

19.1 Principles of Genetic Technology

Question Paper

Course	CIEA Level Biology
Section	19. Genetic Technology
Topic	19.1 Principles of Genetic Technology
Difficulty	Easy

Time allowed: 30
Score: /21
Percentage: /100

Question 1a

Define the term **recombinant DNA**.

[1 mark]

Question 1b

Recombinant DNA is produced during the process of genetic engineering.

Genetic engineering involves the use of several groups of enzymes.

Name the groups of enzymes used for the following techniques in genetic engineering:

(i)
Cutting DNA at specific base sequences.

[1]

(ii)
Making a single-stranded DNA copy of a piece of mRNA.

[1]

(iii)
Joining pieces of DNA together, e.g. a desired gene and a plasmid.

[1]

[3 marks]

Question 1c

Plasmids are loops of bacterial DNA that can be altered during genetic engineering to contain desired genes, e.g. a gene that provides pest resistance in crops.

In addition to such desired genes, plasmids may be further altered to contain additional sections of DNA.

Describe **one** example, **other than** the desired gene, of a section of DNA that might be added into a plasmid during genetic engineering.

[2 marks]

Question 1d

Plasmids can be used to transfer recombinant DNA into the cells of living organisms.

Give the biological term used to describe components that transfer DNA into the cells of organisms.

[1 mark]

Question 2a

Fig.1 below shows the polymerase chain reaction (PCR).

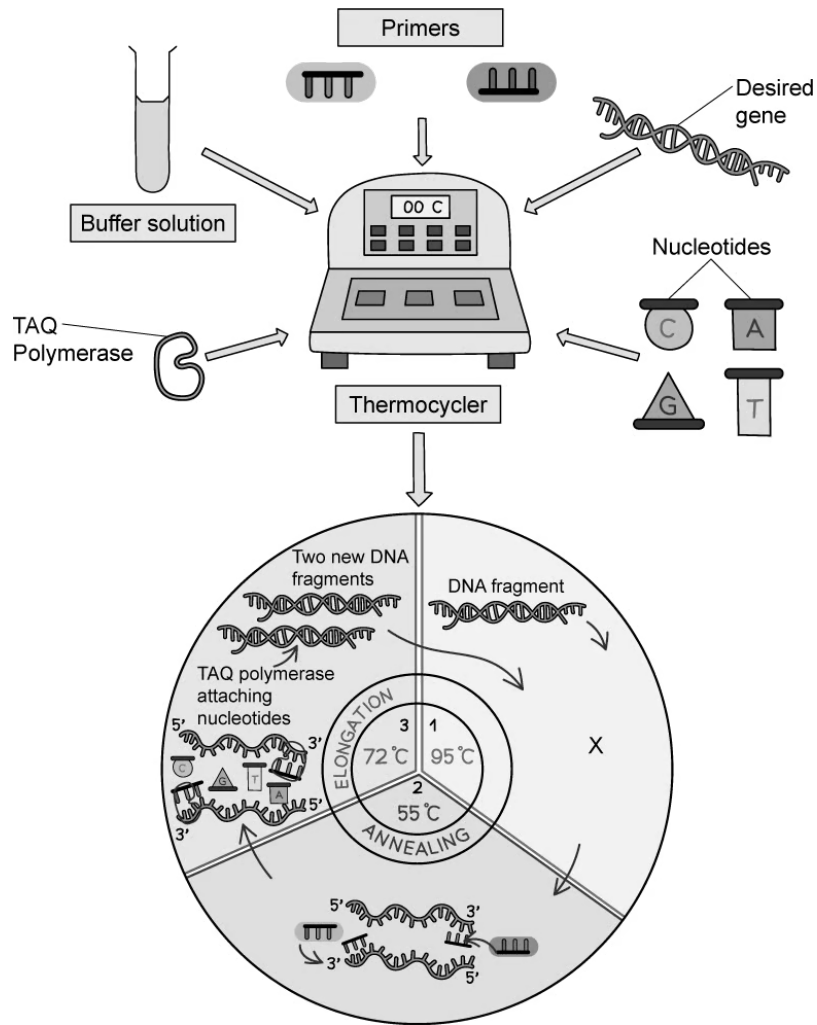


Fig. 1

State the purpose of PCR.

[1 mark]

Question 2b

State **and** explain the purpose of the following molecules/substances in the thermocycler shown in Fig. 1.

- (i)
Primers [1]
 - (ii)
Buffer solution [1]
 - (iii)
Free DNA nucleotides [1]
- [3 marks]**

Question 2c

Describe **and** explain the events taking place at the point marked **X** in Fig. 1.

[2 marks]

Question 2d

Taq polymerase is a DNA polymerase enzyme usually found in the cells of the thermophilic bacterium *Thermus aquaticus*.

State why Taq polymerase is used in the elongation stage of the PCR cycle rather than human DNA polymerase.

[1 mark]

Question 3a

Fig. 1 below shows the result from a genetic fingerprinting (also known as genetic profiling) test using gel electrophoresis.

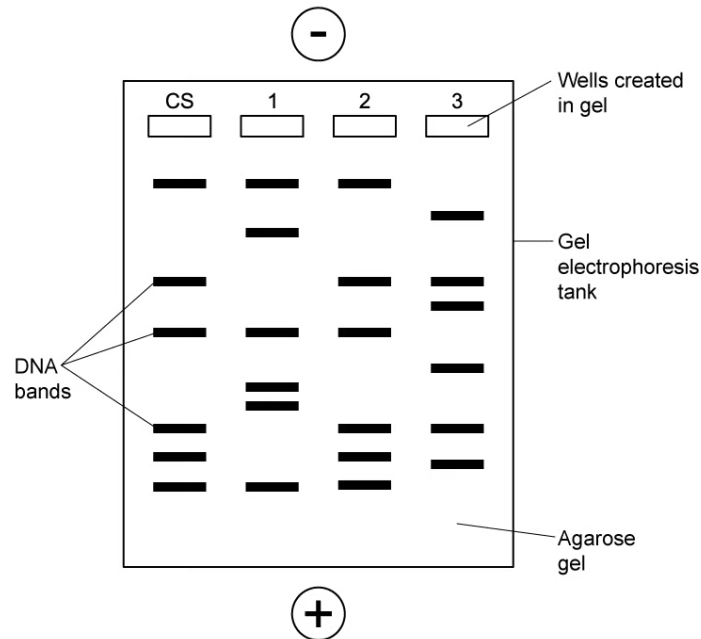


Fig. 1

Genetic fingerprints use sections of DNA known as variable number tandem repeats (VNTRs); short sequences of repeated bases found within non-coding sections of DNA.

State why VNTRs are useful for carrying out genetic fingerprints like that shown in Fig. 1.

[1 mark]

Question 3b

After being cut into fragments, DNA is initially placed into the wells at the top of the gel in Fig. 1, before the electrodes, represented by (-) and (+), are switched on.

The DNA bands show the final position of DNA fragments after a specified amount of time has passed.

Explain why DNA fragments travel through the gel **and** why they appear as bands at different positions.

[2 marks]

Question 3c

The wells in Fig. 1 are labelled CS for crime scene, and 1, 2 and 3 for three different suspects who may or may not have been present at the crime scene.

Identify which of the suspects is likely to have been present at the crime scene.

Explain your answer.

[2 marks]

Question 3d

Other than in crime scene investigations, suggest **two** other applications of genetic profiling techniques.

[2 marks]