



**ADVANCED GCE**  
**BIOLOGY**  
 Central Concepts

**2804**

Candidates answer on the Question Paper

**OCR Supplied Materials:**  
 None

**Other Materials Required:**

- Electronic calculator
- Ruler (cm/mm)

**Wednesday 16 June 2010**  
**Morning**

**Duration:** 1 hour 30 minutes



Candidate  
Forename

Candidate  
Surname

Centre Number

Candidate Number

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**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 **90**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- This document consists of **20** pages. Any blank pages are indicated.

Examiner's Use Only:

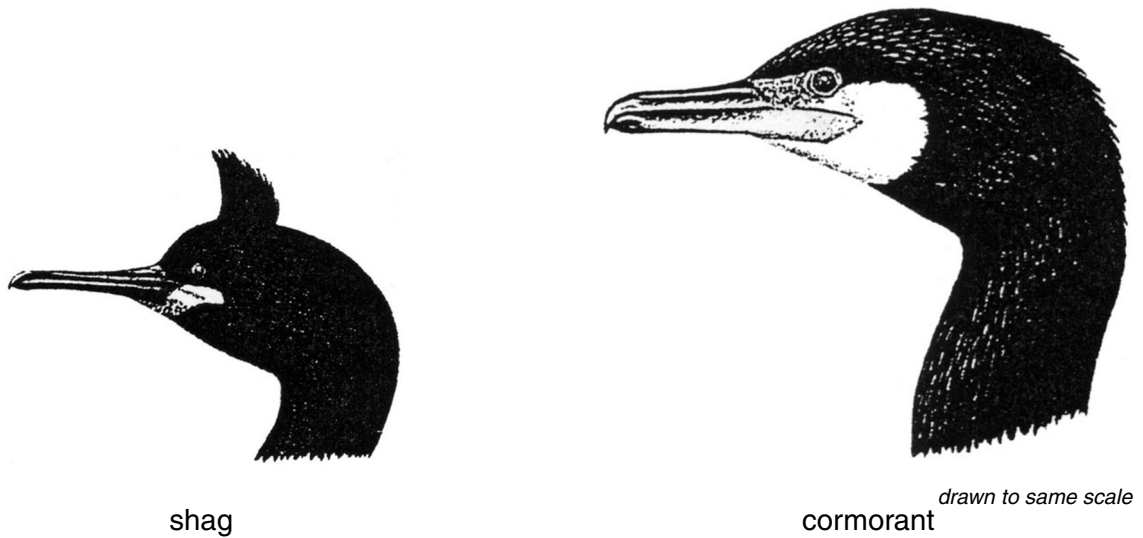
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Answer **all** the questions.

- 1 (a) Define the term *interspecific competition*.

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

Fig. 1.1 shows the shag, *Phalacrocorax aristotelis*, and the cormorant, *Phalacrocorax carbo*, which feed in the same waters and nest on the same cliffs.



**Fig. 1.1**

Table 1.1 shows the prey eaten by these two birds.

**Table 1.1**

| prey             |                 | percentage of prey eaten by: |           |
|------------------|-----------------|------------------------------|-----------|
|                  |                 | shag                         | cormorant |
| surface swimming | sand eels       | 33                           | 0         |
|                  | herring         | 49                           | 1         |
| bottom feeding   | flat fish       | 1                            | 26        |
|                  | shrimps, prawns | 2                            | 33        |

- (b) State why the results for each species of bird do not add up to 100%.

..... [1]

- (c) With reference to Fig. 1.1 and Table 1.1, describe how the behaviour of shags and cormorants avoids direct competition.

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

- (d) Suggest a resource for which these two species show interspecific competition.

..... [1]

[Total: 7]

- 2 Human kidneys process  $1200\text{cm}^3$  of blood every minute. Approximately  $125\text{cm}^3$  of fluid is filtered from this blood into the renal capsules, resulting in  $1500\text{cm}^3$  of urine being produced each day.

- (a) (i) Calculate the volume of filtrate, in  $\text{cm}^3$ , produced by the kidneys in a day.  
Show your working.

Volume = .....  $\text{cm}^3$  [2]

- (ii) Calculate the **percentage** of the filtrate that is reabsorbed into the bloodstream.  
Show your working.

Answer = ..... % [2]

- (b) Table 2.1 shows the composition of fluids in the kidney.

