

4.1 Species, Communities, Ecosystems & Energy Flow

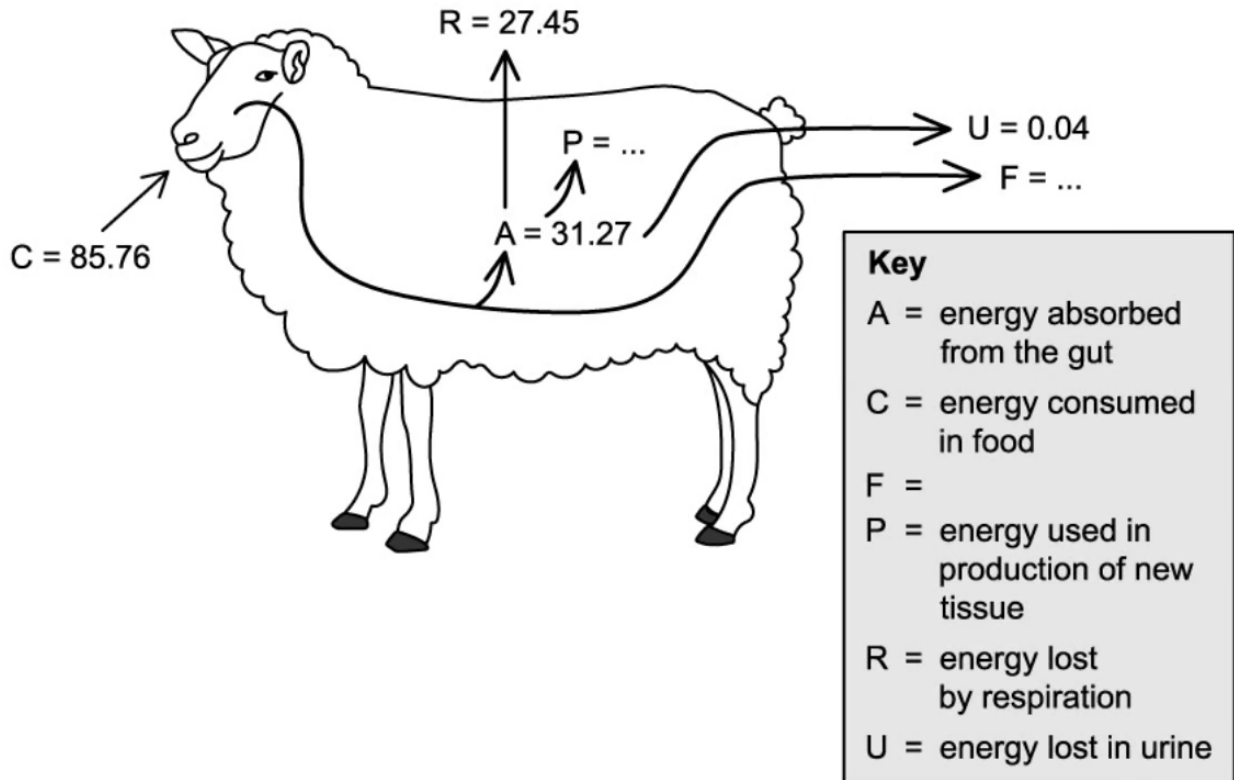
Question Paper

Course	DPIB Biology
Section	4. Ecology
Topic	4.1 Species, Communities, Ecosystems & Energy Flow
Difficulty	Medium

Time allowed: 60
Score: /46
Percentage: /100

Question 1a

- a) The diagram shows the flow of energy through a sheep. The figures are in $\text{kJ} \times 10^6 \text{ year}^{-1}$.



Suggest what label **F** represents.

[1 mark]

Question 1b

- b) Calculate the value of **P**. Give your answer in $\text{kJ} \times 10^6 \text{ year}^{-1}$.

[1 mark]

Question 1c

- c) A sheep farmer wanted to increase the amount of energy used for the production of new tissue (P) in his livestock (his sheep).

Suggest **two** methods that could be used by the farmer to achieve this.

