

**A Level Biology A**  
**H420/02 Biological Diversity**

**Question Set 15**

1

DNA can be obtained from a variety of plant and animal cells.

- (a) A group of students tried to purify some DNA from leek cells using the following method. They decided that exact volumes were not necessary.

1. Grind a leek leaf to a fine pulp using a pestle and mortar.

2. Add salt and cold water and mix again for at least 10 s.

3. Add protease enzyme and mix again for at least 10 s.

4. Filter the liquid into a test tube and stand for at least 10 min.

5. Tilt the test tube and gently pour in ice-cold ethanol.

6. A white layer of DNA forms between the sample and the ethanol.

7. Extract the white layer carefully using a glass rod.

- (i) State the purpose of step 1. [1]  
**To break down the cell walls.**
- (ii) Suggest why a protease enzyme added in step 3 is needed to purify DNA. [1]  
**Because the protease breaks down the histones.**
- (iii) The students considered using pineapple juice as a source of protease enzyme.  
Suggest why this would **not** be an appropriate source of protease when attempting to produce a pure sample of leek DNA. [1]  
**Because the DNA of the pineapple will mix the leek DNA so it's no longer a pure sample.**
- (iv) State one important step that the students had left out of their method. [1]  
**They forgot to mix sample with detergent which breaks**
- (v) Name the process described in step 6. **down the cell membrane** [1]  
**Precipitation**

- (b) Genes isolated from DNA can be used in gene therapy.

Cystic fibrosis (CF) is a disease that could be treated using gene therapy.

Healthy individuals have a gene that codes for a channel protein, called CFTR, found in the plasma membrane of a variety of cells, including those lining the airways of the lungs.

People suffering from CF have two copies of a recessive allele and so their cells do not synthesise the correct channel protein.

The allele that codes for the functioning CFTR protein can be inserted into the DNA of CF sufferers. The cells can then synthesise the correct CFTR protein and function as normal.

- (i) The treatment of cystic fibrosis is described as **somatic** gene therapy. Another type of gene therapy is known as **germ-line** gene therapy.

Complete the table below to show **three** differences between somatic gene therapy and germ-line gene therapy.

Somatic	Germ-line
not passed on to the next generation	passed on to the next generation
only some cells get the functioning gene	all cells get the functioning gene
treatment can be short lived	treatment is long-lived

[3]

- (ii) Some attempts at gene therapy have resulted in changes to the functioning of other genes.

Explain how inserting a new gene into a chromosome could affect the functioning of other genes in that chromosome.

A frameshift could occur resulting in altered triplet base codes and different (non-functional) protein being formed. [2]

- (iii) CF occurs when individuals have two copies of a recessive allele.

Huntington's disease is a lethal disease caused by a dominant allele that codes for the protein huntingtin.

Suggest why gene therapy is unlikely to work as a treatment for Huntington's disease.

Huntingtin is still synthesised after gene therapy as it's a dominant allele. [1]

**Total Marks for Question Set 15: 11**

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