Q1. Human activities affect the environment.

(a) Deforestation results in an increase in carbon dioxide levels in the atmosphere.

Give **two** reasons why.

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(2)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A dairy farmer washes out his cow shed each day. The waste water contains urine and faeces. The waste water overflows into a stream by mistake.

The waste water will have an effect on the plants and invertebrates living in the stream.

Explain why.

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(6)
(Total 8 marks)

Q2. Some scientists set up a biogas generator.

The table shows how the rate of biogas production and the composition of the biogas changed over the first 30 days.

Time in days	Rate of biogas production in cm^3 per hour	Composition of the biogas	
		Percentage of methane	Percentage of carbon dioxide
1	110	27	56
5	90	20	78
10	50	30	68
15	170	68	30
20	115	72	26
25	110	71	27
30	105	70	28

(a) (i) Name the process that produces the methane in biogas.

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(1)

(ii) For the first 10 days, the gas released from the generator contained a high concentration of carbon dioxide. This was because there was air in the generator when it was first set up.

Explain why the presence of air results in a high concentration of carbon dioxide in the biogas.

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(3)

(b) The scientists concluded that it would not be profitable to collect biogas from the generator until after about 20 days.

Use the data to explain why.

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(1)

(c) The rate of biogas production slowed down towards the end of the investigation.

Suggest **one** reason why.

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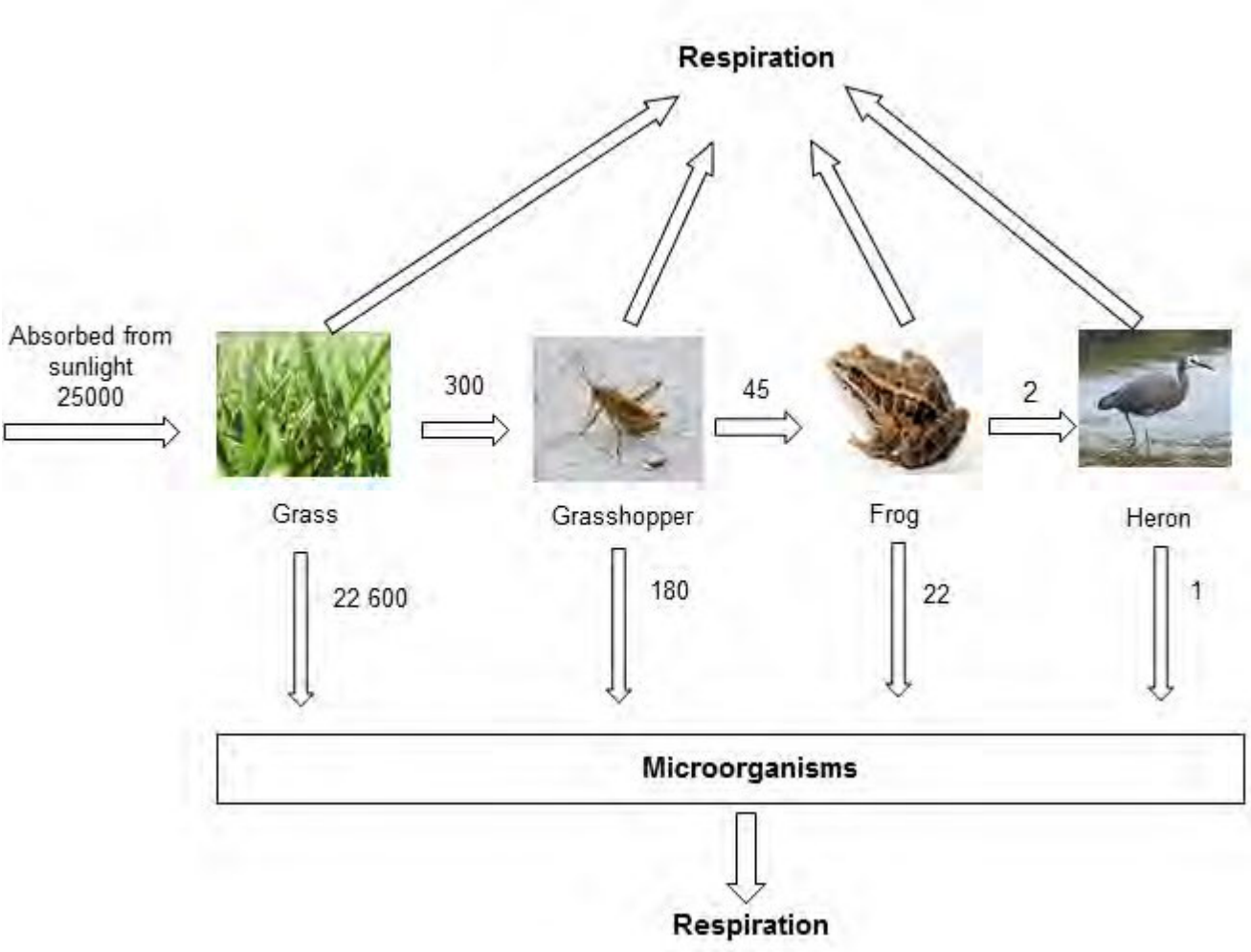
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(1)

