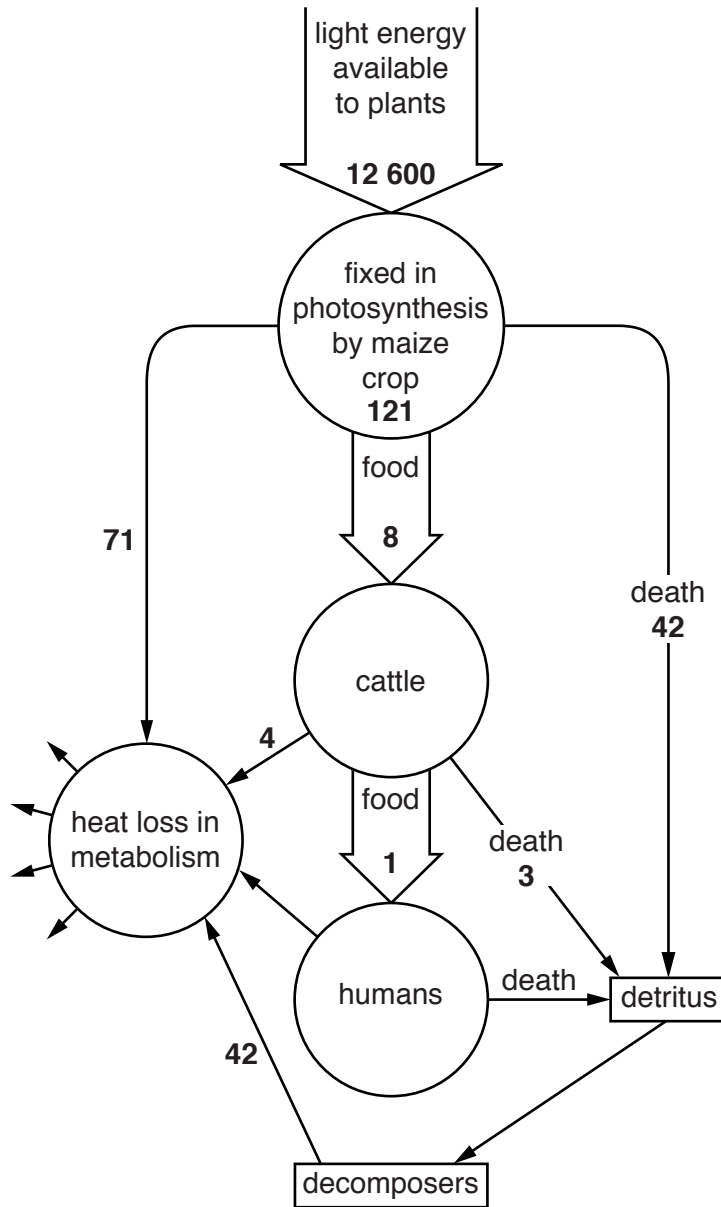


Fig. 4.1

(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]

- (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;

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 [1]

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

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 [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.

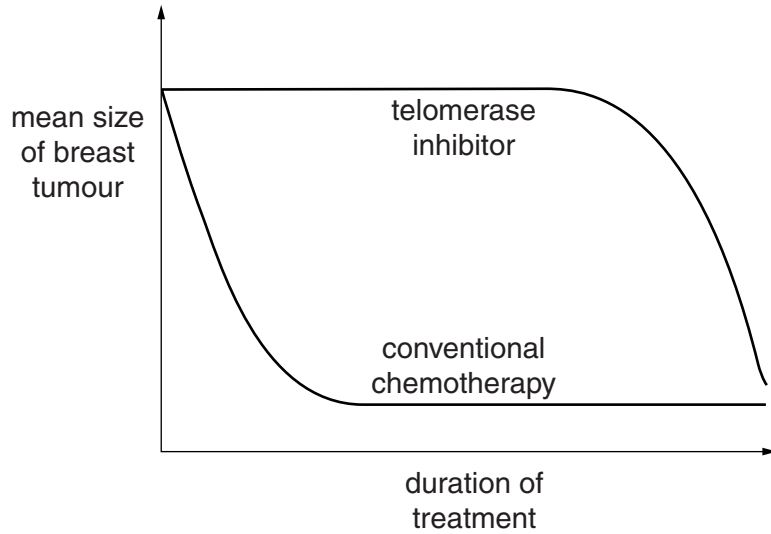


Fig. 5.1

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

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..... [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.

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..... [2]

[Total: 15]
Turn over

- 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

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monozygotic

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..... [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

ADDITIONAL PAGE

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