Bands Tell a Story

Use gel electrophoresis to test a DNA claim

GEN.3.2 "Experimentally demonstrate genetic transformation, protein purification, and/or gel electrophoresis."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the steps that separate and reveal DNA bands. Circle the control results that help you judge the unknown samples.

Which Colony Has the Insert?

1. A student team is checking whether two bacterial colonies carry a DNA insert in a plasmid. Their PCR test makes a 300-base-pair DNA fragment when the plasmid lacks the insert and a 750-base-pair fragment when it contains the insert. The team already has PCR tubes labeled A and B from the colonies. For comparison, they also have a known empty-plasmid PCR product, a known insert-containing PCR product, and a no-template PCR tube made with water instead of DNA. These controls help them distinguish a meaningful band from a failed or contaminated test.

2. With a teacher supervising, the team loads the PCR products into separate wells in an agarose gel. They put a DNA size ladder in another well. The ladder contains fragments of known lengths, so it provides a scale for judging the bands. After the teacher turns on the power, DNA moves through the gel toward the positive electrode. Smaller fragments usually travel farther through the gel in the same time. The team keeps the gel and electrical equipment untouched until the teacher switches off the power. A stain then makes the separated DNA bands visible.

3. The finished gel has six lanes. Lane 1 is the ladder; its labeled positions include 300 and 750 base pairs. Lane 2, the empty-plasmid control, has one band at 300 base pairs. Lane 3, the insert-containing control, has one band at 750 base pairs. Lane 4, sample A, has one band aligned with the 750-base-pair position. Lane 5, sample B, has one band aligned with the 300-base-pair position. Lane 6, the no-template control, has no visible band. The controls behaved as expected, but band size alone cannot confirm the insert's exact DNA sequence.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare sample A with the two plasmid controls. What does its band suggest about its plasmid?

2. Which sample band traveled farther through the gel, A or B? Explain using the fragment sizes.

3. What does the no-template lane help the team check? What did it show in this run?

4. How does the DNA size ladder help the team interpret the bands in samples A and B?

3 YOUR TURN

Your own words

Plan a follow-up gel test to see whether sample A's result repeats. In 3 or 4 sentences, name what you would retest, include two controls, describe a supporting band pattern, and describe a result that would make you question the first test.

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PART 1 · READ AND MARK

Underline the steps that separate and reveal DNA bands. Circle the control results that help you judge the unknown samples. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare sample A with the two plasmid controls. What does its band suggest about its plasmid?	**Sample A's 750-base-pair band matches the insert-containing control, suggesting that A carries the insert.**
2	Which sample band traveled farther through the gel, A or B? Explain using the fragment sizes.	**B's 300-base-pair band traveled farther than A's 750-base-pair band because smaller fragments usually move farther through the gel.**
3	What does the no-template lane help the team check? What did it show in this run?	**It helps check for detectable contamination in the PCR materials. It showed no visible band.**
4	How does the DNA size ladder help the team interpret the bands in samples A and B?	**Its known fragment lengths provide a scale for estimating that A's band is 750 base pairs and B's is 300 base pairs.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would make a fresh PCR from colony A and run its product on a new gel. I would also run the known 750-base-pair product and a no-template tube as controls. If A again gives a 750-base-pair band while the known control matches it and the no-template lane stays blank, the result is repeatable. A 300-base-pair band instead would make me question the first result.

Accept conclusions that treat band size as evidence for an insert, not proof of its exact sequence. For the follow-up, accept other appropriate controls if the student explains how their results would help judge sample A.