

Name:

Date:

Section:

Na-K Pump Activity: Active Transport in Cells

Investigating the Na⁺/K⁺ Pump

Phase 1: ENGAGE (2 minutes)

Getting Started:

Open peebedu.com and navigate to Sodium-Potassium Pump Interactive

Observe the membrane and pump setup.

Essential Question:

How do cells maintain different ion concentrations inside vs outside? _____

Initial Observation:

- Where is sodium concentration higher? INSIDE / OUTSIDE
- Where is potassium concentration higher? INSIDE / OUTSIDE
- This pump must work: WITH / AGAINST concentration gradients

Phase 2: EXPLORE (10 minutes)

Operate the Pump

Click through the pump cycle and observe.

Part A: The Transport Cycle

1. Binding Phase (Inside):

- What must be present for binding? _____
- Pump shape: OPEN INSIDE / OPEN OUTSIDE

1. ATP Phase:

- The pump changes shape to: OPEN INSIDE / OPEN OUTSIDE
- Na⁺ ions are: RELEASED / STILL BOUND

1. Second Binding Phase (Outside):

- From which side? INSIDE / OUTSIDE
- Na⁺ ions have been: RELEASED / KEPT

1. Return Phase:

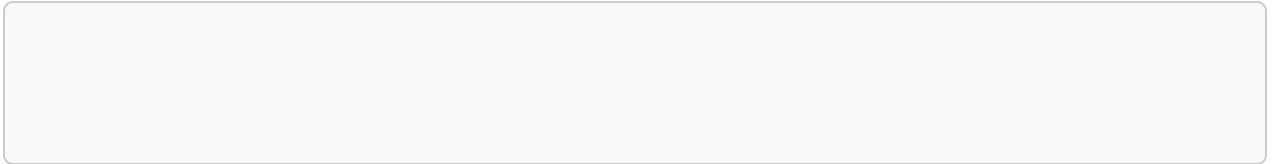
- The pump returns to: OPEN INSIDE / OPEN OUTSIDE
- K⁺ ions are: RELEASED / STILL BOUND
- Ready for another cycle? YES / NO

Part B: Pattern Recognition

After several cycles, observe:

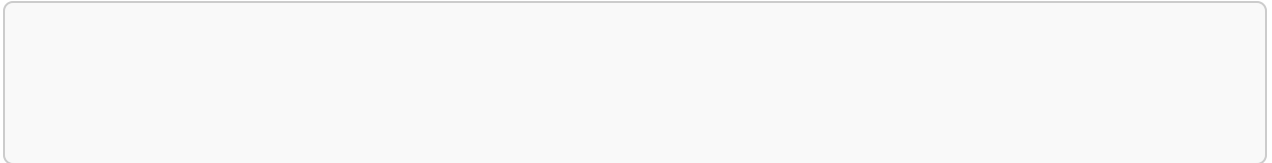
1. Ion Movement Pattern:

- Na^+ always moves: IN \rightarrow OUT / OUT \rightarrow IN
- K^+ always moves: IN \rightarrow OUT / OUT \rightarrow IN



1. Energy Requirement:

- Cycles without ATP: WORK / DON'T WORK



Phase 3: EXPLAIN (6 minutes)

Understanding the Mechanism

1. Why ATP?

Moving ions against their gradients requires:

1. The 3:2 Ratio:

For every ATP used, the pump moves:

- 3 Na⁺ _____ (in/out)

This creates a net movement of _____ positive charge out.

1. Shape Changes:

The pump has two main shapes:

- E1: Open _____, binds _____

ATP causes the change from _____ to _____.

1. Why This Matters:

The Na⁺/K⁺ gradient is used for:

Phase 4: ELABORATE (1 minute)

Real-World Connections

1. Digitalis (Heart Medicine):

This drug partially blocks the pump.

Effect: _____ Na^+ inside heart cells

Result: Stronger heart contractions

1. Nerve Function:

Without this pump, neurons couldn't:

Phase 5: EVALUATE (1 minute)

Quick Assessment

1. Active vs Passive:

The Na⁺/K⁺ pump is active transport because:

1. Energy Flow:

ATP → Pump _____ → Ions move _____ gradient → _____ established

Reflection:

Why do cells spend ~30% of their ATP on this one pump?