**Table 2.1**

| component                           | concentration/g $100\text{cm}^{-3}$ |                              |                             |
|-------------------------------------|-------------------------------------|------------------------------|-----------------------------|
|                                     | blood plasma<br>entering glomerulus | filtrate in renal<br>capsule | urine in collecting<br>duct |
| water                               | 90 – 93                             | 97 – 99                      | 96                          |
| proteins                            | 7 – 9                               | 0.0                          | 0.0                         |
| glucose                             | 0.1                                 | 0.1                          | 0.0                         |
| urea                                | 0.03                                | 0.03                         | 2.0                         |
| other nitrogenous<br>waste products | 0.003                               | 0.003                        | 0.24                        |
| sodium ions                         | 0.32                                | 0.32                         | 0.30 – 0.35                 |

- (i) State why there are no proteins in the filtrate in the renal capsule.

..... [1]

- (ii) Explain why there is glucose present in the filtrate but not in the urine.

.....

.....

.....

..... [2]

- (iii) Explain why the concentration of urea is greater in the urine than it is in the filtrate.

.....

.....

.....

..... [2]

- (iv) Name **two** other nitrogenous waste products found in urine.

1 .....

2 ..... [2]

**QUESTION 2(c) STARTS ON PAGE 6**

Describe the sequence of events that results in the water potential of the blood plasma returning to normal.

..... [7]

**[Total: 19]**

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**QUESTION 3 STARTS ON PAGE 8**

- 3** Coat colour in rabbits is determined by a single gene which has four different alleles. The gene is **not** sex linked.

- The allele for agouti colour,  $C^A$ , is dominant to all the other alleles.
- The allele for albino,  $C^a$ , is recessive to all the other alleles.
- The allele for chinchilla,  $C^{Ch}$ , is dominant to the Himalayan allele,  $C^H$ .

- (a)** State **all** the possible genotypes for the following phenotypes:

chinchilla .....

agouti ..... [2]

- (b)** A young girl owns a pet female Himalayan rabbit. She wants to know whether it is homozygous (pure breeding) for this trait. Her friend owns a male albino rabbit, and says that if they cross the two rabbits and they find any albino offspring she can be sure that the female is not pure breeding.

- (i)** Name the type of cross that they will carry out.

..... [1]

- (ii)** The friend's statement is valid. Explain why.

You may use genetic diagrams in your answer.

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[3]



- (c)** In the wild, rabbits have a high reproductive rate. However, the population size remains fairly stable.

Explain how this stability is maintained **and** how the gene pool of the rabbit population may be affected.

[5]

**[Total: 11]**

- 4 Fig. 4.1 represents the relationship between parts of two nerve cells (neurones).

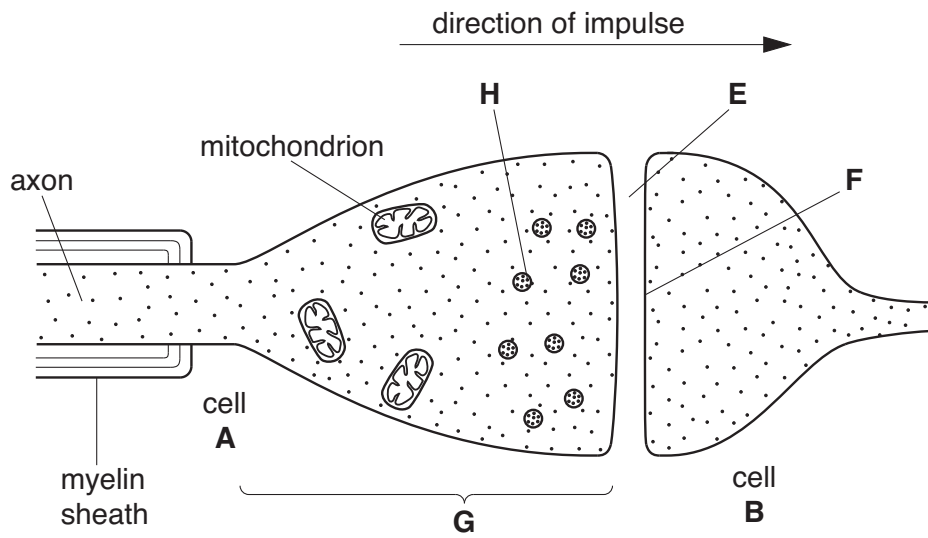


Fig. 4.1

- (a) Name E to H.

