PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 7: MODERN GENETICS

FACTORS AFFECTING GENE EXPRESSION

SCORE	PERCENTAGE
/63	%

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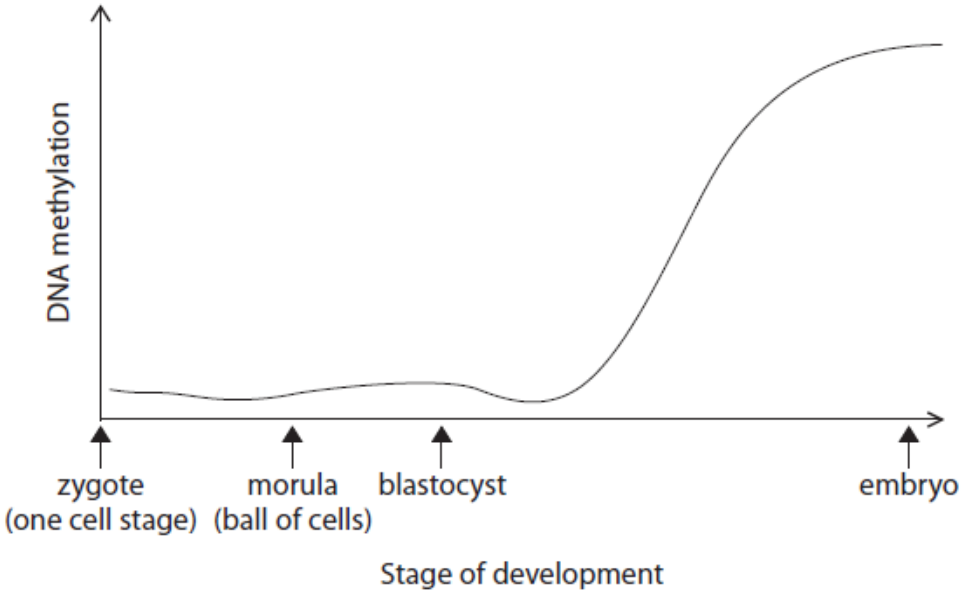
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Q1.

Epigenetic modifications are involved in the development of an embryo.

The graph shows the changes in DNA methylation during the development of an embryo from a zygote.



(i) State the meaning of the term DNA methylation.

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(ii) Describe the differences between totipotent, pluripotent and multipotent

stem cells during the development of an embryo.

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(iii) Analyse the graph to explain why DNA methylation is involved in the development of an embryo.

