1 **Figure 1** shows a pyramid of energy for an ecosystem.

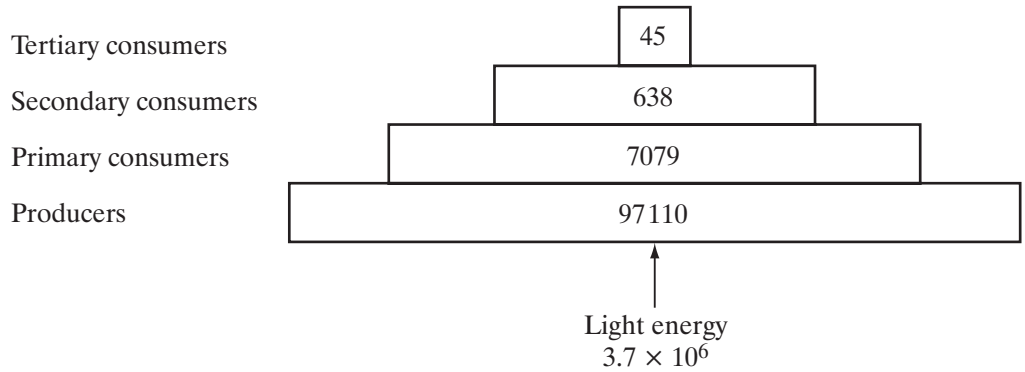


Figure 1

(a) Suggest suitable units for the measurement of energy transfer in this pyramid of energy. *(1 mark)*

(b) (i) Calculate the percentage of energy transferred from primary consumers to tertiary consumers.

(ii) Give **two** reasons why the percentage of energy transferred between consumers is generally low. *(3 marks)*

(c) Give **two** reasons why all the light energy reaching the producers cannot be used in photosynthesis. *(2 marks)*

AQA, 2007

2 **Figure 2** shows a simplified food web in an aquatic ecosystem.

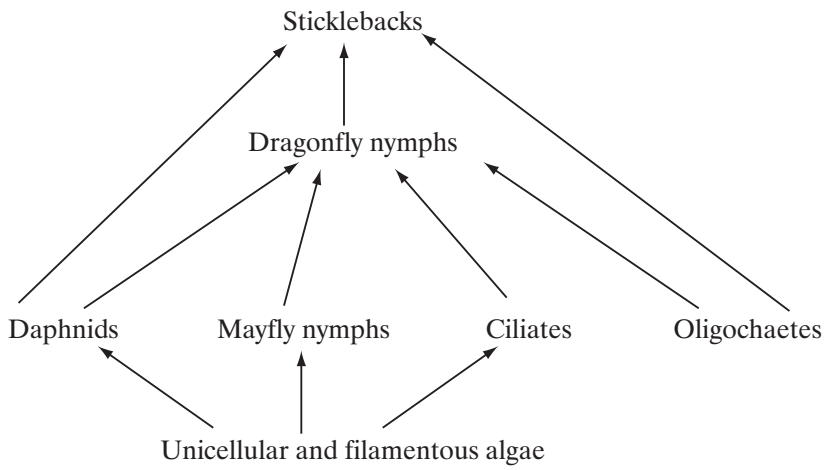


Figure 2

(a) In this food web, which organisms feed as tertiary consumers? *(1 mark)*

(b) The biomass of organisms in an ecosystem can change during the year. In this aquatic ecosystem, the biomass of primary consumers is temporarily greater than that of the producers during the early summer.

(i) Sketch the pyramids of biomass in early summer and autumn for this ecosystem. Name the trophic levels.

(ii) Suggest suitable units to represent biomass in these pyramids. *(3 marks)*

(c) Explain why food chains rarely have more than five trophic levels. *(2 marks)*

AQA, 2003

3 Potato plants originate from the Andes mountains in South America. They are adapted for survival in a cool climate. The potatoes we eat are food storage organs, called tubers, and are produced on underground stems.

Figure 3 shows the rate of photosynthesis and respiration for one variety of potato plant.

