

NAME \_\_\_\_\_

Section: \_\_\_\_\_

Last 4 Of PID: \_\_\_\_\_

# Lab 1: Diffusion and Homeostasis

## Part I: Diffusion

### A. Description

Understanding concentration gradients is essential to understand life processes. Any time a cell has something move into or out of it, a gradient is either involved or created in the process. This activity simulates osmosis in the cell. Dialysis tubing is used to simulate an animal cell.

### B. Objectives

After the completion of this section of the lab, students will understand the essential principles governing diffusion and osmosis. Concepts such as permeability and concentration gradients will be highlighted in this portion of the lab.

### C. Materials

Thistle tube

Buret clamp

Rubber band

Wax pencil

Beaker of unknown glucose / sucrose/fructose solution

Beaker of a known concentration of glucose / sucrose / fructose solution

One segment of semi permeable dialysis tubing

One bottle of de-ionized water

One piece of string

Small ruler

### D. Procedure

1. Take the thistle tube and affix half of the dialysis tubing to end of the tube and use a rubber band to secure it.
2. Use the piece of string to tie off the other end tightly. NOTE: This is the critical part of the lab. If you do not do this correct, it will leak and will have to be repeated.
3. After securing the dialysis tubing to the thistle tube, place it on the buret clamp.
4. Add deionized water to the thistle tube until it reaches about half way up.
5. Place the thistle tube into a beaker filled with the known solution.
6. Use a wax pencil to mark the level.
7. Take notice of the changes in the level of water by marking on the thistle tub with the wax pencil every minute. Keeping tracking for 5 minutes.
8. Measure the displacement between the initial and final markings on the thistle tube.
9. Repeat steps 5-7 with a solution of unknown concentration.
10. Make appropriate conclusions and observations.
11. Break down your set-up by taking off the dialysis tubing from the thistle tube and pour deionized water in the sink. Remove the wax markings made on the thistle tube.
12. Clean lab bench

**E. Answer the following questions correctly for credit:**

What are your observations? **(0.25 Points)**

Solutions	Total Displacement (cm)	Tonicity of Solution relative to deionized water. (hyper, hypo, or iso -tonic)
Known		
Unknown		

Circle the correct statement based on the above findings: (0.25 POINTS)

The known is hypertonic to the unknown.

The known is hypotonic to the unknown.

The known is isotonic to the unknown.

Define the following terms: (1 POINT -ALL DEFINITIONS MUST BE CORRECT)

Semi-permeability:

Facilitated Diffusion:

Active Transport:

Osmosis:

Passive Diffusion:

Set Point:

Integration center:

Sensor:

Effector:

## Part II: The Effects of Exercise on Homeostasis

### A. Objective

This laboratory session will enable students to efficiently observe the effect that various levels of exercise have on various homeostatic parameters. We will measure skin color, perspiration, heart rate, respiration rate, blood pressure (BP), and body temperature before and after exercise. We must observe and explain how the body activates effectors to help the body return to the resting parameters.

### B. Materials

Treadmill  
Oscillating bike  
Skipping Rope  
Thermometer (Thermoscan)  
Thermoscan probe covers  
Blood Pressure/Heart Rate Monitor  
Stop watch

### D. Introduction

In the following lab 1 member of your group of 4-6 students will exercise for 6 minutes by skipping, walking/jogging or biking. The parameters listed above will be recorded at rest, then during exercise at 2-4-6 minutes, and 2 minutes after exercise has stopped.

**Note:** *During the time intervals the subject should stop just long enough for the needed measurements to be taken; resume activity immediately.*

### C. Procedure

1. Choose the member of the group that will be tested. This member cannot be pregnant, fasting, or have any type of metabolic disease such as diabetes.
2. The other group members should be responsible for measuring one parameter each. Make sure you are familiar with the instructions and instruments to be used

