Group Member Names \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Diffusion**

**Pre Activity:**

1. For which Design is the Diffusion Flux of Cu the greatest?

Explain your response.

**Concentration Cu**

Design A

Design B

**Position (x)**

**Activity I: Fick’s Laws**

 

1. Give an explanation of the diffusion flux, J, which another student who has never had materials

science would understand.

1. In Fick’s First Law, why is J, the diffusion flux, proportional to the concentration gradient, 

(i.e. the change in concentration with position) rather than being proportional to the concentration, C?

1. What does the minus sign mean physically? What would happen if the minus were to become a plus

sign?

1. In steady state diffusion, what quantity is “steady”?
2. Are atoms moving in steady state diffusion?
3. Is there anything that is changing in steady state diffusion?
4. How does the diffusion flux, J, change with position when diffusion is in steady state?
5. Give a physical example of steady state diffusion.
6. Draw the Concentration graph and the Diffusion Flux graph as a function of position in steady state diffusion.

**Activity II: Representing Diffusion by Drawing and Graphing**

1. A slab of Ni atoms (gray) are perfectly sandwiched between two slabs of Cu atoms (white), as shown on the first graph marked “t = 0 seconds”. Given are the graphs for the Cu concentration and the Cu diffusion flux as a function of position at t = 0 seconds. Draw the graphs for t = a few hours later (non-steady state) and t = long time after (equilibrium), show how the atoms would be distributed (i.e. color in Ni atoms) and draw the graphs for the Cu concentration and the Cu diffusion flux as a function of position.

**Given**

Diffusion Flux

Cu Concentration

t = 0 seconds

t = a few hours later

Cu Concentration

Diffusion Flux

Diffusion Flux

Cu Concentration

t = long time after

**Activity III: Post Activity**

**Consider the graph below of concentration vs. position.**

1. Rank, smallest to largest, the magnitude of the diffusion flux at each of the six points (a-f).
2. Represent the direction of the diffusion flux at each of the six points below by drawing arrows on the graph.
3. Is the concentration at point **c** increasing or decreasing with time? How do you know this?

Concentration

x

a

b

c

d

e

f