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91159



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Level 2 Biology, 2015

91159 Demonstrate understanding of gene expression

9.30 a.m. Monday 16 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of gene expression.	Demonstrate in-depth understanding of gene expression.	Demonstrate comprehensive understanding of gene expression.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Not Achieved

TOTAL

5

ASSESSOR'S USE ONLY

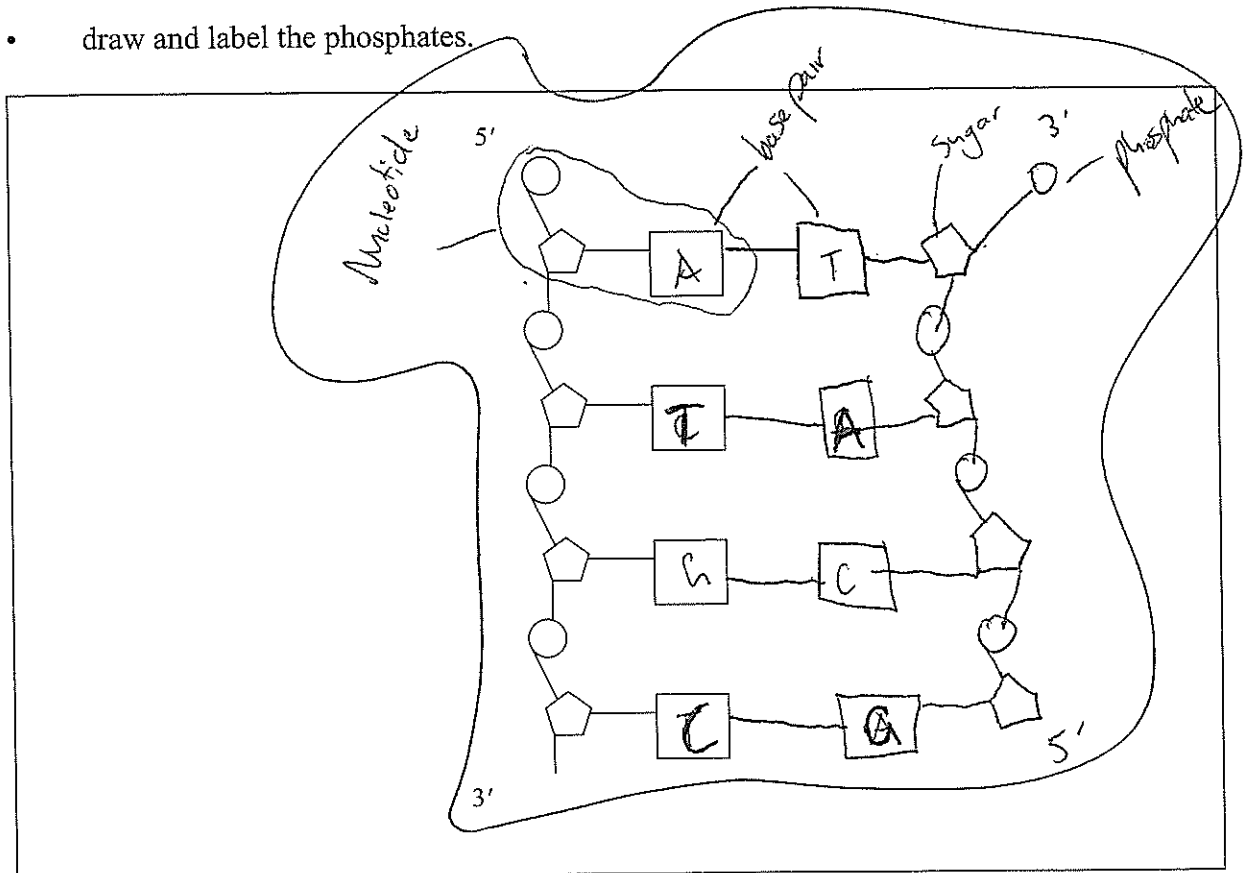
QUESTION ONE: MAKING PROTEINS

- (a) The structure of DNA is made up of nitrogen bases, deoxyribose sugars, and phosphates.

Draw the corresponding **anti-parallel** complementary strand in the box below.