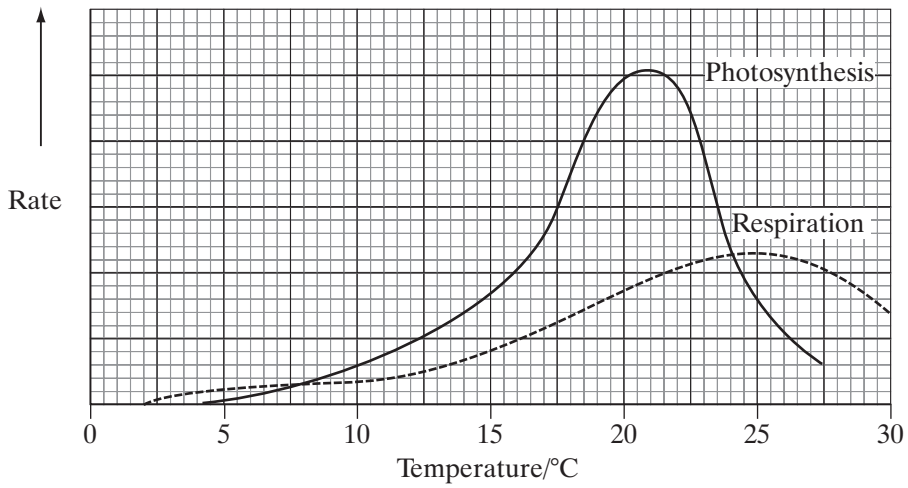


Figure 3

(a) Between which temperatures is there a net gain in energy by the potato plant? *(1 mark)*

(b) When this variety was grown in a hot climate, with a mean daytime temperature of 23.5°C, it failed to produce tubers. Use information in **Figure 3** to explain why no tubers were produced. *(2 marks)*

(c) Suggest what causes the rate of photosynthesis to decrease at temperatures above 21°C. *(2 marks)*

AQA, 2003

4 Purple loosestrife is a plant which grows in Europe. It was introduced into the USA where it became a pest.

(a) Suggest why purple loosestrife became a pest when it was introduced into the USA, but is not a pest in Europe. *(2 marks)*

(b) A European beetle was tested to see whether it could be used for the biological control of purple loosestrife in the USA. In an investigation beetles were released in an area where purple loosestrife was a pest. The table shows some of the results.

Time after releasing beetles / years	Mean number of purple loosestrife stems per square metre	Mean number of beetles per square metre
1	22	5
2	8	40
3	6	68
4	7	62

Are the beetles effective in controlling purple loosestrife? Give evidence from the table to support your answer. *(2 marks)*

(c) Fire-ants are a serious pest in parts of the USA. An investigation was carried out to find the best way to control the fire-ant population. **Figure 4** shows the results of this investigation.

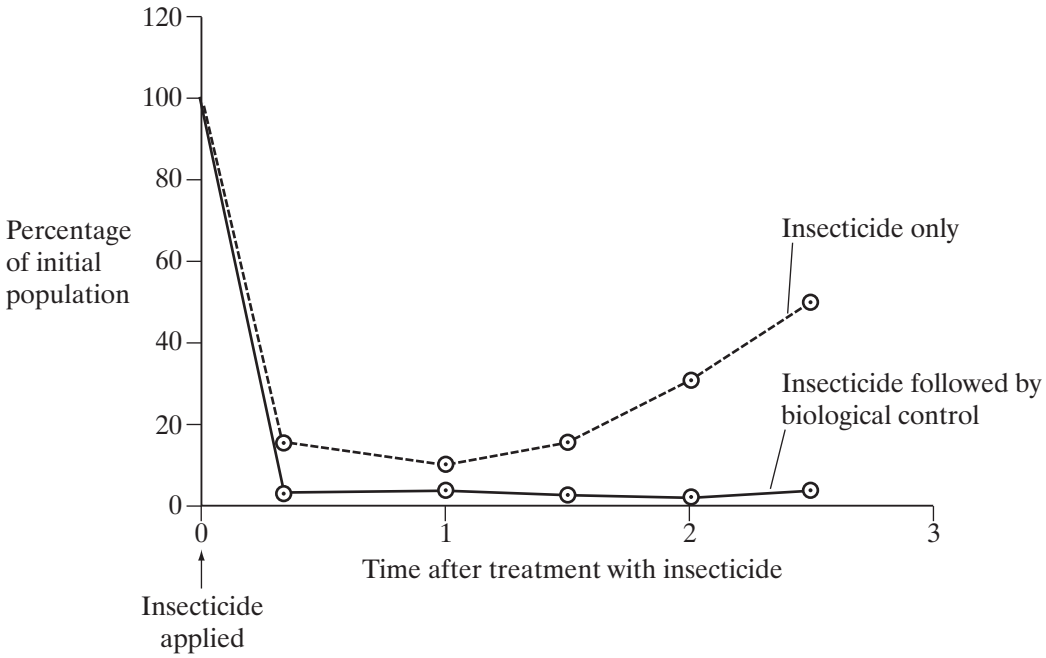


Figure 4

(i) Describe the effect of using insecticide followed by biological control.

