

Candidate Name	Centre Number	Candidate Number
		2



GCE A level

315/01

BIOLOGY BI5

P.M. WEDNESDAY, 18 June 2008

2 hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	12	
2.	16	
3.	16	
4.	10	
5.	12	
6.	13	
7.	11	
Total mark	90	

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions in section A and B.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

SECTION A*Answer all questions*

1. The table below shows the classification of a sample of animals belonging to class Mammalia.

- (a) Each column represents a different taxon. Write the names of the taxa in the spaces available at the head of each column. [2]

.....
Carnivora	Canidae	Vulpes	vulpes
Carnivora	Canidae	Canis	lupus
Perissodactyla	Equidae	Equus	zebra
Perissodactyla	Equidae	Equus	asinus
Carnivora	Felidae	Felis	silvestris
Carnivora	Felidae	Panthera	tigris
Artiodactyla	Giraffidae	Giraffa	camelopardalis
Artiodactyla	Giraffidae	Okapia	johnstoni
Primates	Hominidae	Gorilla	gorilla
Primates	Hominidae	Homo	sapiens

- (b) (i) Explain what is meant by the binomial system for naming organisms. [2]

.....

.....

- (ii) Give the binomial name of the tiger. [1]

.....

- (iii) Suggest binomial names for [1]

Zebra,

Gorilla.

- (c) The diagram below shows the results of tests used to find out how closely related some of the animals are. Samples of ribosomal RNA from the animals were mixed with restriction enzymes, placed in the wells labelled **A**, **B**, **C**, **D**, **E**, and an electrical current applied.

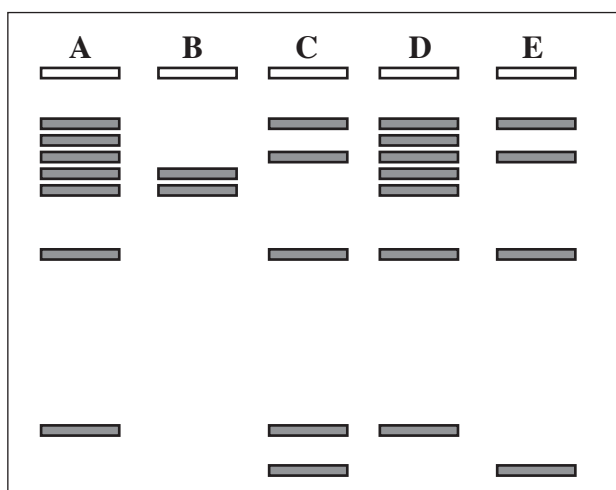
(i) Name this technique. [1]

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(ii) What purpose did the restriction enzymes perform? [2]

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.....



(iii) Which **two** animals in the table opposite are most likely to have provided samples **A** and **D**? [1]

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(iv) Explain your answer to part (c) (iii). [2]

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(Total 12 marks)

2. In breeding experiments, moths whose wings were black with small white marks near the wing tips were crossed with moths whose wings were grey and had no white marks near the wing tips. The offspring all had black wings with no white markings.

(a) Assuming the genes for wing colour and wing markings are carried on separate chromosomes, choose appropriate symbols and construct a genetic diagram to explain the outcome of this cross. [4]

(i) Allele for black wings, Allele for grey wings

Allele for wing markings, Allele for no wing markings

(ii) Parental phenotypes: X

..... X

Parental genotypes: X

(iii) Gametes: X

(iv) F₁ genotypes

(b) Two F_1 moths were crossed.

(i) Construct a genetic diagram of this cross.

[4]

(ii) Use the results of the cross to complete the table which follows, if 96 offspring were collected. [2]

<i>Phenotype</i>	<i>Number of Offspring</i>

- (c) In the gene pool of a large population, where mating is random, the relative proportion of the dominant allele and the recessive allele of any gene remains constant from generation to generation. This principle only applies if there is no selection taking place.

(i) Define the term *gene pool*. [1]

.....

.....

(ii) Apart from selection give **one other** reason why the relative allele frequency might change from one generation to the next, in a large population, breeding randomly. [1]

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(iii) Explain how different levels of air pollution might cause two different forms of the moths in part (a) to develop. [3]