In your answer:

- fill in the template strand containing the bases adenine (A), thymine (T), guanine (G), cytosine (C)
- draw the corresponding **anti-parallel** complementary strand
- draw and label the sugars
- draw and label the phosphates.



- (b) Protein synthesis is the process of making proteins. Triplets, codons, and anti-codons are important components in the process.

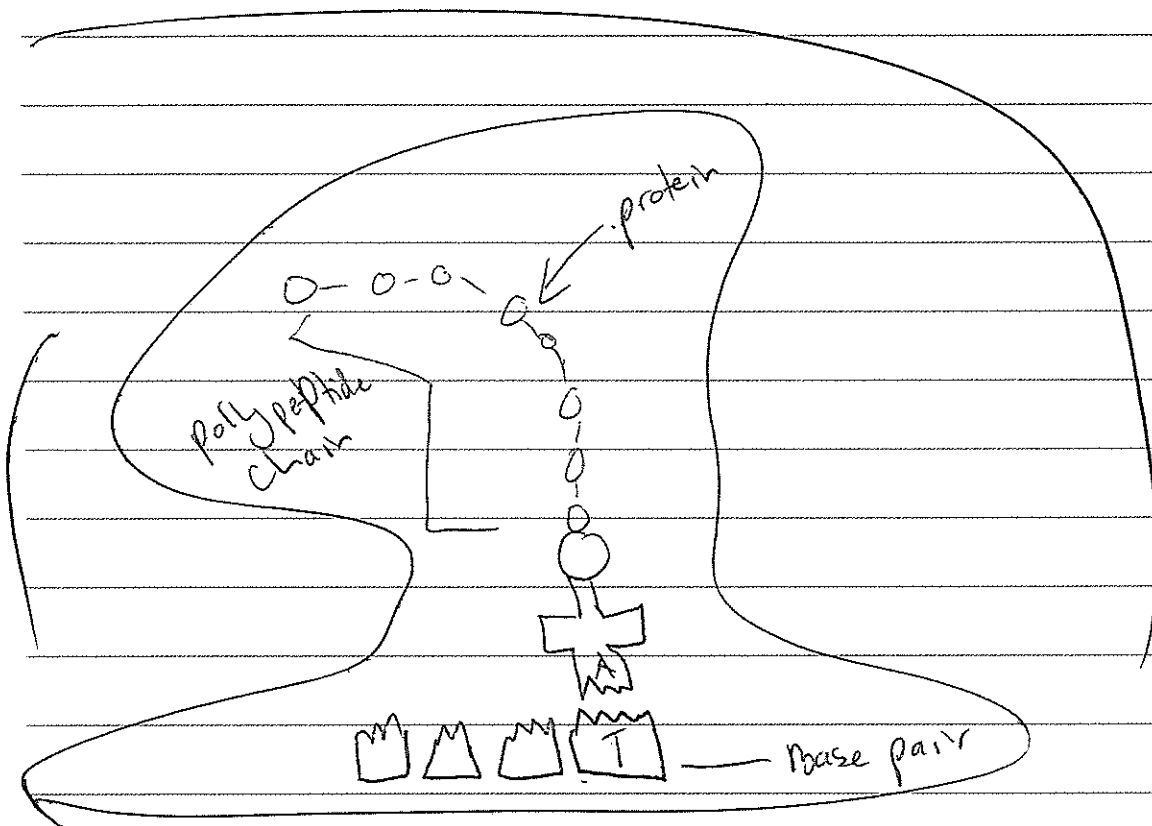
Discuss the relationship between triplets, codons, and anti-codons, and how they interact to form a protein.

In your answer include:

- a description of a triplet, codon, and anti-codon
- an explanation of what a start codon and a stop codon are
- a discussion of how triplets, codons, and anti-codons interact during transcription and translation to form a protein.

