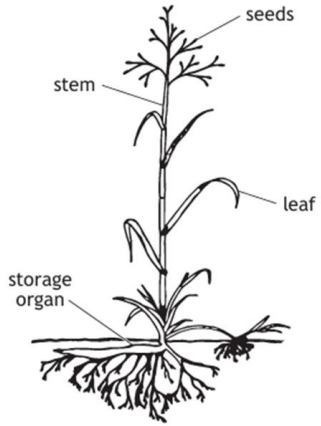
1. The diagram shows a perennial weed found in agricultural land in Scotland.



Which feature of this weed indicates that it should be controlled by a systemic herbicide?

A Seeds
B Stem
C Storage organ
D Leaf

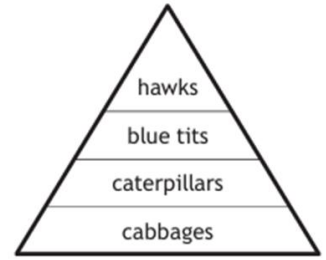
2. The following are features of weeds that compete with crop plants:

1. Storage organs
2. Vegetative reproduction
3. Short life cycle

Which are features of perennial weeds?

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

3. The diagram illustrates the energy content at different trophic levels of a food chain.



Pesticides are used to control caterpillar populations on cabbage crops.

Which of the following describes a possible bioaccumulation in this food chain after pesticide treatment of the cabbage crop?

A Decrease in energy content between caterpillars and blue tits
B Increase in concentration of pesticides between blue tits and hawks
C Increase in concentration of pesticides in caterpillars
D Increase in pesticide resistance in caterpillar populations

4. Glyphosate is a non-selective herbicide used to control weeds. Recombinant DNA technology has been used to produce GR-maize crops that are resistant to glyphosate.

Which of the following would be an advantage to humans of planting GR-maize?

A Glyphosate could be used without reducing the yield of maize
B The GR-maize crops are resistant to all herbicides
C Glyphosate would not be needed to control weeds
D Glyphosate resistance in weed species would occur

5. Examples of recombinant DNA technology used to increase yield in crop plants are listed:

1. Insertion of Bt toxin gene into cotton plants.
2. Insertion of glyphosate resistance gene into maize plants.
3. Insertion of drought resistance gene into wheat plants.

Which of these examples would **decrease** the use of chemicals?

A 1 only
B 2 only
C 1 and 2 only
D 1 and 3 only

6. Dandelions are weeds which often grow in grass lawns.

Which of the following could be sprayed onto a lawn to remove the dandelions?

A non-selective herbicide
B non-selective fungicide
C selective herbicide
D selective fungicide

7. The Bt toxin gene can be inserted into maize plants using recombinant DNA technology.

As a result of inserting the Bt toxin gene into maize

A herbicides will kill weeds but not the maize
B systemic herbicides will be more effective
C the maize will be resistant to insect pests
D fungicides will be more effective.

8. The table below shows the number of beet armyworm larvae found in plots of cotton plants.

Some plots were treated with insecticide on 27 June and 1 August and other plots left untreated.

		Number of beet armyworm larvae	
Sampling date		Treated plots	Untreated plots
July	8	3	3
	15	33	2
	22	22	17
	29	42	10
August	5	120	8
	12	160	10

Which of the following is the most likely explanation for the differences between the treated and untreated plots?

A The insecticide kills a predator of the larvae
B The larvae are resistant to the insecticide
C The beet armyworm breeds in July
D The larvae have a short lifecycle

1. The yield of strawberries is often decreased by leaf-eating insects.

(i) Explain why the presence of leaf-eating insects decreases the yield of strawberries.

2

(ii) Describe how biological control can be used to reduce infestations of leaf-eating insects.

1

(iii) Describe a risk of using biological control.

1

(iv) Control of insect pests can be more successful when integrated pest management is used.

Describe this approach.

1

2. Applications of fungicides to control *Botrytis* are often based on disease forecast.

State a benefit of applying fungicides based on a disease forecast. **1**

3. Apples and plums are grown in North America as food crops. Brown stink bugs (*Halyomorpha halys*) feed on apples and plums reducing fruit yield. Insecticides are often sprayed onto fruit crops to help control these pests.