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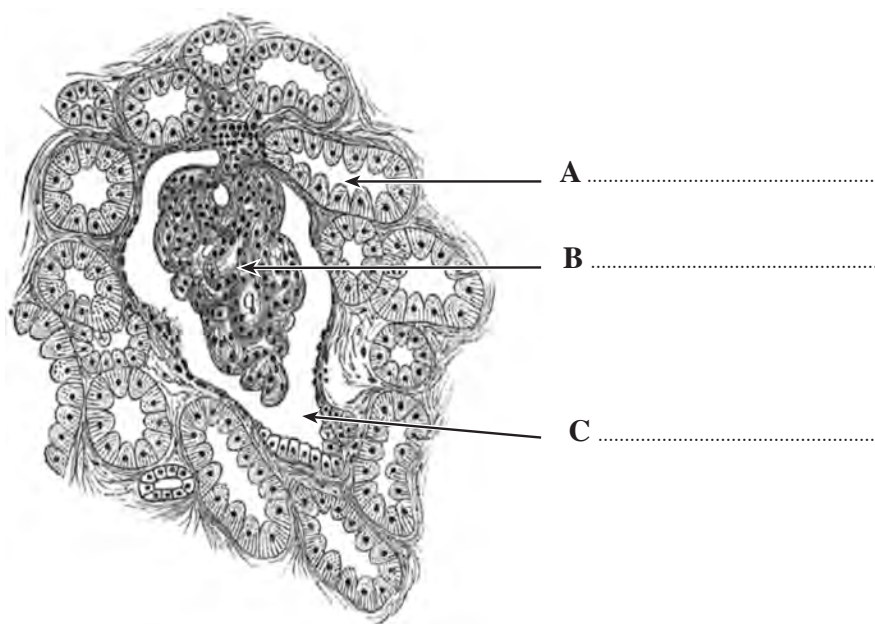
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(iv) What might the outcome be if the two forms were genetically isolated by a breeding barrier? [1]

.....

(Total 16 marks)

3. (a) The drawing below shows a section through part of a kidney.



- (i) Label **A**, **B** and **C**. [2]

- (ii) From which region of the kidney is this section taken? [1]

.....

- (iii) Draw an arrow to show where you would expect to find podocytes. [1]

- (iv) Explain how cells of the proximal convoluted tubule are adapted to carry out their function. [2]

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.....
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.....

- (b) The table below shows typical values for some important substances found in plasma, glomerular filtrate and urine and how much of each is reabsorbed by the kidney tubules per day.

<i>Substance</i>	<i>Plasma</i>	<i>Filtrate</i>	<i>Reabsorbed</i>	<i>Urine</i>
Water (dm ³)	180	180	179	1.0
Protein (mg)	7000-8000	10-20	10-20	0
Chloride (mg)	630	630	625	5
Sodium (mg)	540	540	537	3
Bicarbonate (mg)	300	300	299.7	0.3
Glucose (mg)	180	180	180	0
Urea (mg)	53	53	28	25
Potassium (mg)	28	28	24	4

Turn over.

(i) Name **two** substances that are 100 % reabsorbed.

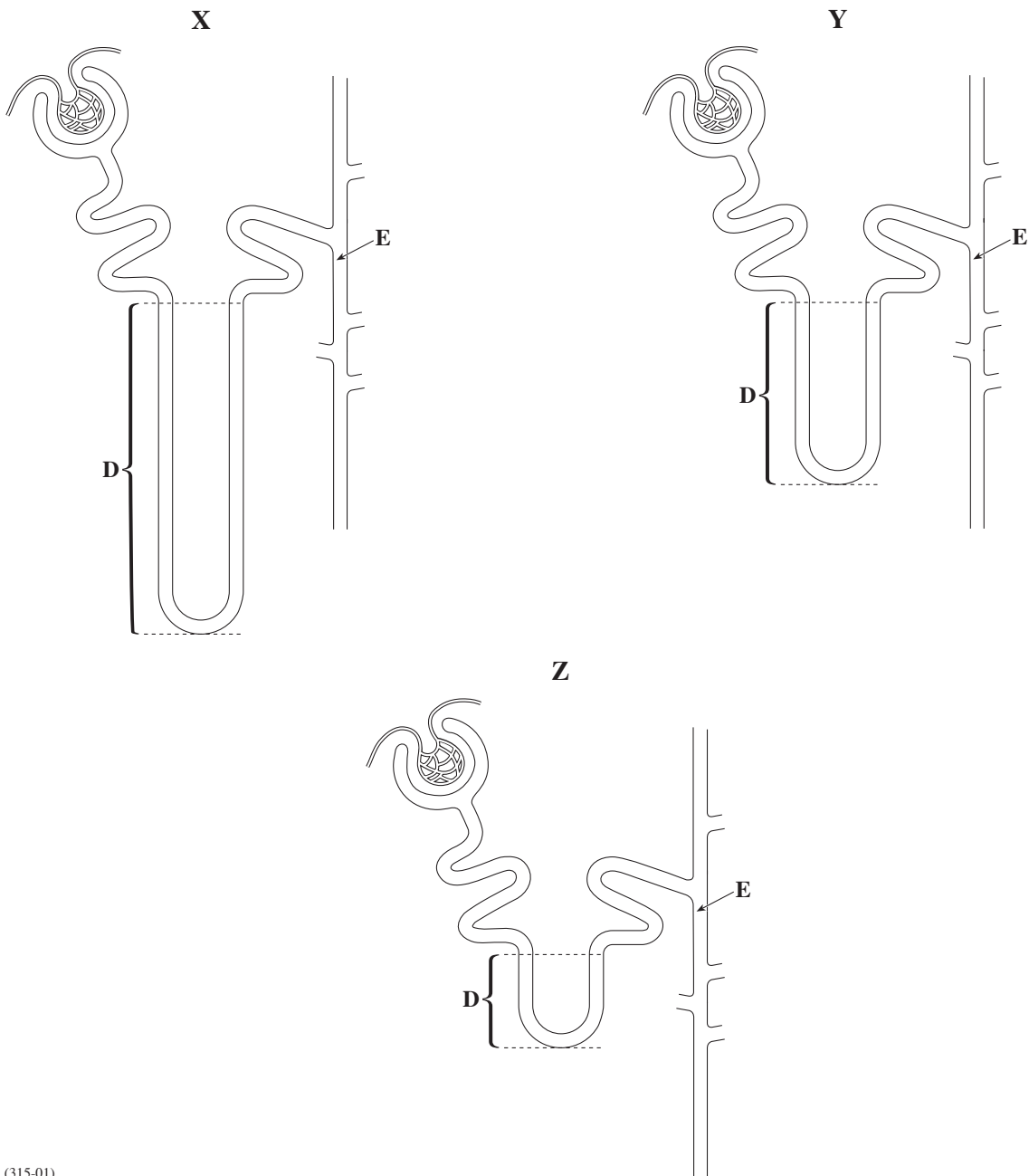
[1]

