**Questions are for both separate science and combined science students
unless indicated in the question**

Q1.

Frogs are animals that lay their eggs in water. The eggs hatch as tadpoles.

Students investigated the number of tadpoles in a pond for 8 weeks.

This is the method used.

1. Collect 10 dm³ of pond water in a bucket.

2. Count the number of tadpoles collected.

3. Put the tadpoles back into the pond.

4. Repeat steps 1 to 3 another three times in different parts of the pond.

5. Repeat steps 1 to 4 at intervals for 8 weeks.

(a)   Suggest **one** improvement to the method.

_____

_____

(1)

The table below shows the results.

Sample number	Number of tadpoles in each sample					
	0 weeks	1 week	2 weeks	3 weeks	5 weeks	8 weeks
1	11	17	8	9	5	0
2	15	11	12	7	0	5
3	23	16	14	10	7	3
4	11	14	16	**X**	4	4
Totals	60	58	50	32	16	12

(b)   Value **X** is the number of tadpoles in sample 4, at 3 weeks.
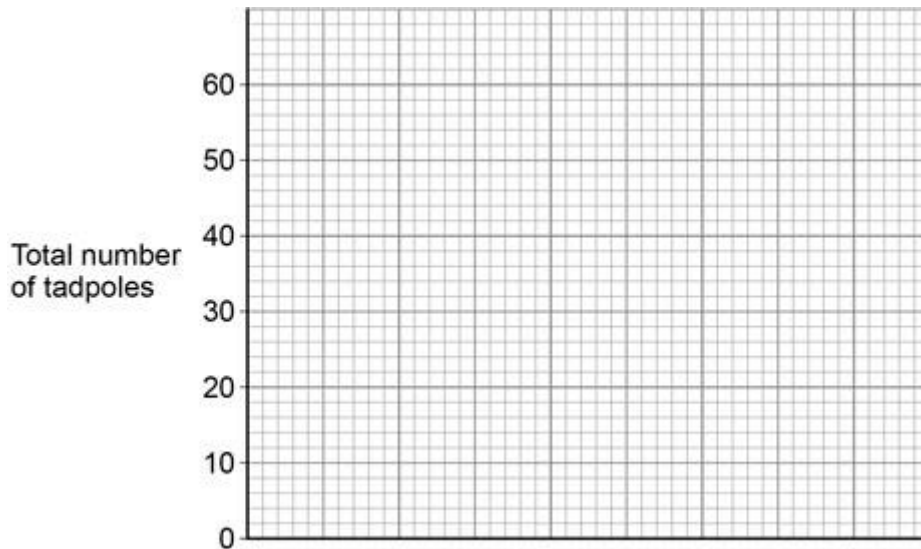
Calculate value **X**.

_____

Value **X** = _____

(1)

(c) Complete the figure below to show how the **total** number of tadpoles changed over the 8 weeks.

You should:

•   label the x-axis

•   use a suitable scale for the x-axis

•   plot the data for the **total** numbers of tadpoles from above table

•   draw a line of best fit.

(4)

(d) After 0 weeks, no more tadpoles hatched in the pond.

Calculate the percentage of the tadpoles that would still be found in the pond at 4 weeks compared with 0 weeks.

Use information from the figure above.

_____

_____

_____

_____

Percentage of tadpoles found at 4 weeks = _____ %

(3)

(e)   After 4 weeks many of the tadpoles had died.

