

Bioenergy
23WSP036

Semester 1

In-Person Exam paper

This examination is to take place in-person at a central University venue under exam conditions. The standard length of time for this paper is **1.5 hours**.

You will not be able to leave the exam hall for the first 30 or final 15 minutes of your exam. Your invigilator will collect your exam paper when you have finished.

Help during the exam

Invigilators are not able to answer queries about the content of your exam paper. Instead, please make a note of your query in your answer script to be considered during the marking process.

If you feel unwell, please raise your hand so that an invigilator can assist you.

Answer **ALL THREE** questions.

All questions carry equal marks.

Use a **SEPARATE** answer book for **EACH** question.

Use of a calculator is permitted - It must comply with the University's Calculator Policy for In-Person exams, in particular that it must not be able to transmit or receive information (e.g. mobile devices and smart watches are not allowed).

1.

- a) With the aid of a diagram:
 - i. Draw a schematic of a waste-to-energy combustion plant. [5 marks]
 - ii. Annotate the diagram to show where losses in energy occur and suggest how these losses could be reduced. [5 marks]
- b) The energy efficiency of waste to energy plants can be improved by utilizing the waste heat in a combined heat and power (CHP) plant. Suggest what problems exist that make the use of heat in CHP challenging and what should be done to mitigate these problems. [10 marks]

2. Discuss the advantages and disadvantages of biofuels as a replacement for petrol, diesel and liquid petroleum gas (LPG). [20 marks]

3.

- a) Explain the differences between fixed-bed and fluidised-bed gasifiers. [6 marks]
- b) Compare and contrast gasification by steam and air gasifying agents. [6 marks]
- c) Assess the potential and challenges in producing hydrogen from biomass. [8 marks]

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