State how the use of insecticides can be harmful to the environment. **1**

4. Describe how biological control can be used to reduce infestations of leaf-eating insects. **1**

5. Wheel bugs (*Arilus cristatus*) are a species of insect native to North America that prey on many different insects, including brown stink bugs. Wheel bugs are used along with insecticides to reduce the number of brown stink bugs.

(i) Explain why this method of control would require the use of less insecticide. **1**

_____

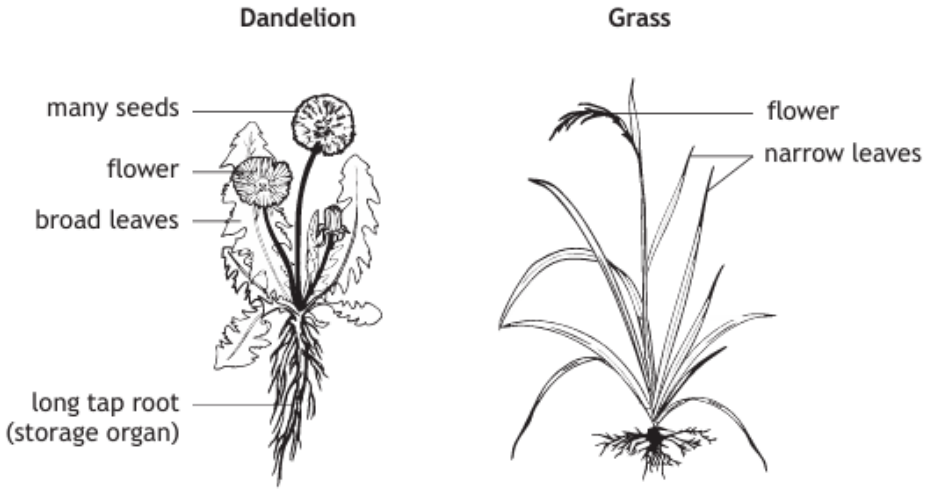
_____

6 Name the method of control that involves using both insecticides and wheel bugs. **1**

_____

7 Write notes on problems with the use of chemicals to control pests and biological control methods to overcome these problems. **4**

8 Selective herbicides are often used in sprays to control perennial weeds such as dandelions growing in areas of grass.



(a) Using information from the diagram

(i) explain why dandelions could be incorrectly identified as annual weeds. **1**

_____

_____

(ii) suggest why a selective herbicide would have a greater effect on dandelions than on grass. **1**

_____

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9 Potato plants are attacked by leaf eating caterpillars. *Bacillus thuringiensis* is a bacterium which can be used to control these pests. The bacteria produce a protein (Bt toxin) which kills these caterpillars.

(a) (i) Explain how an attack by leaf eating caterpillars causes a reduction in crop yield. **2**

_____

_____

_____

(ii) State an advantage of using this type of biological control rather than using chemicals. **1**

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_____

10 Explain the relationship between the total leaf area and total mass of seeds. **2**

_____

_____

_____

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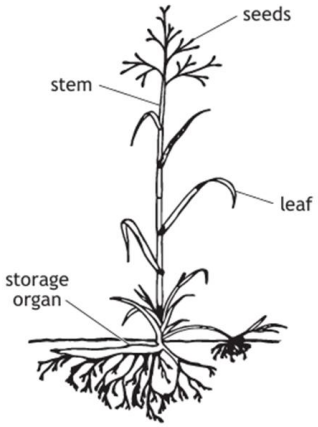

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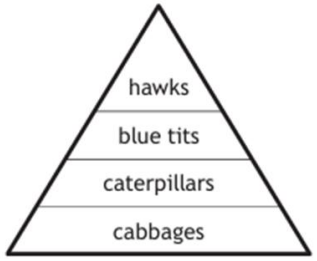

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1. The yield of strawberries is often decreased by leaf-eating insects.

(i) Explain why the presence of leaf-eating insects decreases the yield of strawberries.

2

Less photosynthesis

Less glucose for growth of strawberries

(ii) Describe how biological control can be used to reduce infestations of leaf-eating insects.

1

Introduce a natural predator to kill insects

(iii) Describe a risk of using biological control.

1

May become an invasive species

(iv) Control of insect pests can be more successful when integrated pest management is used.

Describe this approach.