E .....

F .....

G .....

H .....

[4]

- (b) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Describe how a nerve impulse passes from cell A to cell B.

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**(c)** Explain the importance of the myelin sheath in the transmission of a nerve impulse.

[3]

**(d)** Explain what is meant by the 'all or nothing' response of a neurone to a stimulus.

[2]

**Turn over**

- 5 The light dependent stage of photosynthesis takes place on thylakoid membranes in chloroplasts. These membranes surround the thylakoid space (lumen) and are arranged into stacks known as grana. Fig. 5.1 summarises the processes that take place at the thylakoid membrane.

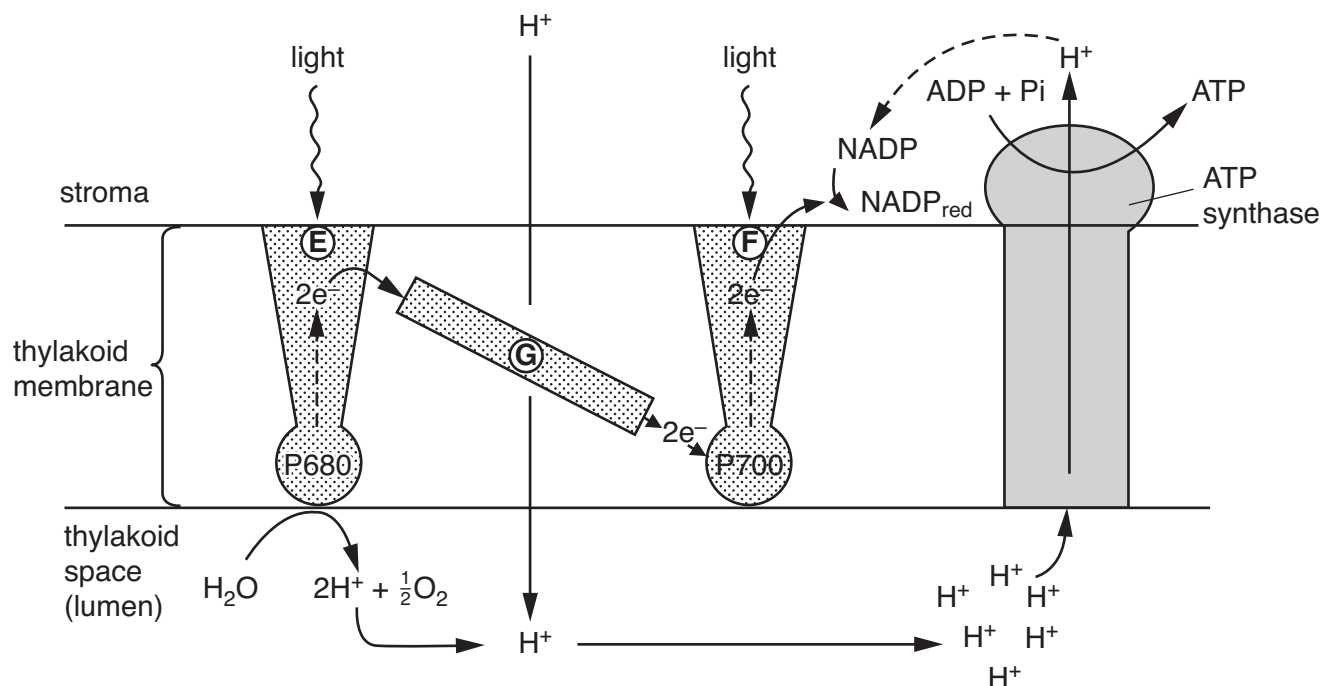


Fig. 5.1

- (a) State the general name of the pigment complexes shown as **E** and **F** on the diagram.  
 ..... [1]
- (b) Name the pigment represented by P680 and P700.  
 ..... [1]
- (c) Name the type of molecule represented by **G**.  
 ..... [1]
- (d) State, **using the information in Fig. 5.1**, why the pH of the thylakoid space (lumen) is lower than that of the stroma.  
 ..... [1]
- (e) Explain the function of this pH gradient.  
 .....  
 .....  
 .....  
 .....

- Explain how this causes plants to die.

[5]

- Suggest why.