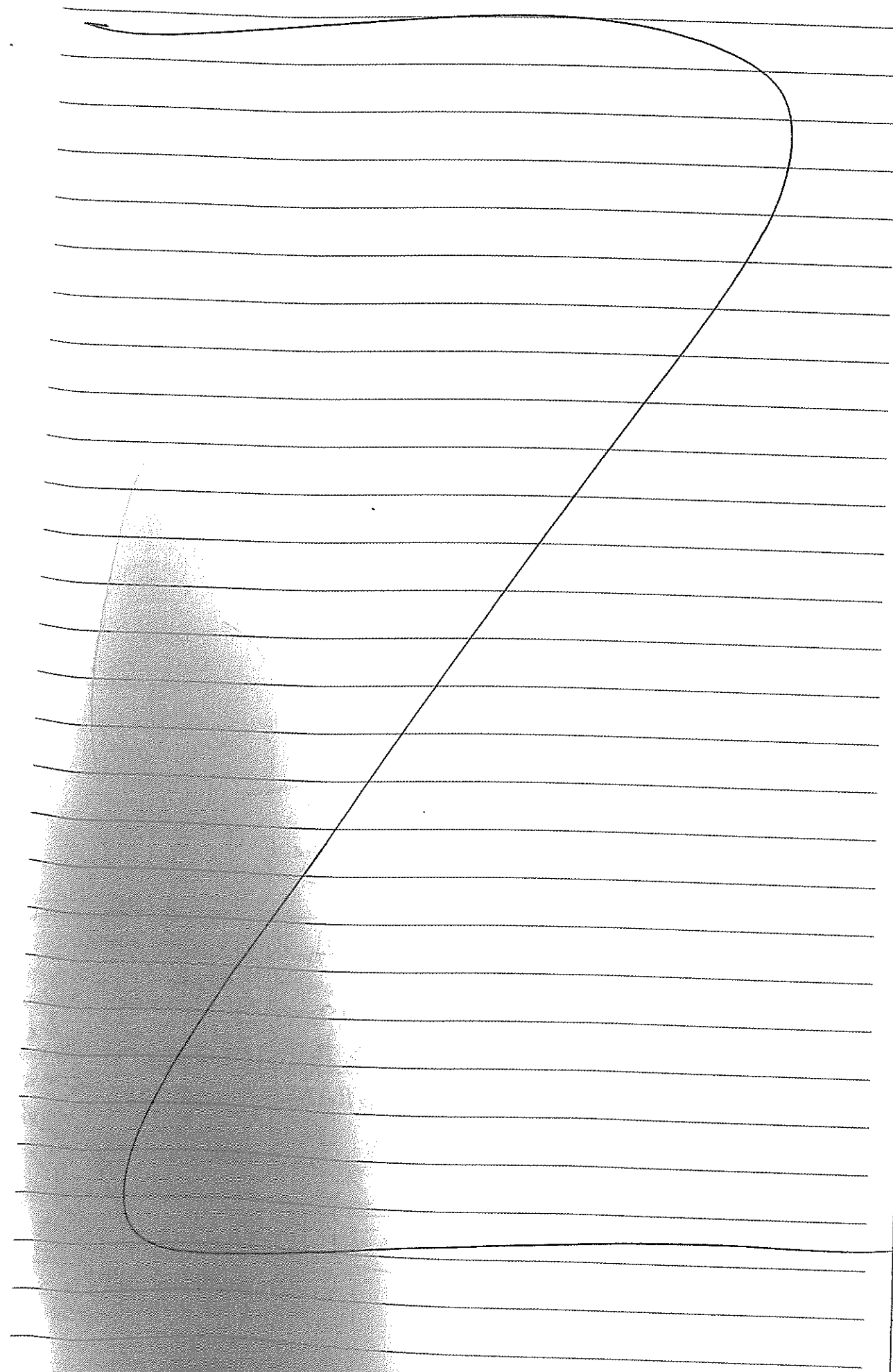
You may use diagrams in your answer.

A stop codon is a put in place to stop the process of protein synthesis and a start codon is to start the process of protein synthesis. A triplet codon is



A triplet codon and an anti-codon ~~are~~ interact to form a protein by the process of transcription key pair bases to gether to make a new strand of DNA called the daughter strand. A stop codon stops this process and a start codon starts this process.

There is more space for your answer to this question on the following page.



