

CHEM-E6130 - Metal Recycling Technologies

Online Exam 8.12.2020, at 8-12,

Student name:

Study number:

The exam is an open book exam, where all printed and electronic material is allowed. The course content is divided into five topics each question giving maximum 6 points.

Write your answer in this same Word file.

The completed exam (as a Word file) needs to be submitted until noon (12:00) on same day (8. December 2020). Before submission please rename the Word file with your name. The submission box is in section 'Final exam' on MyCourses web page.

Topic 1 – General topics and raw materials.

Question 1-1. How would you explain the concept of circular economy to a layman. Explain how can we transfer economy of metals from linear to circular?

The idea of circular economy is to consider the whole life cycle of products, services, energy and processes, where we take in to account how we are able to recycle and utilize waste streams and direct them back into production flow as a raw material and then I would make the comparison between forest biome in regards of decomposers, plant life, water and air, and a metal foundry utilizing nutrients provided by the waste stream, collection of slag and sulfuric gasses as resources and how they are utilized.

Question 1-2. Explain the concepts of system thinking and give examples of system thinking in metal production and recycling.

Topic 2. – Mechanical Processing.

Question 2-1. What mechanical processing steps would you use to turn an end-of-life laptop to separate recycle streams?

Question 2-2. Explain the concepts of liberation and concentration in WEEE recycling. What methods are available to separate different metals from WEEE?

Topic 3. – Pyrometallurgy

Question 3-1. Advantages and challenges of using scrap in steelmaking. Means to cope with the challenges.

Question 3-2. Your task is to recycle copper scrap containing antimony, lead, tin and aluminium as impurities. What kind of pyrometallurgical processes would you use and why? How these impurities behave in the processes you choose? Is it possible that some of these impurities cause problems in processes or further processing of products?

Topic 4. – Hydrometallurgy

Question 4-1. Explain why traditional copper primary production route by smelting and electrorefining is very efficient in recovering noble metals from secondary sources.

Question 4-2. Make an analysis, why is it necessary to remove tin from coated steel before remelting the steel and describe how would you remove tin using hydrometallurgical methods.

Topic 5. – LCA and Recycling as business

Question 5-1. Explain the procedure to make an LCA analysis. What needs to be decided, what information is needed and how the outcomes of the analysis are produced?

Question 5-2. In WEEE treatment process, what is the most important step to improve metals recovery and why?