



ADVANCED GCE
BIOLOGY
 Central Concepts

2804

Candidates answer on the Question Paper

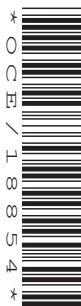
OCR Supplied Materials:
 None

Other Materials Required:

- Electronic calculator
- Ruler (cm/mm)

Thursday 28 January 2010
Morning

Duration: 1 hour 30 minutes



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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.
- 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.

Examiner's Use Only:			
1			
2			
3			
4			
5			
6			
Total			

Answer **all** the questions.

- 1 Fig. 1.1 shows some of the reactions in a cell which occur during aerobic respiration.

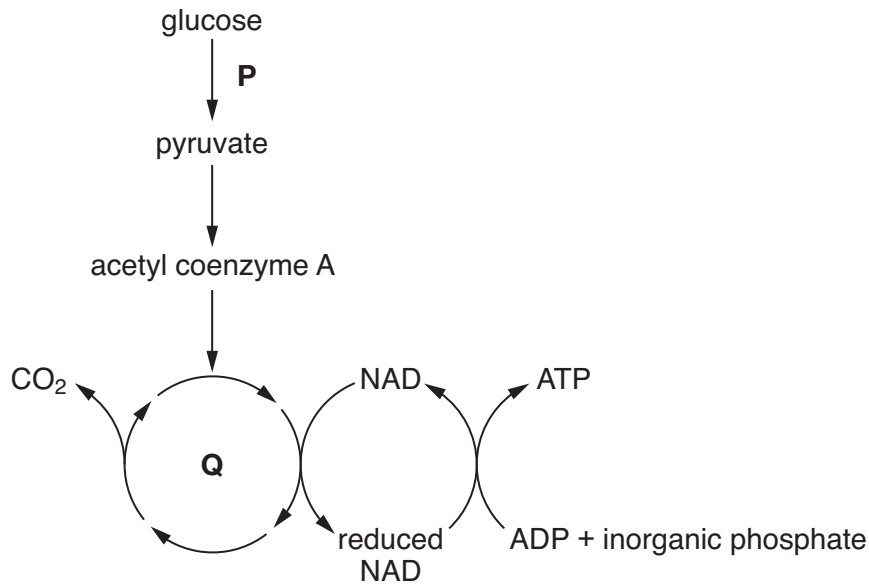


Fig. 1.1

- (a) (i) Name the reaction pathways **P** and **Q**.

P

Q [2]

- (ii) State where reaction pathway **P** occurs.

..... [1]

- (b) One of the enzymes involved in the conversion of pyruvate to acetyl coenzyme A is called pyruvate dehydrogenase.

Explain why this enzyme is given this name.

.....

 [3]

- (c) State what is meant by the term *decarboxylation*.

..... [1]

(d) The respiratory quotient (RQ) is a measure of the ratio of carbon dioxide given out to the oxygen consumed by an organism over a given period.

(i) State what information is gained from determining RQ values.

.....

.....

..... [2]

(ii) Table 1.1 shows RQ values of seeds and seedlings at different stages of germination and growth.

Table 1.1

stage of germination and growth	RQ
seeds soaked in water	5.6
seeds after 12 hours in soil	0.8
seedlings after 21 days	1.0

Suggest an explanation for each of the RQ values shown in Table 1.1.

seeds soaked in water

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seeds after 12 hours in the soil

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seedlings after 21 days

.....

.....

..... [6]

[Total: 15]

- 2 A cell suspension of a species of *Chlorella*, a photosynthetic protocistan, was supplied with carbon dioxide, initially at a concentration of 3%. The concentration of carbon dioxide was reduced to 1% after 100 seconds, and then to 0.03% after a further 200 seconds.

The suspension was illuminated with a bench lamp and kept at a temperature of 25°C. The levels of ribulose biphosphate (RuBP) and glycerate 3-phosphate (GP) present were determined at intervals.

The results are shown in Fig. 2.1.

