

(While normally all hand-in problems must be done on separate pages & short answer questions typed, you may skip these directions for this problem set)

1. For a polar solute, S , crossing a plasma membrane from outside a cell to inside the cell...
 - a. Provide a plausible equation (*e.g.* $A \rightarrow B$) for the process of passive diffusion of S .
 - b. Modify your equation from (a) as a complete mechanism (think enzyme-catalyzed mechanism chemical equations) to reflect the facilitated diffusion of S across the membrane via the transport protein, T .
 - c. If the concentration of S outside the cell is 4.97 mM and the concentration of S inside the cell is 491 μM , is the passive diffusion of S to the inside of the cell spontaneous?
 - d. Given the concentrations in (c), is the facilitated diffusion of S to the inside of the cell spontaneous?
 - e. If the existing chemical gradient of S was used to drive the transport of glucose across the membrane to the inside the cell using secondary active transport, what is the maximum concentration of glucose inside the cell that would render the process thermodynamically favorable if the concentration of glucose outside the cell were 1.08 mM?
 - f. If S was actually a sodium cation, what must be the trans-membrane potential to render its facilitated diffusion not spontaneous in either direction?
 - g. If the activation energy for the passive diffusion of S across the membrane was 6.45 kJ/mol, but 7.41×10^{-2} kJ/mol via active diffusion, how much faster does S diffuse via the transporter?