(Total 6 marks)

Q3. The diagram shows the annual energy flow through 1 m^2 of a habitat.

The unit, in each case, is kJ per m^2 per year.



(a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog.

Show clearly how you work out your answer.

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Answer ..... %

(2)

(b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings.

In what form is this energy lost?

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(1)

(c) Food chains are usually **not** more than five organisms long.

Explain why.

To gain full marks you must use data from the diagram.

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(2)

(d) In this habitat microorganisms help to recycle materials.

Explain how.

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(3)
(Total 8 marks)

Grass by By Catarina Carvalho from Lisboa, Portugal (Flickr) [CC-BY-2.0], via Wikimedia Commons. Grasshopper by I, Daniel Schwen [GFDL, CC-BY-SA-3.0], via Wikimedia Commons. Frog by Brian Gratwicke (Pickerel Frog) [CC-BY-2.0], via Wikimedia Commons. Heron by Glen Fergus (Own work, Otago Peninsula, New Zealand) [CC-BY-SA-2.5], via W kimedia Commons.

Q4. The photographs show four different species of bird.

Great tit



© JensGade/iStock

Blue tit



© Marcobarone/iStock

Coal tit



© MikeLane45/iStock

Long-tailed tit



© Andrew Howe/iStock

The table gives information about the four species of bird in winter.

Bird species	Mean body mass in grams	Mean energy needed in kJ per day	Mean percentage of day spent feeding
Great tit	21	84.2	75
Blue tit	12	62.4	81
Coal tit	9	49.5	88
Lond-tailed tit	7	42.0	92

(a) (i) Calculate the energy needed per day per gram of body mass for the blue tit.

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Answer = ... kJ per day per gram of body mass

(2)

(ii) Describe the trend for energy needed per day per gram of body mass for the four species of bird.

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(1)

(iii) Suggest an explanation for the trend you have described in part (a)(ii).

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(2)

(b) Describe and explain the trend shown by the data for the time spent feeding in winter for the birds.

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(2)

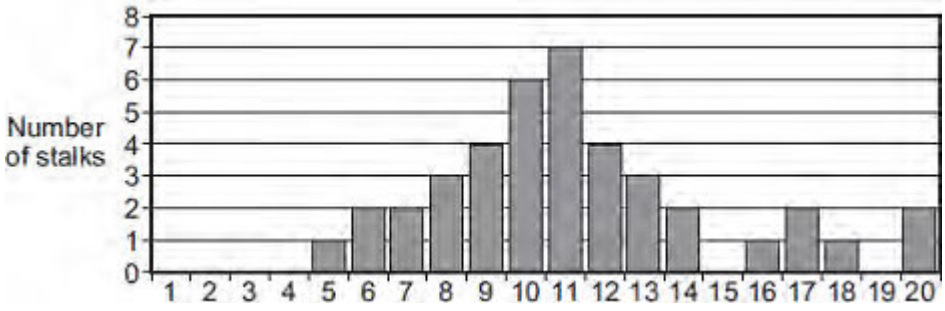
(Total 7 marks)

Q5. Some students studied bluebell plants growing in two different habitats.

