

**Biology**  
**UNIT: 4BI1**  
**PAPER: 2BR**

**Friday 9 June 2023 – Afternoon**

**Diagram Booklet**

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

## INSTRUCTIONS

There may be spare copies of some diagrams in case you need them.

**THIS DIAGRAM BOOKLET **MUST** BE RETURNED WITH THE  
QUESTION PAPER AT THE END OF THE EXAMINATION.**

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## Question 1

### Tissue culture and plants

A black and white photograph shows four glass jars on a table. The jars have a closed lid, and contain growing plant tissues and plant tissue culture media.



In micropropagation, plant tissues are grown **in vitro** on plant tissue culture media, under aseptic conditions in a controlled environment. This technique is possible because plant cells can differentiate and become specialised cells. This allows them to change their metabolism, growth and development to form a whole plant.

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Plant tissue culture media contain substances to support the normal growth and development of plants. The media are mainly composed of minerals, vitamins, and plant hormones. The pH of the media is kept constant.

Plant hormones play an essential role in determining how cells and tissues develop in culture media. Plant cells can differentiate into different tissues and cell types. The concentration of hormones can determine the tissue that develops. Auxins and cytokinins are the most widely used. A balance of both auxin and cytokinin leads to the development of a mass of undifferentiated cells known as a callus.

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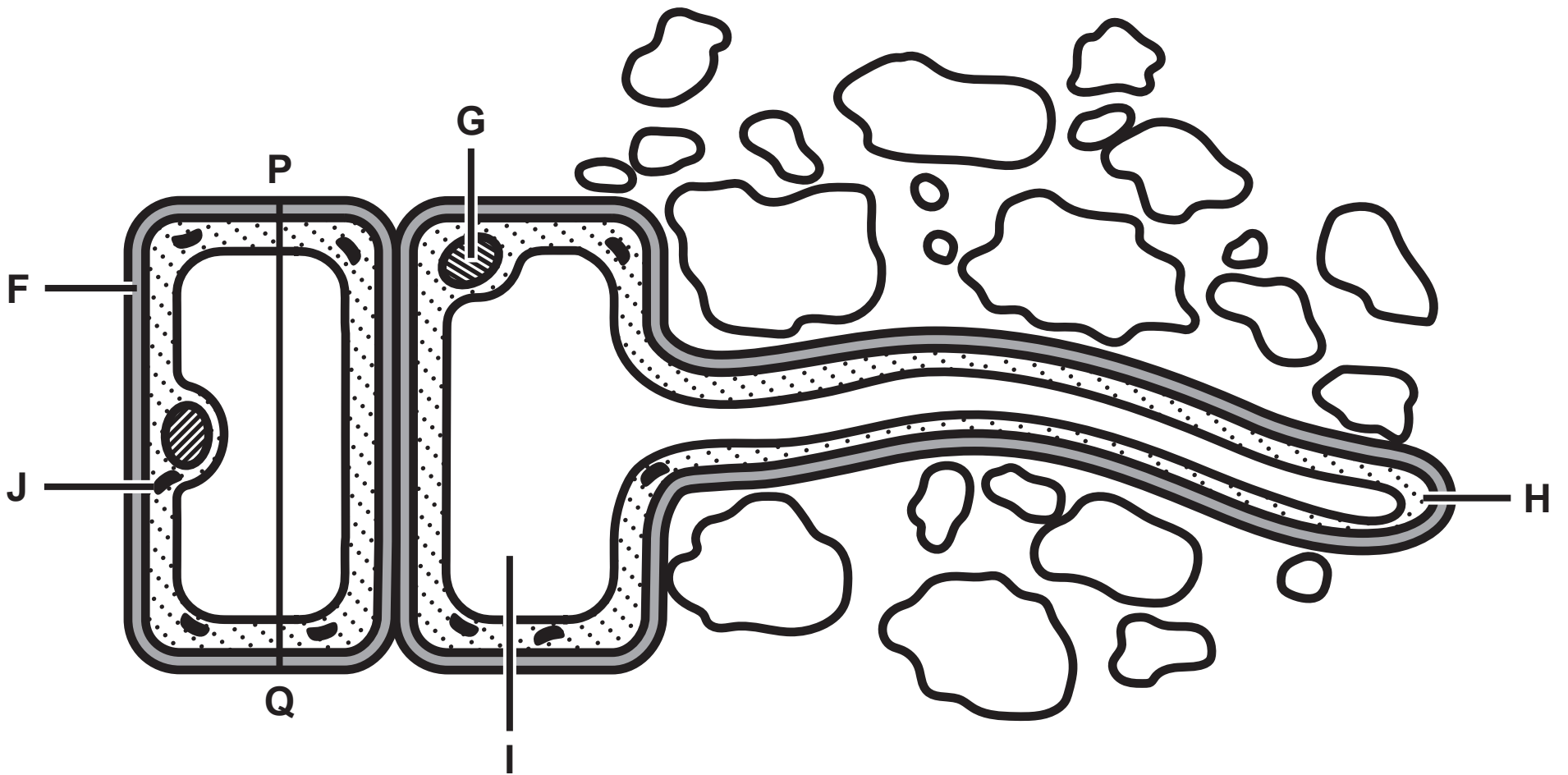
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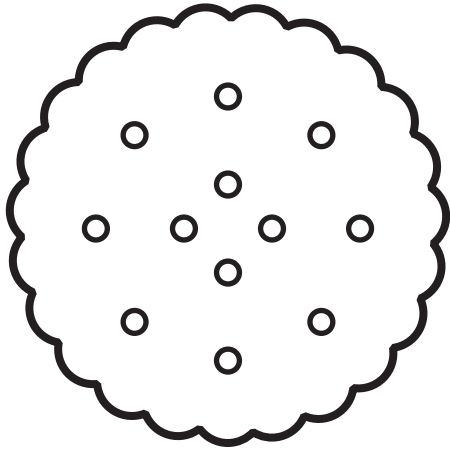
**In vitro** cell culture offers an alternative method for conserving endangered species and varieties. Tissue culture can be used when the plant species produce seeds that do not germinate or have seeds that cannot be stored for a long period of time. These can be successfully preserved using **in vitro** techniques for the maintenance of gene banks. 15