1

Biological control + chemical control + cultural control (any 2)

2. Applications of fungicides to control *Botrytis* are often based on disease forecast.

State a benefit of applying fungicides based on a disease forecast. 1

Prevention is more effective than treating diseased crops

3. Apples and plums are grown in North America as food crops. Brown stink bugs (*Halyomorpha halys*) feed on apples and plums reducing fruit yield. Insecticides are often sprayed onto fruit crops to help control these pests.

State how the use of insecticides can be harmful to the environment. 1

1. Toxic to non target species
2. Persists in environment
3. Creates resistant pest populatioons
4. Causes bioaccumulation & biomagnification

4. Describe how biological control can be used to reduce infestations of leaf-eating insects. 1

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(i) Explain why this method of control would require the use of less insecticide. 1

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2. Persists in environment
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4. Causes bioaccumulation & biomagnification

6 Name the method of control that involves using both insecticides and wheel bugs. 1

Integrated pest management

7 Write notes on problems with the use of chemicals to control pests and biological control methods to overcome these problems.

1. Toxic to non-target species. (1)
2. Persistent in the environment/ soil. (1)
3. Bioaccumulation is the build-up of pesticide/chemical within an organism. (1)
4. Biomagnification is the increasing concentration of a pesticide/ chemical between trophic levels/along food chain. (1)
5. Bioaccumulation and biomagnification with no description. (1)

Only award point 5 if neither point 3 or point 4 are awarded.

6. Result in resistant (populations of) pests. (1)

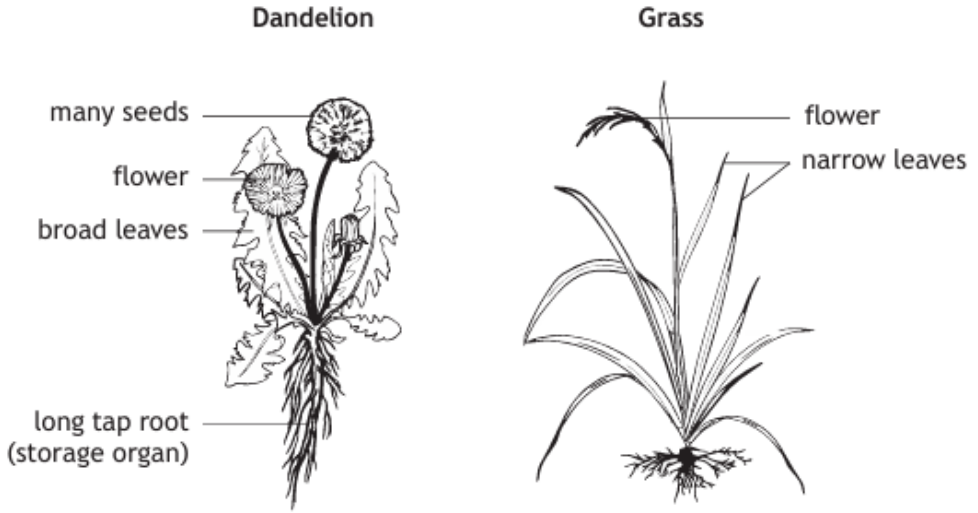
(maximum of 3 from 1 - 6)

7. Biological control introduces a predator/pathogen/parasite of the pest.

OR

Control organism may become an invasive species/parasitise/prey on/be a pathogen of other species.

8 Selective herbicides are often used in sprays to control perennial weeds such as dandelions growing in areas of grass.



4 Using information from the diagram

(i) explain why dandelions could be incorrectly identified as annual weeds. 1

Produce seeds

(ii) suggest why a selective herbicide would have a greater effect on dandelions than on grass. 1

Dandelion has broader leaves

9 Potato plants are attacked by leaf eating caterpillars. *Bacillus thuringiensis* is a bacterium which can be used to control these pests. The bacteria produce a protein (Bt toxin) which kills these caterpillars.

(a) (i) Explain how an attack by leaf eating caterpillars causes a reduction in crop yield. **2**

Less photosynthesis

Less glucose for growth of strawberries

(ii) State an advantage of using this type of biological control rather than using chemicals. **1**

Chemicals are

1. Toxic to non target species
2. Persists in environment
3. Creates resistant pest populatioons
4. Causes bioaccumulation & biomagnification

10 Explain the relationship between the total leaf area and total mass of seeds. **2**

Less photosynthesis

Less glucose for growth of seeds