(ii) Calculate the percentage of water reabsorbed.

[1]

(iii) Calculate the percentage of urea filtered out of plasma which is excreted in urine. [1]

(c) Diagrams of the nephrons of three different mammals are shown below.



- (i) Name the parts labelled **D** and **E**. [1]

D

E

- (ii) Describe how part **D** uses **active transport** and **diffusion** to create an osmotic gradient within the kidney tissues. [2]

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.....

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.....

- (iii) Name the process by which part **E** absorbs water from the surrounding tissues. [1]

.....

- (iv) Which hormone changes the water permeability of the wall of part **E**? [1]

.....

- (v) The table shows urine concentrations in mammals from different habitats;

<i>Mammal</i>	<i>Habitat</i>	<i>Urine concentration (mOsmol l⁻¹)</i>
Domestic cat	mesic	3100
Kangaroo Rat	xeric*	5500
Beaver	freshwater	520

* xeric habitats have limited availability of water.

Use the information in the table to identify the mammals to which the nephrons in the diagram belong. [1]

X

Y

Z

- (vi) Describe the relationship between the mammals' habitat and the length of part **D** in their nephrons. [1]

.....

.....

(Total 16 marks)

[illegible]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

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SECTION B

*Answer **all** questions.*

5. The following passage describes the role of sensory hair cells in the ear:

The deflection of the hair-cell stereocilia opens mechanically gated ion channels that allow any small, positively charged ions (primarily potassium and calcium) to enter the cell. Unlike many other electrically active cells, the hair cell itself does not fire an action potential. Instead, the influx of positive ions from the endolymph in Scala media depolarizes the cell, resulting in a receptor potential. This receptor potential opens voltage gated calcium channels; calcium ions then enter the cell and trigger the release of neurotransmitters, (mainly glutamate), at the basal end of the cell. The neurotransmitters diffuse across the narrow space between the hair cell and a nerve terminal, where they then bind to receptors and thus trigger action potentials in the nerve. In this way, the mechanical sound signal is converted into an electrical nerve signal.

- (a) The plasma membrane of the hair cells shows the typical ‘fluid mosaic’ structure.
- (i) Draw a labelled diagram to show the arrangement of lipids and proteins in the membrane. [3]
-
- (ii) Which components of your diagram would represent the ion channels referred to in the first paragraph of the passage? [1]
-
- (iii) Suggest a process by which glutamate might be released from the hair cell. [1]
-
- (b) (i) Name the transmitter substance used in synapses of peripheral nerves. [1]
-
- (ii) Name the enzyme which destroys the transmitter substance, in part (i). [1]
-
- (iii) Why is the transmitter substance quickly destroyed by enzymes in the synaptic cleft? [1]
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- (c) (i) Some insecticides act as non-competitive inhibitors of these synaptic enzymes. Describe the mechanism of **non-competitive** enzyme inhibition. [3]