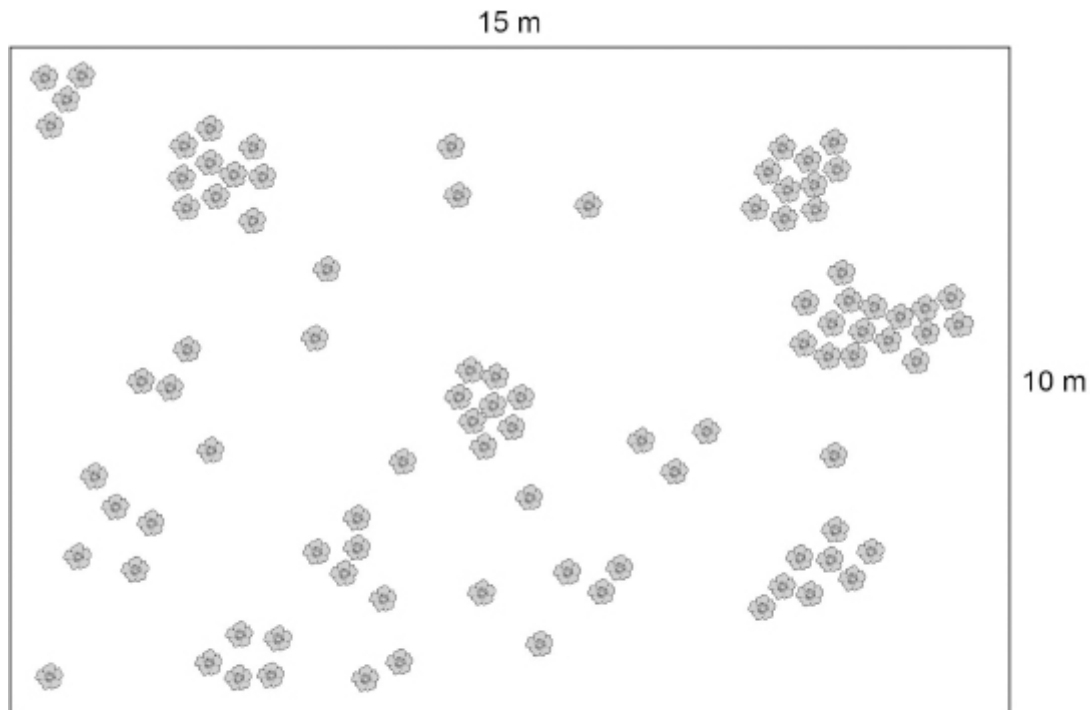Suggest **two** reasons why the tadpoles died.

1 _____

_____

2 _____

_____

(2)
(Total 11 marks)

Q2.

Students estimated the population of buttercup plants growing on a lawn.

The lawn is a rectangle measuring 15 m × 10 m.

The figure below shows the lawn.

15 m

10 m

Key

⚘ Buttercup plant

This is the method used.

1. Measure the length and width of the lawn.

2. Choose five locations to sample.

3. Place a 1 m × 1 m square frame at each location.

4. Record the number of buttercup plants in each square frame.

(a)   Complete the sentences.

Choose answers from the box.

15 cm ruler		**30 m tape measure**
balance	**quadrat**	**transect**

The length and width of the lawn should be measured

using a   _____ .

The 1 m × 1 m square frame is called a   _____ .

(2)

(b)   How should the students choose the five locations to sample?

Tick (✓) **one** box.

Choose locations at random.   ☐

Choose locations at the corners of the lawn.   ☐

Choose locations with lots of buttercup
plants.   ☐

Choose locations with no buttercup plants.   ☐

(1)

The table below shows the results.

Sample number	Number of buttercup plants
1	2
2	7
3	0
4	0
5	1

The students used their results to calculate the population of buttercup plants.

(c)   Complete the sentences.

Choose answers from the box.

area	mean	median	perimeter	volume

Multiply the length of the lawn by the width of the lawn to give the

lawn's _____.

Add up the total number of buttercup plants and divide by 5 to give

the _____.

(2)

(d)   The students calculated that the population of buttercup plants on the lawn
was 300.

How did the students use the results in the table above to calculate the
population?

_____

_____

(1)

(e)   How could the students improve the accuracy of the estimate?

Tick (✓) **one** box.

Count and record more samples.   ☐

Select locations in the middle of the lawn.   ☐

Use a square frame measuring 0.5 m × 0.5 m.   ☐

(1)

(f)   One **abiotic** factor that affects the number of buttercup plants on the lawn is soil pH.

