

Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1075/01

BIOLOGY/HUMAN BIOLOGY - BY5

A.M. WEDNESDAY, 22 June 2011

1¾ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	12	
3.	14	
4.	10	
5.	10	
6.	12	
7.	6	
8.	10	
Total	80	

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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

Answer **all** questions.

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.

1. State the term which applies to the following ecological definitions.

(a) (i) The recolonisation by living organisms of a woodland following its destruction by fire. [1]

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(ii) The first organisms which colonise a bare rock surface. [1]

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(iii) The stable stage of a succession which undergoes no further change. [1]

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(iv) The different stages in a succession. [1]

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(b) (i) The rate at which products such as glucose are produced by a plant. [1]

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(ii) A diagram to represent the quantity of energy passing from one trophic level to the next. [1]

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(Total 6 marks)

2. (a) Complete the table to show **four** differences between insect and wind pollinated plants. [4]

<i>Insect pollinated</i>	<i>Wind pollinated</i>

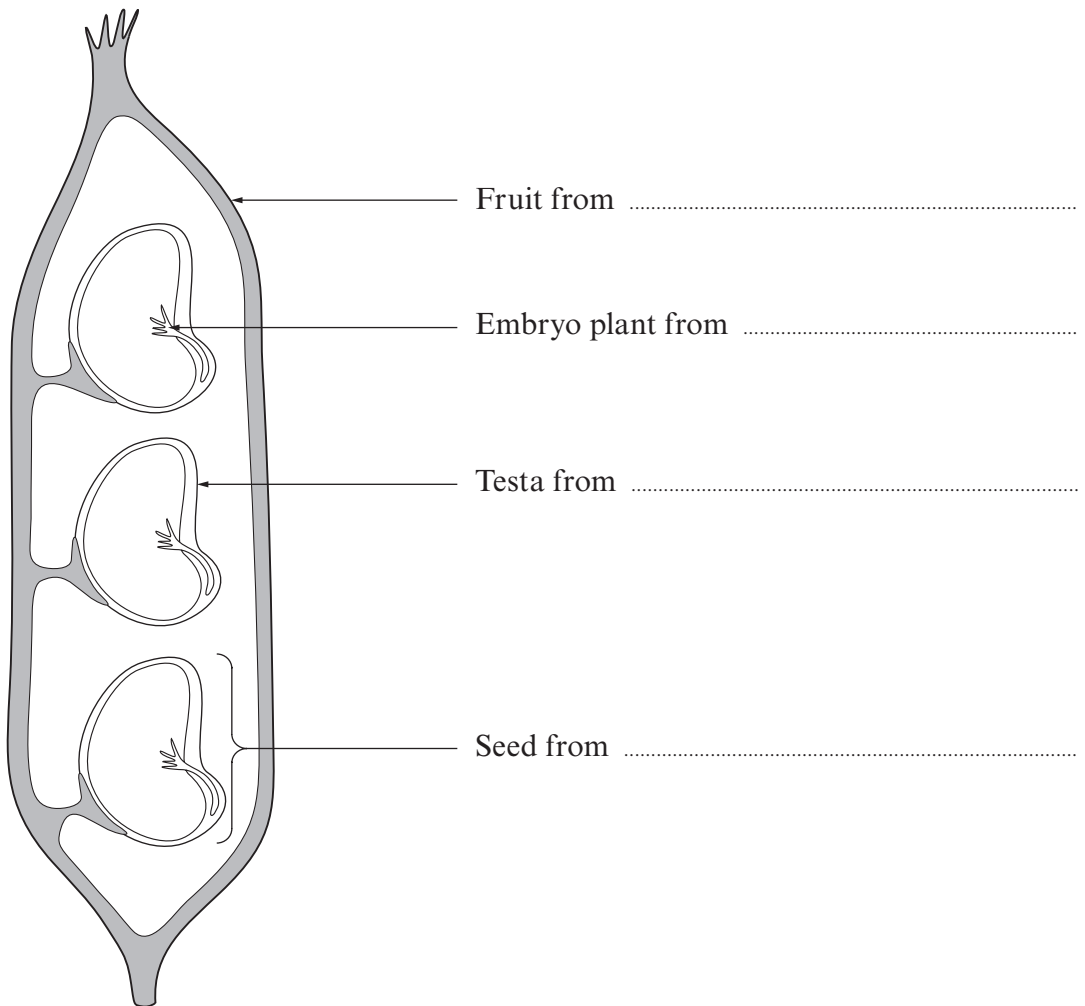
(b) Some flowers can self pollinate. What is the main **disadvantage** of self pollination? [1]