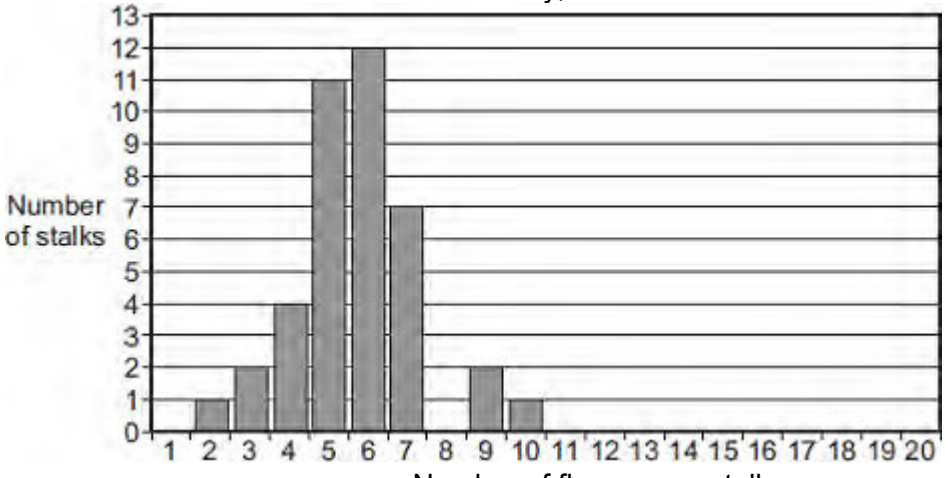
Habitat **A** was a sunny field next to woodland.
Habitat **B** was a shady, moist woodland.

A bluebell plant can have several flowers on one flower stalk. The students counted the number of flowers on each of 40 bluebell flower stalks growing in each habitat.
The bar charts show the results.

Habitat A: Sunny field next to woodland



Habitat B: Shady, moist woodland



(a) The students wanted to collect valid data.
Describe how the students should have sampled the bluebell plants at each habitat to collect valid data.

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(2)

(b) (i) The students used the bar charts to find the mode for the number of flowers per stalk in the two habitats.

The mode for the number of flowers per stalk in habitat **A** was 11.

What was the mode for the number of flowers per stalk in habitat **B**?

Mode = ...

(1)

(ii) The students suggested the following hypothesis:

'The difference in the modes is due to the plants receiving different amounts of sunlight.'

Suggest why.

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(2)

(iii) Suggest how the students could test their hypothesis for the two habitats.

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(2)

(c) Suggest how receiving more sunlight could result in the plants producing more flowers per stalk.

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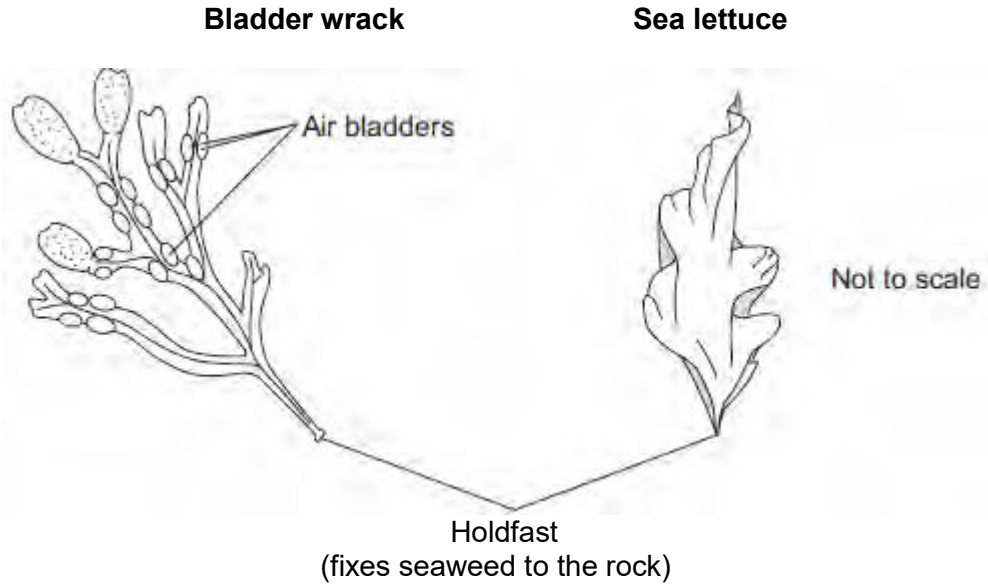
(2)
(Total 9 marks)

