

23MPC101**Sustainability, Recycling and Environmental Issues**

Semester 1 2023/24

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 **2 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.

You may use a calculator for this exam. 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).

Answer **THREE** questions only. Each question carries 20 marks.

1. St Luff-Burgh is an archipelago made up of four main islands, a map of which can be seen in Figure Q1a. Information on the population and the main commercial activity of the four islands is shown in Table Q1a. You have been asked by the government of St Luff-Burgh to act as an advisor on their energy need and supply. Their main concerns are that all citizens have good access to renewable energy whilst protecting the local unique environment and habitats.

Table Q1a: Island data

Name	Population	No. Road Vehicles	Main commercial activities
Roflay	60	2 commercial	Fishing (South)
Kwarne	125	6 commercial	Fishing (North)
Shepers Island	1210	165 (120 private, 45 commercial)	Farming, spiritual retreat at the Burgh (commercial), Eco-tourism.
The Isle of Luff	111,520	5231 (private and commercial) + airport.	Commercial, farming, education, government, tourism, financial.

Explain to the ministers:

- (a) What is meant by the term “renewable energy” and why it must be considered in more detail in terms of carbon footprint and global warming? [2 marks]
- (b) What would a better terminology be for energy production and how it needs to be considered in the selection of power production technologies? [3 marks]
- (c) The population of each island is given in Table Q1a, what other factors need to be considered in terms of power needs for each island? [2 marks]
- (d) What short range usage patterns need to be taken into consideration? [1 mark]
- (e) No information is given on the weather patterns on the islands. What effect would the weather patterns have on possible energy production and why would you need this information to make a full recommendation? [2 marks]
- (f) Detail two possible strategies and technologies that the government might follow:
- (i) If the energy for all the islands is considered as a whole. [5 marks]
- (ii) If the energy for the islands is considered individually for each island. [5 marks]

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Hint: Consider the pros and cons of each. Give position on the maps (using co-ordinates) where you suggest any infrastructure to be sited.