(ii) Explain the change in fire-ant population over the period when they were treated with insecticide alone. *(5 marks)*

(d) Give the advantages and disadvantages of using biological control. *(6 marks)*

AQA, 2006

5 (a) Insecticides are pesticides which kill insects. A low concentration of insecticide was sprayed on the leaves of rose plants to kill greenfly which were feeding on the plants. Ladybirds eat greenfly. One month after spraying, the concentration of insecticide in the tissues of ladybirds was found to be higher than the concentration sprayed on the rose plants. Suggest why. *(3 marks)*

(b) Spotted knapweed is a common weed in the USA. Two methods, chemical control and biological control, have been used to reduce the numbers of spotted knapweed plants. The table shows the results of an investigation comparing the effectiveness of these two methods.

Month	Mean number of spotted knapweed plants per m²	
	Chemical control	Biological control
February	2	2
March	15	3
April	3	3
May	20	5
June	3	4
July	16	3
August	2	2

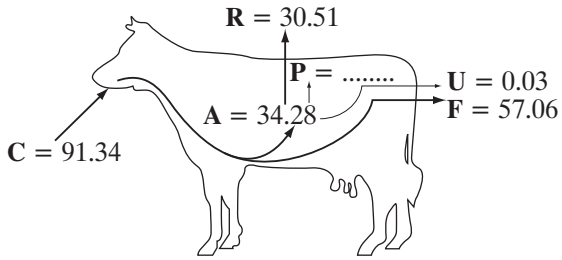
(i) Describe the pattern of plant numbers resulting from the use of:
chemical control;
biological control.

(ii) Explain how chemical control leads to the changes in the number of spotted knapweed plants from March to June. *(3 marks)*

(c) Explain why the spotted knapweed plants were never completely eliminated when using:
(i) chemical control;
(ii) biological control. *(4 marks)*

AQA, 2004

6 **Figure 5** shows the transfer of energy through a cow. The figures are in kJ × 10^6 $year^{-1}$.



Key: **A** = energy absorbed from the gut
C = energy consumed in food
F = energy lost in faeces
P = energy used in production of new tissue
R = energy lost by respiration
U = energy lost in urine

Figure 5

(a) (i) Complete the following equation for the energy used in the production of new tissue. Use only the letters **C**, **F**, **R** and **U**.
P =
(ii) Calculate the value of **P** in kJ x 10^6 $year^{-1}$. *(2 marks)*

(b) It has been estimated that an area of 8100 m^2 of grassland is needed to keep one cow. The productivity of grass is 21 135 kJ m^{-2} $year^{-1}$. What percentage of the energy in the grass is used in the production of new tissue in one cow? Show your working. *(2 marks)*

(c) Keeping cattle indoors, in barns, leads to a higher efficiency of energy transfer. Explain why. *(1 mark)*

AQA, 2004

7 A food chain found in an oak woodland is shown below.

Organism	Oak tree	→	Aphid	→	Hoverfly	→	Great tit	→	Parasitic mite
Trophic level	**A**		**B**		**C**		**D**		**E**

The pyramid of numbers and pyramid of biomass representing this food chain are shown in **Figure 6**.

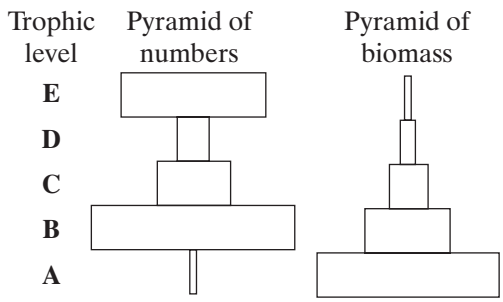


Figure 6

(a) Not all the light energy entering the leaves of the oak tree is used in photosynthesis. Give **one** reason for this. *(1 mark)*

(b) Give **two** ways in which energy is lost between trophic levels **A** and **B**. *(2 marks)*

(c) Explain the difference between the shapes of the two pyramids at trophic levels **D** and **E**. *(2 marks)*

AQA, 2005