OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2804

Central Concepts

Monday **24 JANUARY 2005** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- 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.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	9	
2	12	
3	12	
4	7	
5	16	
6	19	
7	15	
TOTAL	90	

This question paper consists of 16 printed pages, 4 blank pages and an insert.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 Erythropoietin is a protein produced in minute quantities in the kidneys. It is transported in the bloodstream to the bone marrow where it stimulates the production of red blood cells. It is broken down in the liver.

(a) Describe the evidence from the above passage which suggests that the kidneys are acting as endocrine organs.

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.....[3]

(b) Plant growth regulators are important in chemical communication in plants.

Name **two** plant growth regulators and in each case describe **one** role in flowering plants.

name .....

role .....

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name .....

role .....

.....[6]

[Total: 9]

2 On large trees, the leaves at the top grow in full sunlight. These are known as **sun leaves**. The leaves of the lower branches are often permanently shaded. These are known as **shade leaves**. Fig. 2.1, on an insert, shows photographs of sections through sun and shade leaves of beech, *Fagus sylvatica*.

(a) Suggest why the sun leaf has a greater depth of palisade mesophyll than the shade leaf.

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.....[2]

(b) Describe **two** other ways, **that are visible in Fig. 2.1**, in which the shade leaf differs from the sun leaf.

1 .....

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2 .....

.....[2]

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

Explain how the palisade mesophyll cells of a leaf are adapted for photosynthesis.

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Quality of Written Communication [1]

[Total: 12]

3 In the fruit fly, *Drosophila melanogaster*, the gene for eye colour is **sex linked**. The allele for red eye is dominant to the allele for white eye. A student carried out two crosses.

Cross 1. A red-eyed female was crossed with a white-eyed male. Two fruit flies of the F_1 generation were then crossed. The following F_2 phenotypes were produced:

95 red-eyed females, 49 red-eyed males, 56 white-eyed males

Cross 2. A white-eyed female was crossed with a red-eyed male. Two fruit flies of the F_1 generation were then crossed. The following F_2 phenotypes were produced:

48 red-eyed females, 51 white-eyed females, 52 red-eyed males, 49 white-eyed males

(a) Complete the genetic diagrams to explain the crosses. Use the following symbols.

X^R = red , X^r = white (female = XX and male = XY)

	Cross 1	**Cross 2**
Parental phenotypes:	red-eyed female x white-eyed male	white-eyed female x red-eyed male
Parental genotypes:	.....	.....
Gametes:	.....	.....
F_1 genotypes:	.....	.....
F_1 phenotypes:	.....	.....
Gametes:	.....	.....
F_2 genotypes:	.....	.....
F_2 phenotypes:	.....	.....
Expected F_2 phenotypic ratio:	.....	.....

[8]

(b) The white eye allele in fruit flies is the result of a mutation. Mutations also occur in humans.

Describe a **named** example of a mutation in humans **and** explain how it affects the phenotype.

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[Total: 12]

[Turn over

4 **(a)** Define the term *interspecific competition*.

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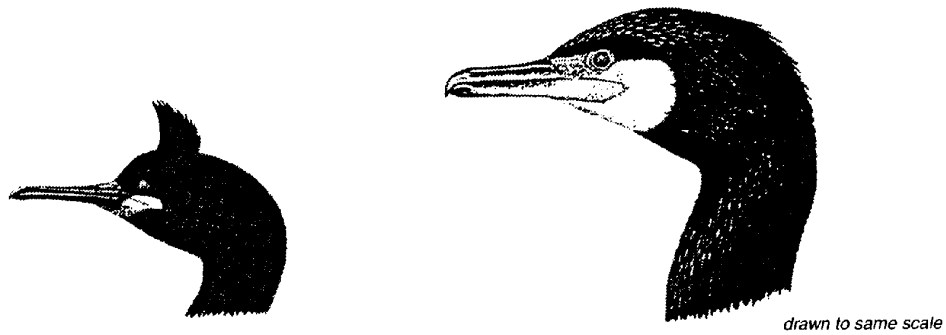
.....[1]

The shag, *Phalacrocorax aristotelis*, and the cormorant, *Phalacrocorax canbo*, feed in the same waters and nest on the same cliffs. Table 4.1 shows the prey eaten by these two birds.



shag cormorant

drawn to same scale

Fig 4.1

Table 4.1

prey		% of prey taken 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%.

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(c) With reference to Fig. 4.1 and Table 4.1, describe how the behaviour of shags and cormorants avoids direct competition.