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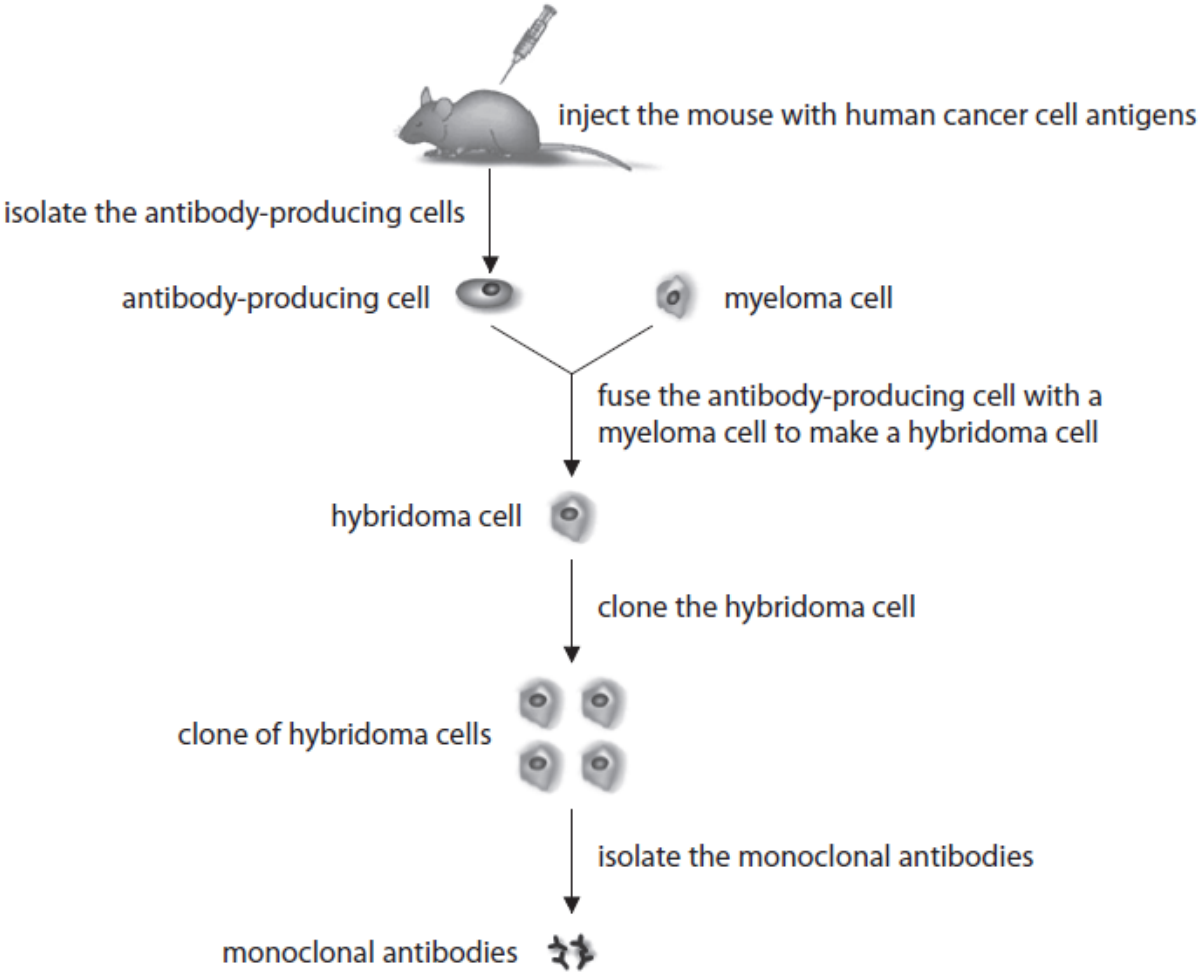
(Total for question = 6 marks)

Q2.

Monoclonal antibodies can be made against a wide range of different antigens. They are used in research and medicine.

Monoclonal antibodies are made by fusing an antibody-producing cell with a myeloma cell.

The diagram shows some of the steps involved in making monoclonal antibodies against human cancer cell antigens.



Epigenetic modification is involved in the formation of the antibody-producing cells.

Describe epigenetic modification.

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(Total for question = 3 marks)

Q3.

Hypoxia is an inadequate supply of oxygen to tissues and cells that restricts their function.

The body responds to hypoxia by releasing hypoxia-inducible transcription factors (HIF).

Investigations have shown that one effect of HIF is an increase in the rate of glycolysis in the affected cells.

(i) Explain how HIF could result in an increase in the rate of glycolysis.

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(ii) Explain why cells need to respond to hypoxia with an increase in the rate of glycolysis.