Embryo culture is a type of plant tissue culture that is used to grow embryos from seeds in nutrient media. In embryo culture, the plant develops directly from the embryo or indirectly through the formation of a callus and then subsequent formation of shoots and roots. The technique has been developed to break dormancy in seeds, and to reproduce rare species and haploid plants. 20  
25

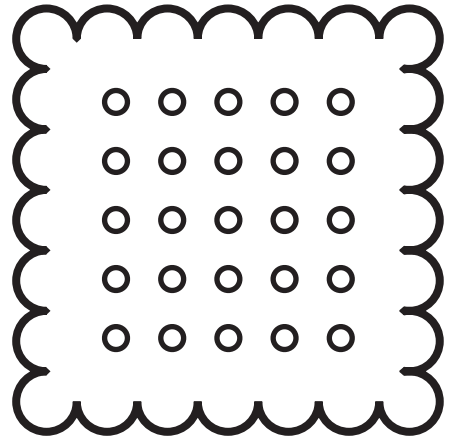
Scientists are also using cell suspension culture systems from which products can be extracted. A suspension culture is developed by transferring a portion of the callus into liquid media. The media are maintained under suitable conditions of agitation, light and temperature. This system can provide a continuous, reliable source of natural products independent of climate and soil conditions. The first commercial application of large-scale suspension cultivation of plant cells was carried out to produce shikonin. Shikonin is used in traditional Chinese medicine and is a potential anti-cancer treatment. 30