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

.....[1]

[Total: 7]

5 Fig. 5.1 shows the key events in the evolution of common wheat. Three different sets of chromosomes are involved, shown as **A**, **B** and **D**. Each of these haploid sets contains 7 chromosomes.

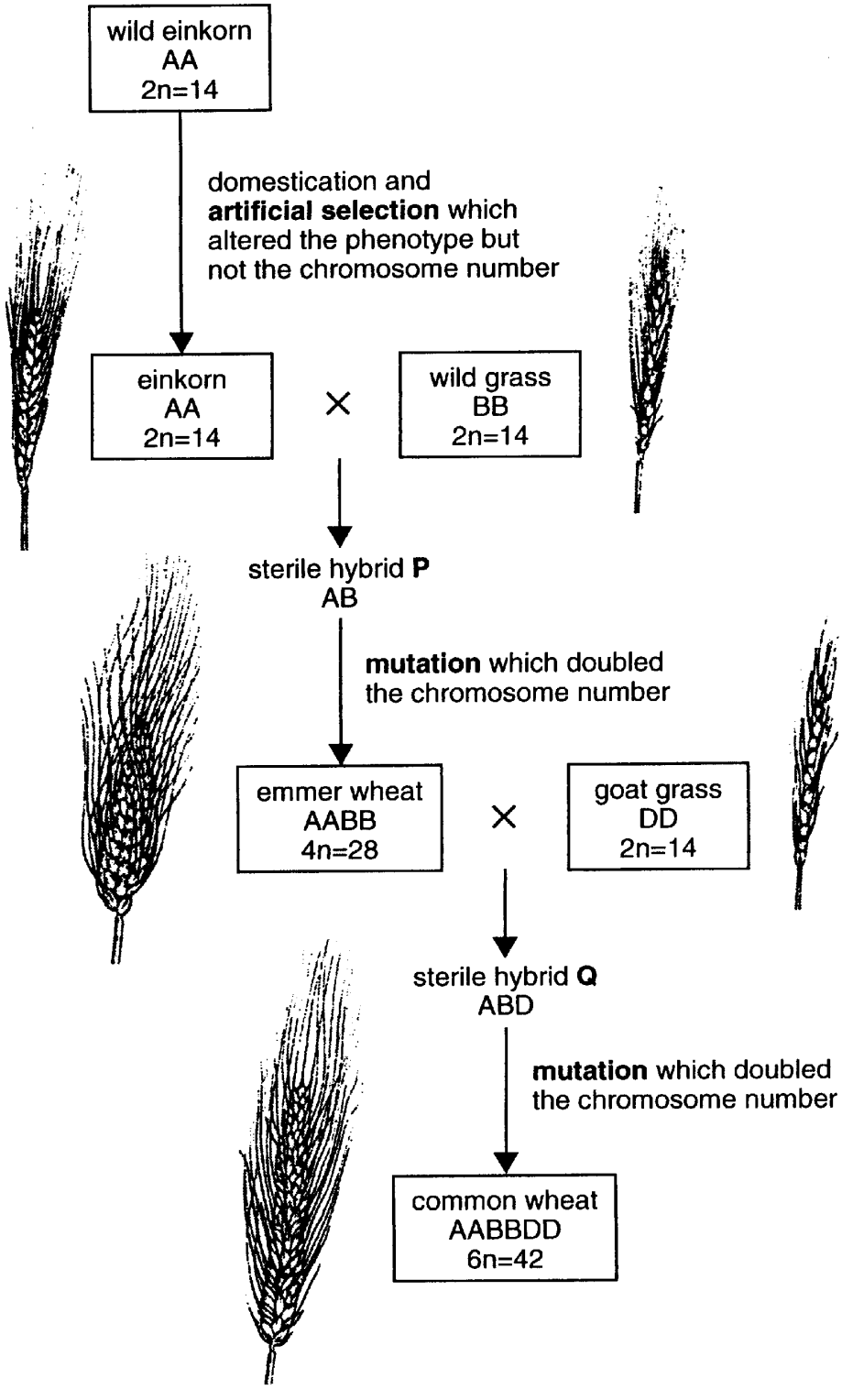

Fig. 5.1

(a) Wild einkorn has the following phenotypic features:

- small grains
- few grains on each shoot
- grains that fall from the plant easily.

Explain how phenotypic features such as these can be changed by artificial selection.

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.....[5]

(b) State the number of chromosomes in the gametes of:

einkorn .....

emmer wheat .....

common wheat ..... [1]

(c) Explain why hybrids **P** and **Q** were sterile but emmer wheat is fertile.

