

WASTE MANAGEMENT (KBT135)

Exam in Waste Management 2012-04-13, 9:00-13:00

Examiner: Professor Britt-Marie Steenari

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Grading: Total points: 50 + points from project work (max 6 p)

Points	Grading
<25	Failed
25-32	3
32.5-39.5	4
40-56	5

Closed book exam, a non-technical language dictionary is permitted. Please note: Each question must be answered on separate paper.

1. Ashes (6 p)

- a. Which are the two most common combustor types used for incineration of municipal solid waste? (2p)
- b. Consider a suggested utilization of an ash from combustion of a combination of bark and sewage sludge as mineral fertilizer in agriculture. More specifically as a fertilizer on soil used for growing wheat. Describe the positive and negative effects of this application. If you were given the task to decide if such an application should be allowed, would you say yes or no? (4p)

2. Waste flows in society (7 p)

- a. What are the four basic approaches for source reduction of waste from consumer products? (2p)
- b. As countries get richer, what are the typical trends for the following waste fractions: organic waste, paper waste and plastic waste? (2 p)
- c. What is the trend for the amount of electronic scrap (“e-waste”) now? (1p)
- d. Describe the waste management hierarchy. (2p)

3. Hydrothermal waste treatment (6 p)

Describe the three main hydrothermal waste processes. Give a brief and generic explanation of each one of them. Also discuss which waste flows that are preferably treated with this type of processes and why.

4. Thermal waste treatment (6 p)

- a. Which acid gases are commonly formed when combusting municipal solid waste? (1p)
- b. Which are the most common particle separation devices used in MSW incineration plants? (2p)
- c. The abbreviation SNCR is used among combustion engineers. What does that mean? Describe the chemical process used in SNCR. (3p)

5. Contaminated soil treatment (6p)

- a. What is phytoremediation? (1p)
- b. Discuss the most important factors/variables that influence the biological degradation in for example contaminated soil. (2 p)
- c. Describe how to increase accessibility for biological degradation of contaminated soil. (2 p)

6. Recycling of metals (4 p)

Describe the processes involved in the recycling of circuit boards.

7. Radioactive waste (4 p)

Describe the Swedish system for handling of spent nuclear fuel.

8. Recycling of plastics (5 p)

- a. Plastics contain a large number of additives. Give at least 4 important additive types. (2p)
- b. Describe the 7 steps in the common recycling process for plastic waste. (3p)

9. Waste water treatment and sludge handling (6 p)

- a. What is the approximate amount of sludge produced in municipal waste water treatment in Sweden per year? (1p)
- b. Describe an activated sludge treatment process for treatment of municipal waste water. (3 p)
- c. In a waste water treatment plant, the sludge produced usually is dewatered prior to further processing. Dewatering can be difficult to achieve. What is done to improve the dewatering properties of the sludge? (2p)