# Study Guide — MI Unit 1: How to Fight Infection (Mid-Unit Test)

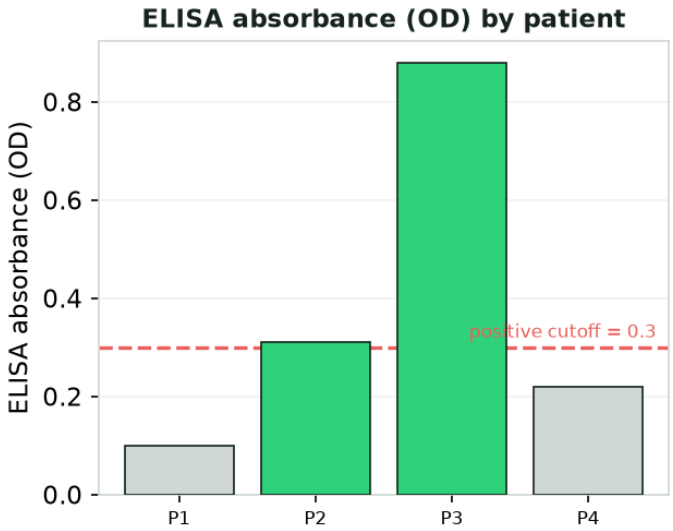
Medical Interventions (Genetics of Disease) · Unit 1 — How to Fight Infection · Modeled on the PLTW Guided Review format

## Vocabulary to know cold

| Term | Definition |
|---|---|
| Pathogen | A disease-causing agent — bacterium, virus, fungus, or parasite. |
| Antigen | A molecule (often on a pathogen) that the immune system recognizes as foreign and that an antibody binds |
| Antibody | A Y-shaped protein made by the immune system that binds one specific antigen; the basis of ELISA. |
| ELISA | Enzyme-Linked ImmunoSorbent Assay; uses an enzyme-linked antibody and a color-changing substrate to |
| Optical density (OD) | The amount of light absorbed by an ELISA well; higher OD = more color = more target present. |
| PCR | Polymerase Chain Reaction; makes millions of copies of a specific DNA target through repeated cycles. |
| Primer | A short single-stranded DNA piece that anneals to the target and gives DNA polymerase a place to start co |
| Taq polymerase | A heat-stable DNA polymerase that survives the ~95°C denaturation step of PCR. |
| Gel electrophoresis | A technique that separates DNA fragments by size using an electric field; smaller fragments travel farther. |
| Base pair (bp) | The unit of DNA length used to measure fragment size on a gel (e.g., a 300 bp band). |
| BLAST | Basic Local Alignment Search Tool; compares a DNA/protein sequence to databases to identify the closest |
| Antibiotic | A drug that kills or stops bacteria by targeting bacterial-specific structures; it does NOT work on viruses. |

## Worked examples (follow the reasoning)

**Example 1.** Read this ELISA plate (cutoff = 0.30) and decide which patients are positive: P1 = 0.10, P2 = 0.31, P3 = 0.88, P4 = 0.22.




- A POSITIVE result means OD is at or above the cutoff value.
- Compare each OD to 0.30.
- P1 (0.10) is below 0.30 → negative.
- P2 (0.31) is just above 0.30 → positive.
- P3 (0.88) is well above 0.30 → positive.
- P4 (0.22) is below 0.30 → negative.

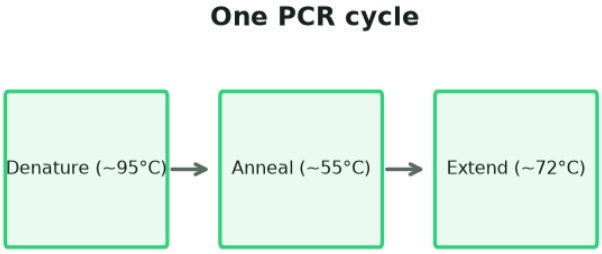
**Answer:** P2 and P3 are positive; P1 and P4 are negative.