Give **one** other **abiotic** factor that could affect the number of buttercup plants on the lawn.

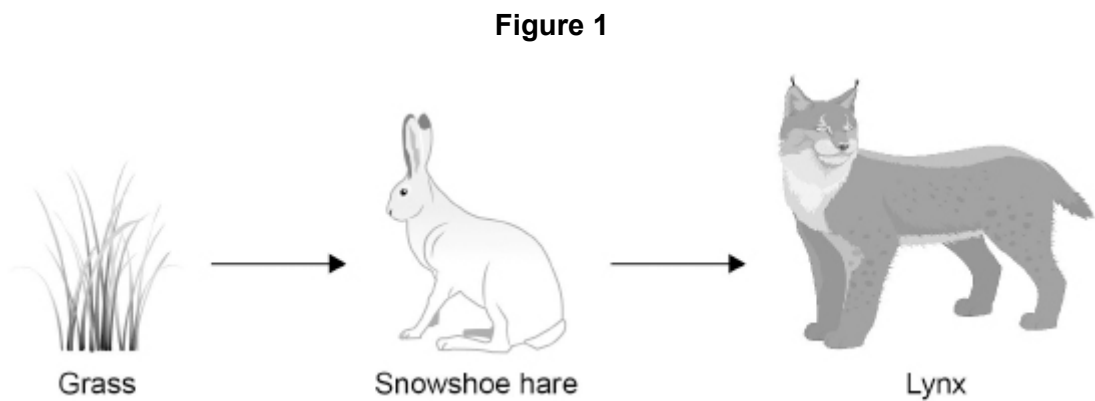Do **not** refer to soil pH in your answer.

_____

(1)
(Total 8 marks)

Q3.

Different species in a habitat may depend on each other for food.

Figure 1 shows a food chain.

Figure 1

Grass   Snowshoe hare   Lynx

(a)   The grass needs energy to grow.

What is the source of energy for the grass?

_____

(1)

(b)   The table below lists different types of feeding relationship.

Feeding relationship	Organism
Secondary consumer	Lynx
Primary consumer	
Producer	
Herbivore	
Carnivore	
Prey	
Predator	

Write the name of **one** organism from **Figure 1** in each box in the table above.

Each organism may be written in one box or in more than one box.

The first box has been completed for you.

(3)

(c)   **Figure 2** shows the appearance of the snowshoe hare in the summer and in the winter.

Figure 2

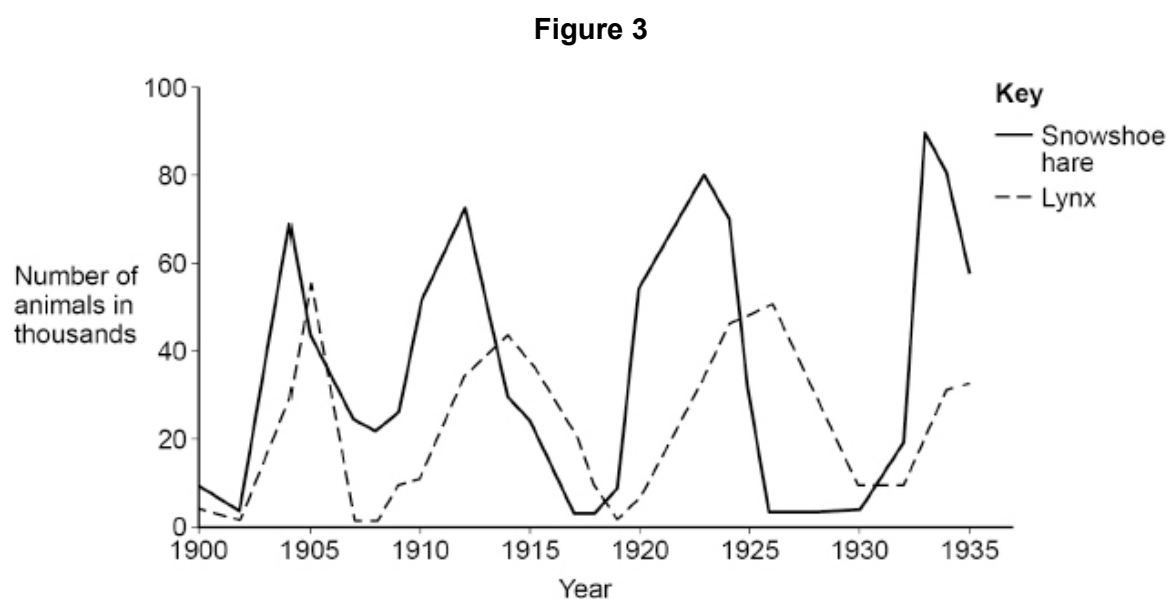Snowshoe hare in summer   Snowshoe hare in winter