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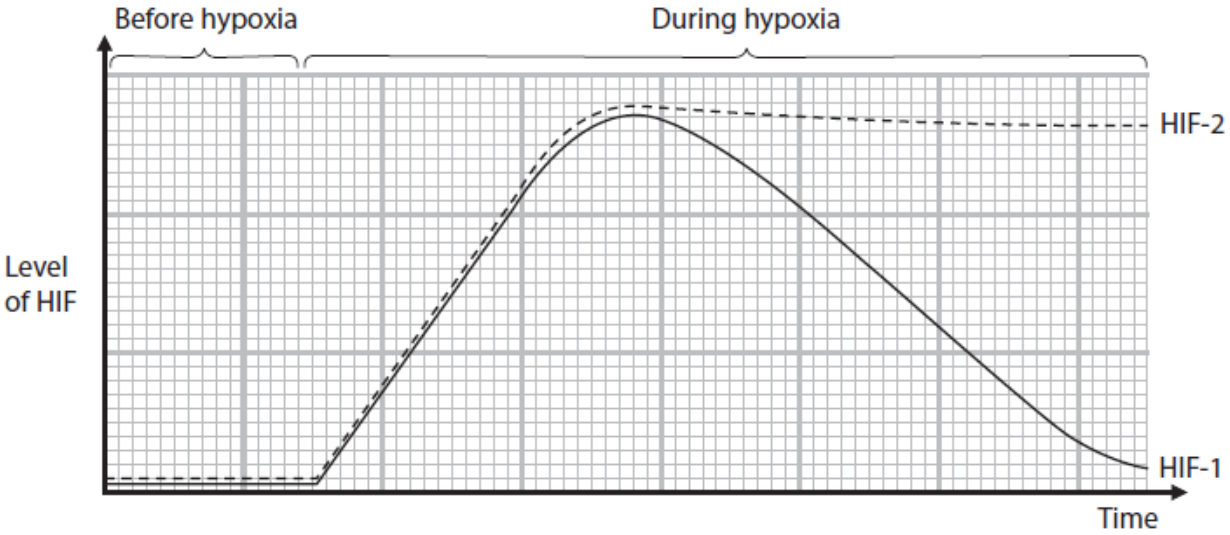
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(iii) The graph shows the changes in levels of two HIFs, HIF-1 and HIF-2, before and during hypoxia.



Compare and contrast the changes in the levels of HIF-1 and HIF-2 during hypoxia.

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(iv) Explain the changes in levels of HIF-1 and HIF-2 during hypoxia.

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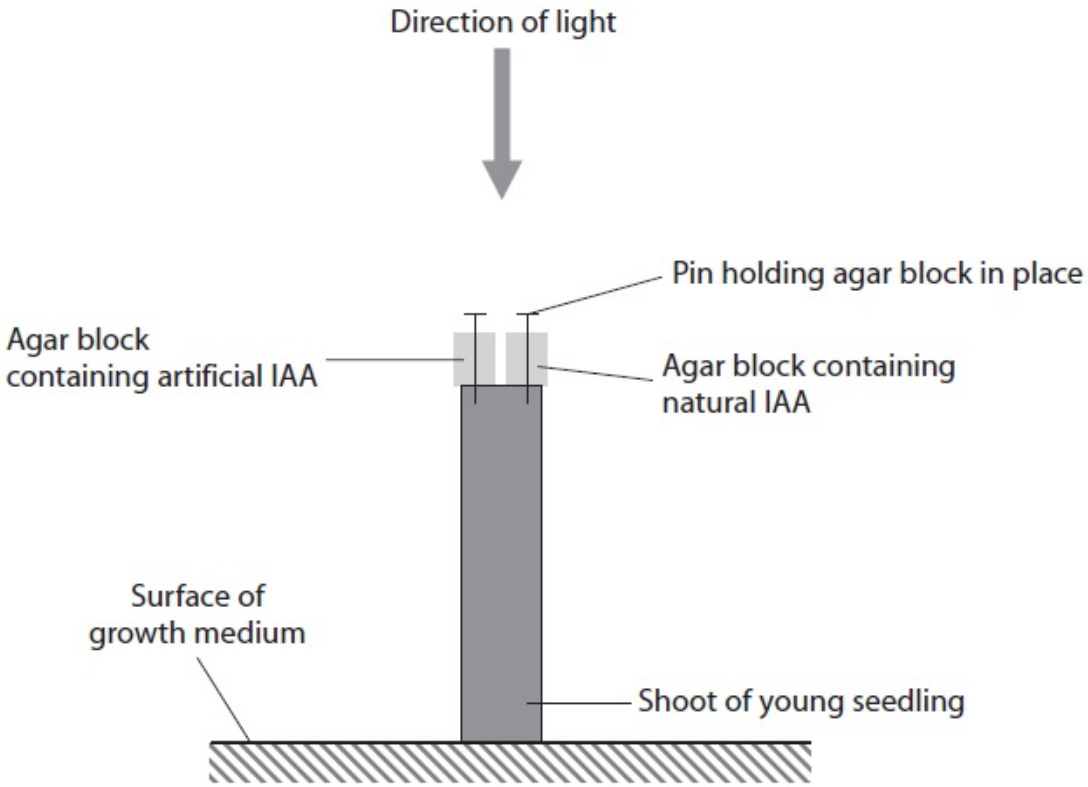
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(Total for question = 10 marks)

Q4. IAA (auxin) is a plant growth substance.