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(c) State how the production of pollen grains has enabled flowering plants to adapt to terrestrial life. [3]

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(d) On the following diagram of a broad bean pod (drawn in section), show which parts of the flower have developed into the labelled structures. [4]



(Total 12 marks)

3. (a) Cattle can have coats which are white, red or an even distribution of white and red hair (Roan). Roan is caused by incomplete dominance between the alleles for red and white hair (heterozygous condition). Cattle can have horns or be hornless. Horns are a result of a double recessive allele and hornless is caused by a dominant allele.

Key:
 WW = white H = hornless
 RW = roan h = horned
 RR = red

The genetic diagram shows the cross between a hornless white animal with a horned red animal.

parental phenotype:	hornless white	×	horned red
parental genotype:	HH WW		hh RR
genotype gametes:	HW		h R
genotype offspring:	Hh W R		
phenotype offspring:	hornless roan		

- (i) The offspring were then bred together. Complete the Punnett square to show the possible genotypes of the offspring. [4]

Gametes				

(ii) Complete the following table to show the different phenotypes you would expect and the ratio. [6]

<i>Phenotype</i>	<i>Ratio</i>

(b) The ancestors of modern cattle originated in the tropics. These animals evolved light coats and darkly pigmented skin by natural selection to adapt them to high solar radiation. Explain what is meant by the phrase ‘evolved light coats and darkly pigmented skin by natural selection’. [4]

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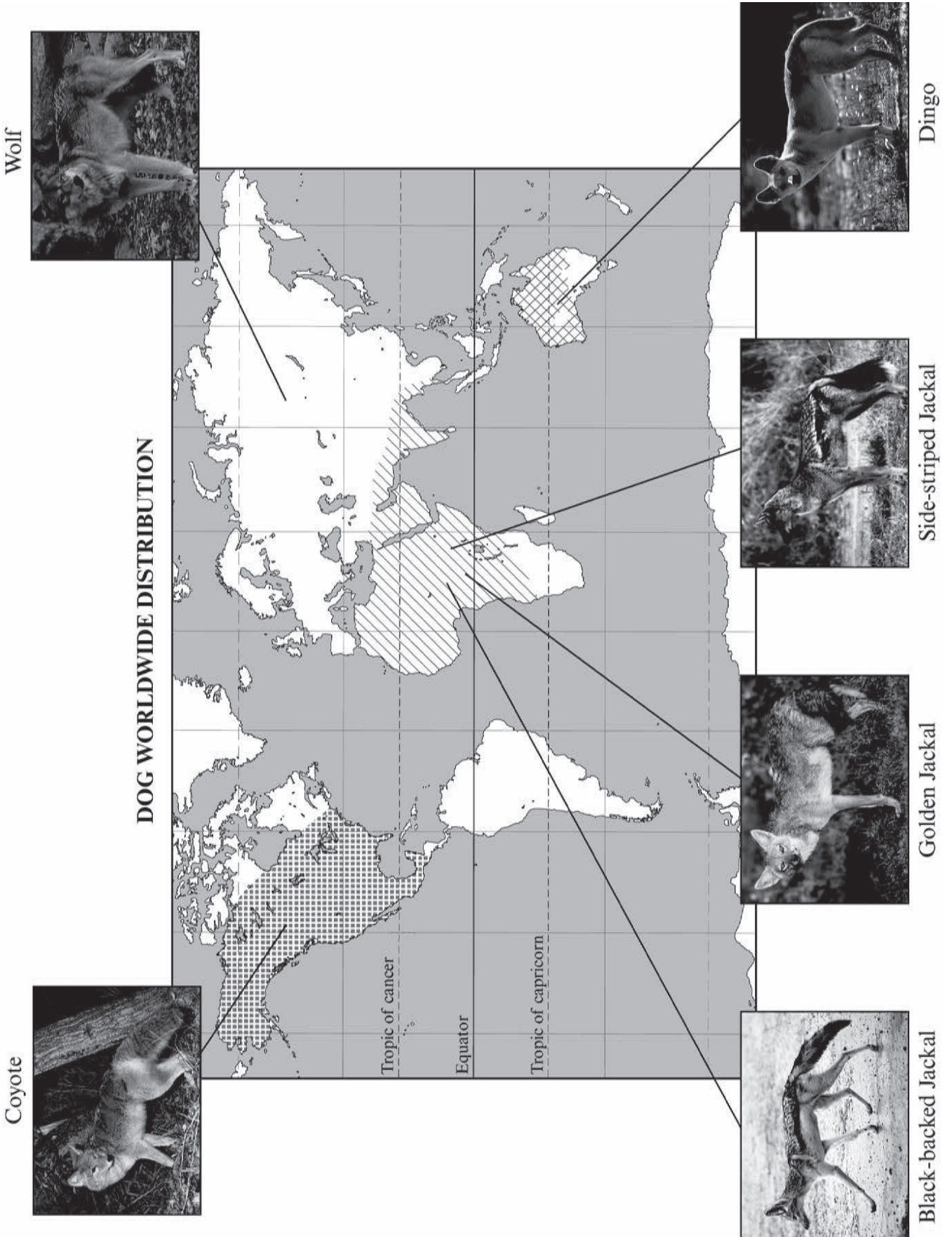
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(Total 14 marks)