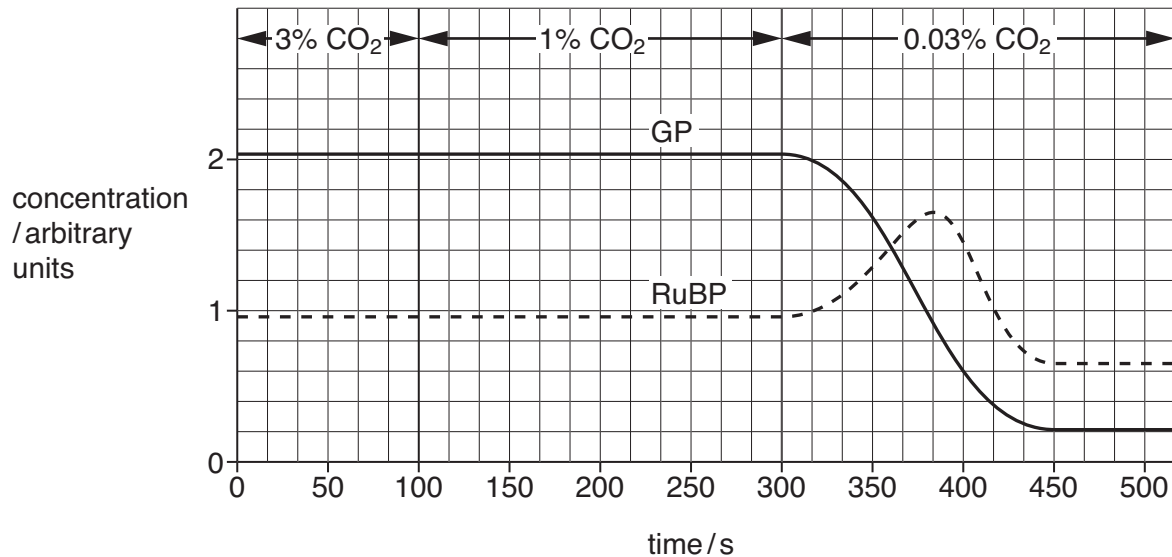


Fig. 2.1

- (a) (i) State **two** distinguishing features of organisms classified in the kingdom Protocista.
- 1
- 2 [2]
- (ii) Suggest an advantage of using *Chlorella*, rather than whole leaves from a plant, when carrying out experiments such as the one used to obtain the results shown in Fig. 2.1.
-
- [1]
- (iii) Name the biochemical pathway that involves the chemicals RuBP and GP.
- [1]
- (iv) State where this pathway occurs in the chloroplasts of *Chlorella*.
- [1]

(b) With reference to Fig. 2.1,

- (i) describe the changes in the concentrations of RuBP and GP when the carbon dioxide concentration is reduced from 3% to 1% and then to 0.03%;

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..... [3]

- (ii) explain the change in the concentration of RuBP during the 85 seconds immediately after the carbon dioxide concentration is reduced to 0.03%.

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..... [4]

- (c) Photosynthetic protocists such as *Chlorella* often form 'blooms' in ponds and lakes. These blooms are caused by rapid population growth. In the United Kingdom, these blooms often occur in May and June.

Suggest why rapid population growth can occur in May and June.

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.....

.....

..... [3]

[Total: 15]

Turn over

- 3 (a) Meiosis produces variation amongst offspring. Two processes leading to variation are crossing over and independent assortment of homologous chromosomes.

Describe these processes **and** how they lead to variation.

crossing over

.....

.....

.....

.....

independent assortment of homologous chromosomes

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.....

.....

..... [6]

- (b) Most beef in the United Kingdom comes from male cattle. Artificial insemination is a method by which a farmer can produce cattle of the required sex. Producing male cattle in this way is an example of artificial selection.

State **three** differences between artificial selection and natural selection.

artificial selection	natural selection
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- (c) In short horn cattle, coat colour is controlled by a codominant pair of alleles C^R and C^W .

The homozygous genotype $C^R C^R$ produces a red coat. The other homozygous genotype produces a white coat. The heterozygous genotype produces a mixture of red and white in the coat which is known as roan.

The presence of horns is controlled by a separate pair of alleles, where the homozygous recessive genotype hh results in the presence of horns. The hornless condition is controlled by the dominant allele H .

- (i) State the genotype of a horned roan animal.

