

Study Guide — BI Problem 4: Environmental Health (End-of-Unit Cumulative Test)

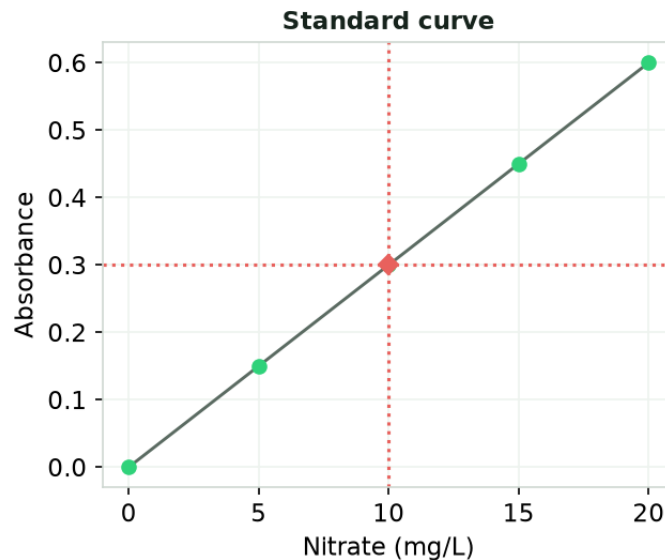
Biomedical Innovations · Problem 4 — Environmental Health · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Threshold dose	The dose below which no measurable adverse effect occurs.
LD50	Dose lethal to 50% of a test population; a lower LD50 means greater toxicity.
Standard curve	A plot of known concentrations vs. signal used to read an unknown's concentration.
Representative sampling	Collecting samples (across sites or over time) so results reflect the whole system.
Pre-analytical error	A mistake made before measurement — in collection, labeling, storage, or transport.
Chemical segregation	Storing incompatible chemical wastes apart to prevent dangerous reactions.
Hazardous chemical waste	Toxic chemical waste (e.g., heavy metals) collected in labeled containers, never poured down the drain.
Biohazard waste	Material with infectious/biological risk, decontaminated or biohazard-bagged before disposal.
Sharps container	Rigid, puncture-resistant, labeled container for needles, blades, and contaminated broken glass.
Cold-chain storage	Keeping samples at the proper low temperature (often -4°C) from field to lab to preserve integrity.
Confounding variable	An uncontrolled factor that can create a misleading correlation between exposure and effect.
Sensitivity/specificity	Sensitivity = ability to correctly detect true positives; specificity = ability to correctly identify true negatives.

Worked examples (follow the reasoning)

Example 1. An unknown well-water sample gives an absorbance of 0.30 in a nitrate assay. Using the standard curve, determine its nitrate concentration and state whether it exceeds the 10 mg/L drinking-water limit.



- Locate the unknown's signal, 0.30 absorbance, on the y-axis.
- Trace horizontally to the standard curve, then down to the x-axis.
- 0.30 absorbance corresponds to 10 mg/L nitrate.
- Compare to the 10 mg/L limit: it is right at the limit, so it meets but does not safely fall below it.

Answer: ≈10 mg/L nitrate — at the drinking-water limit; flag for re-test.

Example 2. At the end of an environmental lab you have: a used needle, a Petri plate with live bacteria, leftover lead-solution, and an unlabeled water tube. State the correct handling for each.

- Needle → red puncture-resistant sharps container.
- Live-bacteria plate → autoclave or biohazard waste bag (biohazard).
- Leftover lead solution → labeled hazardous chemical-waste container (never the sink).
- Unlabeled water tube → cannot be trusted; discard/recollect because traceability is lost (pre-analytical error).

Answer: Needle = sharps; plate = biohazard; lead = hazardous chemical waste; unlabeled tube = reject/recollect.

Practice questions (with reasoning)

1. A chemical shows no effect up to 5 mg/kg, then harm rises sharply. The 5 mg/kg point is the:

- A. LD50
- B. Threshold dose
- C. Standard
- D. Control

Answer: B. The threshold dose is the highest dose causing no measurable effect.

2. Which is the correct disposal pairing?

- A. Needle → recycling
- B. Heavy-metal waste → labeled chemical waste container
- C. Live culture → regular trash
- D. Acid → mixed with bleach

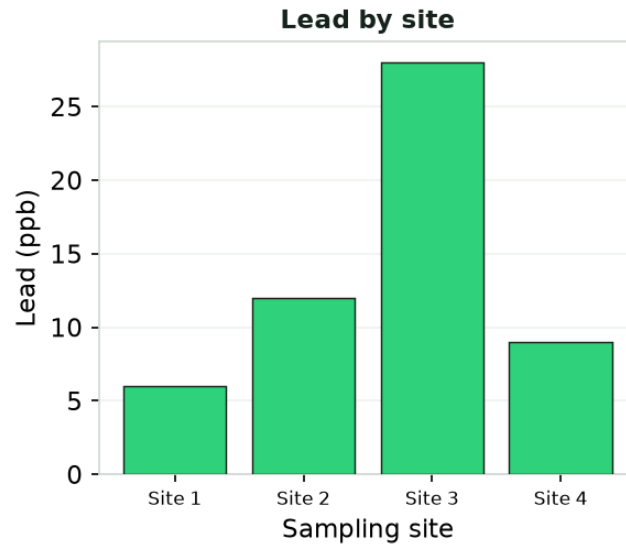
Answer: B. Toxic heavy-metal waste goes to labeled hazardous chemical waste; the other options are unsafe.

3. SPIRAL: A blood-pressure cuff gives readings of 120, 121, and 119 on the same calm patient, but all three are 15 points below an arterial-line gold standard. The device is:

- A. Accurate but not reliable
- B. Reliable (consistent) but not accurate
- C. Both accurate and reliable
- D. Neither reliable nor consistent

Answer: B. Consistent repeat readings = reliable; a steady offset from the true value = not accurate (Problem 3 concept).

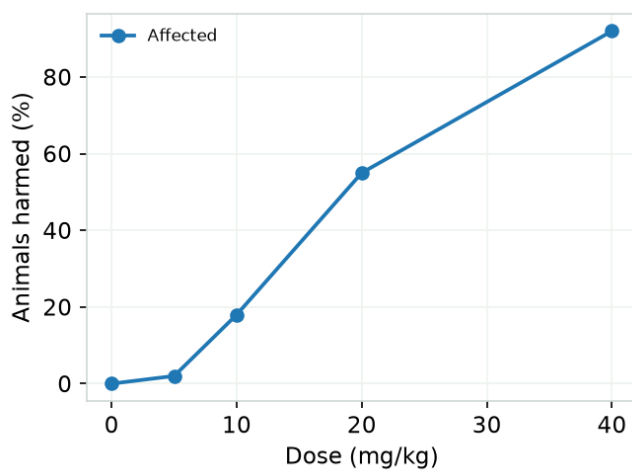
4. The bar graph shows measured lead concentration in water sampled from four sites. The drinking-water action limit is 15 ppb. Which site most urgently exceeds the limit?



- A. Site 1
- B. Site 2
- C. Site 3
- D. Site 4

Answer: C. Site 3 at 28 ppb is the only site above the 15 ppb action limit, so it is the most urgent.

5. The graph plots percent of test animals showing harm against dose of a contaminant. What does the trend show?



- A. Effect decreases as dose increases
- B. No relationship between dose and effect
- C. A dose-response trend: harm rises as dose rises
- D. The effect is constant at all doses

Answer: C. The percent harmed climbs steadily with dose, a classic positive dose-response relationship.