(a) A student investigated the effect of natural IAA and artificial IAA on shoot growth.

The diagram below shows how she set up her investigation.



(i) The student also set up a control.

Describe a suitable control for this investigation.

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(ii) After 48 hours, the student recorded her observations of the growth of the shoots.
From her observations, she concluded that both natural and artificial IAA affected growth. She also concluded that the artificial IAA had a greater effect than the natural IAA.

Suggest what she recorded and explain how the IAA in the agar affected the growth of the shoot.

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(b) IAA is known to bind to transcription factors.

Suggest how IAA can stimulate cells to synthesise proteins.

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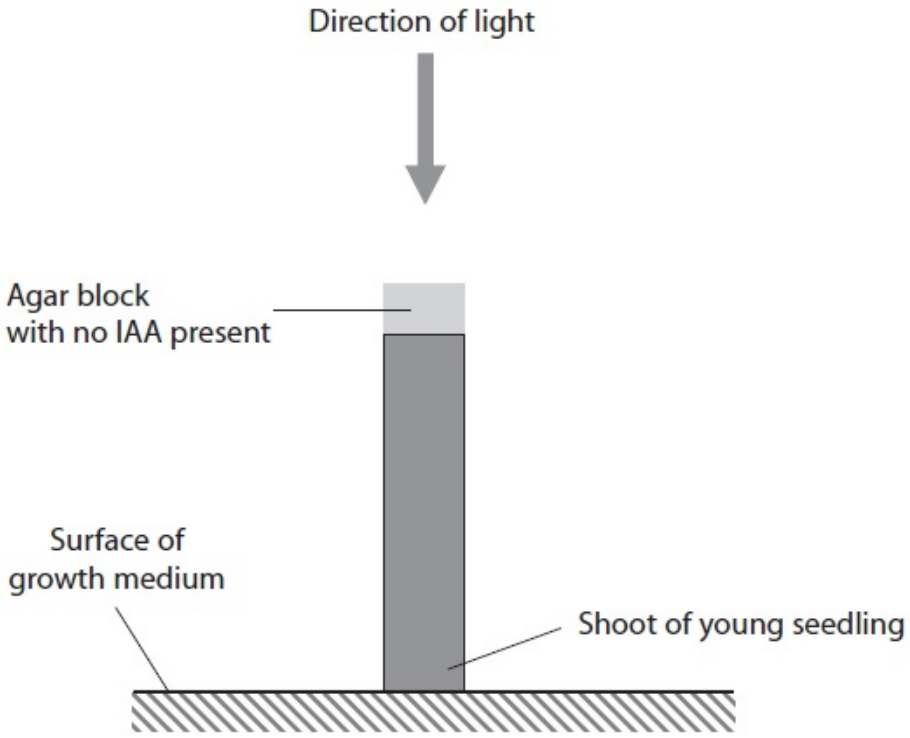
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(Total for Question = 10 marks)

Q5. IAA (auxin) is a plant growth substance.

(a) A student investigated the effect of different concentrations of IAA on shoot growth.

The diagram below shows how she set up her control.



(i) Describe the role of the control in this investigation.

(1)

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(ii) After 48 hours, the student recorded her observations of the growth of the shoots.

From her observations, she concluded that IAA affected growth. She also concluded that a higher concentration of IAA had a greater effect.

Suggest what she recorded and explain how the IAA in the agar affected the growth of the shoots.

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(b) IAA can interact with transcription factors to stimulate cells to produce proteins.

Suggest how the presence of IAA can cause cells to produce proteins.