..... [1]

- (ii) Complete the genetic diagram to show the expected phenotypic ratio if a horned roan cow is mated with a heterozygous hornless white bull.

Parental phenotypes: horned roan cow hornless white bull

Parental genotypes:

Gametes:

Offspring genotypes:

Offspring phenotypes:

Phenotypic ratio: [5]

[Total: 15]

- 4 The data in Table 4.1 was taken from a healthy individual. The table shows the concentrations of protein, glucose and urea in each of the following:

- blood plasma of the glomerular capillaries
- filtrate entering the loop of Henlé
- urine.

Table 4.1

	concentration / g 100cm ⁻³		
	blood plasma of glomerular capillaries	filtrate entering loop of Henlé	urine
protein	7.00	0.00	0.00
glucose	0.10	0.00	0.00
urea	0.03	0.15	2.00

- (a) (i) Explain why no protein and no glucose are found in the filtrate entering the loop of Henlé or in the urine.

protein

.....

.....

glucose

.....

..... [4]

- (ii) Explain how urea becomes more concentrated as the filtrate passes along the kidney tubule.

.....

.....

.....

..... [2]

- (b) In the human kidney the average rate of glomerular filtration is 125 cm³ min⁻¹.

Calculate the rate of glomerular filtration per day. Give your answer in dm³ day⁻¹.

Show your working.

Answer = dm³ day⁻¹ [2]

Describe the mechanisms involved in reabsorption in the proximal convoluted tubule **and** describe the adaptations for reabsorption shown by the epithelial cells of the proximal convoluted tubule.

[8]

Turn over

- 5** The upper and lower limits of the range of an individual species found on a rocky shore are determined by environmental and biological factors.

This creates a pattern of distinct parallel bands or zones of species across the shore. This pattern is called intertidal zonation.

Fig. 5.1 shows a profile of a rocky shore.

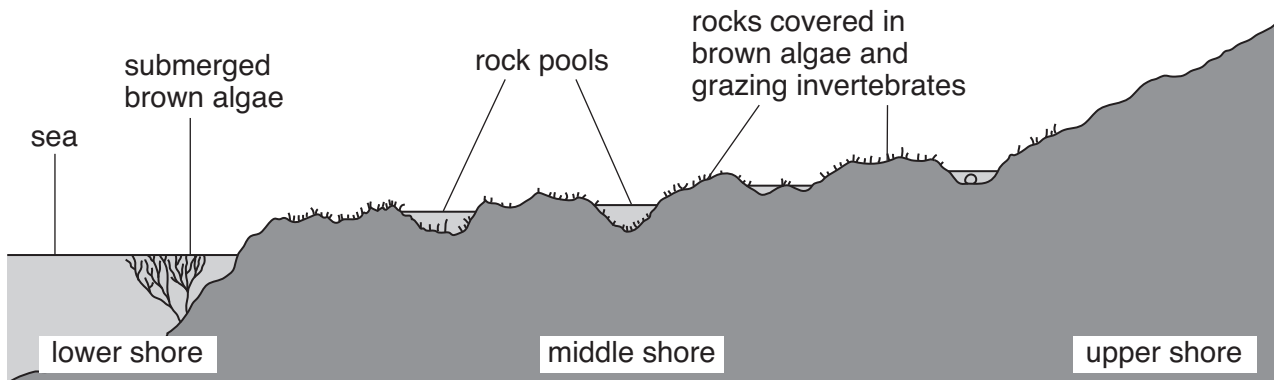


Fig. 5.1

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

Describe how systematic sampling can be used to determine the abundance of various species in the zones on a rocky shore.

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QUESTION 5 CONTINUES ON PAGE 12

Fig. 5.2 shows a graphical representation of a set of student results for an investigation into zonation on two rocky shores – one very sheltered and one very exposed to wave action.

