

A Level Biology B

H422/03 Practical skills in biology

Question Set 6

1. (a) Farmers rotate different crops on their land to produce higher yields. Crops like beans are used in the rotation to fix atmospheric nitrogen. This reduces the need for synthetic fertilisers.

Name the type of crop, such as beans, that can fix nitrogen.

[1]

- (b) (i) The roots of bean plants form nodules due to infection by the nitrogen-fixing bacteria, *Rhizobium*.

Rhizobium can be cultured in a laboratory.

The table shows information for the preparation of agar plates used to culture *Rhizobium*.

Complete the table by suggesting a role for mannitol.

Constituent added to agar	Role of constituent
Mannitol (a carbohydrate)
Yeast extract	source of nitrogenous compounds
Magnesium sulfate	source of essential ions
Dipotassium phosphate and sodium chloride	pH and osmotic buffers

[1]

- (b) (ii)* Write a method that could be used to prepare a culture of *Rhizobium* bacteria in the laboratory.

You are provided with:

- plates with agar containing the constituents listed in the table in part (i)
- a bean plant
- school or college resources.

In your answer you should describe how you would minimise potential hazards associated with the preparation.

[6]

- (b) (iii) After preparation in the laboratory, *Rhizobium* cultures are usually kept at 30 °C.

Explain why this is a suitable temperature.

[2]

- (c) (i) In response to infection by *Rhizobium*, bean plant nodule cells produce protein called leghaemoglobin.

Researchers wanted to find out more about three genes that code for leghaemoglobin.

They used RNA interference (RNAi) to inhibit the production of leghaemoglobin using miRNA.

They measured the relative transcript level of the leghaemoglobin genes of bean plants treated with miRNA (RNAi plants) and those of untreated bean plants.

The results are shown in Table 1.

Name of leghaemoglobin gene	Relative transcript level of gene	
	Untreated plants	RNAi plants
LjLb1	3.5	0.085
LjLb2	4.0	
LjLb3	2.0	0.045

Table 1

Transcript levels for gene LjLb2 in the RNAi plants were reduced by 97.4% compared with the untreated plants.

Calculate the relative transcript level for LjLb2 in the RNAi plant.

Show your working.

[3]

- (c) (ii) Describe how miRNA inhibits the mRNA of the treated plants.

[3]

- (c) (iii) Explain why the researchers chose miRNA rather than siRNA (small interfering RNA) to inhibit the transcription of the leghaemoglobin genes.

[1]

Total Marks for Question Set 6: 17

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