Names _____ Block _____ Date _____

Diffusion Lab

Background

Today we will be working with a special kind of Jell-O. No, you can't eat it, and it would probably taste terrible anyway. Not only is there no sugar in it, but it's been made with NaOH (a base with a high pH) and a pH indicator called phenolphthalein. Phenolphthalein is pink in basic conditions and clear in acidic conditions.

We are going to use blocks of this pink Jell-O to observe diffusion. When the pink, basic Jell-O is submerged in HCl (a strong acid), the acid molecules will diffuse into the Jell-O and cause it to become clear, showing that diffusion is occurring. We are going to use this model to answer the following guiding question:

Guiding Question – How does surface area and volume affect the rate diffusion?

Materials

- Goggles
- 6 Agar blocks (with NaOH and phenolphthalein)
  - 3 are cubes (same shape), but different sizes (volumes)
  - 2 are blocks of the same volume, but different shapes (surface areas)
- Plastic cups
- 0.1 M HCl
- Timer

Procedure – Part 1 (Surface Area)

1. Look at your first set of agar blocks. Decide which block has the largest surface area, which is medium, and which is small.
2. Carefully pour the HCl solution into the cup with the blocks until they are covered. Start the timer.
3. Observe the blocks carefully. Write down the time at which each block loses all of its pink color.

Data Table 1 – Surface Area vs. Diffusion Time

Surface Area	Time for Diffusion
Small	
Large	

Procedure – Part 2 (Volume)

4. Look at your second set of agar blocks. Decide which block has the largest volume, which is medium, and which is small.
5. Carefully pour the HCl solution into the cup with the blocks until they are covered. Start the timer.
1. Observe the blocks carefully. Write down the time at which each block loses all of its pink color.

Data Table 2 – Volume vs. Diffusion Time

Surface Area	Time for Diffusion
Small	
Medium	
Large	

Conclusion

Restate Guiding Question	
Claim (Remember to address both surface area and volume.)	
Evidence (Summarize your data for both surface area and for volume)	Reasoning (Try to explain why your results turned out this way by talking about the process of diffusion)

Analysis Questions

1. All cells are tiny. Explain why your results suggest one reason why small cells have an advantage over large cells.

2. Cells come in a variety of shapes. Many cells, such as skin cells, are extremely wide and flat instead of forming a sphere or cube; other cells, such as the cells lining your intestines, have long extensions called microvilli (see below).

   a) How do these specialized shapes and structures affect the surface area of the cell?

Microvilli

Microvilli

Cell membrane

Mitochondrion

Golgi apparatus

Nucleus

Rough endoplasmic reticulum

Nucleolus

Intestinal epithelial cell

   b) How might these specialized shapes and structures help the cell?