Name: **Date:** **Section:**

Membrane Explorer Activity: Cell Membrane Structure and Function

Exploring Cell Membrane Gatekeepers

Phase 1: ENGAGE (5 minutes)

- *Getting Started:**

Open peebedu.com and navigate to Membrane Permeability Explorer

Explore the membrane model shown.

- *The Challenge:**

Cells need to control what enters and exits - like a selective security system!

- *Initial Questions:**

1. What molecules do you see? _____
2. What might temperature affect? _____

- *Prediction:**

Polar or nonpolar? _____

Why? _____

Phase 2: EXPLORE (18 minutes)

- *Investigation 1: Size Matters**

Test molecules of different sizes (no channels activated).

- *Size Comparison Data:**

Molecule	Relative Size	Time to Cross	Speed Rating
O_2	Tiny	_____ s	Fast/Medium/Slow
CO_2	Small	_____ s	Fast/Medium/Slow
Water	Small	_____ s	Fast/Medium/Slow
Glucose	Large	_____ s	Fast/Medium/Slow
Protein	Huge	_____ s	Fast/Medium/Slow

- *Pattern discovered: _____**

- *Investigation 2: Polarity Tests**

Compare polar vs nonpolar molecules.

- *Polarity Effects:**

Molecule Type	Examples	Crossing Ease	Why?
Nonpolar	O_2, N_2, Steroid		
Polar	Water, Glucose		
Charged	Na^+, K^+		

- *The "Like Dissolves Like" Rule:**

So _____ molecules pass through easily.

- *Investigation 3: Channel Power**

Activate channels and observe changes.

- *Channel Effects:**

Molecule	Without Channel	With Channel	Improvement
Glucose	_____ s	_____ s	_____ × faster
Na^+	_____ s	_____ s	_____ × faster
K^+	_____ s	_____ s	_____ × faster
Water	_____ s	_____ s	_____ × faster

- *Biggest improvement: _____**

- *Investigation 4: Temperature Effects**

Vary temperature and observe O_2 movement.

- *Temperature Data:**
- Room (25°C): _____ s
- Hot (50°C): _____ s

- *Pattern: Higher temperature = _____**

Phase 3: EXPLAIN (15 minutes)

- *Understanding Membrane Transport**

1. **The Phospholipid Bilayer:**

Draw and label:

```

Outside cell: [Watery]

Membrane: Heads (love water) oooooooo

| Tails (hate water) |
| --- |
| Tails (hate water) |

Heads (love water) oooooooo

Inside cell: [Watery]

```

Barrier to: _____ molecules

Permeable to: _____ molecules

1. **Transport Types:**

- *Simple Diffusion:**
- No help needed
- Goes: High → Low concentration
- Energy: Not required

- *Facilitated Diffusion:**
- Needs: Channel or carrier
- Goes: High → Low concentration
- Energy: Not required

- *Active Transport:**
- Needs: Pump protein
- Goes: Low → High concentration
- Energy: Required (ATP)

1. **Why Temperature Matters:**

Higher temperature causes:

- Molecules move _____
- Diffusion rate _____

Like butter: Cold = solid, Warm = soft

1. **Channel Specificity:**

Glucose channel fits only glucose because:

- Shape matching
- Size restriction
- Chemical recognition

Like a lock and key!

Phase 4: ELABORATE (10 minutes)

- *Real-World Applications*

1. **Medical Connections:**

- *IV Solutions:*
- Hypotonic (0.45% salt): Cells _____

Why this matters: _____

1. **Drug Delivery:**

To enter cells, drugs should be:

- Size: _____ (small/large)
- Charge: _____ (charged/uncharged)

Example drug that crosses easily: _____

1. **Environmental Adaptations:**

Fish in saltwater vs freshwater:

Environment	Challenge	Solution
Ocean	Too much salt outside	
River	Too little salt outside	

Both need: _____

- *Design Challenge:**

Create a drug delivery system:

- Target: Brain cells
- Challenge: Blood-brain barrier
- How it works: _____

Phase 5: EVALUATE (7 minutes)

- *Assessment Questions**

1. **Concept Check:**

Which would cross a membrane fastest?

- [ ] Large polar molecule
- [ ] Small nonpolar molecule
- [ ] Charged ion
- [ ] Large protein

Explain: _____

1. **Problem Solving:**

A cell needs glucose but membrane has no glucose channels.

Options:

- Wait for diffusion
- Make channels
- Use energy to pump
- Change membrane composition

Best solution: _____ because _____

1. **Data Analysis:**

Molecule X crosses in:

- 10 seconds at 20°C
- 5 seconds at 30°C
- 2.5 seconds at 40°C

Pattern: _____

At 50°C predict: _____ seconds

1. **Application:**

Why do cells die in pure water?

- Water moves: _____ the cell
- Result: _____

How organisms prevent this: _____

1. **Critical Thinking:**

Why don't cells make membranes that let everything through?

- Need to maintain: _____
- Control: _____

- *Model Evaluation:**

Two things this simulation shows well:

1. _____

One limitation:

- *Big Picture:**

How do membrane transport problems cause disease?

Example: _____

Effect: _____

Treatment: _____

- --

Key Vocabulary:

- **Phospholipid Bilayer:** Double layer of molecules forming membrane
- **Selective Permeability:** Allowing some things through, blocking others
- **Diffusion:** Movement from high to low concentration
- **Channel Protein:** Tunnel through membrane for specific molecules
- **Concentration Gradient:** Difference in amount between two areas