4. The map shows the world distribution of different members of the canine (dog) family and the grid following shows if mating between different members of the canine family results in fertile offspring.



	dog	wolf	dingo	coyote	golden jackal	black-backed jackal	side-striped jackal
dog	✓	✓	✓	✓	✓	×	×
wolf	✓	✓	✓	✓	✓	×	×
dingo	✓	✓	✓	✓	✓	×	×
coyote	✓	✓	✓	✓	✓	×	×
golden jackal	✓	✓	✓	✓	✓	×	×
black-backed jackal	×	×	×	×	×	✓	×
side-striped jackal	×	×	×	×	×	×	✓

Key:

Fertile offspring = ✓

Infertile offspring = ×

- (a) Using the data, state which members of the canine family are the same species as the dog. Give a reason for your answer. [2]

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- (b) Suggest **two other** pieces of evidence which would confirm that they were members of the same species. [2]

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(c) (i) Use the map to suggest which species are likely to have been produced by sympatric speciation. [1]

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(ii) Suggest a possible isolating mechanism. [1]

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(d) The chromosome number of the dog is $2n = 78$ and the European Red Fox is $2n = 38$. Rare cases of mating between dogs and foxes have been recorded (resulting in an animal called a dox) but the offspring are all sterile. Give reasons for this sterility. [4]

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(Total 10 marks)

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5. Meselson and Stahl investigated whether DNA replicated in a conservative or semiconservative way.

(a) What is meant by the term semiconservative replication? [2]

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(b) The bacterium *Escherichia coli* (E.coli) was cultured in a nutrient broth, containing the heavy isotope as a source of nitrogen ^{15}N instead of the normal ^{14}N . After several generations all of the DNA in all of the bacteria contained the heavy isotope ^{15}N . They were then washed and transferred to a ^{14}N medium and allowed to replicate. After each generation, bacteria were removed and ruptured to release the DNA. The DNA was then placed in a medium and spun in a centrifuge. The position of the DNA in the medium was then determined.

