

Name: _____

CVEN 689 – Sustainable Environmental & Water Resources Systems
Summer Semester 2004
Drs. Robin Autenrieth & Kelly Brumbelow, Texas A&M University

Midterm Exam

Closed-book Section (3 pages, 5 questions); Time allowed: 40 minutes

1. What is a *commons*? Give one example of a commons existing today. (10 points)
2. As explained by Herman Daly, what is the difference between *natural resources* and *natural capital*? Give one example of natural capital and accompanying natural resources. (15 points)
3. What is the difference between *strong sustainability* and *weak sustainability*? (15 points)
4. What is *entropy*, and why is it a useful concept for discussing the sustainability of a specific project? (10 points)
5. What is an *externality*? Give one example. (15 points)

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Midterm Exam

Open-book Section (1 page, 1 question); Time allowed: Remainder of period

1. From the perspective of physics, the energy used to travel by automobile is almost all used to produce entropy; if the vehicle moves up in elevation on the trip, some energy is converted to additional gravitational potential energy. Thus, a car's mileage in miles per gallon provides a means by which to calculate entropy production in moving people from one place to another. We could speak of the entropy production in terms of gallons of gasoline per mile per person transported (gal/mi/person).

A significant number of cities now have High Occupancy Vehicle (HOV) or carpool lanes on highways. In this problem, you are to calculate the average entropy production for a group of people traveling along a section of highway with varying fractions of travelers using the HOV lanes. Assume that 10,000 persons will all travel for 20 miles along a section of highway. All vehicles have a gas mileage of 20 miles/gallon, and all persons have the choice of driving alone or carpooling with one other person. Under these assumptions, calculate the entropy production of travel of this population (gal/mi/person) for carpool rates of 0%, 25%, 50%, 75%, and 100% of travelers. Graph your results, and comment on what these results might suggest that public policy makers should do to encourage "sustainable transportation." (35 points)