AP BIOLOGY • EXERCISE SHEET

6.8 Biotechnology

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS pcr 聚合酶链式反应 • gel electrophoresis 凝胶电泳 • genetic engineering 基因工程 • biotechnology 生
• codons 密码子

Objective

Build the skills to answer exam questions on **biotechnology**.

You must be able to:

- describe **PCR** 聚合酶链式反应, **gel electrophoresis** 凝胶电泳, and **genetic engineering** 基因工程
- state what each technique is used for
- interpret a simple gel result

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ PCR

PCR (polymerase chain reaction) makes **many copies** of a DNA segment. Cycles of heating and cooling with a polymerase double the DNA each cycle — useful when only a tiny sample exists.

■ Gel electrophoresis

Gel electrophoresis separates DNA fragments by **size**. An electric field pulls the negatively charged DNA through a gel; **smaller** fragments move **farther**. It produces a pattern of bands.

■ Reading a gel

Bands nearer the far end are smaller fragments; matching band patterns between samples suggest a match (used in DNA fingerprinting/forensics).

■ Genetic engineering

Genetic engineering inserts a gene from one organism into another (using a vector like a plasmid), e.g. putting the human insulin gene into bacteria so they make insulin.

2 Practice

Now apply the methods above.

2.1 What does PCR do? [1]

2.2 What property separates DNA in gel electrophoresis? [1]

2.3 Which fragments travel farther in a gel? [1]

3 Exam-style questions

3.1 Gel electrophoresis separates DNA fragments according to their [1]

- **A** color
- **B** size
- **C** base sequence only
- **D** temperature

3.2 Bacteria are engineered to produce human insulin.

(a) Name the technique used to insert the human gene. [1]

(b) Explain why bacteria can make a human protein from this gene. [2]

3.3 A crime-scene DNA sample is tiny. Explain how PCR and gel electrophoresis together could help identify a suspect. [3]

Solutions

2.1 Makes many copies of a DNA segment.

2.2 Size (length) of the fragments.

2.3 The smaller fragments.

3.1 B — size.

3.2 (a) Genetic engineering (using a plasmid/vector). (b) The genetic code is universal, so the bacterium's ribosomes read the human gene's codons and translate it into human insulin.

3.3 PCR amplifies the tiny sample into many copies; gel electrophoresis separates the DNA into a band pattern; matching the pattern to a suspect's DNA can identify them.