



GCE Biology

S21-A400U20-1

Assessment Resource 13

Continuity of Life Resource D

1. A recently developed technique in genetic engineering is called CRISPR. In this technique guide RNA is made which attaches to complementary sequences on DNA.

Nucleic acid molecules are constructed from sub-units called nucleotides.

- (a) Describe **three** ways in which a DNA molecule differs from an RNA molecule. [2]

.....

.....

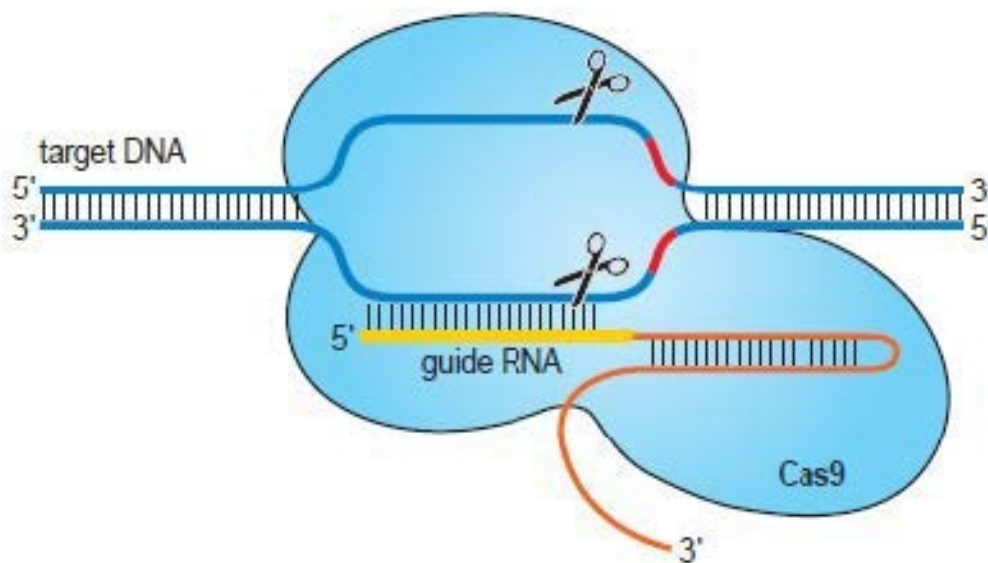
.....

.....

The CRISPR technique can be used to remove a target gene.
In this technique:

- Guide RNA is made.
- The guide RNA and Cas9 endonuclease combine to form a CRISPR/Cas9 complex.
- The complex is then inserted into a cell.
- The guide RNA attaches to the target gene as shown in Figure 1.1

Figure 1.1



- (b) Cas9 enzyme is a restriction endonuclease. State what is meant by a restriction endonuclease. [2]

.....

.....

.....

.....

Genetic engineers have discovered that by synthesising guide RNA with particular nucleotide sequences they can target any gene in any organism, if they know its nucleotide sequence. Using this technique it is possible to remove a target gene.

- (c) Scientists have identified a gene that is essential for fertility in mosquitoes of the genus *Anopheles*.

Suggest how the CRISPR technique could be used to modify mosquito eggs to produce sterile adult mosquitoes. [3]

.....

.....

.....

.....

.....

.....

- (d) Explain how releasing these sterilised mosquitoes into the wild might benefit humankind and suggest an ethical reason for not doing so. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

2. In order to investigate the effects of mowing on biodiversity, a group of students carried out surveys on two different sites on their school fields.

- A playing field that was mown regularly throughout the growing season.
- A meadow set aside for conservation that was mown once a year.

The students used quadrats to estimate the numbers of plants of the species found on the two sites.

The results were analysed using the Simpson's Diversity Index.

(a) Explain the steps the students should have taken to ensure their sampling methods produced representative totals. [3]

.....

.....

.....

.....

.....

.....

(b) The meadow had a Simpson's Diversity Index of 0.58. The results for the playing field are shown below. Calculate the Simpson's Diversity Index for this site. [3]

Species	n	(n-1)	n(n-1)
ryegrass	401		
daisy	11		
buttercup	2		
dandelion	2		
yarrow	4		
plantain	3		
clover	11		
(N)	434	$\sum n(n-1) =$	
$N(N-1) =$			

$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$, where N = number of organisms present and n = the number in each species.

$D =$

(c) State a conclusion about the effect of mowing on the biodiversity of grassland. [2]

.....