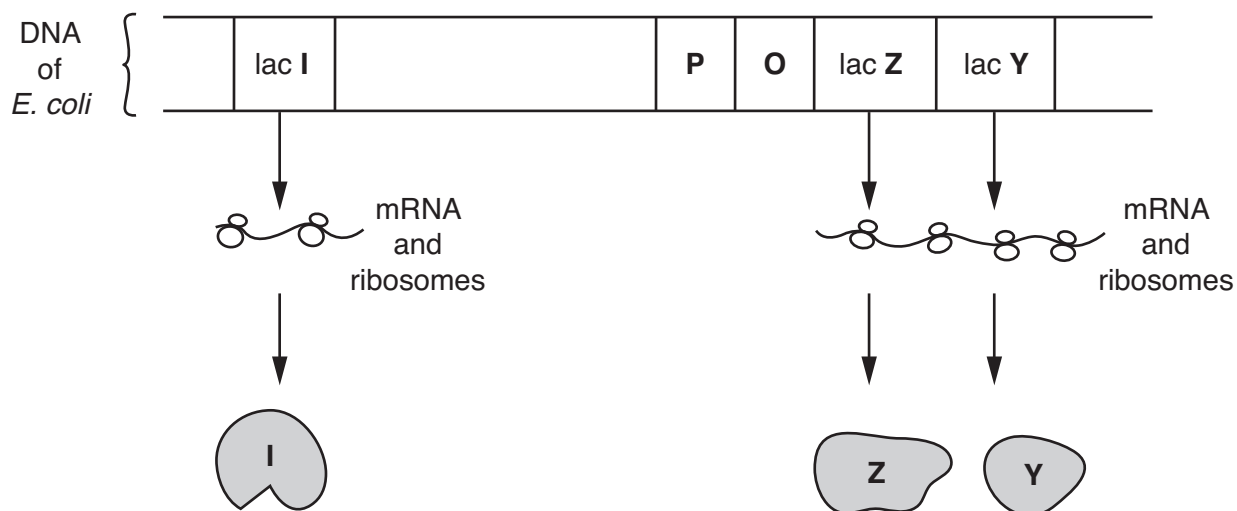
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**Turn over**

- 6 The bacterium, *Escherichia coli* (*E. coli*), can use either glucose or lactose as a respiratory substrate.

When grown in a medium containing lactose, but no glucose, the genes coding for the enzymes required to use lactose are switched on.

These genes are located together in the ***lac operon*** as shown in Fig. 6.1.



**Fig. 6.1**

- (a) Complete the table below stating the functions of **O**, **P**, **I**, **Z** and **Y**. The function of *lac I* has been done for you.

|                               | function                                 |
|-------------------------------|--|
| <b>lac I</b>                  | controls production of repressor protein |
| <b>O</b> – operator           |  |
| <b>P</b> – promoter           |  |
| <b>I</b> – repressor molecule |  |
| <b>Z</b> – beta galactosidase |  |
| <b>Y</b> – lactose permease   |  |

[5]

- (b) Explain why beta galactosidase and lactose permease are **not** produced when lactose is absent.

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..... [3]

- (c) Outline the events that occur within *E. coli* when lactose is the **only** respiratory substrate available.

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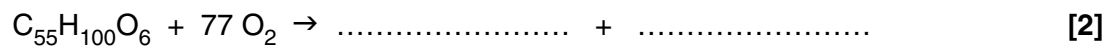
..... [4]

[Total: 12]

- 7 (a) State what is meant by the term *respiratory quotient (RQ)*.

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

- (b) Complete and balance the following equation for the aerobic respiration of **compound A**,  $C_{55}H_{100}O_6$ .



- (c) Calculate the RQ for this reaction.

Answer = ..... [2]

- (d) Identify, from the RQ value calculated in (c), the type of molecule to which **compound A** belongs.

..... [1]



- (e) After surface sterilisation, some seeds were soaked in water for four hours before being left in moist air to germinate. The RQ values of these seeds are shown in Table 7.1.

**Table 7.1**

| time                                      | RQ   |
|---|------|
| immediately after soaking                 | 6.34 |
| after 12 hours in air                     | 2.22 |
| after 36 hours in air, radicles appearing | 1.02 |

Explain the changes in RQ values of these germinating seeds.

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..... [4]

**[Total: 10]**

**END OF QUESTION PAPER**

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