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(d) Explain why emmer wheat and common wheat are considered to be separate species.

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(e) Many high-yielding varieties of common wheat require a high concentration of available nitrogen in the soil to achieve maximum productivity. This is often achieved by the addition of artificial fertilisers.

Explain the link between increased use of these fertilisers and decreased species diversity in streams and rivers.

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[Total: 16]

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

(a) (i) Calculate the volume of filtrate, in cm^3, produced by the kidneys in a day. Show your working.

Volume = ...cm^3 [2]

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

Answer = ...% [2]

(b) Table 6.1 shows the composition of fluids in the kidney.

Table 6.1

component	concentration / g 100 cm^{-3}		
	blood plasma entering glomerulus	filtrate in renal capsule	urine in collecting 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 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.

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.....[2]

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

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

1 .....

2 .....[2]

(c) In this question, one mark is available for the quality of the use and organisation of scientific terms.

When little water is ingested, when heavy sweating occurs or when a large amount of salt is absorbed in the diet, the water potential of the blood plasma becomes more negative.

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

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Quality of Written Communication [1]

[Total: 19]

7 **(a)** ATP is often described as the immediate source of energy for all living cells. Fig. 7.1 is a diagram of the structure of an ATP molecule.

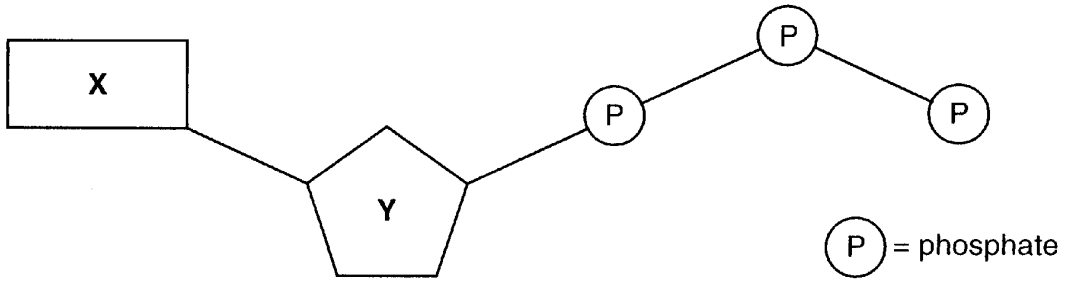

Fig. 7.1

(i) Name the base labelled **X** .....

(ii) Name the sugar labelled **Y** .....[2]

(b) In a liver cell, ATP is formed during the respiratory pathway either directly (substrate level phosphorylation) or by oxidative phosphorylation.

Indicate at which stage of respiration these two mechanisms occur by placing a tick (✓) or a cross (✗) in the appropriate box in Table 7.1. The glycolysis line has been completed for you.

Table 7.1

stage of respiratory pathway	substrate level phosphorylation	oxidative phosphorylation
glycolysis	✓	✗
link reaction		
Krebs cycle		
electron transport chain		

[3]

(c) A photosynthetic plant cell can also make ATP by photophosphorylation.

(i) Name the organelle in which photophosphorylation occurs.

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(ii) Describe the **similarities** between the mechanisms of photophosphorylation and oxidative phosphorylation.

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(d) ATP is used by nerve cells so that they are able to transmit nerve impulses.

Explain how ATP enables nerve cells to transmit impulses.

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[Total: 15]