## Question 2





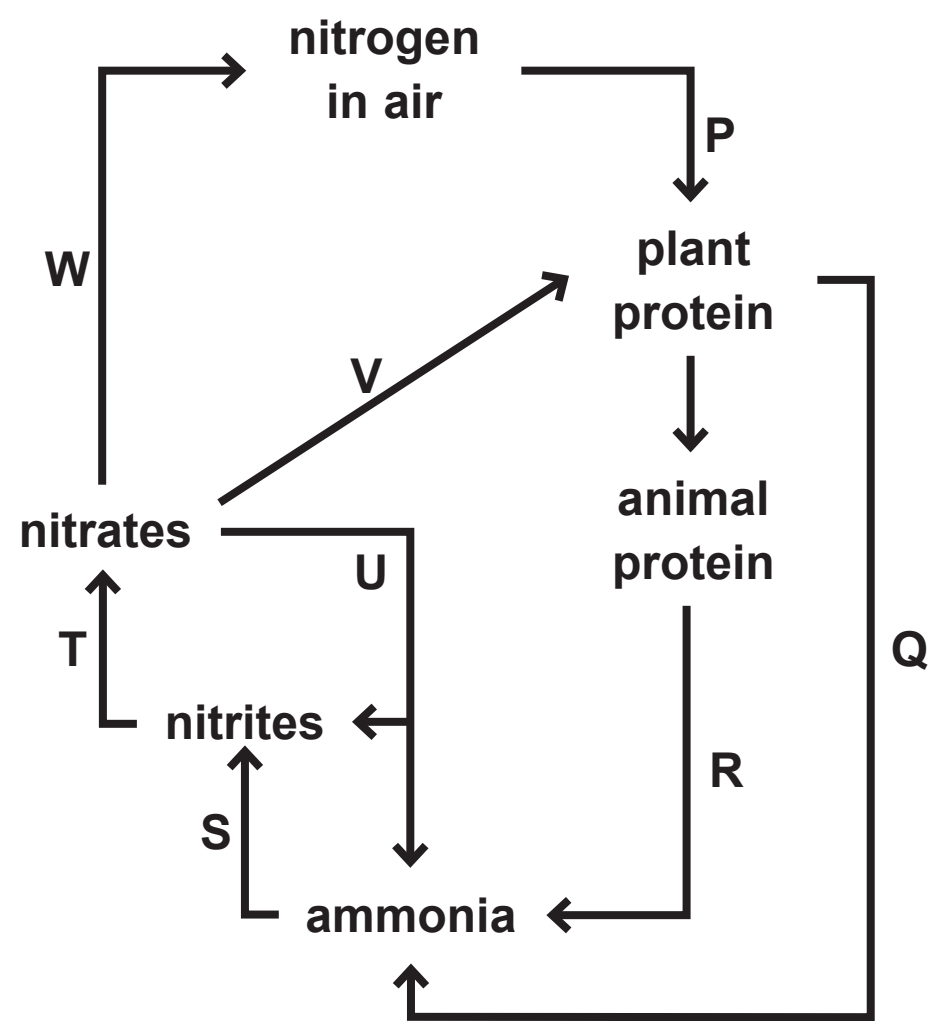
Biscuit A



Biscuit B

Biscuit	Energy in kJ per 100 g	Lipid in g per 100 g	Carbohydrates in g per 100 g			Protein in g per 100 g	Salt in g per 100 g
			starch	sugars	total		
A	1860	13·6	66·5	1·5	68·0	10·0	1·2
B	1653	3·7	75·8	1·2	77·0	10·5	0·9