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QUESTION TWO: METABOLIC PATHWAYS

In 1941 biologists George Beadle and Edward Tatum exposed the bread mould *Neurospora crassa* to radiation. The mutated moulds lost their ability to produce an amino acid (arginine), and this slowed or stopped their growth. However, they found when they provided the mould with the amino acid arginine, growth was restored. They concluded that a gene mutation inactivates an enzyme needed to synthesise the amino acid in a metabolic pathway.

(a) Describe what a gene mutation is.

A Gene mutation is a
a change in a gene
eg: if you had CATCATCAT

and there was a mutation such as a deletion of the
first letter C you would have ATC ATC AT
and this can change the gene completely.

www.dnafb.org/16/

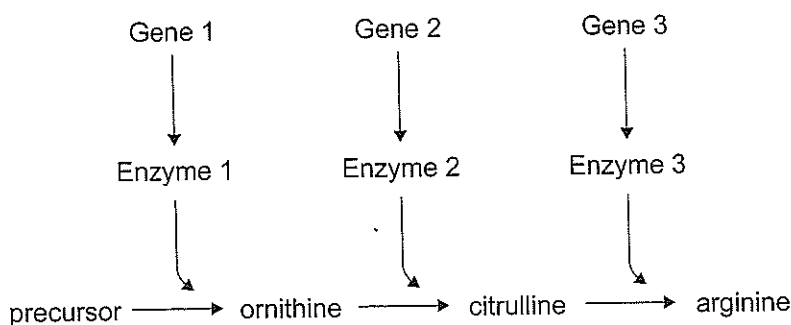
ASSESSOR'S
USE ONLY

- (b) The biologists carried out further experiments and found three mutations prevented the amino acid arginine from being made.

Using the *Neurospora crassa* metabolic pathway below, discuss why there are three mutations that can occur for the amino acid arginine not to be produced.

In your answer:

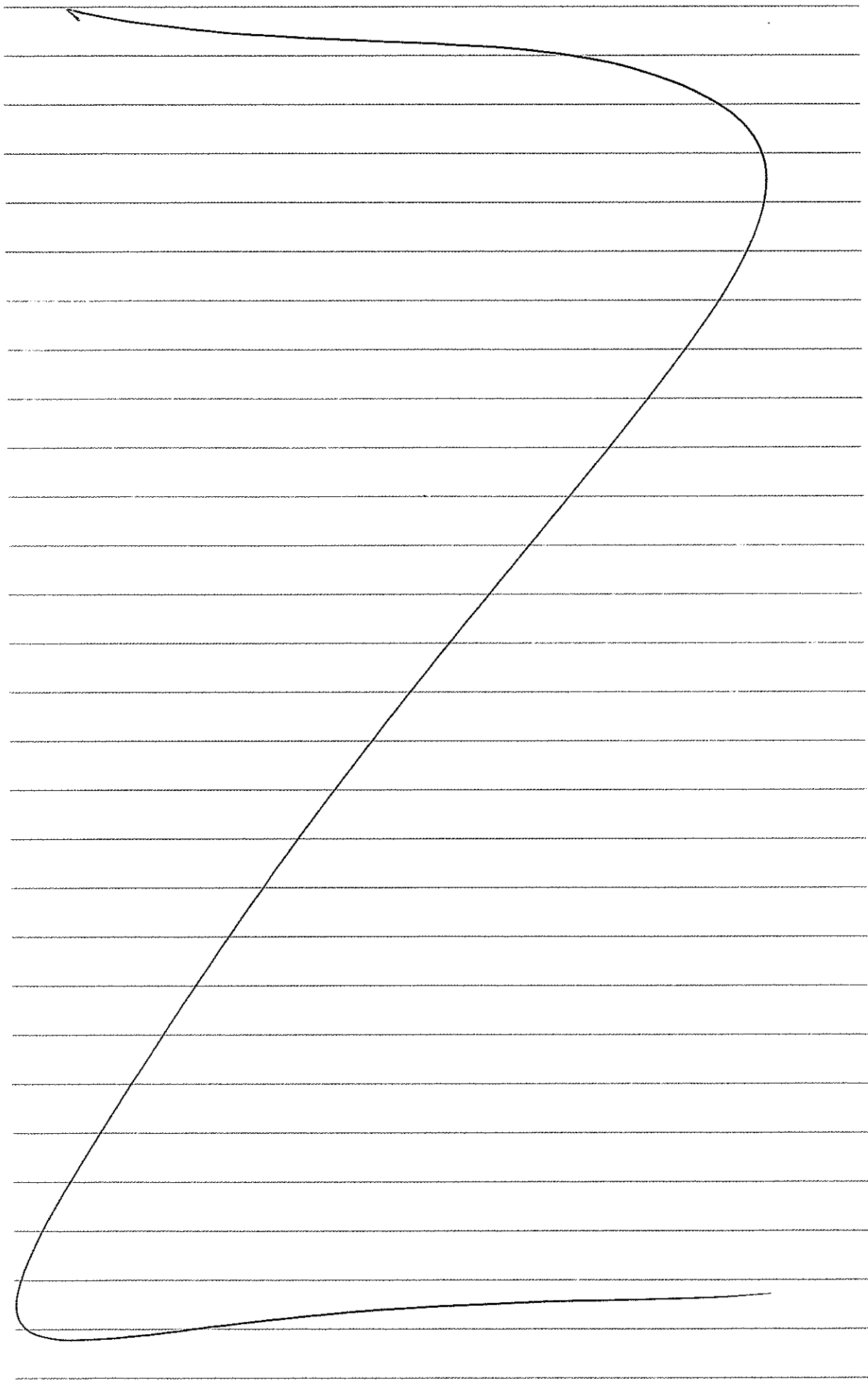
- explain what a metabolic pathway is ✓
- discuss why a mutation to any one of the genes can result in arginine not being produced ✓
- discuss why the biologists concluded 'One Gene Codes for One Protein'.