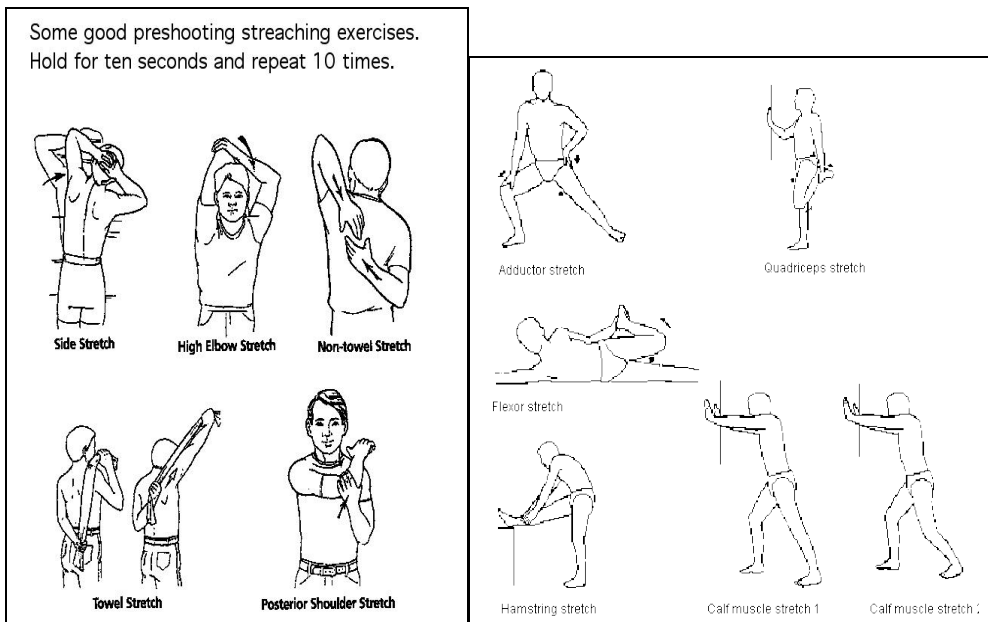
#### Blood pressure/Heart rate:

The cuff should be placed on the arm just above the elbow joint. The red part of the cuff needs to rest on the inside of your arm at your elbow where a pulse can be measured. In order to avoid an "error" reading the subject needs to be *perfectly still* when you are taking blood pressure/heart rate measurements. Leave the cuff *on the subject* at all times. During exercise the cuff and tube can be detached from the monitor.

#### Body temperature (Thermoscan digital ear thermometer)

Place the thermoscan with a clean probe cover in the subject's external auditory canal, press the button firmly and wait few seconds until you get an accurate reading (you will hear a BEEP when it is done. After each reading you must replace the ear probe cover in order to start the next reading.

3. Record the resting observations and values of your subject for each of the 6 parameters.
  - i. Record normal skin color of hands and face (i.e, pale, pink, red etc.)
  - ii. Record normal perspiration level (i.e. none, mild, medium, high)
  - iii. Record external body temperature.
  - iv. Record the resting blood pressure and heart rate.
  - v. Determine the breathing rate by counting the number of breaths in 1 minute.
4. Warm up before exercising.
5. Subject may begin exercise. Be sure to exercise at a level that can be maintained for 6 minutes.
6. Take readings at the 2, 4, 6 minute time markers. Be sure to take final readings 2 minute after your subject has stopped exercising.
7. Record all of the readings in the table provided.



**D. Answer the following questions correctly for credit:**

**DATA TABLE (0.5 POINTS)**

Time measurement was taken	Skin pigmentation	Perspiration level	Body Temperature (°F)	Heart rate (Beats/Min)	Blood Pressure (sys/dia)	Respiration (Breaths/Min)
Resting (basal parameters)						
After 2 Minutes (total time)						
After 4 Minutes (total time)						
After 6 Minutes (total time)						
After exercise (2 min after)						

**Data Analysis (1 POINT- 0.25 POINTS EACH GRAPH)**

Plot your data on graphs. You should have a total of 4 graphs (body temperature, heart rate, blood pressure and respiration rate versus the duration of exercise (the four time points)).

PLEASE NOTE: When plotting your blood pressure graph you should show one line for systolic pressure (the higher number) and another line for diastolic pressure (the lower number) on the same graph.

Make your graphs on the following page.

Body Temperature

Heart Rate

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Blood Pressure

Respiratory Rate

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Discussion Questions (2 POINTS- 0.5 POINTS EACH Question)

Answers must demonstrate that you understand WHY these things occur i.e. why does the body need more oxygen during exercise?

1. What are the changes you observed in skin color and perspiration level in response to? How do these changes contribute to the maintenance of homeostasis?
2. Why do you think a change in body temperature occurs? Describe some of mechanisms that your body uses to maintain it's homeostatic temperature?
3. Why does an increase in heart rate and breathing rate accompany exercise?
4. By studying your measurements after exercise has stopped, what conclusions can you draw about your body's ability to maintain homeostasis?