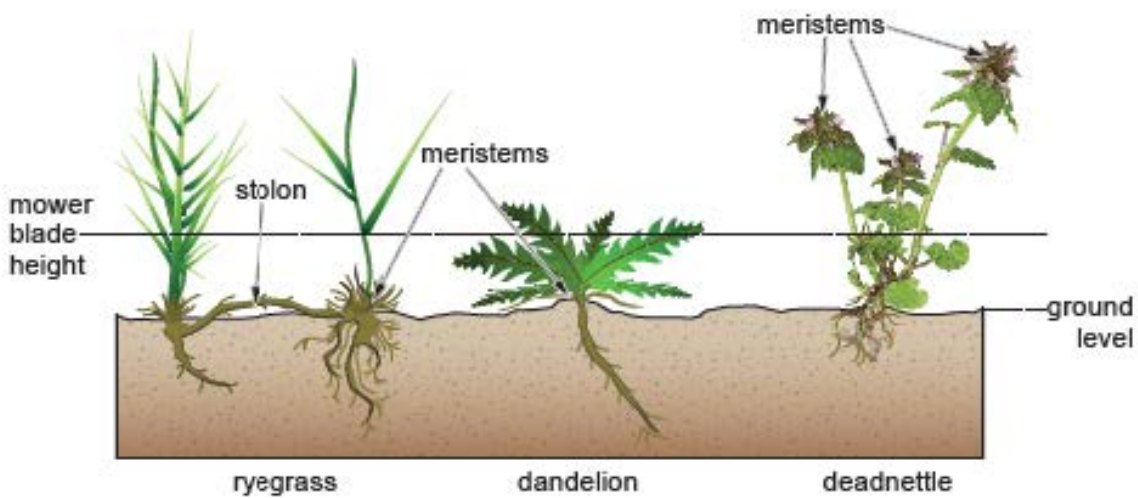
.....

.....

.....

Figure 2.1 shows the morphology of common meadow species: ryegrass, dandelion and deadnettle. It also shows the height the mower blade passes over the ground.

Figure 2.1



A40 00201
08

(d) Using information from figure 2.1 give an explanation that could account for your conclusion in part (c). [4]

.....

.....

.....

.....

.....

.....

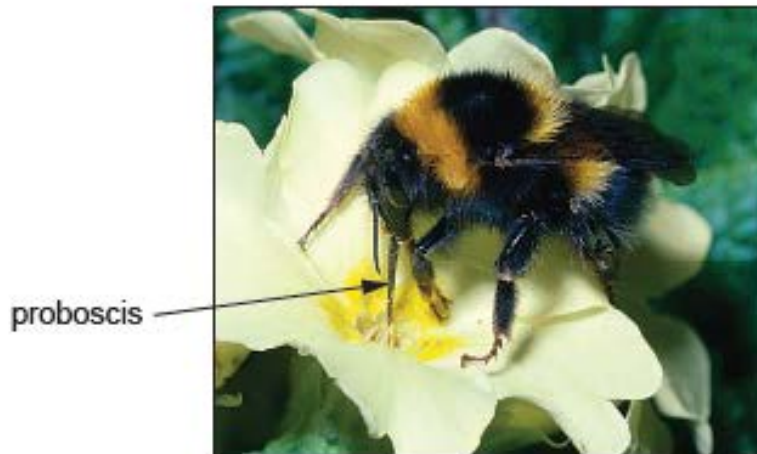
.....

.....

.....

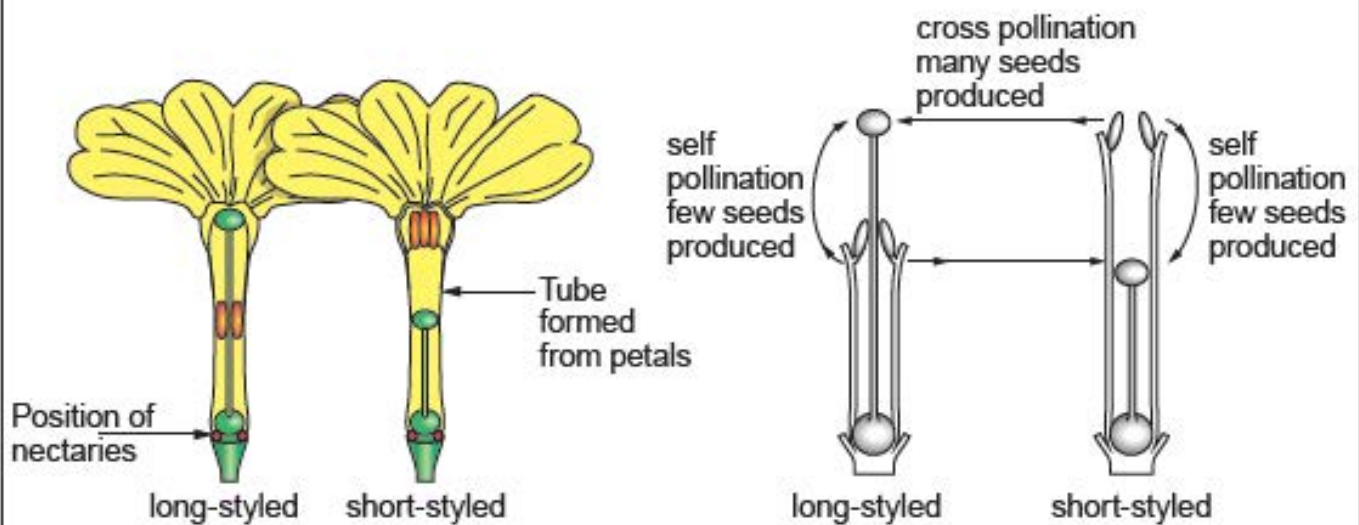
3. Figure 3.1 shows a bumble bee collecting nectar from a flower of *Primula vulgaris*.

