

QUESTION ONE: For arsenate transport —utilizing both arsA and arsB, or arsB alone— calculate the relative efficiencies of arsenate exclusion from the bacterium. What are the effects of stoichiometry and the net charge of the arsenate oxyanion on exclusion?

(Hints: You will need to consider the Gibbs free energy difference. For ATP hydrolysis, use $\Delta G^\circ = 10$ kcal/mole. For comparisons of the effects of stoichiometry and net oxyanion charge, use more than 2 values, to identify trends, if any. Bacterial membrane potentials are difficult to measure, most measured values cluster around -100 mV, negative inside. Finally, it is probably easiest to keep the extracellular concentration constant — 10 mM might work well.)

QUESTION TWO: Based on the biochemical properties of the various oxidative states and chemical forms of arsenic, is there any advantage to modifying the oxidative state or chemical form of the arsenic to minimize the energetic requirements for transport out of the cell? Propose a mechanism, with explanation.

(Hint: Bear in mind that some chemical modifications may require energy input.)

Ground Rules: I expect that students may (or may not) wish to work with each other on the assignment (depending on personal preference), and may certainly come to me for help. But, please ensure that the work you hand in is in your own words (it's your voice I want to hear).