

Study Guide — BI Problem 2: Human Physiology (Mid-Unit Test)

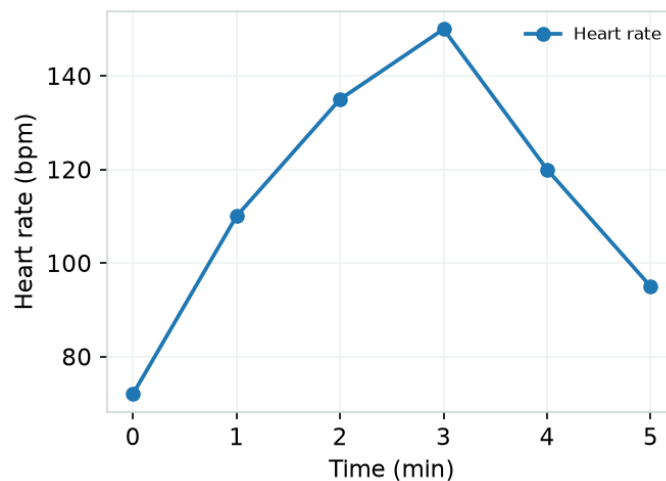
Biomedical Innovations · Problem 2 — Human Physiology · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Independent variable	The single factor the experimenter changes on purpose (e.g., exercise vs. rest).
Dependent variable	The measured response (e.g., blood glucose, heart rate, breathing rate).
Constant (controlled variable)	A factor held the same across all groups (e.g., time of day, room temperature) to avoid confounding.
Control group	The untreated baseline group used for comparison.
Random assignment	Placing subjects into groups by chance to balance unknown differences and reduce bias.
Hypothesis	A testable, falsifiable prediction about how the variables relate.
Plasma / serum	The straw-colored liquid separated to the top of a blood tube after centrifugation.
Pre-analytical error	A mistake made before testing (mislabeling, wrong storage temperature, hemolysis) that ruins the specimen.
Sharps container	Puncture-resistant container for lancets and needles.
Biohazard waste	Container/bag for blood-contaminated non-sharp items such as used tubes, swabs, and gloves.
PPE	Personal protective equipment, such as gloves and eye protection, worn when handling body fluids.
SDS	Safety Data Sheet listing a chemical's hazards, handling, storage, and disposal information.

Worked examples (follow the reasoning)

Example 1. Read the heart-rate line graph. During which phase is the heart working hardest, and what does the descending segment after minute 3 represent?



- Find the highest y-value: 150 bpm at minute 3 -> peak demand at the end of exercise.
- Look at minutes 3 to 5: values fall from 150 to 95 -> heart rate is decreasing.
- Decreasing heart rate after exercise stops = recovery toward the resting baseline (72 bpm).

Answer: Hardest at minute 3 (150 bpm); the descending segment is recovery toward resting heart rate.

Example 2. Design a clean exercise study: 'Does a 10-minute warm-up lower injury-related muscle soreness?' Name the IV, DV, control group, and two constants.

- IV = what you change: warm-up vs. no warm-up.
- DV = what you measure: reported muscle soreness score.
- Control group = subjects who do NO warm-up.
- Constants = same exercise routine, same soreness scale, same time of day, same room temperature (pick any two).

Answer: IV = warm-up vs. none; DV = soreness score; Control = no-warm-up group; Constants = same routine, scale, time, temperature.

Practice questions (with reasoning)

1. A used lancet from a fingerstick must be placed in the:

- A. Biohazard bag
- B. Sharps container
- C. Regular trash
- D. Recycling

Answer: B. Lancets are sharps and require a puncture-resistant sharps container.

2. Which factor, if NOT held constant, would most confound a study comparing post-exercise heart rates?

- A. Subject ID numbers
- B. Resting baseline measured at different times of day
- C. The color of the stopwatch
- D. The brand of the chair

Answer: B. Time of day affects heart rate; not controlling it confounds the comparison.

3. Why use a fresh sterile pipette tip for each plasma sample?

- A. To save money
- B. To prevent cross-contamination between samples
- C. To increase sample size
- D. To change the independent variable

Answer: B. A fresh tip per sample prevents carryover contamination that would corrupt results.

4. A blood specimen left at room temperature overnight before testing is an example of a:

- A. Good control
- B. Pre-analytical error
- C. Random assignment
- D. Large sample size

Answer: B. Improper storage before analysis is a pre-analytical error that degrades the specimen.