

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

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## IB ESS

# 1.2 Systems and Models

### Significant Ideas:

A systems approach can help in the study of complex environmental issues.

The use of systems and models simplifies interactions but may provide a more holistic view without reducing issues to single processes.



# What is a System?

1.

a) Compare reductionism with the systems approaches to scientific research.

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b) Describe what is meant by the term "emergent properties".

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2. There are several components that are present for most systems. Match the words below with the descriptions

*Flow*      *Input*      *Output*      *Storages*      *Boundary*

	The stock of matter or energy within a system.
	The movement of matter or energy from one storage to another, or into/out of the system.
	The designated area separating the system from its surroundings.
	Matter or energy entering the system.
	Matter or energy exiting the system.



3. Flows can be categorized into two distinct types depending on whether the matter/energy is changed or just moved. State and describe what these categories are.

Type of flow: \_\_\_\_\_

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Type of flow: \_\_\_\_\_

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4. Draw a systems diagram to represent:

a) A supermarket



b) A fish farm

*(The fish are in the ocean but contained within the farm by a net until caught and sold. They are provided with food and medicine, and produce waste products, sometimes polluting the surrounding water. Bacteria/pathogens will also feed on the food and may cause infections in the fish.)*



## Types of System

1. Systems can be categorized depending on whether or not energy and matter are able to enter/exit the system. Outline what is meant by the following in terms of energy and matter:

*Open system*

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*Closed system*

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*Isolated system*

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2. State whether the following are open, closed or isolated systems.

Type of system	Description
	A natural forest ecosystem
	A closed zip-lock bag
	A fishbowl
	An adiabatic* drinks flask (This is only theoretical – not physically possible)

\* "Adiabatic" means it is a perfect insulator – if you put hot tea in it, it would never cool down. Ever.



# Models

1. Define the term "model".

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2. There are a number of types of model such as:

- *Physical models*
- *Computer simulations*
- *Mathematical models (often using computers if they are very complex)*
- *Diagrams (e.g. systems diagrams)*

a) Describe a physical model you have seen or used recently.

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b) If you have ever checked the weather forecast, you have used (or seen the results of) a computer simulation model. Explain why weather forecast tools are considered models.

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c) Explain why a systems diagram is considered a model.

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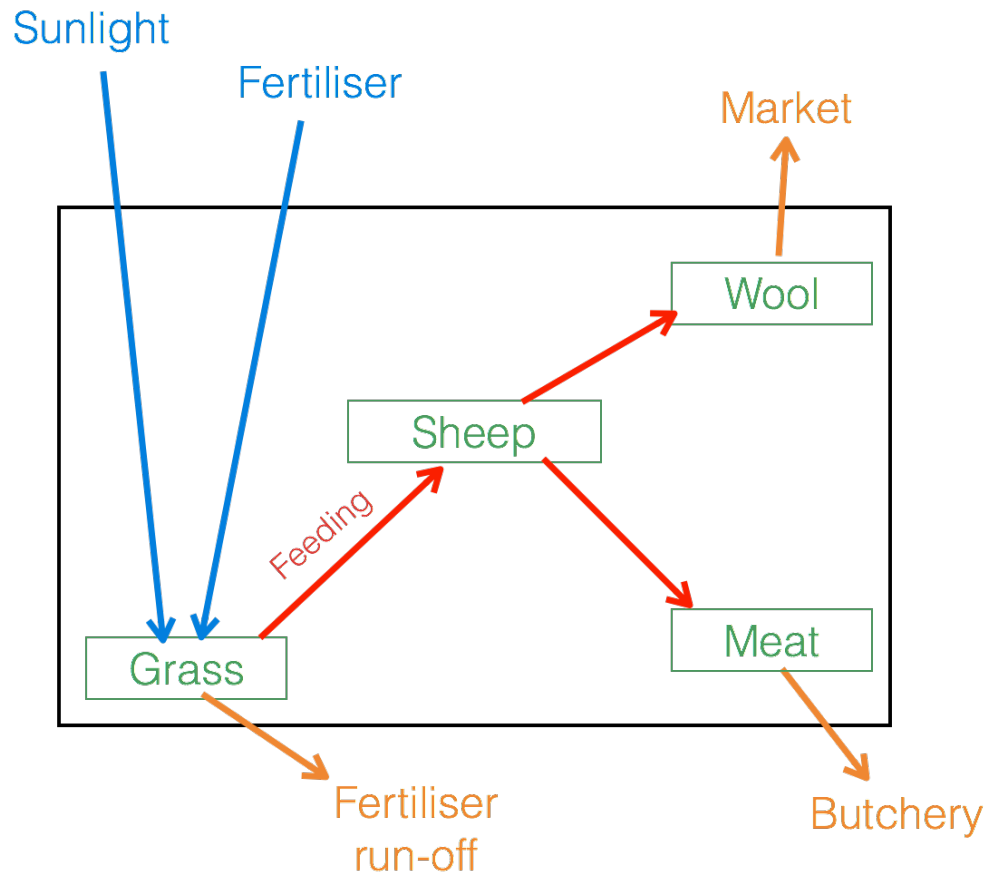
3. Models are very useful but also have their limitations and disadvantages.

a) Using the table, summarise the advantages and disadvantages of using models. Use the headings to guide your answers.

<b>Advantages</b>
Simplifying a complex reality _____ _____
Predicting future changes _____ _____
Identifying patterns _____ _____
Visualising small or large systems _____ _____
<b>Limitations</b>
Simplification vs accuracy _____ _____
Specialist knowledge (or lack of) _____ _____
Quality of input data _____ _____



4. Evaluate the following model of a sheep farm system:




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