

Study Guide — MI Unit 1: How to Fight Infection (End-of-Unit Test)

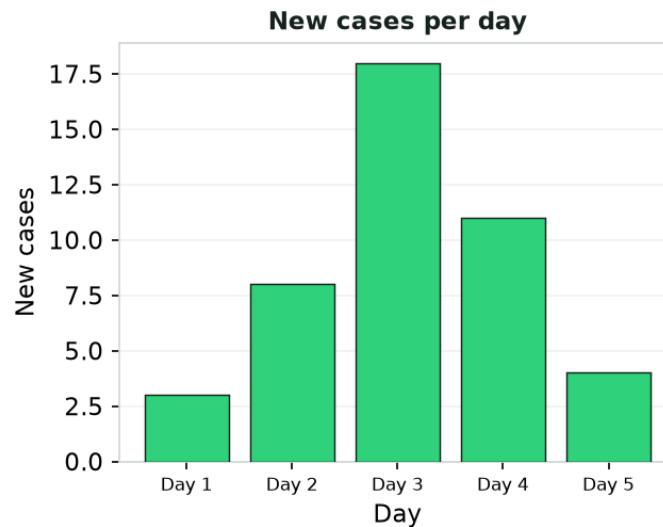
Medical Interventions (Genetics of Disease) · Unit 1 — How to Fight Infection · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Innate immunity	The body's fast, non-specific first defenses: skin/barriers, inflammation, and phagocytes.
Adaptive immunity	The slower, specific response of B cells (antibodies) and T cells targeted to a particular antigen.
Memory cell	A long-lived immune cell that remembers an antigen, giving a faster, stronger second response.
Vaccine	A harmless form of an antigen given to build memory cells and immunity before real infection.
Epidemiology	The study of how, when, and where disease spreads in populations.
Epidemic curve	A bar graph of new cases over time used to track an outbreak's start, peak, and decline.
Index case	The first identified case in an outbreak.
Aseptic technique	Practices (flaming loops, sterile tools, working near a flame) that prevent contamination of cultures.
Growth medium (agar)	Nutrient gel on which microbes grow; can be general-purpose, selective, or differential.
Colony-forming unit (CFU)	A countable colony assumed to have grown from one viable cell; used to estimate viable cell number.
Serial dilution	Stepwise diluting a sample so plates show a countable number of separate colonies.
No-template control (NTC)	A PCR control with no DNA added; it must stay blank to prove there was no contamination.
Positive control	A sample with known target DNA/antigen; it must give a signal to prove the assay worked.
Specificity	A test's ability to correctly identify those WITHOUT the disease (avoiding false positives).

Worked examples (follow the reasoning)

Example 1. An outbreak's daily new-case counts are: Day 1 = 3, Day 2 = 8, Day 3 = 18, Day 4 = 11, Day 5 = 4. Find the peak day and state whether the outbreak is slowing by Day 5.



- Read the height of each bar (new cases that day).
- Compare values: 3, 8, 18, 11, 4.
- The largest value is 18 on Day 3 → that is the peak.
- After Day 3, counts fall (11, then 4), so new cases are declining.

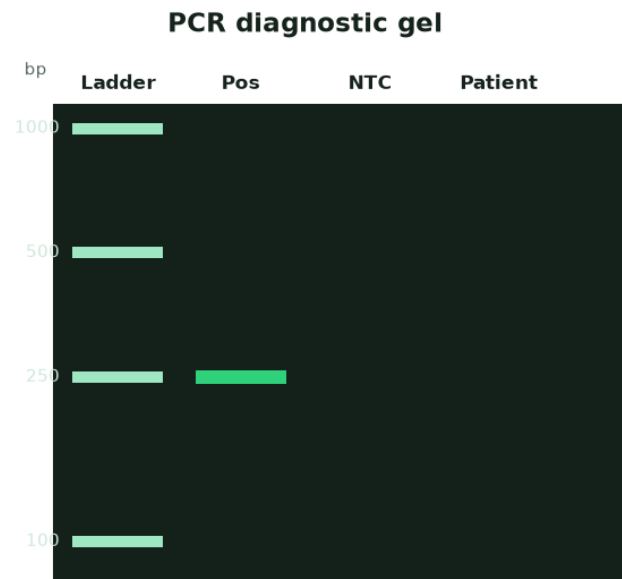
Answer: The outbreak peaked on Day 3 and is slowing by Day 5.