The snowshoe hare has a different fur colour in the summer than in the winter.

Explain how the different fur colour increases the chance of survival of the snowshoe hare.

_____

_____

_____

_____

_____

_____

(3)

Figure 3 shows how the number of snowshoe hares and the number of lynx varied in one area between 1900 and 1935.

Figure 3

(d) **Figure 3** shows that the number of snowshoe hares and the number of lynx increase and decrease several times.

Suggest **two** reasons why the number of **snowshoe hares** increases.

1 _____

_____

2 _____

_____

(2)

(e) The number of snowshoe hares increased and decreased four times between 1900 and 1935.

What effect does an **increase** in the number of snowshoe hares have on the number of lynx?

_____

_____

(1)

(f) Suggest **one** reason why the number of lynx decreased from 1915 to 1919.

Use information from **Figure 3**.

_____

_____

(1)

(g) When the snowshoe hare eats grass, about 90% of the biomass of the grass is lost.

Give **two** ways the biomass is lost. **(biology only)**

1 _____

_____

2 _____

_____

(2)
(Total 13 marks)

Q4.

Bacteria are one type of organism that cause decay.

(a)   Which other type of organism causes decay? **(biology only)**

Tick (✓) **one** box.

Fungi

Plants

Viruses
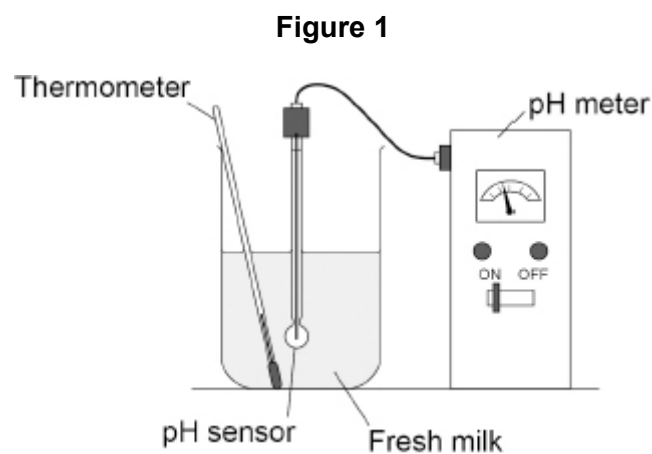
(1)

Students investigated the effect of temperature on the decay of milk.

The decay was caused by bacteria in the milk.

Figure 1 shows the apparatus used.

Figure 1

This is the method used.

1. Set up the apparatus as shown in **Figure 1** with the milk at 20 °C.

2. Record the pH each day for 7 days.

3. Repeat with more samples of milk at 5 °C and at 30 °C.

(b)   What was the dependent variable in the investigation? **(biology only)**

Tick (✓) **one** box.

The pH of the milk ☐

The type of milk ☐

The volume of the milk ☐

(1)

(c)   How could the students keep the milk at 30 °C for 7 days? **(biology only)**

Tick (✓) **one** box.