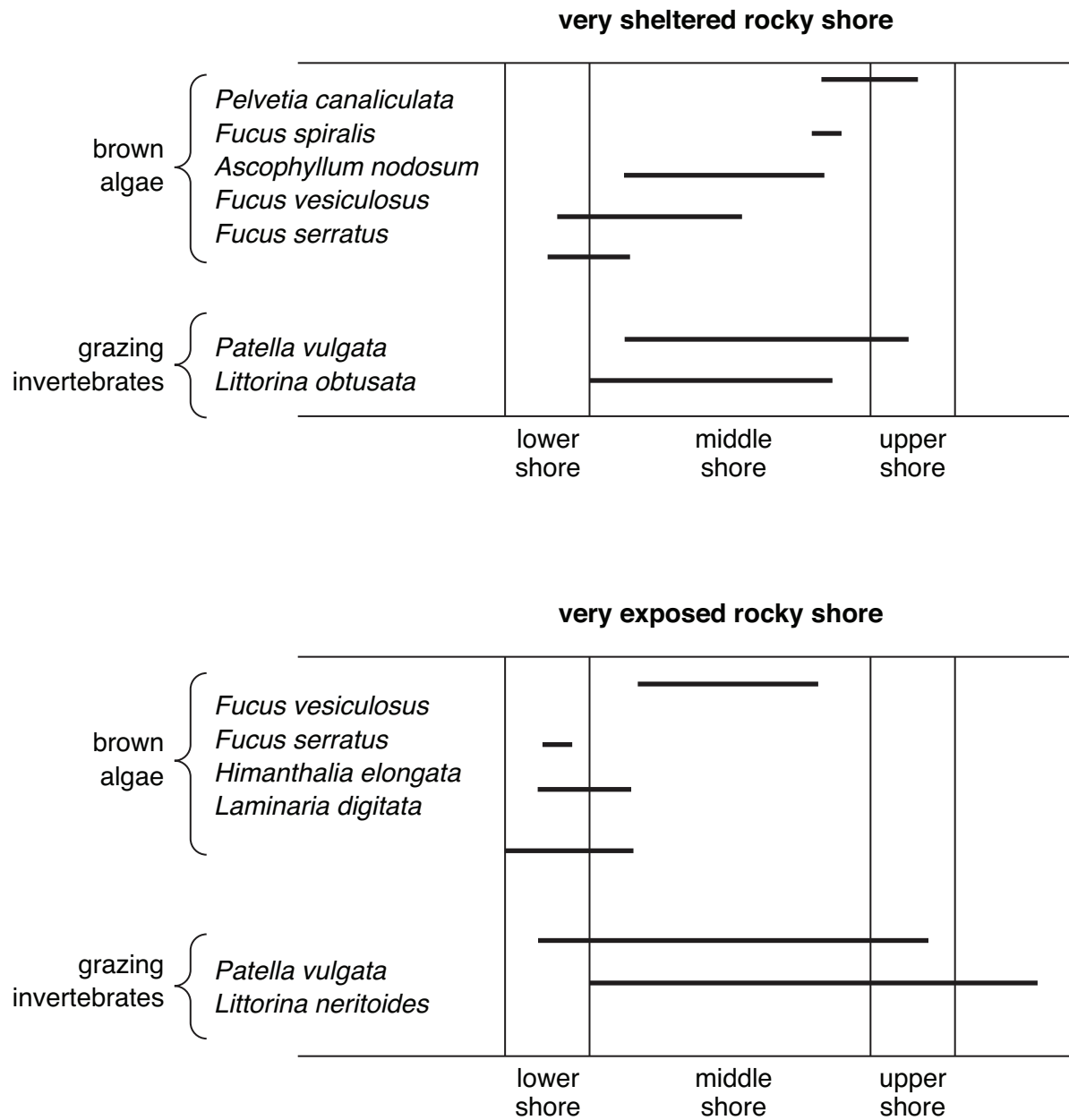


Fig. 5.2

(b) (i) Name **two** species that are found on both shores shown in Fig. 5.2.

1

2 [2]

(ii) Name the species occupying the greatest range on the **very sheltered rocky** shore.

..... [1]

(c) Brown algae are photosynthetic organisms.

- (i) Name the brown algae showing interspecific competition in the lower shore region of the **very sheltered rocky shore**.

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

- (ii) State **two** resources they will be competing for.

1
2 [2]

(d) Suggest how zonation differs from succession.