Q6. At the seashore, the tide comes in and goes out twice each day.

Some students investigated whether two different species of seaweed could live only at certain positions on a rocky shore.
Seaweeds are plant-like organisms that make their food by photosynthesis.

Figure 1 shows the two species of seaweed that the students investigated.

Figure 1



(a) The students:

1 placed a 50-metre tape measure on the rocks at right angles to the sea

2 placed a quadrat next to the tape measure

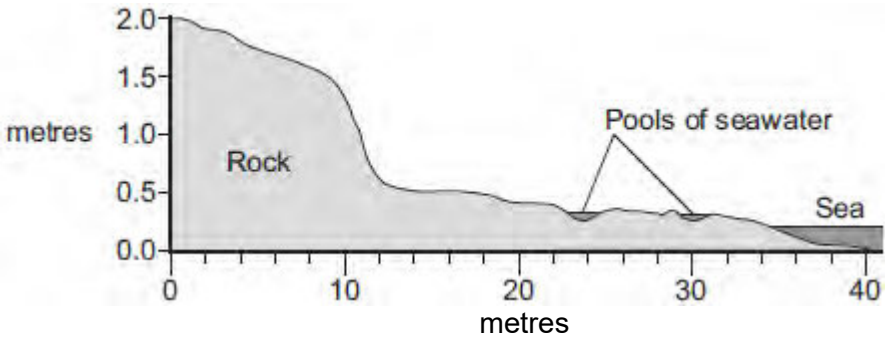
3 recorded whether each species was present or not.

The students repeated steps 2 and 3 every metre down the shore.

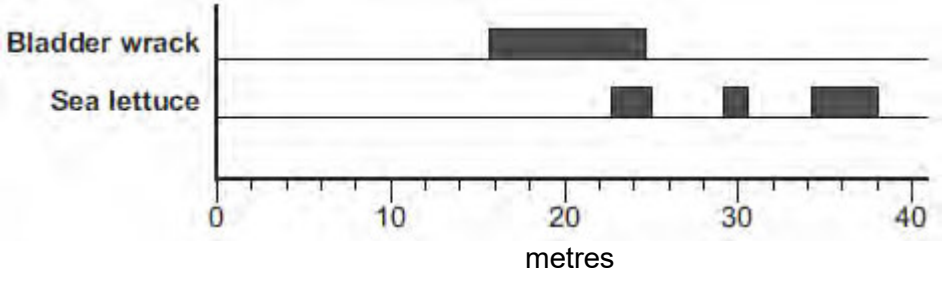
Figure 2 shows a section of the seashore and the students' results.

Figure 2

Section of the seashore



Students' results



(i) The students placed the quadrat at regular intervals along a transect line rather than placing the quadrat at random positions anywhere on the rocky shore.

Explain why.

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(2)

(ii) How could the students have improved their investigation to ensure that they produced valid data?