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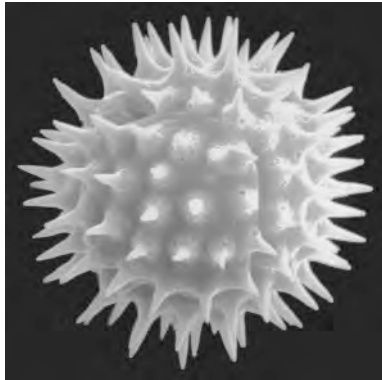
- (ii) What would be the result if the inhibitor acted at neuromuscular junctions? [1]

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(Total 12 marks)

6. The two structures shown have similar roles in reproduction.

**Q****R**

- (a) (i) Identify the structures; [2]
Q **R**
- (ii) What is their common role in reproduction? [1]

- (iii) State whether **Q** and **R** are adapted for aquatic or terrestrial existence. [1]
Q **R**
- (iv) Identify **one** adaptation visible in each photograph and explain how it adapts for terrestrial or aquatic existence. [2]
Q

R

- (b) How are organisms which produce gametes adapted to aquatic existence able to successfully reproduce on dry land? [1]

- (c) (i) Which type of cell division is essential to the production of gametes? [1]

- (ii) Draw a labelled diagram to show how two pairs of homologous chromosomes would be arranged at the equator of a cell at metaphase I of this type of cell division. [3]

- (iii) Explain the significance of this type of cell division. [2]

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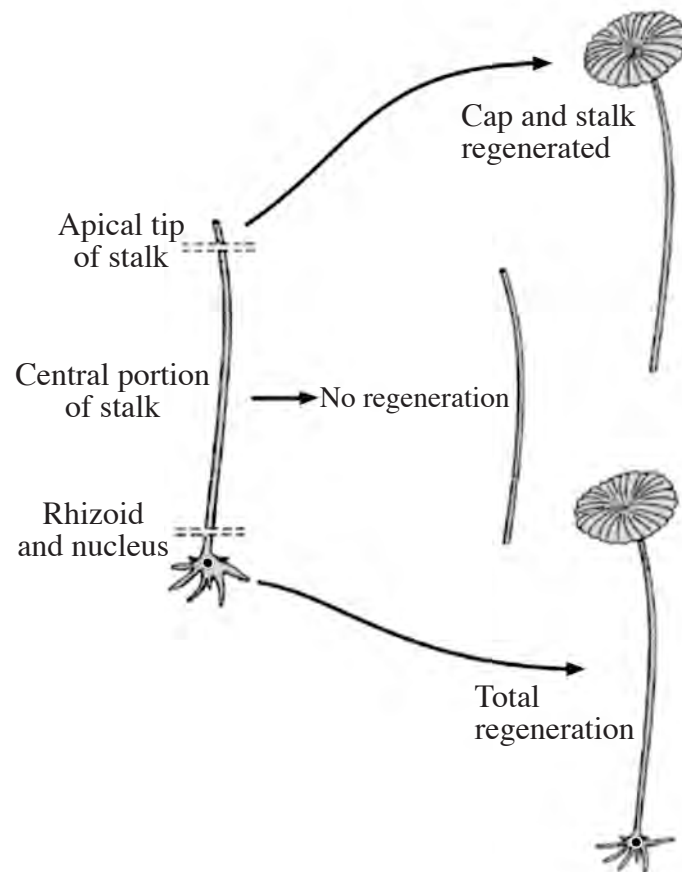
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(Total 13 marks)

7. Nuclear control of cell development and the interaction of nucleus and cytoplasm are demonstrated in studies of the protoctist *Acetabularia*. This enormous single cell (2–4 cm long) consists of three parts: a cap, a stalk, and a rhizoid.

In 1934 Hämmerling cut young *Acetabularia* cells into several parts as shown below.



The portion with the nucleus eventually formed a new cap, as expected; so did the apical tip of the stalk. However, the intermediate portion of the stalk did not form a cap.

A modern conclusion might say, “In this unicellular organism, ‘development’ is controlled at both the transcriptional and translational levels.”

(a) For the processes of transcription,

- (i) state where it takes place in the cell, [1]

.....

- (ii) name the template molecule, [1]

.....

- (iii) and name the molecule produced. [1]

.....

(b) For the process of **translation**, name

(i) the cell organelle involved;

[1]

.....

(ii) the adaptor molecule, that carries amino acids;

[1]

.....

(iii) the class of molecules produced, which are needed to construct the cap.

[1]

.....

(c) Use information from your answers to part (a) and (b) to suggest why, in the above experiment, the apical tip of the stalk produced a cap but the central portion did not. [1]

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(d) These experiments were early stages in the development of cloning. List the steps in the technique used to produce an animal clone, which involves nuclear transfer. [4]

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(Total 11 marks)