Figure 3.1



There are two different forms of these flowers. Each plant only has one of the two forms.

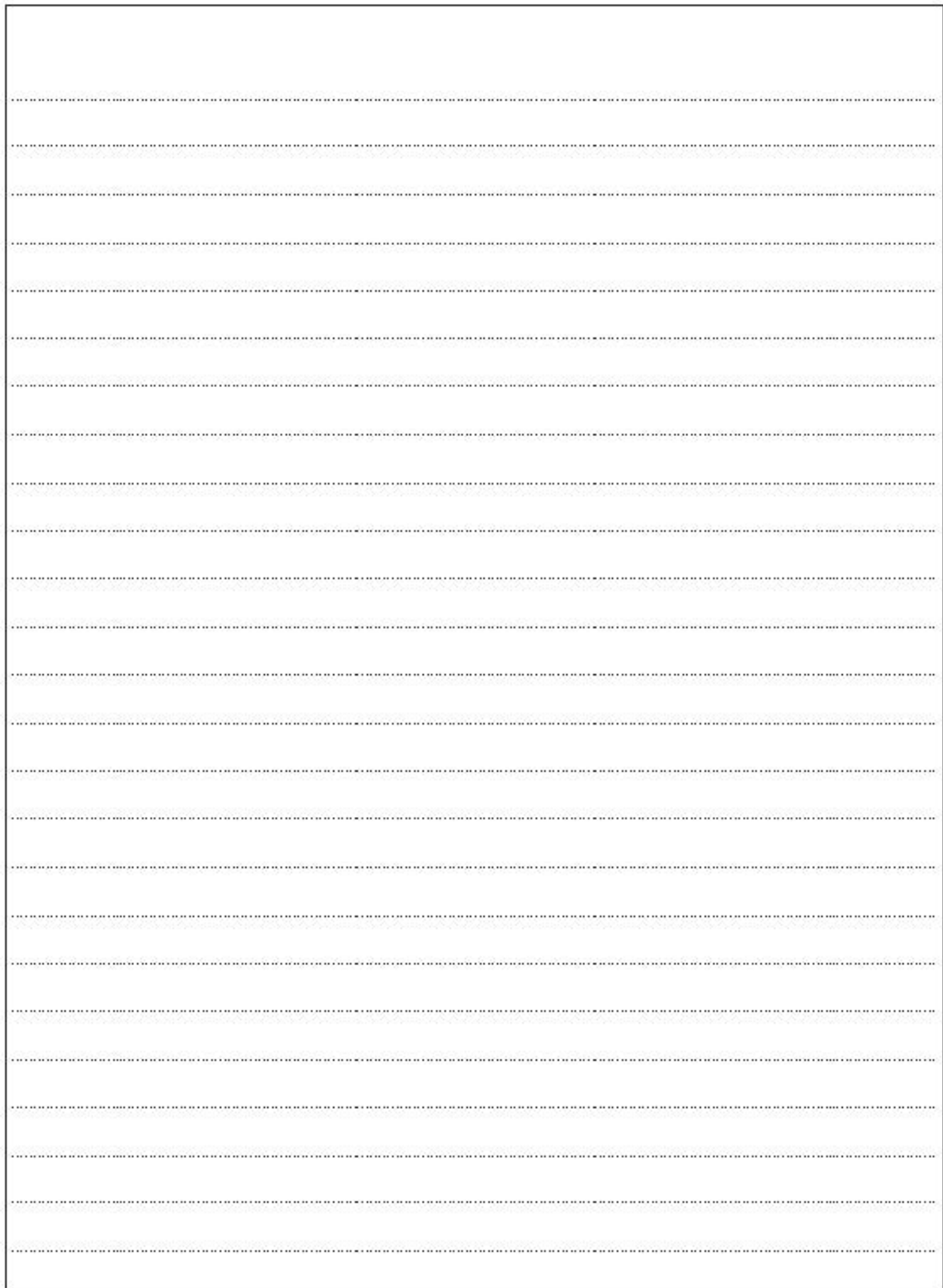
Figure 3.2



Apart from the length of the style, there are other differences between the two types:

- the stigma is rougher in the long-styled flowers;
- the pollen-grains are smaller in the long-styled flowers;
- the pollen-grains of the long-styled flowers are more triangular.

Experiments have been carried out where some flowers have been protected from insects (to force self-pollination) and others were allowed to cross pollinate. The number of viable seeds produced was counted as a measure of fertility. The structure of the flowers and the results are shown above.



END OF PAPER