SAS
S07

BAE 103
Energy in Biological Systems

Problem Set No. 1
Concepts of Areas and Related Rates
Due Date: Wednesday, January 17

1.1 Assume the world's human population (6.3 billion people) all travel to central Kentucky. Everyone attends a meeting that is held in Jessamine, Fayette, and Woodford Counties. What area (standing room) is available to each person (area in square feet)? Assume the combined surface area of these three counties is 647 square miles.

1.2 City water is used as the growth media in a hydroponic greenhouse complex. Each time a crop is cycled through the house the water is changed to avoid disease problems. The complex is segmented into 0.5-acre sections. Assume that water flows from the 1.5 inch (I.D.) diameter water supply line at the rate of 5.0 m/s. How long (hours) will it take to fill the floor of the one section of the complex to a depth of 3.0 cm?

1.3 Yews (taxus) are to be planted at a density of 20,000 plants per hectare within an experimental plot at a research and development company that produces paclitaxel (active compound in Taxol) to treat cancer patients. Assume these the yews will be planted in rows spaced 2.0 meters apart to facilitate periodic harvesting. What should the plant spacing be within these rows (cm) to achieve the desired plant population?

1.4 A compost turner is used to enhance to the biological activity within rows of composted municipal yard waste. A commercial facility consists of 1.7 acre compacted earthen composting pad. Assume the compost turner operates at 3.4 km/h, and that the efficiency of the machine and operator is 75%. The compost rows are spaced 5.0 meters apart. How long (hours) will it take turn the compost?