

**AS Level Biology A**  
**H020/01 Breadth in Biology**

**Question Set 15**

1. The downy birch tree, *Betula pubescens*, produces varying numbers of leaf hairs.

These hairs are between 200µm and 500µm long in response to different environmental conditions.

- (a) State the **pattern** of variation shown by leaf hair density.

..... [1]

- (b) Leaf hair density can be measured in the laboratory.

Outline a practical method that could be used to determine the density of hairs on the underside of a leaf.

[3]

- (c) A group of students investigated the relationship between the distance of different trees from a river and the mean leaf hair density.

Table 25 shows the results of their investigation.

Distance from river (m)	Rank of distance	Mean leaf hair density (number mm <sup>-2</sup> )	Rank of hair density	Difference in ranks ( <i>d</i> )	Difference squared ( <i>d</i> <sup>2</sup> )
9.1	4	33.1			
13.7	1	34.8			
5.5	7	11.3			
0.3	10	3.4			
5.4	8	27.3			
11.5	3	30.3			
1.7	9	6.3			
6.0	6	22.9			
11.9	2	5.7			
6.8	5	23.2			

Table 25

- (i) Complete Table 25 by calculating the difference between the ranks and then squaring the difference.

[Answer on Table 25]

[2]

- (ii) Use the formula below to calculate Spearman's rank correlation coefficient for this data.

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

..... [2]

(d) The students concluded that there is a positive correlation between distance of the tree from the river and mean leaf hair density.

(i) Suggest reasons for this positive correlation.

[2]

(ii) For this investigation, the students randomly selected leaves from ten downy birch trees at varying distances from the river.

Suggest **three** ways in which the students could improve the validity of their sampling method.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) Another group of students repeated this investigation and calculated  $r_s = 0.589$ . The critical value of  $r_s$  at the 5% level for 9 degrees of freedom is 0.600.

They concluded that their results showed a weak positive correlation between leaf hair density and distance of the tree from the river.

Evaluate the conclusion of this group of students.

[2]

**Total Marks for Question Set 15: 15**

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