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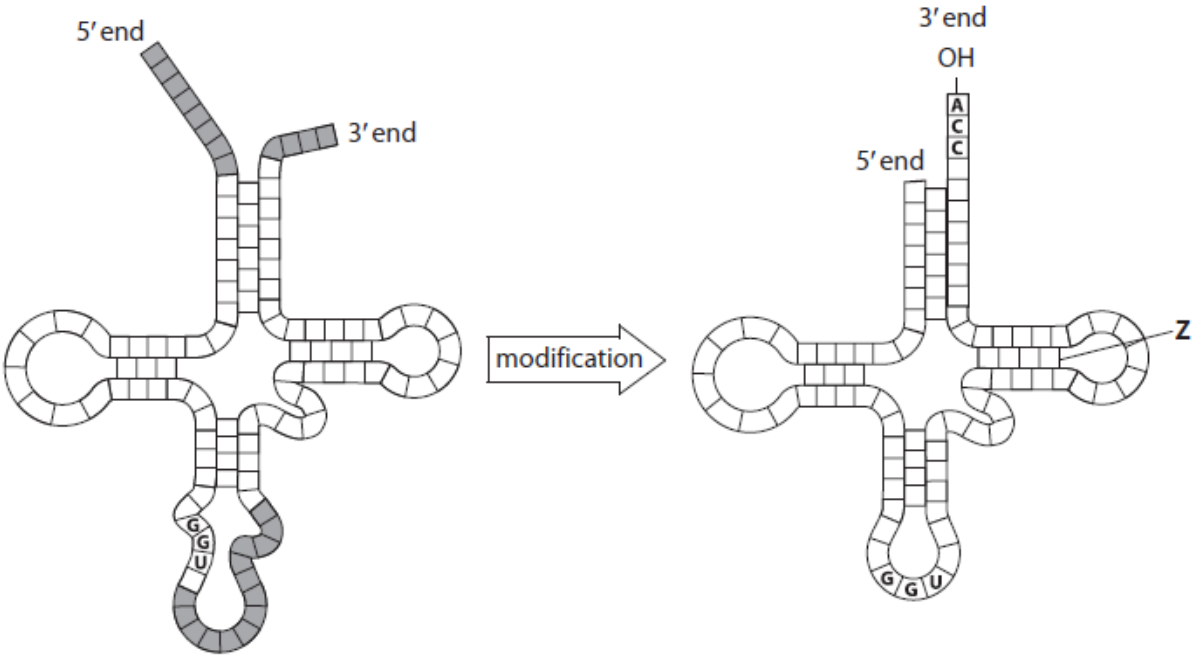
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(Total for Question = 10 marks)

Q6.

A molecule of tRNA is made from a precursor molecule that is modified. Modification includes splicing, trimming and attachment of new nucleotides.

The diagram shows a precursor molecule for a tRNA specific for the amino acid proline, and a tRNA molecule specific for the amino acid proline. Some of the bases are shown in each diagram.



precursor molecule

tRNA molecule specific for the amino acid proline

Describe how this precursor molecule is modified to produce a tRNA molecule specific for the amino acid proline.