[2 marks]

Question 1d

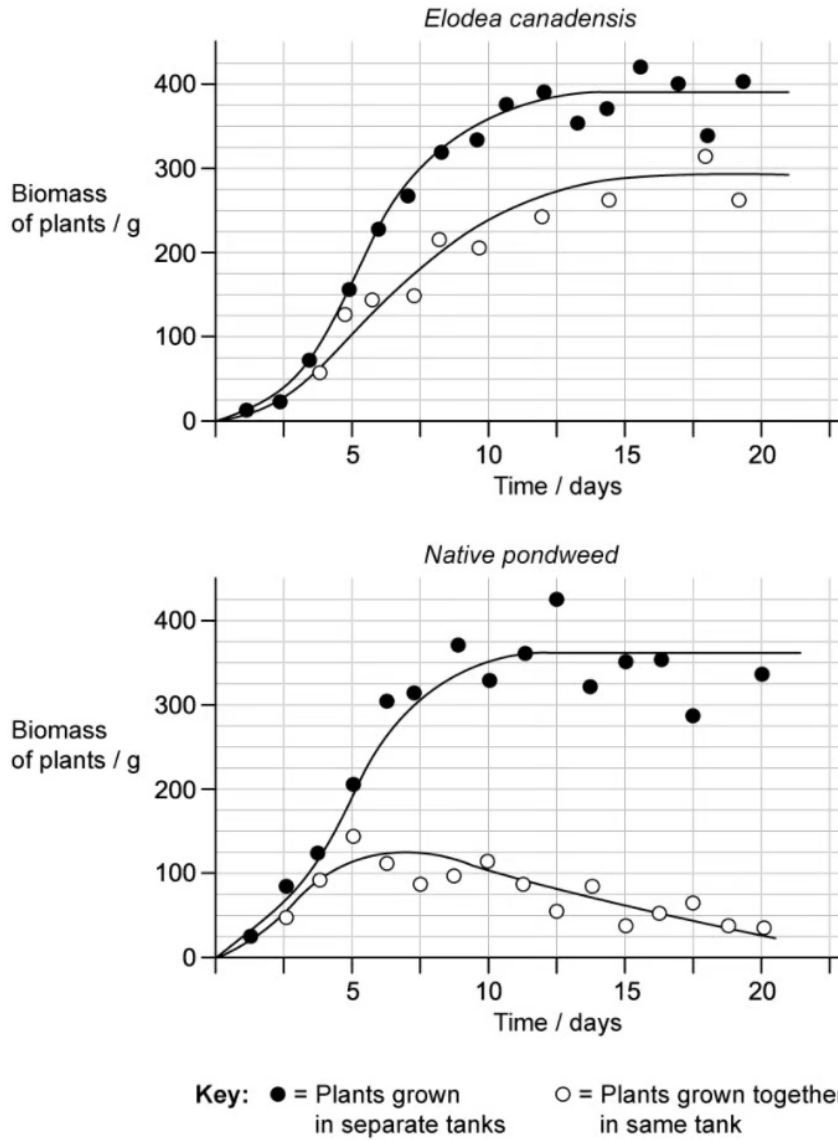
- d) When the sheep have grown to a specific body mass they can be consumed for food by humans. Assume that the sheep consume grass, and that humans gain $0.57 \text{ kJ} \times 10^6 \text{ year}^{-1}$ from eating sheep meat

Draw a labelled pyramid of energy to represent this food chain.

[3 marks]

Question 2a

- a) *Elodea canadensis* (Canadian pondweed) is a species of aquatic plant from North America. A student grew *Elodea canadensis*, along with a pondweed species native to the UK, in water tanks both separately and together. The graphs below show their results.



State **two** abiotic factors the student should have controlled throughout the experiment.

[2 marks]

Question 2b

- b) Calculate the difference in biomass between native pondweed grown separately and native pondweed grown in a tank together with *E. canadensis* after 15 days.

[1 mark]

Question 2c

- c) Explain the results for native pondweed for when both species of pondweed are grown together.

[2 marks]

Question 2d

- d) Evaluate the benefit of mesocosm experiments, similar to the one in part (a), in understanding interactions between organisms in their natural environment.

[3 marks]

Question 3a

- a) Ecologists studied a rocky shore habitat which contained, among other organisms, several barnacle species, purple topshell snails (*Gibbula umbilicalis*), seaweeds, and lichens.

State, with a reason, which of the organisms listed above make up a single population.

