

Name: _____ Pledge (sign): _____

Env Studies 201 Test #2 KEY

Point Total: 100 pts possible

- 6 pts 1. According to Julian Simon, what is 'the ultimate resource?'
- Simon, an economist, was a 'technologist' in outlook and believes that human ingenuity is the ultimate resource. He doesn't believe that there are meaningful resource limits because when one becomes scarce, human ingenuity will be spurred to efficiency increases and to finding alternatives. He supports his contention with the fact that the marginal prices of the services provided by most natural resources have tended to fall over time.
- 6 pts 2. (a) Briefly (1-2 sentences) define *the hydrogen economy*.
- The Hydrogen Economy is a hypothetical large-scale system in which elemental hydrogen (H₂) is the primary form of energy storage, and fuel cells would be the primary method of conversion of hydrogen to electrical energy. In particular, hydrogen plays a central role in transportation.
- 6 pts (b) What are the potential advantages of the hydrogen economy? List as many as you can and briefly (1 sentence each) explain each.
- It provides a way to transition to greater dependence on renewable energy sources. Through electrolysis, hydrogen is a way to store (electrical) energy provided by intermittent sources such as wind or solar energy. Such a system is cleaner, will not run out of fuel, and lessens our dependence on fossil fuel from other countries.
 - Fuel cells are an efficient way to generate electricity (they are not heat engines).
 - Fuel cells are a clean (and silent) way to generate electricity—they produce only water. In particular, vehicles powered by fuel cells are cleaner because it is easier to control pollution from smaller a number of fixed hydrogen generators than from a large number of mobile (gasoline-powered) vehicles.
 - Fuel cells are scalable, so we can go to a distributed generation energy network, which is more reliable than our current system.
- 6 pts (c) List some potential roadblocks to implementing this energy system. Be complete—list as many items as you can.
- *Production* of enough hydrogen in a manner that is renewable and environmentally friendly. We might desire that this production also be decentralized to some extent (ie, distributed generation), which is another aspect to this challenge.
 - *Storage* of hydrogen in a manner that does not waste too much energy
 - Creating an infrastructure to *distribute* the hydrogen to end users
 - Creating cheap *fuel cells* of all sizes to convert the hydrogen to electricity
 - Creating *automobiles* based on fuel cells that are comparable—in price and performance—to those based on combustion engines

- 8 pts 3. Define the *materials economy*, as presented in *The Story of Stuff*; be sure to identify the 'golden arrow' and explain its significance.

As presented by Annie Leonard, the materials economy is a description of the 'cradle-to-grave' flow of raw material from their source to their eventual disposal as waste. She describes it as a linear system from natural resource *extraction*; *production*, *distribution* and *consumption* of goods and services; and finally *disposal* of the waste products in the process. The *golden arrow* is the flow of materials from distribution to consumption; according to Leonard, it largely determines the overall rate of flow of materials through the system.

- 8 pts 4. (a) What is the *demographic transition*, and what is the effect of this transition on a country's population?

The demographic transition is a description and model of the population increase that is frequently observed to accompany the transition of a country from a pre- to a post-industrialized economy. Before the transition the population level is stable, it increases during the transition before stabilizing at a higher level. Ultimately the population is higher and characterized by a shift to older age groups.

- 12 pts (b) What causes the demographic transition? Explain in some detail.

There are four stages in an ideal transition, though some demographers argue that a fifth and even sixth stage should be added.

Stage 1: *preindustrial*. This is characterized by equal but high birth and death rates, and a largely agricultural economy.

Stage 2: *transitional*. Death rates fall due to better sanitation, more secure food sources, and better health care; infant mortality, in particular, is greatly reduced. However, birth rates are still high, resulting in a population explosion.

Stage 3: *industrial*. Birth rates begin to fall due to urbanization, and wider availability and adoption of contraceptive methods. Population is still rising but the *rate* of population increase is falling.

Stage 4: *postindustrial*. Birth rates have fallen to levels equivalent to the death rates, so population stabilizes. The age structure of the population will also shift due to increases in life expectancy and the aging of the 'bubble' of children born during stages 2-3.