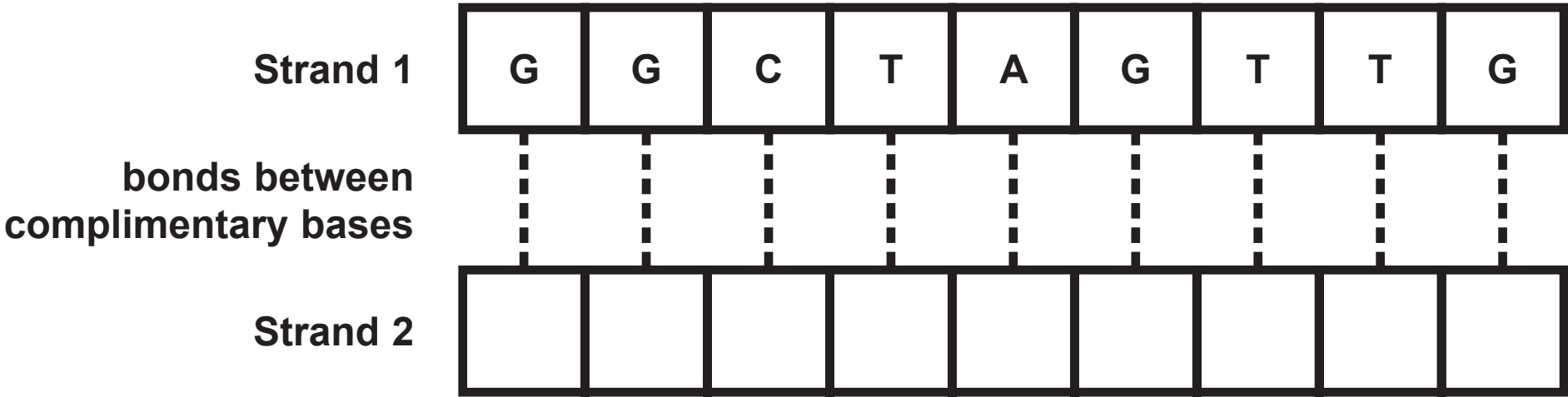
## Question 4





Question 5(a)(i)

