



Aalto University School of Chemical Technology

Puu-0.3340 Industrial Symbiosis and Environmental Management 7 ECTS

Roope Husgafvel / Gary Watkins

Exam 19.05.2015

Answer ONLY FIVE (5) of the following 8 questions. All questions are worth 5p.

1. Explain (briefly) the meaning of the following terms: (1p each point. 5p total.)
 - Tragedy of the Commons
 - Eco-efficiency
 - Sustainability
 - The Master Equation
 - Industrial ecology and sustainable engineering
 2. What are the main features and key stages of life cycle assessment (LCA)? What are the key benefits for industry? What are the potential limitations of this methodology? 5p.
 3. According to Chertow et al. three types of symbiotic transactions can occur in industrial ecopark:
 - a. Utilizing waste as raw material inputs from others (by-product exchanges),
 - b. Sharing utilities or access to services (such as energy or waste treatment), and
 - c. Cooperating on issues of common interest such as emergency planning, training or sustainability planning.
- Which of those above-mentioned symbiotic transactions occurs at the Harjavalta industrial eco-park? Please, also give practical examples of each. 5p.
4. Describe the 5 different types of Eco-Industrial Park (EIP) in terms of the location and role of actors and the types of material exchanges and relationships between them. 5p.
 5. Describe and discuss the key challenges of material efficiency in the context of global material flows. What are the potential implications for Finnish industry? 5p.
 6. Choose a manufacturing process, with which you are familiar and, to the extent possible, evaluate the process, pointing out its strengths and weaknesses from an industrial ecology and sustainable engineering standpoints. 5p.
 7. As they grow, how might Less Developed Countries (LDCs) develop their infrastructure (transportation, energy, water, waste treatment) in ways different from the traditional Highly Developed Countries' (HDCs) model? What gains could be made by doing so? 5p.

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8. Discuss the differences between the ecosystem types shown in Figure 1 below. Suggest in which ways industrial ecology type thinking can approach a Type II system for human systems. Is a fully functioning Type II industrial ecosystem the ultimate? Is it realistic to work towards a Type III industrial ecosystem? Does a true Type III system exist in nature? 5p.

Figure 1 - Ecosystem Types I, II, III