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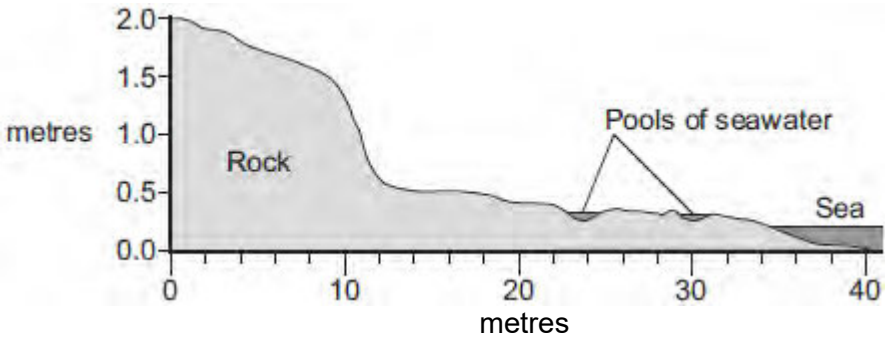
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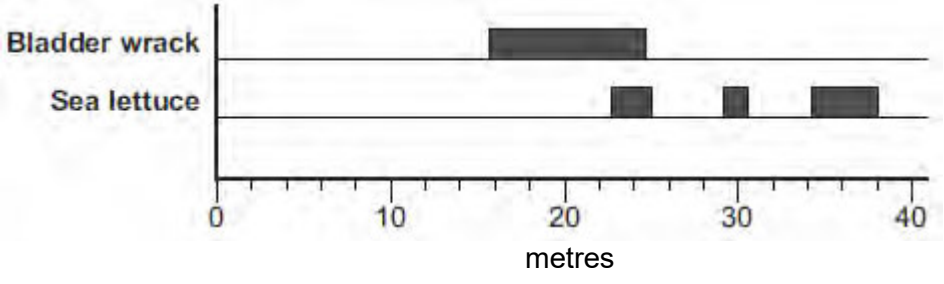
(iii) **Figure 2** is repeated here to help you answer this question.

Figure 2

Section of the seashore



Students' results



The students concluded that bladder wrack is better adapted than sea lettuce to survive in dry conditions.

What is the evidence for this conclusion?

Use information from **Figure 2**.

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(2)

(b) The bladder wrack has many air bladders.
The air bladders help the bladder wrack to float upwards when the sea covers it.

Suggest how this helps the bladder wrack to survive.

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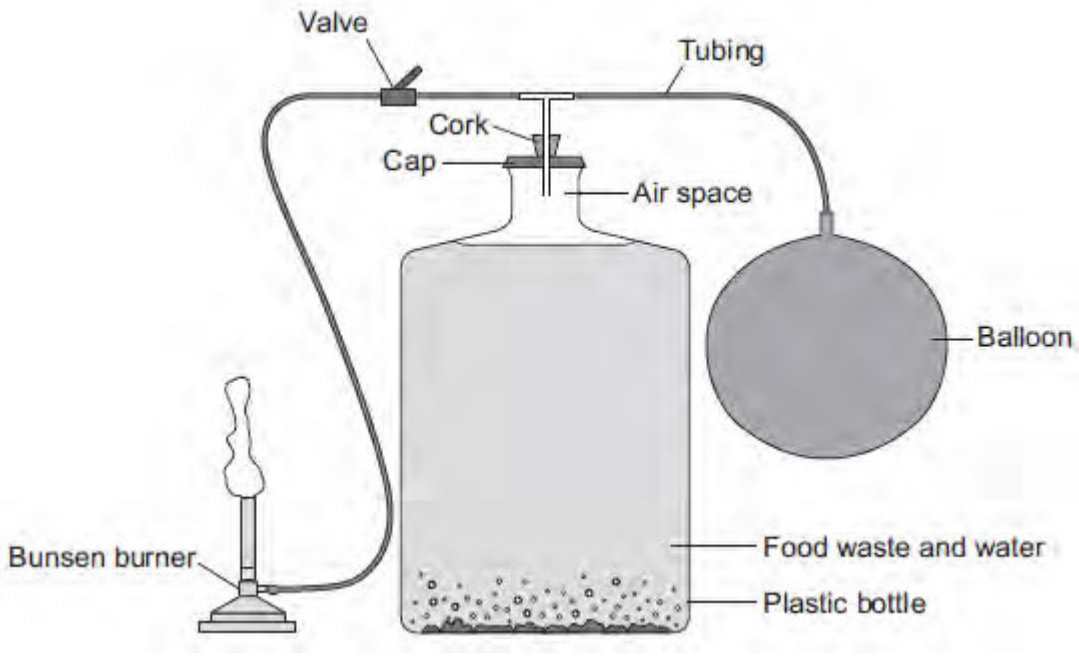
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(2)
(Total 8 marks)

Q7. The image below shows a model biogas generator.