END OF QUESTION PAPER

OCR

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

BIOLOGY 2804

Central Concepts

INSERT

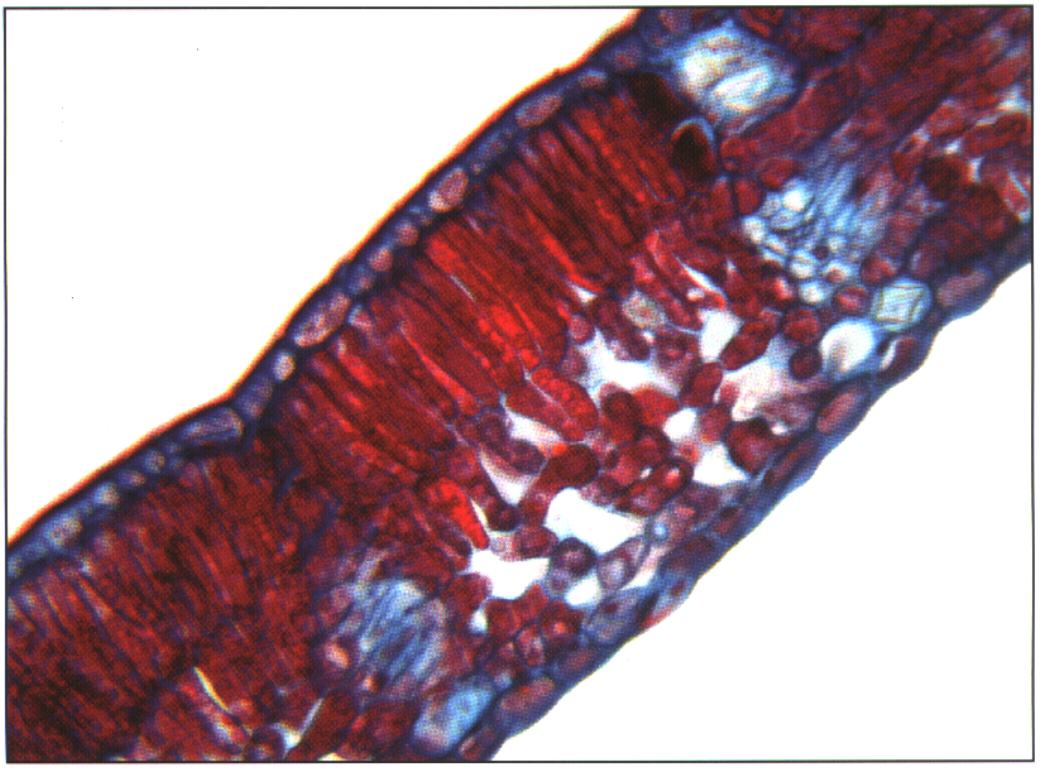
Monday **24 JANUARY 2005** Morning 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

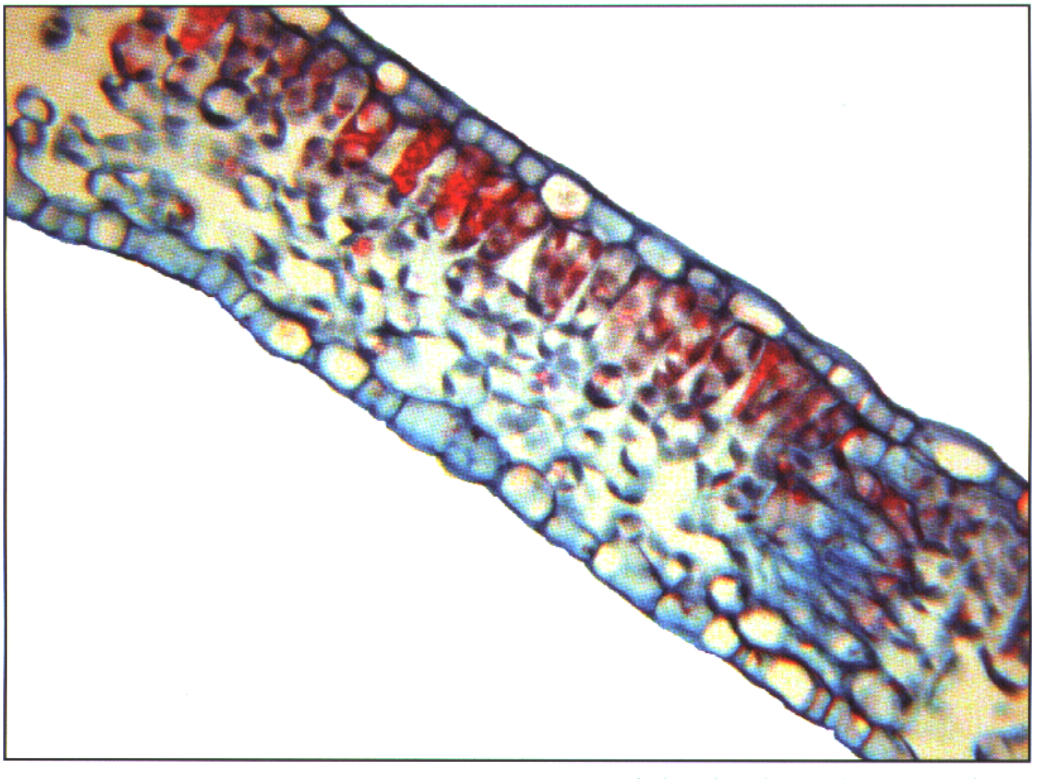
- This insert contains Fig. 2.1 for Question 2.

This question paper consists of 2 printed pages.

Registered Charity Number: 1066969
[Turn over



sun leaf



both sections shown at the same magnification

shade leaf

Fig. 2.1