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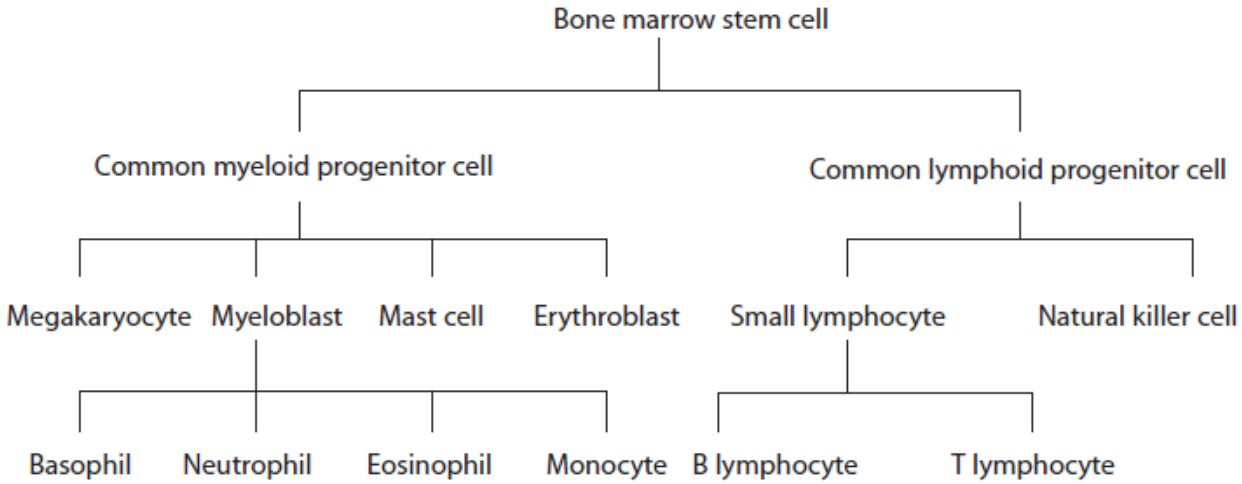
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(Total for question = 3 marks)

Q7.

The diagram shows some stages in the production of blood cells from bone marrow stem cells.



Explain how a bone marrow stem cell differentiates into either a common myeloid progenitor cell or a common lymphoid progenitor cell.

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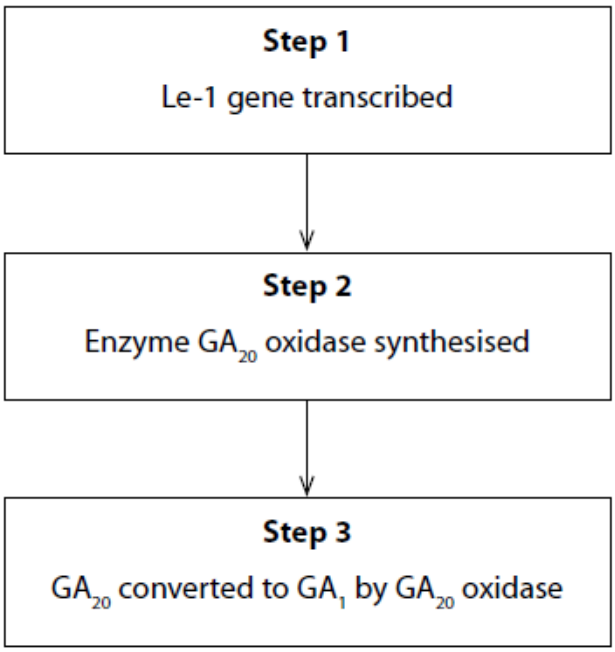
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(Total for question = 4 marks)

Q8.

'DELLA' proteins normally prevent transcription factors from binding to important growth-stimulating genes in the cells of plant stems.

The diagram below shows part of the biochemical pathway leading to the synthesis of an active plant growth substance called gibberellin (GA_1). GA_1 reduces the effect of 'DELLA' proteins.



(a) The Le-1 gene codes for the enzyme GA_{20} oxidase. A mutation of this gene forms a recessive allele which, when translated, leads to a single amino acid change in this enzyme. This change significantly reduces the activity of GA_{20} oxidase.

Explain how a single amino acid change can bring about a change in the structure and activity of GA_{20} oxidase.

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(b) (i) Explain why homozygous recessive plants will have short stems.

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(ii) An ecological survey of a stable population of one species of plant found that 36% had short stems.

Calculate the percentage of heterozygous individuals in this population.
Assume that there are only two alleles for this gene.

(4)

Answer .....

(Total for question = 12 marks)

Q9.

The scientific article you have studied is adapted from articles in *Nature* and *Scientific American*.

Use the information from the article and your own knowledge to answer the question.

'While the manipulated individual may look like an ant, it represents a fungal genome expressing fungal behaviour through the body of an ant' (paragraph 33).

Suggest how fungal genes may be expressed and affect the behaviour of these ants.

(5)