Students used the model biogas generator to investigate which type of food waste produces the greatest yield of biogas.

Gas collects in the balloon. The gas is then released through the valve and is burned at the Bunsen burner.

The students:

- put 500 g of potato peelings in the plastic bottle with some water and sealed the apparatus
- released the gas from the balloon after day two and timed how long the gas burned for
- released the gas that had collected in the balloon from day two to day four and timed how long the gas burned for
- repeated the investigation using 500 g of cooked rice, then 500 g of cabbage leaves and then 500 g of cooked pasta.

(a) **Table 1** shows the students' results.

Table 1

Type of food waste	Length of time the gas burned in seconds	
	After day two	From day two to day four
Potato peelings	0	175
Cooked rice	0	100
Cabbage leaves	0	150
Cooked pasta	0	160

(i) Suggest why the gas collected in the balloon and released after day two did not burn.

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(3)

(ii) Suggest why potato peelings produced the most biogas.

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(1)

(b) Scientists investigated the production of biogas from different types of animal manure.

Table 2 shows the scientists' results.

Table 2

Type of mannure	Volume of biogas produced in m^3 per kg of manure	Methane in the biogas as % of total volume
Cow	0.34	65
Pig	0.58	68
Hen	0.62	60
Horse	0.30	66
Sheep	0.61	67

(i) Calculate the volume of methane produced from 1 kg of cow manure.

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Volume of methane = ... m^3

(2)

(ii) One scientist concluded that it would be better to use sheep manure in a biogas generator than to use cow manure.

What is the evidence for this conclusion?

Use information from **Table 2** in your answer.

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(2)

(Total 8 marks)

Q8. On a rocky shore, when the tide goes in and out, organisms are exposed to the air for different amounts of time.

(a) On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

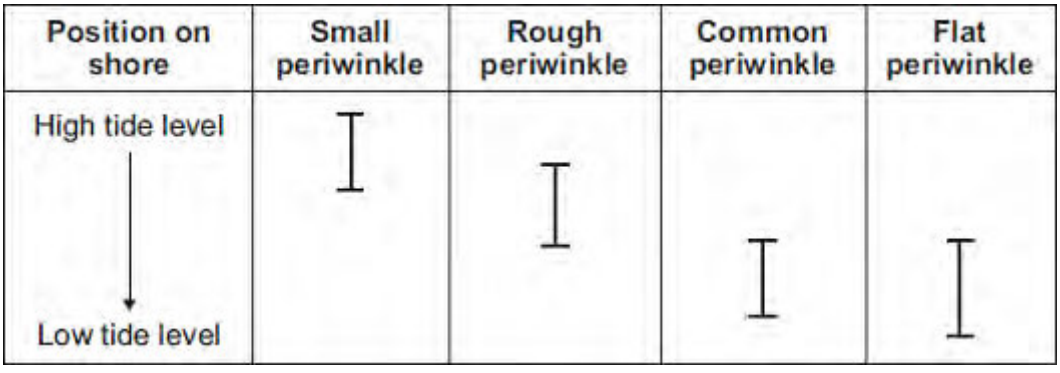
What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

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(1)

(b) Periwinkles are types of snail.
Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students' survey.
The highest position that the sea water reaches on the shore is called the high tide level.
Each bar represents the range of habitats for each type of periwinkle.



(i) Which **two** types of periwinkle are likely to compete with each other to the greatest extent?

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(1)

(ii) Explain your answer to part (b)(i).

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(1)

(iii) The small periwinkle can survive much nearer to the high tide level than the

flat periwinkle.

Suggest **two** reasons why the flat periwinkle cannot survive near to the high tide level.

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(2)
(Total 5 marks)