[2 marks]

Question 3b

- b) The ecologists wanted to find out whether there was an association between the distributions of purple topshell snails and the common rock barnacle, *Semibalanus balanoides*.

Outline the method ecologists would use to collect data to determine whether or not such an association existed.

[3 marks]

Question 3c

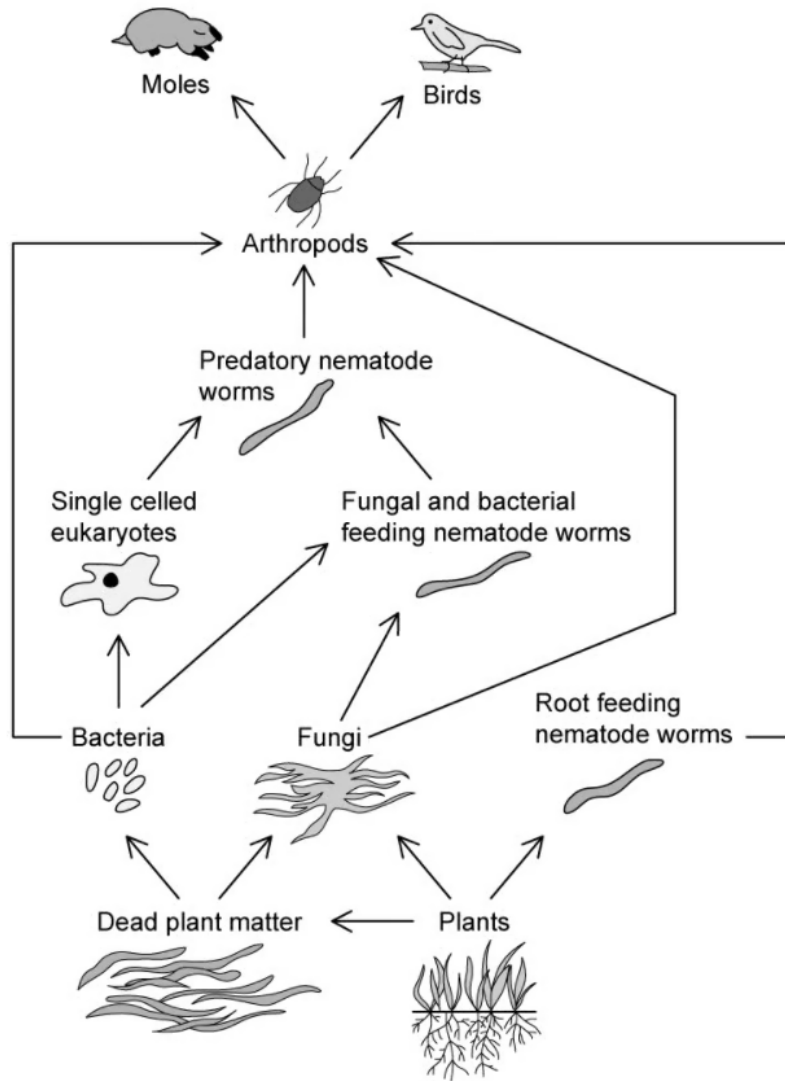
- c) A chi-squared test was carried out to determine whether or not there was a significant association between purple topshells and common rock barnacles on a rocky shore. When the calculated chi-squared value was compared to values in a critical values table it was found to be smaller than the critical value at a 0.05 probability level.

Deduce what can be concluded from this analysis?

[2 marks]

Question 4a

a) The diagram below shows a soil food web.



State the specific mode of nutrition used by the following organisms:

- i. Plants
- ii. Fungi
- iii. Root feeding nematode worms

[3 marks]

Question 4b

- b) Draw a food chain that includes bacteria from the food web shown above.

[1 mark]

Question 4c

- c) The longest food chain in the food web above contains 7 organisms. Explain why it is unusual to see food chains of this length.

[2 marks]

Question 4d

- d) Outline how the soil food web will be affected by a farmer harvesting crop plants from a field.

[3 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

- a) Outline the processes by which energy flows through ecosystems.

[7 marks]

Question 5b

- b) Some plants are parasitic, gaining their carbon compounds by tapping into the roots of other plants, for example.

Explain how this mode of plant nutrition is unusual.

[3 marks]

Question 5c

- c) Explain the concept of ecosystem sustainability.

[5 marks]