Example 2. A technician plates a diluted sample and counts 60 well-separated colonies. Explain what those 60 colonies represent and why dilution was necessary.

- Each visible colony is a colony-forming unit (CFU) — assumed to start from one viable cell.
- 60 separate colonies means an estimated 60 viable cells landed on the plate (before correcting for dilution factor).
- Dilution spreads cells apart so colonies don't merge into an uncountable lawn.
- A countable plate falls roughly in the 30–300 colony range.

Answer: The 60 colonies estimate ~60 viable cells (CFUs); dilution was needed so colonies stayed separate and countable.

Example 3. A PCR diagnostic gel shows: Positive control = band, NTC = blank, Patient = blank. Interpret the result and explain why the controls make it trustworthy.



- Positive control shows a band → reagents and machine worked.
- NTC is blank → no contamination occurred.
- Both controls behaved correctly, so the assay is valid.
- The patient lane is blank → the pathogen DNA was not present.

Answer: The patient is **NEGATIVE**, and the result is trustworthy because the positive control worked and the NTC was clean.

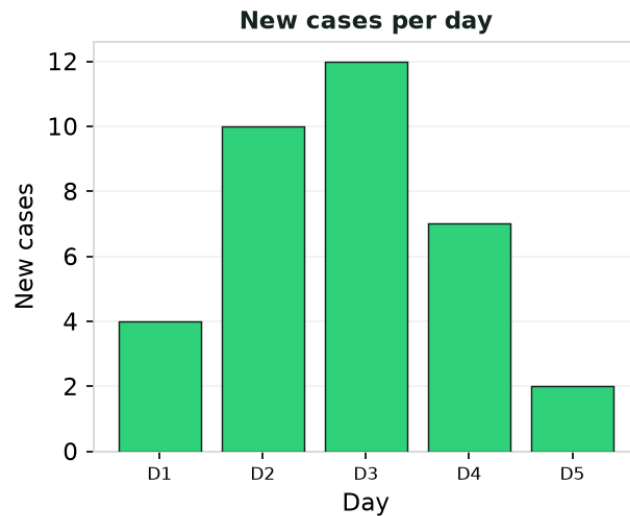
Practice questions (with reasoning)

1. Why does a person usually NOT get chickenpox a second time?

- A. The virus dies out worldwide
- B. Memory cells from the first infection respond quickly to a second exposure
- C. Antibiotics stay in the blood
- D. The skin becomes immune to all viruses

Answer: B. Memory B and T cells persist and mount a rapid secondary response, preventing illness on re-exposure.

2. On an epidemic curve, the bars rise for several days and then fall after public-health measures begin. The falling bars suggest:



- A. The outbreak is getting worse
- B. The interventions may be slowing the spread
- C. The lab made an error
- D. The pathogen changed species

Answer: B. Declining daily new cases after interventions indicate the spread is slowing.

3. Which is a proper aseptic technique?

- A. Leaving the agar plate uncovered on the bench
- B. Flame-sterilizing the inoculating loop before each transfer
- C. Touching the agar with bare fingers
- D. Reusing a contaminated pipette tip

Answer: B. Flaming the loop kills contaminating microbes, keeping the culture pure.

4. A spread plate is completely covered with overlapping growth and cannot be counted. The best fix is to:

- A. Count anyway and guess
- B. Dilute the sample more before plating
- C. Add more sample
- D. Throw away the CFU method

Answer: B. Further dilution yields separated, countable colonies in the 30–300 range.

5. A PCR run shows a band in the NTC lane. What should the technician conclude?

- A. The patient is definitely positive
- B. The run is contaminated and must be repeated
- C. The polymerase worked perfectly
- D. The ladder failed

Answer: B. A band in the no-template control means contamination, so the results cannot be trusted and the run must be repeated.