Interrupted due to fire alarm.

A metabolic pathway is a chain that one substance leads to another. If a mutation happens in Gene 1 arginine could not be made as the gene would stop the ornithine and citrulline being made which makes the arginine. The same with the other two genes if a mutation occurs in them the substance will not make the next substance so therefore arginine would not be made.

biologists concluded that one gene codes for one protein as each gene consists of one enzyme which makes one protein before moving onto the next gene.

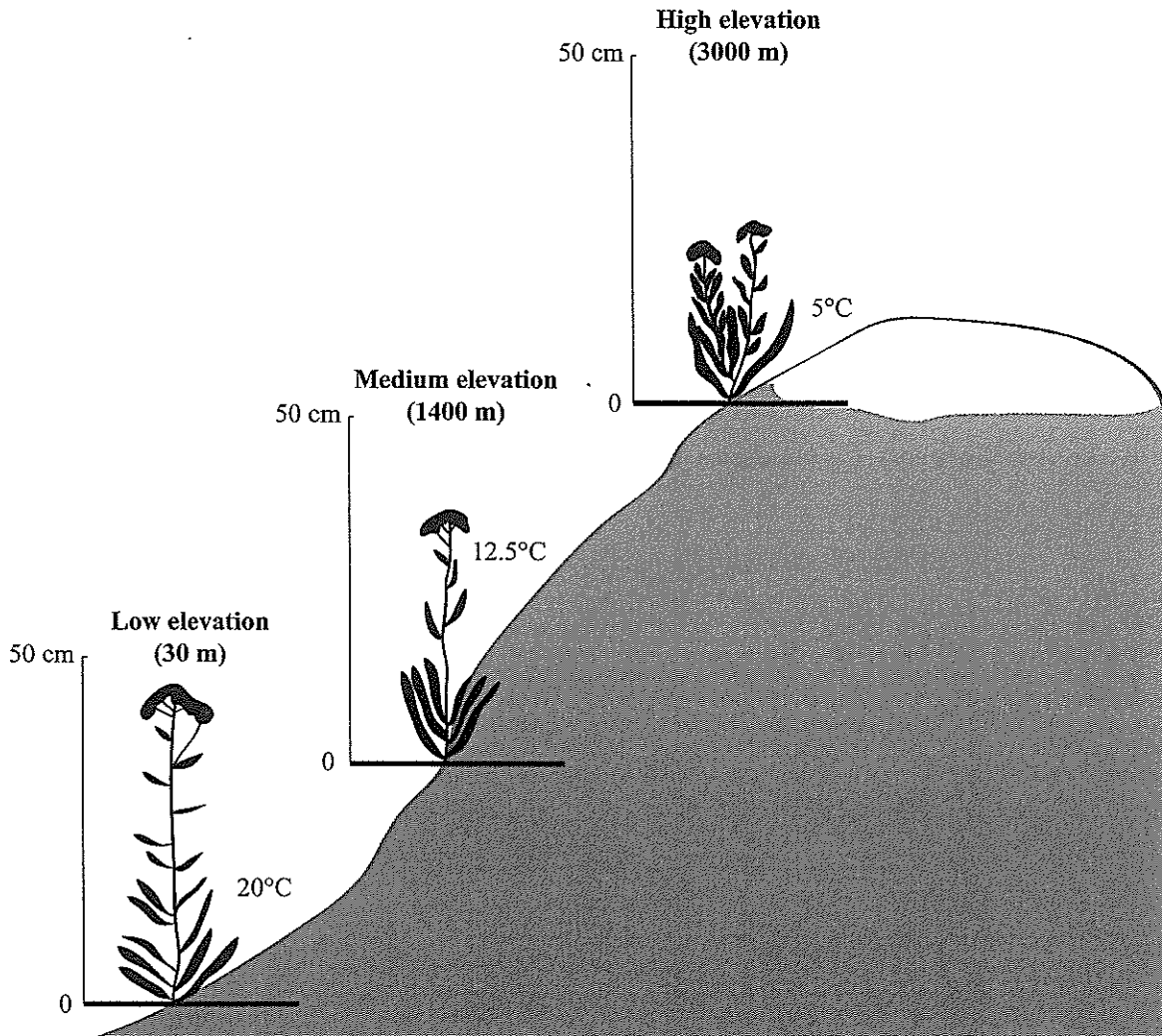


A3

QUESTION THREE: ENVIRONMENT, GENOTYPE INTERACTIONS

The common yarrow plant, *Achillea millefolium*, can be cut into several sections, and each section will grow asexually (reproduces without fertilisation or exchanging gametes) when put into soil. In an experiment, biologists cut one yarrow plant into three sections and planted each section at a different elevation to determine how phenotype is affected by the environment. See figure below.

Achillea millefolium growth response to different elevations



Adapted from http://www.flyfishingdevon.co.uk/salmon/year3/psyc364evolutionary_psychobiology/psy364_genotype_phenotype/psy364_genotype_phenotype.htm

- (a) Describe the difference between genotype and phenotype.

Phenotype is the size of and the appearance of something where genotype is what the individual is made up of.

- (b) Explain why the biologists used genetically identical cuttings, at the different elevations.

Biologists used genetically identical cuttings at different elevations to make the test fair and accurate because if you didn't have identical