**Example 2.** A lab runs PCR on a patient sample, then a gel. The patient lane and the positive control both show a 300 bp band; the NTC lane is blank. Explain what each lane tells you and what the overall result means.


- The positive control shows a 300 bp band → the reaction worked and 300 bp is the expected pathogen size.
- The NTC (no-template control) is blank → no contamination occurred.
- The patient lane shows a band at the SAME 300 bp position as the positive control.
- Because the controls behaved correctly, the patient band is trustworthy.

**Answer:** The patient is POSITIVE for the pathogen — the 300 bp band matches the positive control, and the blank NTC confirms no contamination.

**Example 3.** Order one full PCR cycle and state what happens in each step.




- Step 1 – Denature (~95°C): heat separates the double-stranded DNA into two single strands.
- Step 2 – Anneal (~55°C): the temperature drops so primers can bind to their matching target sequence.
- Step 3 – Extend (~72°C): Taq polymerase adds nucleotides, building a new complementary strand from each primer.
- Repeating the cycle ~30 times doubles the target each time, producing millions of copies.

**Answer:** Denature → Anneal → Extend, repeated about 30 cycles to amplify the target DNA.

## Practice questions (with reasoning)

**1.** A patient's cold is caused by a virus. Why won't the doctor prescribe an antibiotic?

**A.** Antibiotics are too expensive
**B.** Viruses lack the bacterial targets that antibiotics attack
**C.** The patient is not sick enough
**D.** Antibiotics only work in the summer

**Answer: B.** Antibiotics act on bacterial structures; viruses don't have them, so the drug has nothing to attack.

**2.** In gel electrophoresis, a 100 bp fragment and a 900 bp fragment are run in the same gel. Which travels FARTHER from the wells?

**A.** The 900 bp fragment
**B.** The 100 bp fragment
**C.** They travel the same distance
**D.** Neither one moves

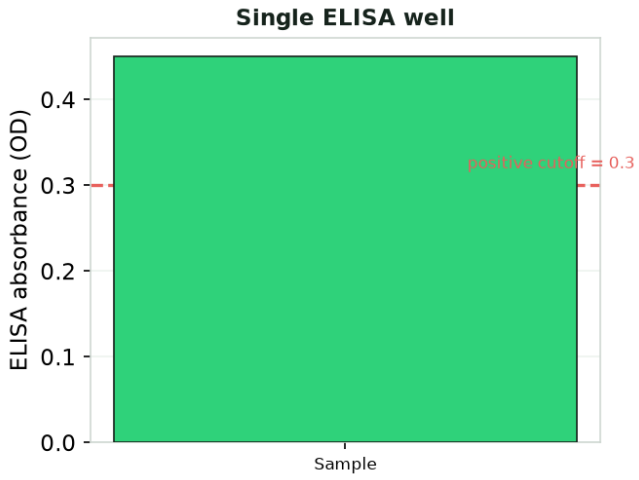
**Answer: B.** Smaller fragments move faster through the gel, so the 100 bp fragment travels farther.

**3.** A scientist gets an unknown DNA sequence and wants to know which organism it came from. The best next tool is:

**A.** Run an ELISA
**B.** Perform a BLAST search
**C.** Use a thermometer
**D.** Add more primers

**Answer: B.** BLAST compares the sequence to databases and returns the closest known match, identifying the organism.

**4.** An ELISA reads OD = 0.45 with a cutoff of 0.30. The result is:




**A.** Negative
**B.** Positive
**C.** Invalid
**D.** Cannot be determined

**Answer: B.** 0.45 is at or above the 0.30 cutoff, so the result is positive for the target.

**5.** Which control on a PCR gel proves the run had NO contamination?

**A.** The ladder
**B.** The positive control
**C.** A blank no-template control (NTC)
**D.** The patient lane

**Answer: C.** The NTC contains no DNA template; if it stays blank, no stray DNA contaminated the run.