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.....
.....
..... [2]

[Total: 16]

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- 6** Insulin-dependent diabetes most often appears during childhood. It is caused by the autoimmune destruction of β cells in the pancreas. In this autoimmune response, specific white blood cells respond to proteins on the surface of the β cells.

(a) (i) Name the hormone that will become deficient due to the autoimmune destruction of the β cells.

..... [1]

(ii) Name the pancreatic tissue in which the β cells are found.

..... [1]

(iii) Suggest what happens to the proteins on the cell surface membranes of the β cells to stimulate the autoimmune response.

.....

..... [1]

(b) In individuals with insulin-dependent diabetes, there is excessive secretion of glucagon. Increased glucagon concentration in the blood results in additional metabolic changes to those caused by damaged β cells.

Describe the effects of increased glucagon concentration on the liver.

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..... [3]

QUESTION 6(c)(i) STARTS ON PAGE 16

- (c) Fig. 6.1 shows the changes in blood glucose concentration following a meal in a diabetic individual and in a healthy individual.

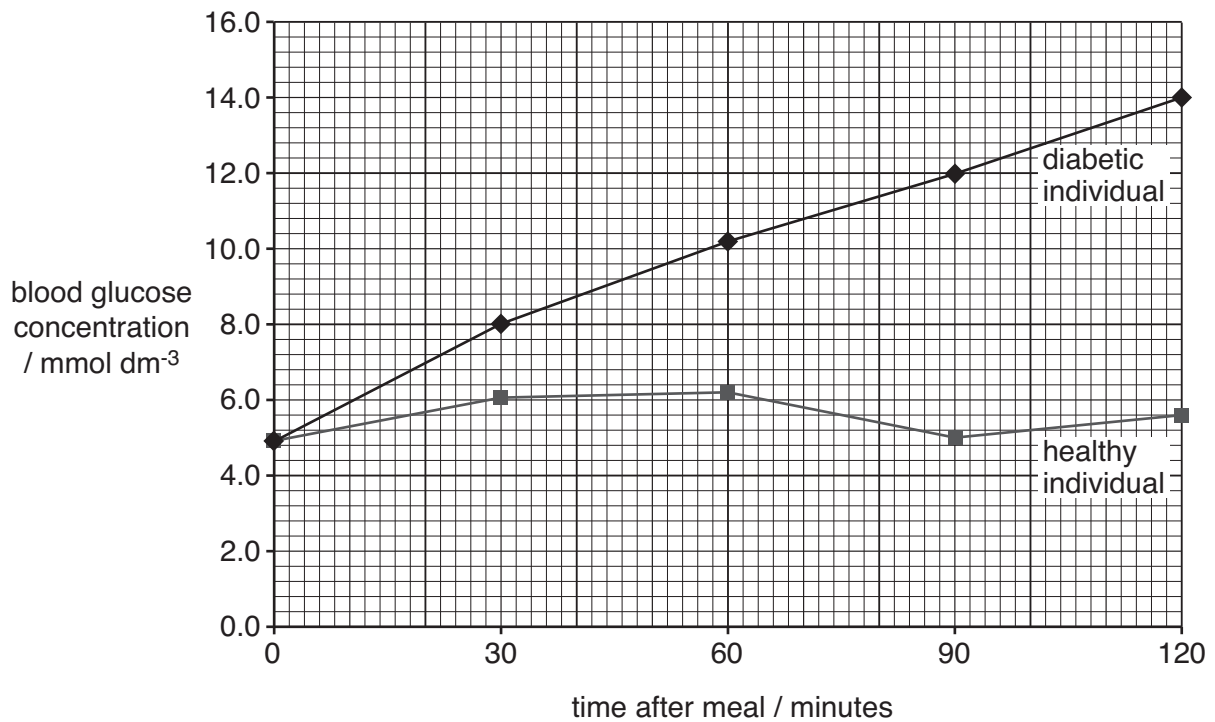


Fig. 6.1

- (i) **Describe** the changes in blood glucose concentration in the **diabetic** individual for the 120 minutes following the meal.

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..... [3]

- (ii) **Explain** the changes in blood glucose concentration in the **healthy** individual for the 120 minutes following the meal.

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..... [3]

[Total: 12]

END OF QUESTION PAPER

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