



Aalto University School of Chemical Technology
Industrial Symbiosis: Puu-0.3310 5 Cr. / Gary Watkins

Exam 18.12.2013

Answer ONLY FIVE (5) of the following 10 questions. All questions are worth 5p.

1. Explain (briefly) the meaning of the following terms: (1p each. 5p total.)

- Tragedy of the Commons
- Eco-efficiency
- The rebound effect
- Green chemistry
- MFA

2. 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.

3. What are the differences between the Industrial Ecology (IE) and Industrial Symbiosis (IS) approaches? Discuss their scales and focus. Which approach is adopted in which circumstances? Give examples. 5p.

4. What are the main features and key stages of an LCA assessment? Discuss the framing of the question used in your GaBi practical exercise and criticise its specific focus in terms of product impacts. 5p.

5. Discuss the metaphor of "industrial metabolites and enzymes" within the context of industrial symbiosis/ecology. Give examples of each for a chosen system and criticise the value of the application of the metaphor. 5p.

6. 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.

7. What are cultural constructs? Why do industrial ecologists need to understand what they are? What are some common cultural constructions of "nature"? 5p.

8. 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 standpoint. 5p.

9. What are the main features and key stages of an LCA assessment? Discuss the framing of the question used in your GaBi practical exercise and its specific focus in terms of product impacts. 5p.

10. What metallurgical processes form the heart of the Harjavalta eco-industrial system and what are their main positive contributions to the Harjavalta eco-park and to the city of Harjavalta?

END