WASTE MANAGEMENT (KBT135)

Exam in Waste Management 2023-01-09, 08:30-12:30

Examiner: Assoc. Prof. Martina Petranikova

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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

1. Thermal treatment of the waste (2p)

A) In pyrometallurgical recycling processes different metals can be separated and material recycled by different methods and characteristics, melting point is one, give example of at least two more. 1

B) What elements are required to form halogenated dioxins, halogens and hydrogen are two, mention two more? 1

2. Wastewater treatment (4p)

Described briefly the urban water system and how it contributes to the formation of wastewater. What are the main sources of water entering the sewer system? 4

3. Batteries recycling (6p)

A) How are lead batteries recycled? 3

B) Write three reasons why Li-ion batteries are recycled? 3

4. Metals recycling (6p)

A) Write three by-products resulting from the copper production and describe how are they treated. 3

B) What are the main advantages of the hydrometallurgical recycling of the metals? 3

5. Solar panel recycling (4p)

A) Who is responsible for the waste management of solar panels and what are the obligations for a solar panel producer in EU countries according to WEEE legislation? 2

B) Which solar cell type is more important to recycle? What can be recycled from them and why? Please consider the material cycle and sustainability point of view. 2

6. End-of-life vehicle recycling (4p)

A) Why is the management of automotive shredding residue (ASR) critical for the ELV waste management system, and what are the possible approaches and challenges to treat ASR? 2

B) What kind of challenges will the material change create for electronic and autonomous vehicle recycling and which actions can we take for effective recycling? 2

7. Ashes and utilization of ashes (4p)

You are working in a research institute that is handling the analysis of different materials. You are contacted by a heat and power plant owner that wants to use your services and provides you with an ash sample.

A) Which are the four most important factors influencing ash properties that you would request from the client? 2

B) Name two methods (for each landfilling and research) that you will recommend as characterization methods to your client if they want to landfill the ash and if they want to know more about the ash from a research point of view. 1

C) What are the two possible utilization alternatives for the ash that you would recommend to your client and what would be your concerns (what to think about before doing)? 1

8. Nuclear Waste (2p)

What are the driving forces for recycling of nuclear waste? 2

9. Waste flows in society (6p)

A) Explain what is meant by hidden waste flows and also give an indication of how much hidden waste that is typically generated per kg of product that you purchase as a consumer. 3

B) How is municipal waste managed in Sweden? Provide the three main treatment options and a rough percentage for how much of the municipal waste that is managed by each of them? 3

10. Resource recovery from organic waste (4p)

A) Provide and explain two reasons for why the normal 'waste hierarchy' can be challenging to follow for organic/biological waste? 2

B) There can be many different reasons to why thermal hydrolysis is used to treat e.g. sewage sludge. Give two important reasons. 2

11. Thermal recycling of plastics (4p)

Describe the carbon and energy balance of a system where all virgin fossil feedstock to produce plastics of virgin quality is replaced with a feedstock based on wastes. 4

12. Recycling of textiles (4p)

Textile recycling is roughly divided into mechanical or chemical recycling, can you briefly mention a difference between these methods? 4