DIAGRAM 1



**Question 5(a)(iii)**

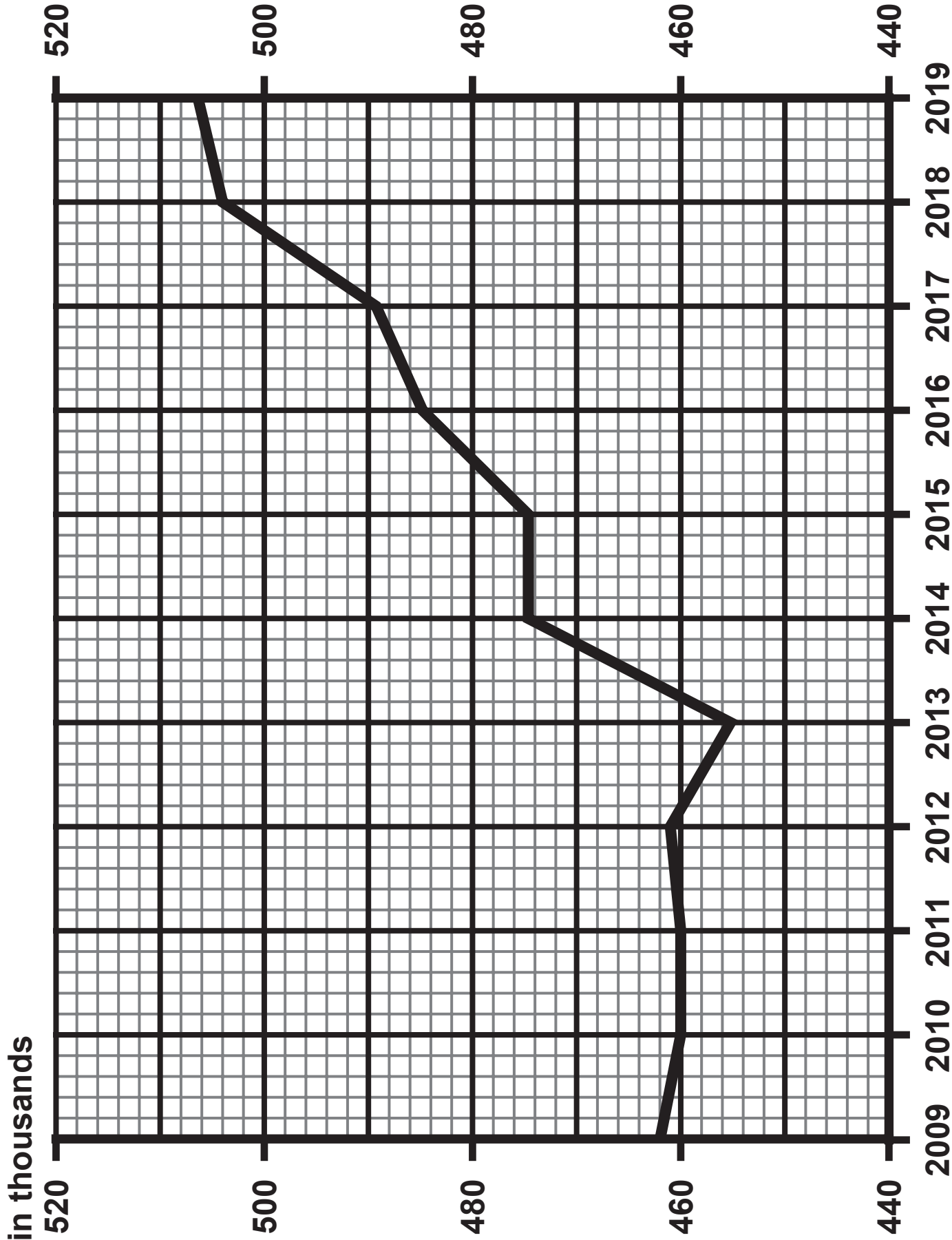
## DIAGRAM 2

DNA	G	G	C	T	A	G	T	T	G
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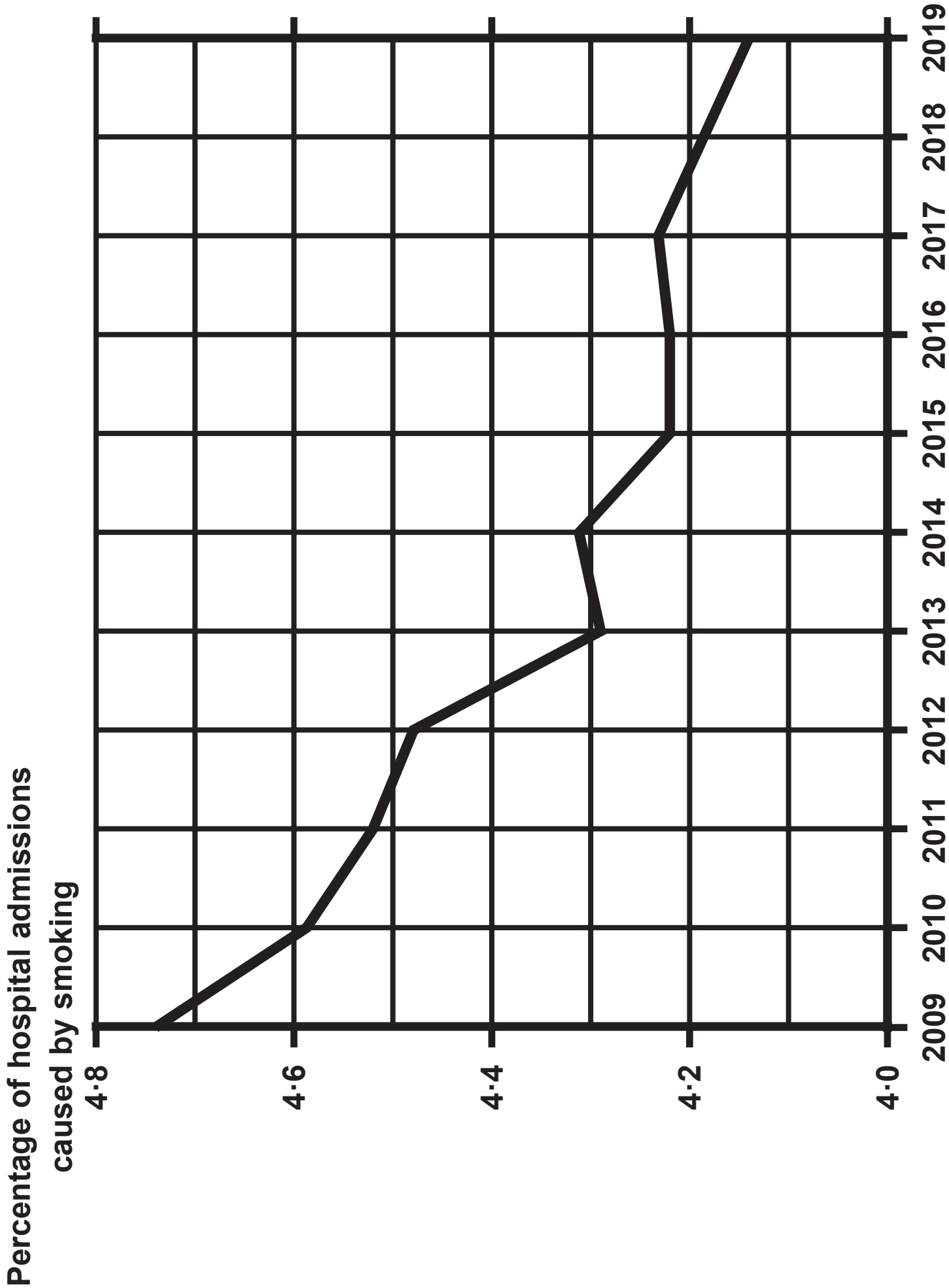
A diagram illustrating translation. A horizontal line labeled "mRNA" runs across the top. Below it, three ribosomes are shown as vertical bars. Each ribosome has a small circle at its base representing the small ribosomal subunit. The ribosomes are positioned at different points along the mRNA strand, indicating they are translating simultaneously.