(i) Name the part of the DNA molecule which contained the ^{15}N . [1]

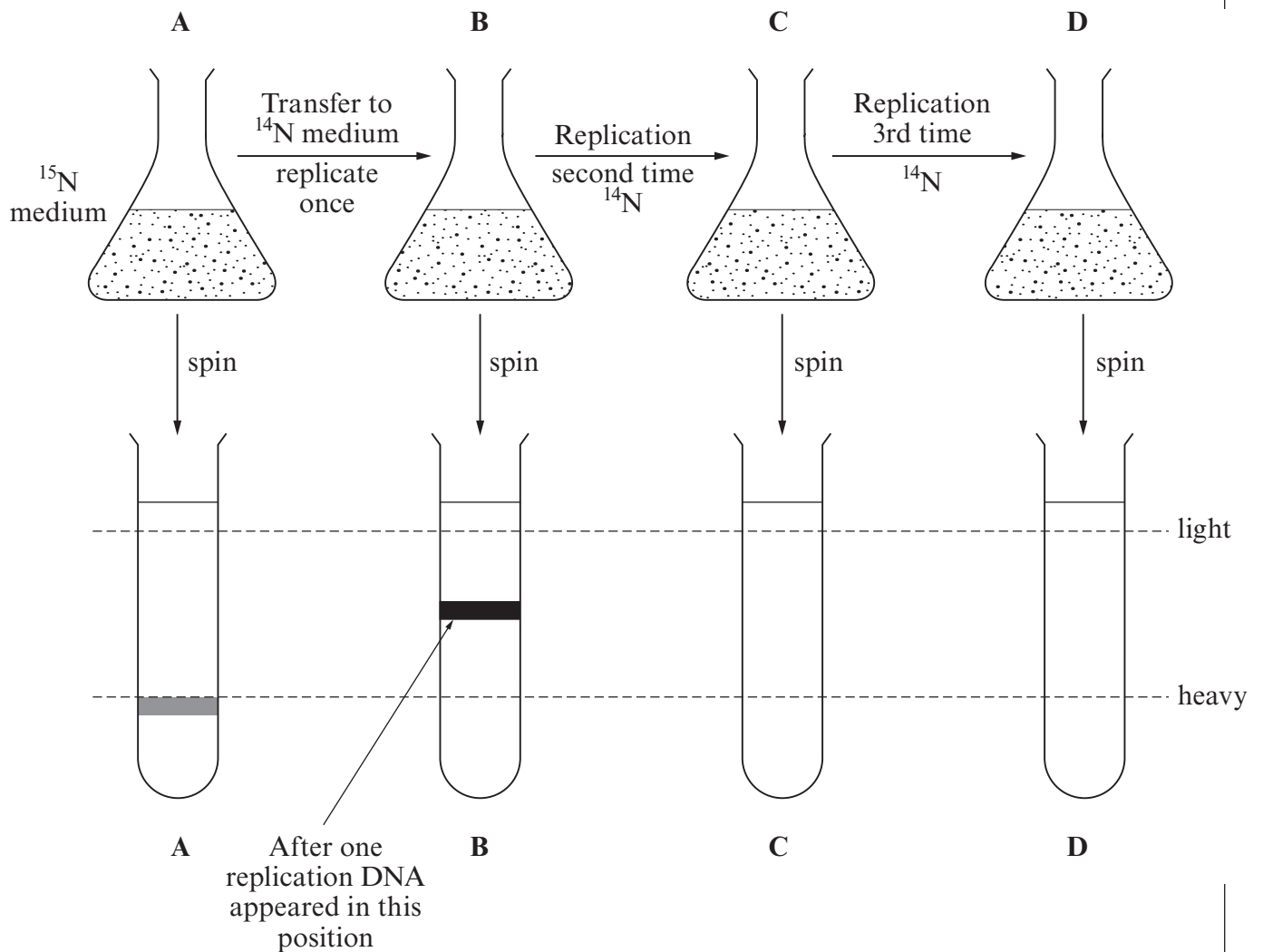
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(ii) If they wanted to show the relative position of DNA from different samples of bacteria, suggest **two** variables which would need to be controlled in the centrifugation process. [2]

1.

2.

(c) The diagram represents the results which they obtained.



(i) Explain why the results in tubes **A** and **B** support semiconservative replication.