Put a lid on the beaker. ☐

Put the beaker in a water bath. ☐

Stir the milk continuously. ☐

Wrap cloth around the beaker. ☐

(1)

(d)   As the milk decays, the bacteria digest fats in the milk.

What type of acid is produced by digestion of fats in the milk?

Tick (✓) **one** box.
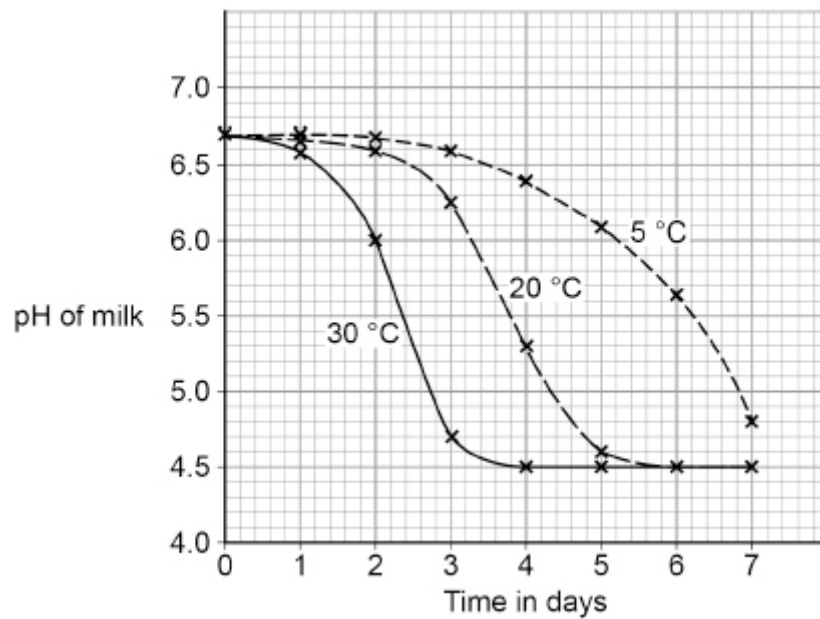
Amino acid ☐

Fatty acid ☐

Hydrochloric acid ☐

(1)

Figure 2 shows the results.

Figure 2

(e)   Why did the pH **not** fall below pH 4.5 at 20 °C?

Tick (✓) **one** box.

All the fat had been digested.   ☐

The reaction was too fast.   ☐

The temperature was too low.   ☐

(1)

The digestion of fat was fastest at 30 °C and slowest at 5 °C.

(f)   Give **one** reason why the rate of digestion was faster at 30 °C than at 5 °C.

_____

_____

(1)

(g)   Calculate the rate of digestion at 30 °C from day 2 to day 3.

Complete the following calculation.

Use data from **Figure 2**.

At 30 °C, the pH at day 2 = _____

At 30 °C, the pH at day 3 = _____

Therefore the fall in pH at 30 °C from day 2 to day 3 = _____ pH
units/day

(2)

(h)   The rate of digestion at 5°C from day 2 to day 3 is 0.1 pH units/day.

How many times faster is the rate of digestion at 30°C than the rate of
digestion at 5°C from day 2 to day 3?

Use your answer to part (g).

_____

_____

_____

Rate at 30 °C is _____ times faster

(2)
(Total 10 marks)

Q5.

Earthworms:

*   live in soil

*   feed on dead and decaying plant matter

*   have soft, moist skin

*   exchange gases through their skin.

(a)   Give **two** abiotic factors and **two** biotic factors that could affect the size of an earthworm population.

Abiotic factors

1 _____

_____

2 _____

_____

Biotic factors

1 _____

_____

2 _____

(4)

(b)   Students investigated the populations of earthworms in the soil in two different areas:

- Area **A**: a grass lawn
- Area **B**: a farmer's field.

Chemical **X** can be mixed with water and poured onto the soil.

The mixture brings earthworms to the surface of the soil but does **not** harm the earthworms.

Plan an investigation using chemical **X** to compare the number of earthworms per m^2 in areas **A** and **B**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 10 marks)