

Study Guide — PBS Unit 4: Innovation Inc (End-of-Unit Cumulative Test)

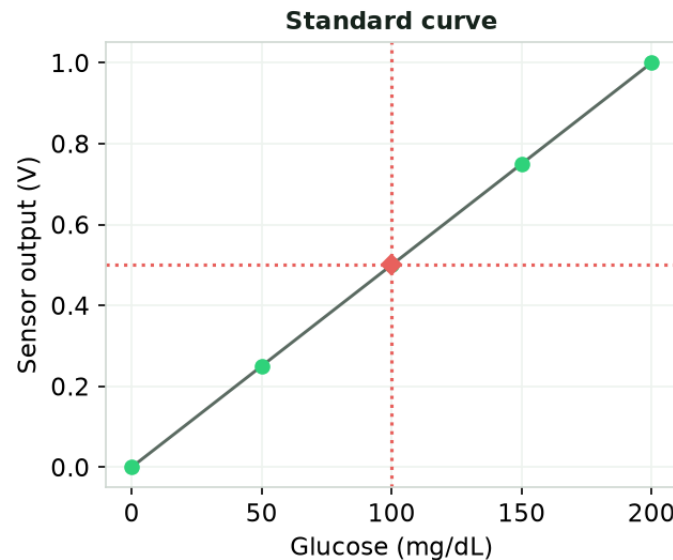
Principles of Biomedical Science · Unit 4 — Innovation Inc · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Artificial pancreas	A continuous glucose monitor paired with an insulin pump that automatically manages blood glucose; supports
SA node	The heart's natural pacemaker in the right atrium; an implanted pacemaker takes over when it fails (cardiovascular)
Nephron	The kidney's functional filtering unit whose waste-removal job is replaced by hemodialysis (urinary system)
Standard / calibration curve	A graph of known concentrations vs. instrument output used to convert a sensor reading into a real measurement
Sensitivity	True-positive rate: how well a device or test detects a condition when it is actually present.
Control group	The comparison group in a trial that lets researchers credit an outcome to the device rather than to other factors
cardiomyopathy	Disease of the heart muscle (cardi/o + myo + -pathy).
-itis / -ectomy / -pathy	Suffixes: -itis = inflammation, -ectomy = surgical removal, -pathy = disease.
dyspnea	Difficult or labored breathing (dys- = difficult, -pnea = breathing); a ventilator can assist.
Deep brain stimulator	Device that delivers electrical pulses to the brain to reduce tremors; interfaces with the nervous system.
Proximal / distal	Proximal = closer to the trunk/attachment; distal = farther from it (residual limb is proximal to a prosthetic foot)
Hemoglobin A1c	A lab test reflecting average blood glucose over ~3 months; high values indicate poorly controlled diabetes
Algor mortis	Postmortem cooling of the body, used to estimate time of death (Unit 1 spiral concept).

Worked examples (follow the reasoning)

Example 1. An artificial-pancreas sensor is calibrated with a standard curve. The sensor output reads 0.50 V. Use the curve to find the glucose concentration, then explain why calibration matters.

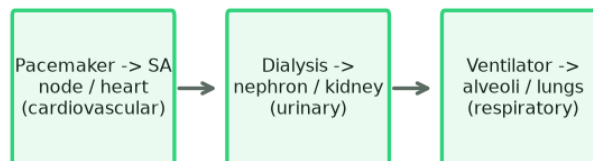


- Locate the output value 0.50 V on the y-axis.
- Trace across to the calibration line, then down to the x-axis.
- Read the matching glucose concentration: 100 mg/dL.
- Calibration converts raw electrical output into a real glucose value so the pump doses correctly.

Answer: An output of 0.50 V corresponds to 100 mg/dL; the standard curve lets the device translate its signal into an accurate glucose reading.

Example 2. Match three devices to the organ systems they support and give the body structure each one replaces or assists: pacemaker, dialysis machine, ventilator.

Devices, systems, and structures



- Pacemaker paces the heart's rhythm, backing up the SA node -> cardiovascular system.
- Dialysis filters blood the way nephrons do -> urinary system.
- A ventilator moves air to the alveoli for gas exchange -> respiratory system.
- Each device replaces or assists a specific organ-system structure.

Answer: Pacemaker = cardiovascular (SA node/heart); dialysis = urinary (nephron/kidney); ventilator = respiratory (alveoli/lungs).

Practice questions (with reasoning)

1. 'Cardiomyopathy' means:

- A. Disease of the heart muscle
- B. Removal of the heart
- C. Inflammation of a joint
- D. Study of the kidney

Answer: A. Cardi/o + myo + -pathy = disease of the heart muscle.

2. High sensitivity in a glucose sensor means it correctly:

- A. Detects high glucose when present
- B. Lowers glucose
- C. Costs less
- D. Ignores the sample

Answer: A. Sensitivity is the true-positive rate for detecting the condition when present.

3. A deep brain stimulator interfaces with which system?

- A. Endocrine
- B. Nervous
- C. Urinary
- D. Skeletal

Answer: B. It delivers pulses to the brain, part of the nervous system.

4. SPIRAL (Unit 1): Postmortem body cooling used to estimate time of death is:

- A. Rigor mortis
- B. Algor mortis
- C. Livor mortis
- D. Autolysis

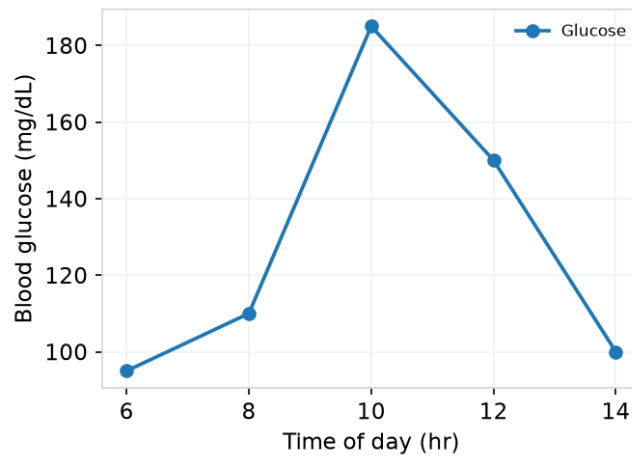
Answer: B. Algor mortis is postmortem cooling.

5. SPIRAL (Unit 3): Antibodies that defend against pathogens are produced by the:

- A. Immune (lymphatic) system
- B. Skeletal system
- C. Endocrine system
- D. Urinary system

Answer: A. The immune/lymphatic system produces antibodies.

6. A continuous glucose monitor logs a patient's blood glucose across the hours around a meal. Based on the line graph, when should the artificial-pancreas system deliver the largest insulin dose?



- A. At 6 hr, when glucose is lowest
- B. At 10 hr, when glucose peaks after the meal
- C. At 14 hr, when glucose returns to normal
- D. Never, because the readings are all normal

Answer: B. Glucose peaks at 185 mg/dL at 10 hr (post-meal), so the device should dose the most insulin then to bring it back toward the normal range.