GRAPH 1

Number of hospital admissions caused by smoking

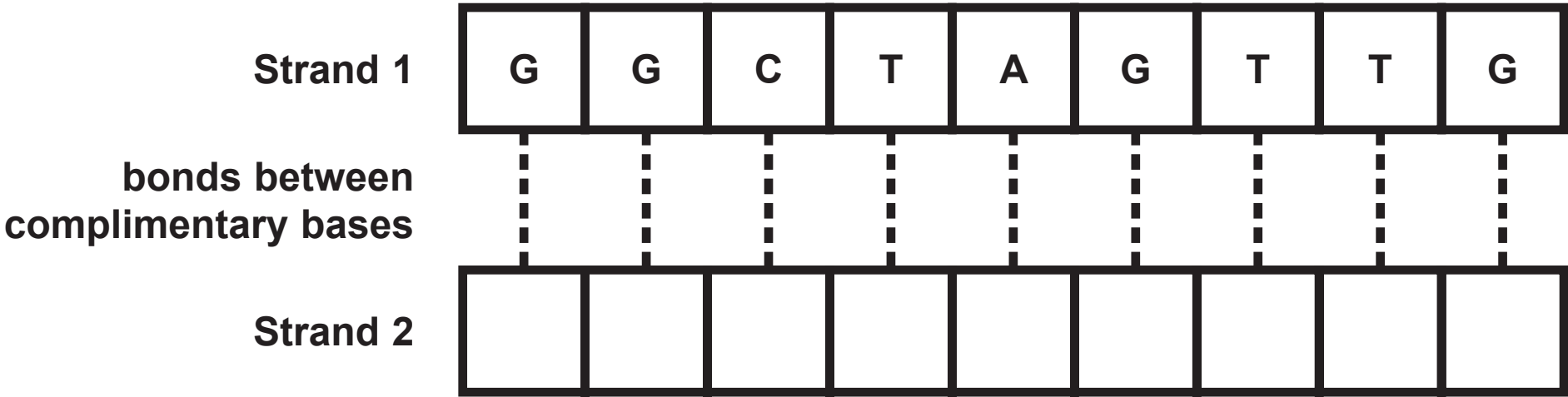


GRAPH 2



Question 5(a)(i)

DIAGRAM 1



**Question 5(a)(iii)**

## DIAGRAM 2

DNA	G	G	C	T	A	G	T	T	G
-----	---	---	---	---	---	---	---	---	---

mRNA

A horizontal line representing an mRNA strand is shown. Below it, nine vertical rectangles represent ribosomes at different stages of translation. Each ribosome contains a small circle representing a tRNA molecule. The first ribosome has a red tRNA with 'A' (anticodon) paired with 'U' (codon). The second ribosome has a blue tRNA with 'C' (anticodon) paired with 'G' (codon). The third ribosome has a green tRNA with 'G' (anticodon) paired with 'C' (codon). The fourth ribosome has a yellow tRNA with 'U' (anticodon) paired with 'A' (codon). The fifth ribosome has a red tRNA with 'A' (anticodon) paired with 'U' (codon). The sixth ribosome has a blue tRNA with 'C' (anticodon) paired with 'G' (codon). The seventh ribosome has a green tRNA with 'G' (anticodon) paired with 'C' (codon). The eighth ribosome has a yellow tRNA with 'U' (anticodon) paired with 'A' (codon). The ninth ribosome has a red tRNA with 'A' (anticodon) paired with 'U' (codon).

## Acknowledgements

### Question 1

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