Study Guide — BI Problem 2: Human Physiology (End-of-Unit Cumulative Test)

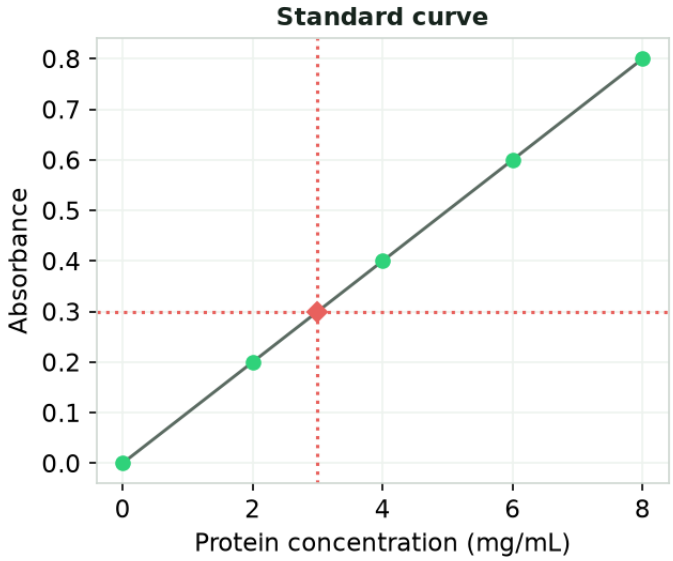
Biomedical Innovations · Problem 2 — Human Physiology · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Independent variable	The factor the experimenter purposely changes.
Dependent variable	The measured response to the independent variable.
Constant (controlled variable)	A factor held the same across all groups to prevent confounding.
Control group	The untreated baseline group used for comparison.
Correlation	An association between two variables; positive, negative, or none. Correlation does not prove causation.
Standard curve	A graph of known concentrations vs. signal used to convert an unknown's signal into concentration.
Reliability	Consistency of measurements across repeated trials.
Replication	Repeating measurements/trials to reduce random error and reveal outliers.
Sampling bias	Systematic error from a sample that does not represent the population.
Pre-analytical error	An error before testing (mislabeling, hemolysis, wrong storage temperature).
Hemolysis	Rupture of red blood cells, often from rough handling, that can invalidate a specimen.
Chain-of-custody	Documentation of who handled a specimen, when, and how, to preserve its integrity (spirals from Problem
Sharps container	Puncture-resistant container for needles and lancets.
Triage	Sorting patients by severity so the most urgent are treated first (spirals from Problem 1 — ER).

Worked examples (follow the reasoning)

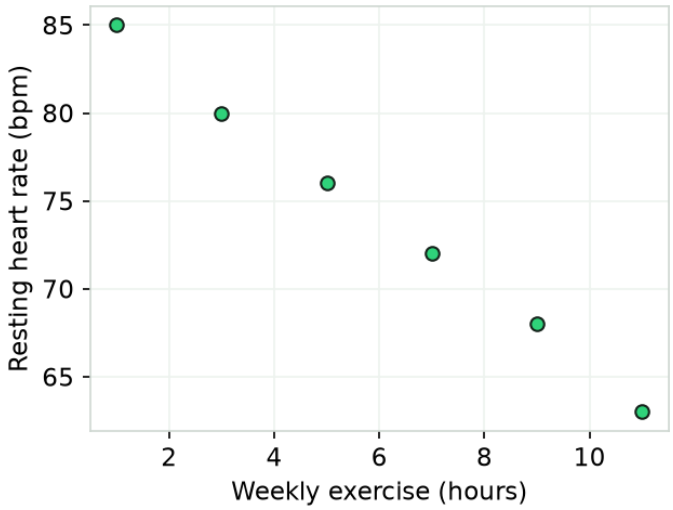
Example 1. Use the standard curve to find the concentration of a plasma sample whose absorbance is 0.30.



- Notice the curve is linear: every 2 mg/mL adds 0.2 absorbance, so 0.1 absorbance per 1 mg/mL.
- Set up: concentration = absorbance / slope = 0.30 / 0.1.
- Solve: 0.30 / 0.1 = 3 mg/mL.
- Check on the graph: 0.30 falls between the 0.2 (at 2 mg/mL) and 0.4 (at 4 mg/mL) points, so 3 mg/mL is reasonable.

Answer: About 3 mg/mL.

Example 2. A scatter plot of weekly exercise hours vs. resting heart rate trends downward. Explain what kind of correlation this is and why you cannot claim exercise 'causes' the lower heart rate from this study alone.

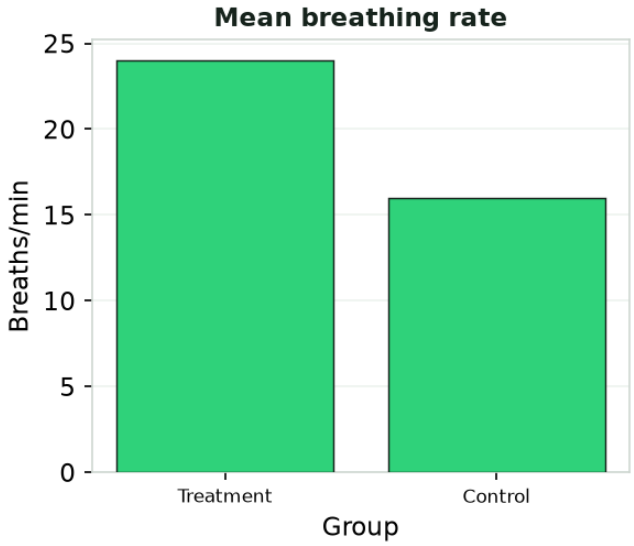


- As x (exercise) increases, y (heart rate) decreases -> negative correlation.
- A scatter plot shows association, not a controlled experiment.
- Other factors (diet, genetics, age) were not controlled, so causation is not established.
- To claim cause, you would need a controlled experiment with random assignment and constants held.

Answer: Negative correlation; it shows association only because confounding factors were not controlled.

Practice questions (with reasoning)

1. A bar graph shows the treatment group's mean breathing rate is higher than the control's. The most important thing to verify before concluding the treatment worked is:



A. The bar colors
B. Adequate sample size and comparable groups
C. The chart title font
D. The axis line thickness

Answer: B. A trustworthy between-group claim requires a sufficient sample size and comparable groups.

2. Long-term storage of a serum hormone sample for several months requires:

A. Room temperature
B. Freezing (e.g., -20 to -80 degrees C)
C. Refrigeration only
D. A sunny shelf

Answer: B. Months-long storage of serum needs freezing to preserve analyte stability.

3. A negative correlation in a scatter plot means that as one variable increases, the other:

A. Increases
B. Decreases
C. Stays exactly constant
D. Becomes the control

Answer: B. In a negative correlation, one variable rises while the other falls.

4. SPIRAL (Problem 1): Documenting who collected a specimen and when supports:

A. Random assignment
B. Chain-of-custody and specimen integrity
C. A standard curve
D. A larger sample size

Answer: B. Recording handling details maintains chain-of-custody and specimen integrity.