genetic plants one could naturally grow bigger than the other. So they needed the plants to be exactly the same to see how different elevations affected the plants.

(c) Analyse the results shown in the figure on the previous page.

In your answer include:

- an explanation of why plants may grow differently at different elevations
- a discussion of the interaction between temperature, genotype, and phenotype expression
- a discussion of environmental factors that would influence the yarrow plants' genetic expression.

Plants may grow differently at different elevations due to the amount of sunlight they receive or how harsh the wind is or how sheltered the plant is at different elevations.

temperature affects the genotype and phenotype as the lower the temperature the smaller the plant seems to grow.

Environmental factors such as wind and rain could influence the yarrow plants genetic expression by limiting or increasing it's growth.

As we can see on the graph the higher the elevation the lower the temperature and the smaller the yarrow plant has grown.

Annotated Exemplar Template

Excellence exemplar for 91159 2015		Total score	05
Q	Grade score	Annotation	
1	N0	This candidate has not provided any clear definition. They have used terms both from protein synthesis and DNA replication further muddling the definitions.	
2	A3	This candidate has weak definitions of a mutation and a metabolic pathway. To gain A4 they would need to provide more information on how the nucleotide sequence change is the mutation and the metabolic pathway is an enzyme controlled series of reactions.	
3	N2	The candidate, like many who got not achieved, did not define basic genetic terms such as phenotype and genotype. They did demonstrate a basic understanding of why the cuttings had to be the same for each altitude.	