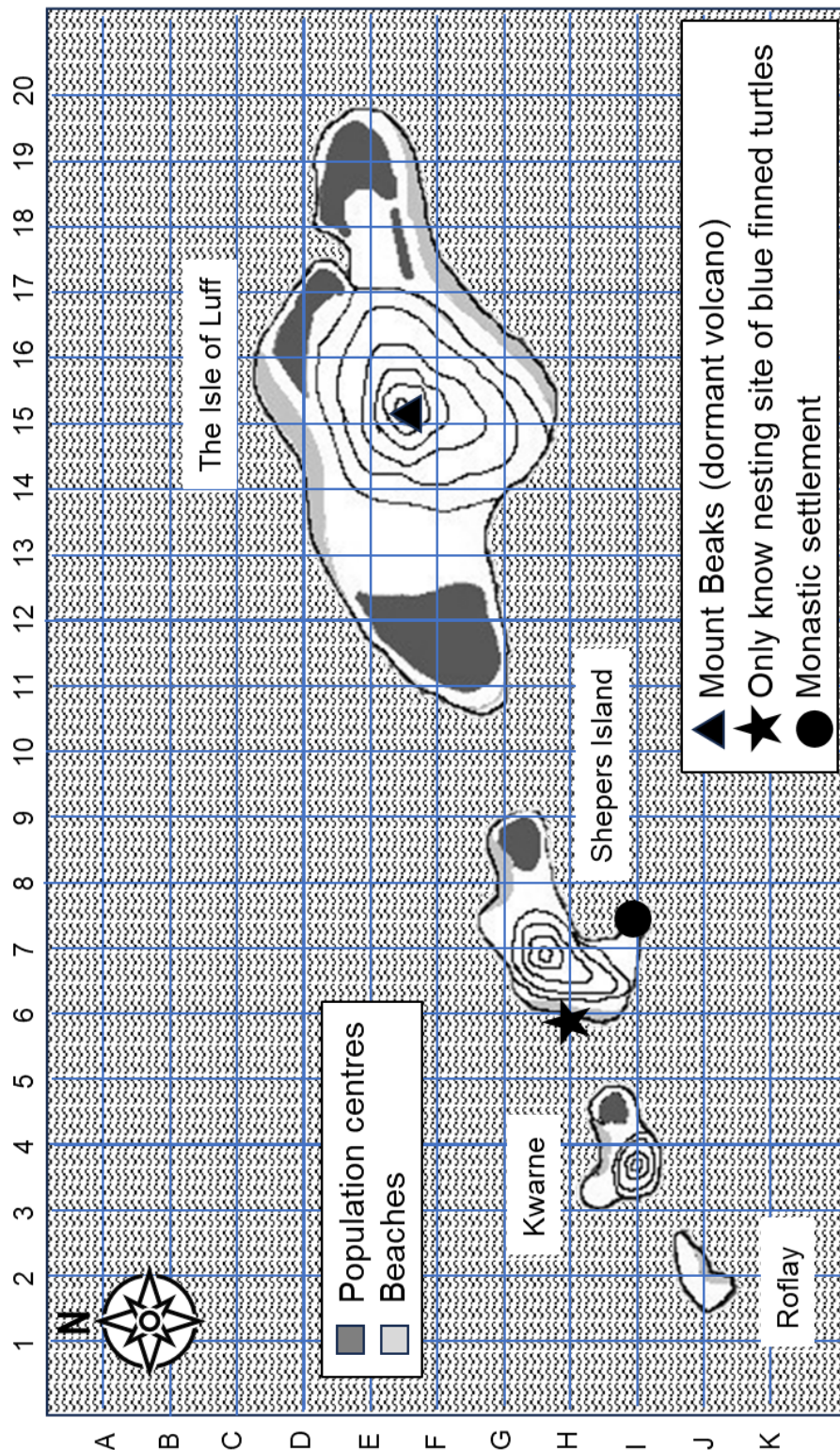


Figure Q1a: Map of St Luff-Burgh

2. You work for a manufacturer specialising in plastic packaging. You have been approached by a customer who needs some material for their new product. They ask your advice on choosing a suitable material and marketing.
- (a) (i) Give 3 questions that you would ask to help you to choose a suitable material, giving reasons for your choices. [6 marks]
- (ii) They are keen to use post-consumer recyclate (PCR) and suggest making their product entirely from this rather than virgin material. Give 2 reasons why this may not be possible, explaining your reasoning. [4 marks]
- (b) (i) Their marketing team ask for help writing a suitable brand statement to represent their use of PCR in the product. Give one example of a good statement, and one example of a bad statement that they could include, explaining your reasoning. [4 marks]
- (ii) The company would like to investigate whether a take back scheme and targeted bins in public places would help to increase the recycling rates for their products. Explain the limitations of such schemes compared to kerbside recycling. [2 marks]
- (c) (i) Material is available from the Ocean Clean-up, who are a non-profit organisation who aim to clean up the Pacific Garbage Patch using boats dragging nets to capture plastic debris from the sea. Describe 2 limitations of this technology. [2 marks]
- (ii) Give 2 reasons why the materials collected can't easily be used to make commercial products. [2 marks]

3. (a) (i) State the main stages involved in choosing and preparing a landfill site for potential use as a brownfield site. [6 marks]
- (ii) Explain the reasons for these stages, considering the environmental and societal impacts of landfill. [4 marks]
- (iii) Describe how UK landfill tax is levied based on the composition of the material being disposed of, giving examples of each type. [4 marks]
- (iv) The rate of landfill tax has increased by 10X from ~£2 per tonne to £100 per ton over the last few decades. Give one positive and one negative effect that this has had. [2 marks]
- (b) Biodegradable polymers can be a very attractive option for single use packaging applications, however they can cause confusion when it comes to recycling and waste disposal.
- (i) Describe the difference between a bioderived and a biodegradable polymer. [2 marks]
- (ii) Explain the main issue associated with the disposal of biodegradable material by landfill. [2 marks]

4. It's not been the best year for your company Brass Bolts and Fittings (BBF) Ltd. The company produces copper-based and aluminium fittings through various processes including casting, extrusion, and machining. After the fly tipping incident in 2023 the company has struggled with its local public image. The weeks following the Christmas shutdown have been particularly bad as local opposition has increased to the point where there have been demonstrations in front of the plant. Your boss agrees to meet a representative of the protest group and discuss the issues.

(a) Your boss asks you to assist them in gathering information to assist in the meeting:

(i) What would be covered by the company's environmental auditing? [1 mark]

(ii) List four benefits to the company of a good environmental audit. [4 marks]

(iii) Explain why your company would carefully monitor the water quality of the outflow, how this meets the UK regulations and how you budget for this annually. [3 marks]

(b) The protest group representative arrives with a folder of information, some of which has been taken from your own webpages. See Figure Q4b.

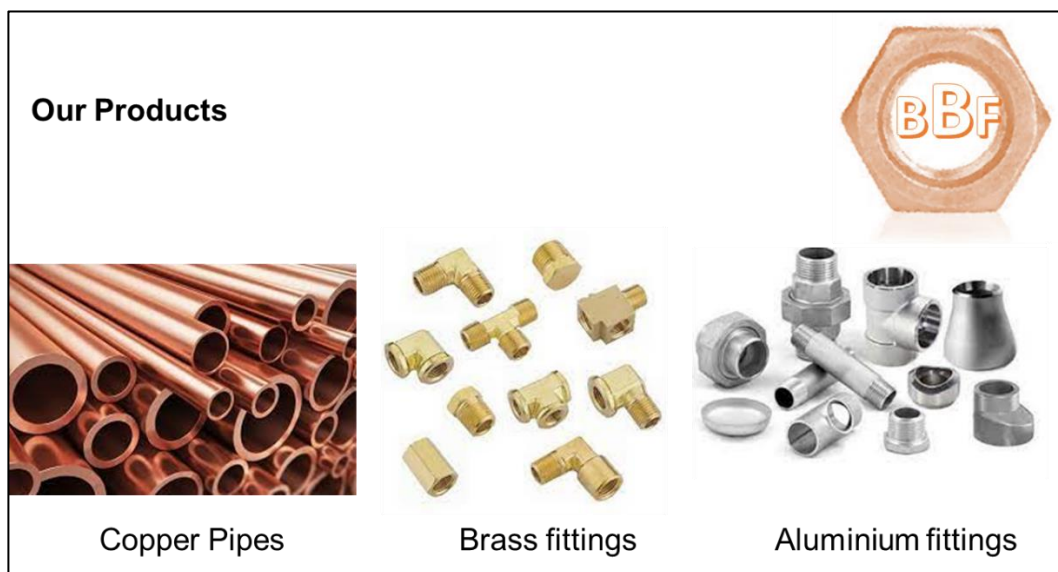


Figure Q4b: Image from company website

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Following a tour of the factory they would like more information on the following:

- (i) After seeing intake and sorting, they want to know why the copper, brass, and aluminium scrap your company takes in needs to be sorted. What needs to be removed and how? [4 marks]
 - (ii) What makes aluminium and copper compatible to be manufactured in the same plant? [1 mark]
 - (iii) Are the company aware of what effect the processing of copper and copper alloys may have on the local plants and wildlife? What precautions are taken to ensure that the company are not releasing any dangerous elements? [4 marks]
- (c) Finally explain to the representative what advantage recycling has to the environment over production from raw materials and what industry and consumers can do to help. [3 marks]

END OF PAPER

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