[3]

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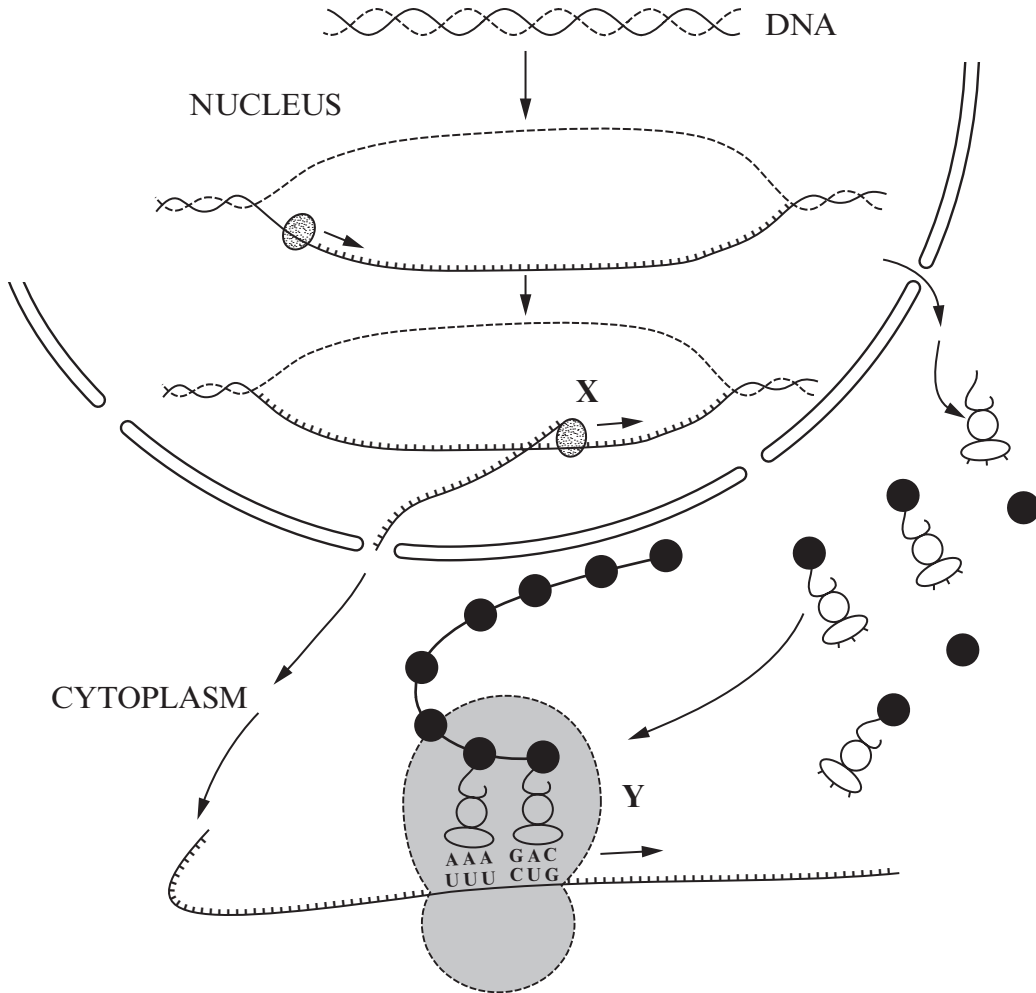
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(ii) Complete diagrams **C** and **D** to show the pattern and relative proportions of DNA you would expect.

[2]

(Total 10 marks)

6. The diagram represents stages of protein synthesis.



(a) (i) Give the name of the processes taking place at **X** and **Y**. [2]

X

Y

(ii) On the diagram label the following structures using clear lines and the letters given. [8]

- M = messenger RNA
- N = nuclear pore
- O = RNA polymerase
- P = codon
- Q = ribosome
- R = transfer RNA
- S = three hydrogen bonds between complementary bases
- T = template/sense strand of DNA

- (b) Transfer RNA (tRNA) molecules are very specific and will only carry one type of amino acid depending on three unpaired nitrogenous bases on the molecule (the anticodon). The table shows the type of tRNA molecules which combine with certain amino acids.