- 8 pts 5. (a) Briefly describe the *tragedy of the commons*, including a description of the important properties of commons pool resources.
- Popularized by Garret Hardin, the 'tragedy of the commons' refers to the degradation or destruction of a common pool resource due to overuse and mismanagement. A common pool resource has two important properties:
- Ease of access: it is difficult, though not impossible, to exclude users from the resource.
 - Subtractability: one person's use of the resource decreases the quantity/quality of the resource available to other users.
- More technically, the resource described by Hardin was an open access resource where there were no barriers to access. Degradation of a CPR occurs when the overall rate of resource extraction exceeds the rate of regeneration of the resource.
- 12 pts (b) There are a variety of strategies to avoid the tragedy. Describe in some detail (use the back of this sheet if necessary) the nature of the three main challenges that a proposed strategy must overcome to manage a commons successfully.
- *Scientific knowledge of the CPR*. The health of the CPR must be monitored as it is being used. It would be nice to have a good idea of the maximum sustainable yield of the CPR to ensure that it isn't exceeded.
 - *Ability to control and/or monitor access*. Users of the CPR must agree to limit their use of the CPR so that it is not degraded. There needs to be a way to deny access to the people who do not agree to use the CPR sustainably; in addition, it would be nice to be able to monitor the compliance of those who do agree and are allowed access.
 - *Ability to deter free-riders*. Free-riders are those who overuse the CPR while others are limiting their use. This behavior must be prevented; the ability to do so is related to the second challenge (ie, denying access, detecting noncompliance) as well as properly structuring incentives to encourage cooperation.
- 8 pts 6. (a) Define *sustainable development*, highlighting its three main aspects (the 'triple bottom line').
- The most common definition of sustainable development, courtesy of the Brundtland Commission, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Current, three dimensions of sustainability are commonly recognized: *people*, *planet* and *profit*. Optimizing this 'triple bottom line' means simultaneously considering aspects of distributional and opportunity equity, environmental degradation and resource (over)use, and economic growth and wealth generation.

- 8 pts (b) List arguments—as many as you can—for and against aggressively pursuing the goals of sustainable development on a global scale. Note: you do not need to limit yourself to the arguments presented in the *Taking Sides* issue.
- Technologists claim that the carrying capacity of the Earth can be increased through technology (elastic ecological niche). Malthusians claim that there is a limit to the concept of economic substitutability, that some natural resources are irreplaceable.
 - Technologists claim that population will not be a problem because of the demographic transition, so we need to focus on developing countries. Malthusians point out that population growth is still strong, and in any event many believe we are already over the carrying capacity.
 - Technologists claim that, as countries get richer, they value a clean environment more and use their resources more efficiently (eg, environmental Kuznets curve). Malthusians point out exceptions to this, for example greenhouse gas emissions.
 - Technologists claim that unfettered economic growth is the best way to increase standards of living for *everyone*, including the poorest segments of society. Malthusians do not think that ‘trickle down economics’ is either just or efficient.
- 6 pts 7. (a) Supporters of GM crops contend that they will help alleviate global hunger with less environmental impact than conventional seeds. Explain their reasoning.
- Increased productivity will decrease food prices, making it more available to the poor.
 - GM crops can be less resource-intensive than conventional crops, requiring less water, fertilizer and/or pesticides.
 - GM crops can be grown on land that is not productive using conventional crops.
- 6 pts (b) Critics of GM crops disagree, stating the GM crops may even aggravate global hunger and can negatively impact the environment. Explain their reasoning.
- Like the Green Revolution before it, GM crops favor the industrialization of agriculture. Subsistence farmers will earn less money and be able to buy less food.
 - Despite claims from its supporters, over the long term using GM crops (especially HRCs) does not reduce pesticide use.
 - ‘Gene escape’ is possible whereby the new GM crops (or cross-breeds from them) proliferate in the wild and negatively impact wild ecosystems.