

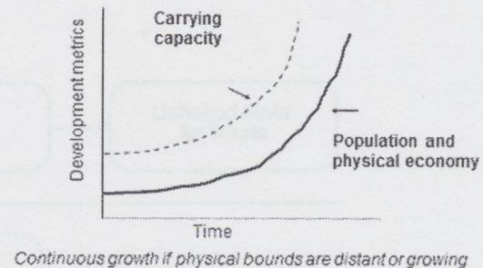
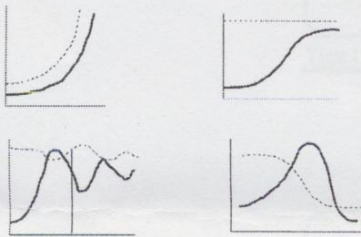
Exam 17.12 2012

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
- DfX
- MFA

2. Discuss the following 4 human development scenarios. What affects possible carrying capacity limits? What are the feedback/correction mechanisms in human development and environment systems? What are the resulting stability/instability characteristics of each scenario and the implications for human development? Give an example of each type of system behaviour from nature and/or human history. Which scenario outcome might industrial ecology thinking in technological development help achieve? 5p.



Continuous growth if physical bounds are distant or growing

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. What are cultural constructs? Why do industrial ecologists need to understand what they are? What are some common cultural constructions of "nature"? 5p.
10. What industrial ecology model class is each of the following? Why?
- Characterising the Japanese annual cycle of tin (Sn)
 - Describing the chemistry of the Antarctic ozone hole.
 - Understanding human demand for water arid regions, the way in which water is provided, and the environmental implications of doing so.
 - Quantifying the environmental effects of zinc ore extraction and refining.

To assist you, **Figure 2** below shows the classification of the IE Model Classes 1A, 1B, 1C, 2A, 2B and 3. 5p.

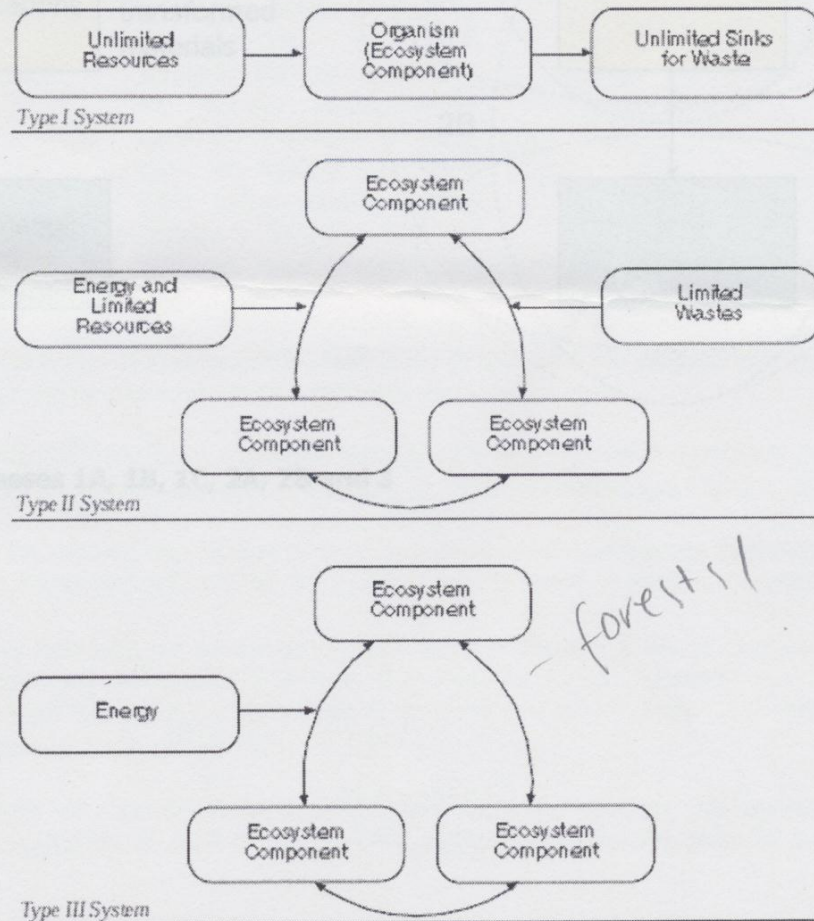
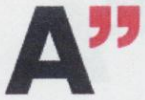


Figure 1 - Ecosystem Types I, II, III



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

Exam 17.12.2012

Answer ONLY FIVE (5) of the following 10 questions. All questions are worth 20 points.

1. Draw and label the resulting of the following terms: (a) driving factors, (b) transformations, (c) environmental implications, (d) waste energy, transformed materials, (e) energy, materials.

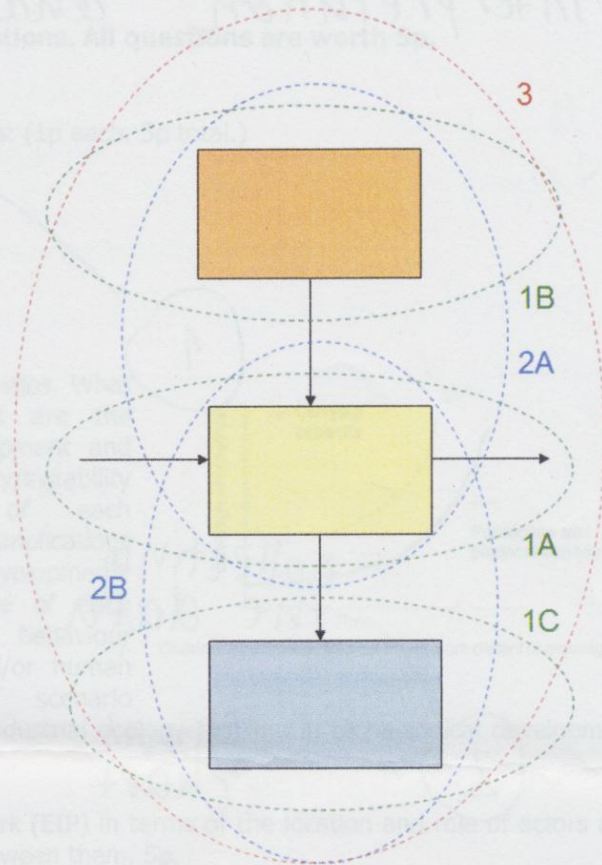
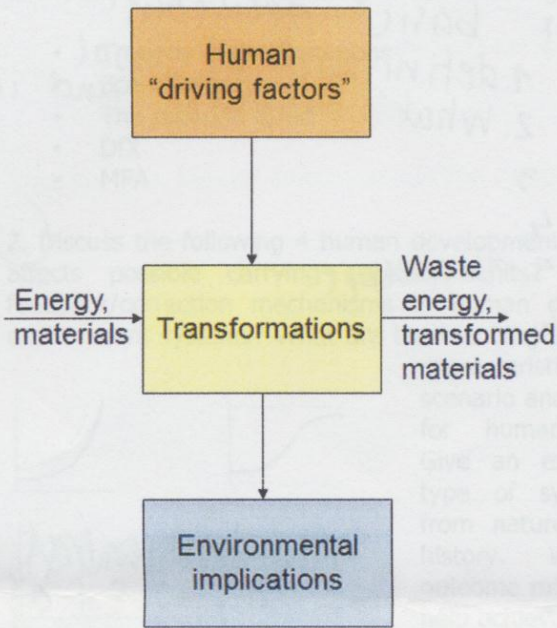


Figure 2 - IE Model Classes 1A, 1B, 1C, 2A, 2B and 3

END