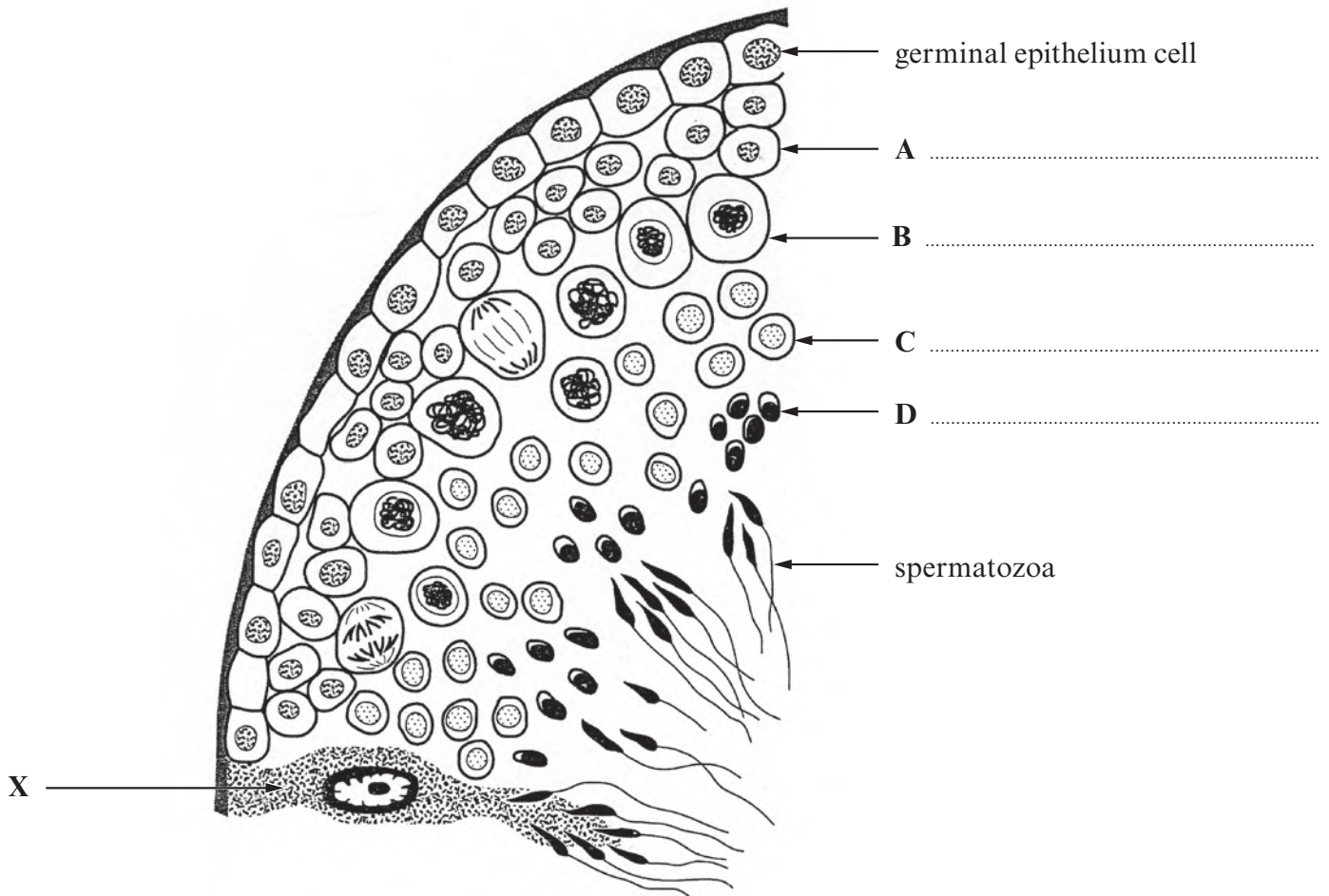
<i>Amino acid</i>	<i>anticodon</i>
glycine	CCU
cysteine	ACA
arginine	GCA
alanine	CGU

Using the information given, state the nucleotide sequence on the **DNA molecule** which codes for the following polypeptide. [2]

glycine-cysteine-arginine-alanine.

(Total 12 marks)

7. The drawing below shows a cross section through a seminiferous tubule.



(a) (i) On the diagram, label cells A-D. [2]

(ii) Name the cell labelled X in the diagram. [1]

(iii) What is the function of the cell labelled X? [1]

(b) (i) State the type of cell division involved in the production of cell A. [1]

(ii) Explain why there are more spermatozoa than cell type A in the tubule. [1]

(Total 6 marks)

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