

Life Science Problem-Based Learning (PBL) Bundle

- ✓ Designed for Middle School Science
- ✓ Complete Chemistry PBL Bundle
- ✓ Engaging, Student-Led Problem-Based Learning Projects



No Prep - Ready to Go!

10 Complete PBL Activities

- **PBL – Classification Keys- Build an ID Guide**
- **PBL – Decomposer Derby- Build a Mini-Compost**
- **PBL – Ecosystem in a Bottle- Model Matter Cycles**
- **PBL – Enzyme Action- Catalase Reaction Lab**
- **PBL – Heart Rate & Recovery- Body Systems in Balance**
- **PBL – Light and Leaves- Photosynthesis Design Test**
- **PBL – Organelle Operations- Build a Working Analogy**
- **PBL – Osmosis in Action- Potato Core Lab**
- **PBL – Schoolyard Bioblitz- Map Our Biodiversity**
- **PBL – Traits & Probability- Model Inheritance**

All PBLs include

- Background for Students
- Full Instructions Sets
- Guiding Questions

PBL – Ecosystem in a Bottle: Model Matter Cycles

Driving Question

How can a closed terrarium support life over several weeks?

Background

Matter cycles (water, carbon, nitrogen) and energy flows sustain ecosystems. A balanced terrarium should recycle resources and stay stable.

Materials (or simple substitutes)

- Clear bottle/jar with lid
- Gravel, activated charcoal, potting soil
- Small plants or moss (teacher-approved)
- Measuring cup, spray bottle
- Labels, camera

Instructions

Step 1: Design layout and water volume; justify choices for drainage and gas exchange.
Step 2: Build terrarium layers; plant and lightly water; seal as directed by your teacher.
Step 3: Monitor weekly: temperature, condensation, plant growth, and any mold; adjust only if permitted.
Step 4: Explain how observed changes show cycling and energy flow.

Final Product

- Observation log with photos.
- Short explanation of water/carbon cycles operating in your terrarium.

Rubric (20 points)

Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Work (1)
Design Rationale	Layering and volumes justified	Some justification	Basic choices	No rationale
Care & Safety	Gentle handling; clean setup	Minor lapses	Occasional lapses	Unsafe/neglect
Observations	Regular, detailed records	Mostly regular	Sporadic	Few records
Systems Reasoning	Accurate cycles/energy links	Mostly correct	Basic	Incorrect
Communication	Clear log & photos	Mostly clear	Some clutter	Unclear

PBL – Heart Rate & Recovery: Body Systems in Balance

Driving Question

How does activity level affect heart rate and recovery time?

Background

Circulatory and respiratory systems work together to deliver oxygen. Heart rate rises during activity and returns toward baseline during recovery.

Materials (or simple substitutes)

- Timer, heart rate measurement (manual pulse or app)
- Space for safe light exercise (teacher-approved)
- Data table

Instructions

Step 1: Measure resting heart rates; plan safe, brief activity (e.g., step-ups).
Step 2: Record heart rate immediately after and every minute for 5 minutes.
Step 3: Graph recovery curves; compare different activity intensities or durations.
Step 4: Discuss body system interactions and factors that affect recovery.

Final Product

- Line graph of heart rate vs. time with analysis.
- Short explanation of system interactions.

Rubric (20 points)

Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Work (1)
Safety	Appropriate, teacher-approved activity	Minor issues	Occasional lapses	Unsafe
Data	Consistent timing; clear records	Mostly consistent	Some gaps	Sparse
Analysis	Well-labeled graph; trends explained	Mostly clear	Basic	Incorrect
Reasoning	Accurate systems explanation	Mostly correct	Basic	Incorrect
Communication	Neat graph & summary	Mostly neat	Some clutter	Unclear

PBL – Osmosis in Action: Potato Core Lab

Driving Question

How does solute concentration affect water movement in plant cells?

Background

Osmosis moves water across membranes from low solute concentration to high. Plant tissues gain or lose mass depending on surrounding solution.

Materials (or simple substitutes)

- Potatoes, cork borer or knife to make similar cores (teacher-supervised)
- Cups with different salt (NaCl) solutions, one with plain water (control)
- Balance for mass measurements, labels, paper towels
- Timer, ruler (optional for length change)
- Goggles, cutting board

Instructions

Step 1: Cut equal-size potato cores; blot dry; measure initial mass for each core.
Step 2: Place cores in labeled solutions for a set time (e.g., 20–30 minutes).
Step 3: Remove, blot, and measure final mass; calculate % mass change.
Step 4: Graph % change vs. solution concentration and interpret net water movement.

Final Product

- Graph of percent mass change versus solute concentration.
- Brief explanation using the terms hypertonic, hypotonic, and isotonic (age-appropriate).

Rubric (20 points)

Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Work (1)
Measurement Quality	Equal core sizes; careful blotting; accurate masses	Mostly careful	Some inconsistencies	Inaccurate/unequal
Data & Graphs	Complete table and accurate graph	Mostly complete	Basic	Sparse/incorrect
Safety & Technique	Knife use supervised; tidy lab	Minor lapses	Occasional lapses	Unsafe
Reasoning	Correct osmosis interpretation	Mostly correct	Basic	Incorrect
Communication	Clear labels and explanation	Mostly clear	Some clutter	Unclear

Marking Rubrics

Who is it for?

- **Life Science Teachers**
- **Teachers who want to increase their student engagement and retention**
- **Teachers who want low-prep and student-led classroom projects**

Save yourself the **STRESS AND TIME**



TWF

Spend your time WISELY

