

# Ecosystems

## Question Paper 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Genetics, evolution and ecosystems
Topic	Ecosystems
Booklet	Question Paper 1

**Time allowed:** 76 minutes

**Score:** /56

**Percentage:** /100

### Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

## Question 1

A scientist was investigating the effect of two different temperatures on the rate of enzyme controlled decomposition of ammonia, in soil bacteria.

They repeated their experiment ten times for each of the two different temperatures.

Which of the following, **A** to **D**, should they use to determine if there was a significant difference between these two sets of times?

- A. standard deviation
- A. Student's t-test
- A. chi squared test
- A. Spearman's rank correlation coefficient

**[Total: 1]**

## Question 2

Which of the following statements about ecosystems is **not** true?

- A. An ecosystem is affected by biotic and abiotic factors.
- B. An ecosystem is all of the organisms and habitats in a large area.
- C. An ecosystem is dynamic.
- D. There is a flow of biomass between trophic levels in an ecosystem.

**[Total: 1]**

### Question 3

Deep sea vents on the ocean floor are surrounded by unusual organisms such as chemosynthetic bacteria and eyeless shrimp.

Which of the following statement(s) about these ecosystems is/are true?

**Statement 1:** The temperature of the vents influences the organisms that live there.

**Statement 2:** A predatory octopus would affect the balance of these organisms.

**Statement 3:** The number of eyeless shrimp found at each vent is constant.

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

[1]

## Question 4

The first stage of primary succession is the pioneer community.

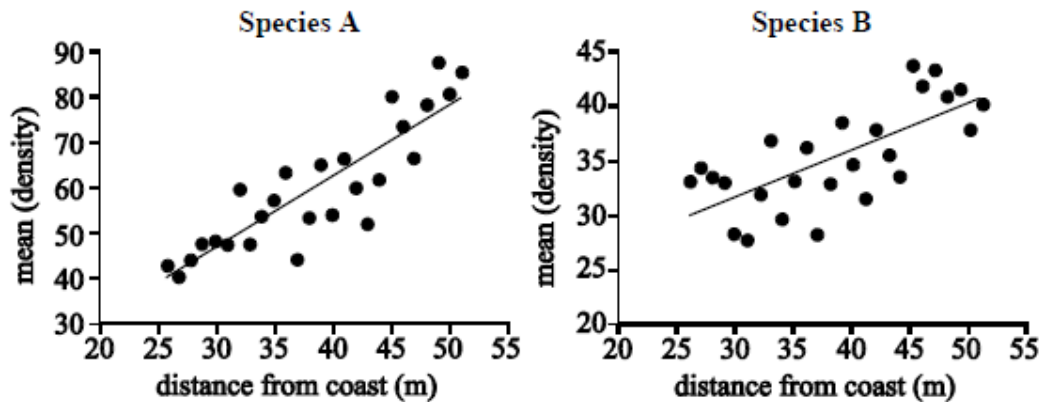
Which of the following statements about a pioneer community are correct?

- 1 species produce large numbers of wind-carried seeds or spores
  - 2 biomass is low
  - 3 many species are lichens and mosses
- A. 1, 2 and 3
- B. Only 1 and 2
- C. Only 2 and 3
- D. Only 1

[1]

## Question 5

The graphs below show the density of two different plant species as proximity to the coast changes.



Which of the following statements correctly describes one aspect of the technique used to collect these data?

- A Quadrats were randomly placed using a random number generator and coordinates.
- B Larger quadrats were required for species A because their mean density was higher.
- C A belt transect has been used to allow calculation of density.
- D Abiotic factors were measured at every point of quadrat sampling.

[1]

## Question 6

Describe the differences between the following biological terms:

(a) a pioneer community and a climax community [2]

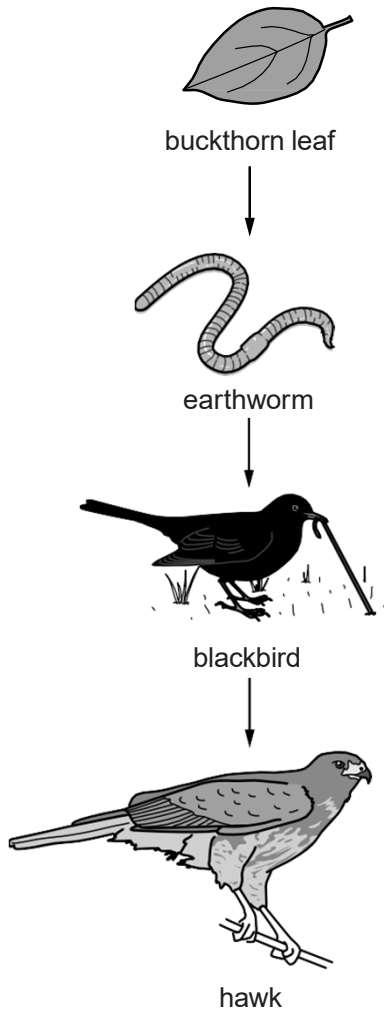
(b) decomposition and denitrification [2]

(c) conservation and preservation [2]

(d) nitrogen fixation and nitrification. [2]

[Total: 8]

Earthworms are abundant in fertile soil where they play an important role in the transfer of energy in the ecosystem. An example of a food chain involving earthworms is shown in Fig. 8.1.



**Fig. 8.1**

(a) Define the following terms:

[3]

*producer*

*consumer*

*trophic level*



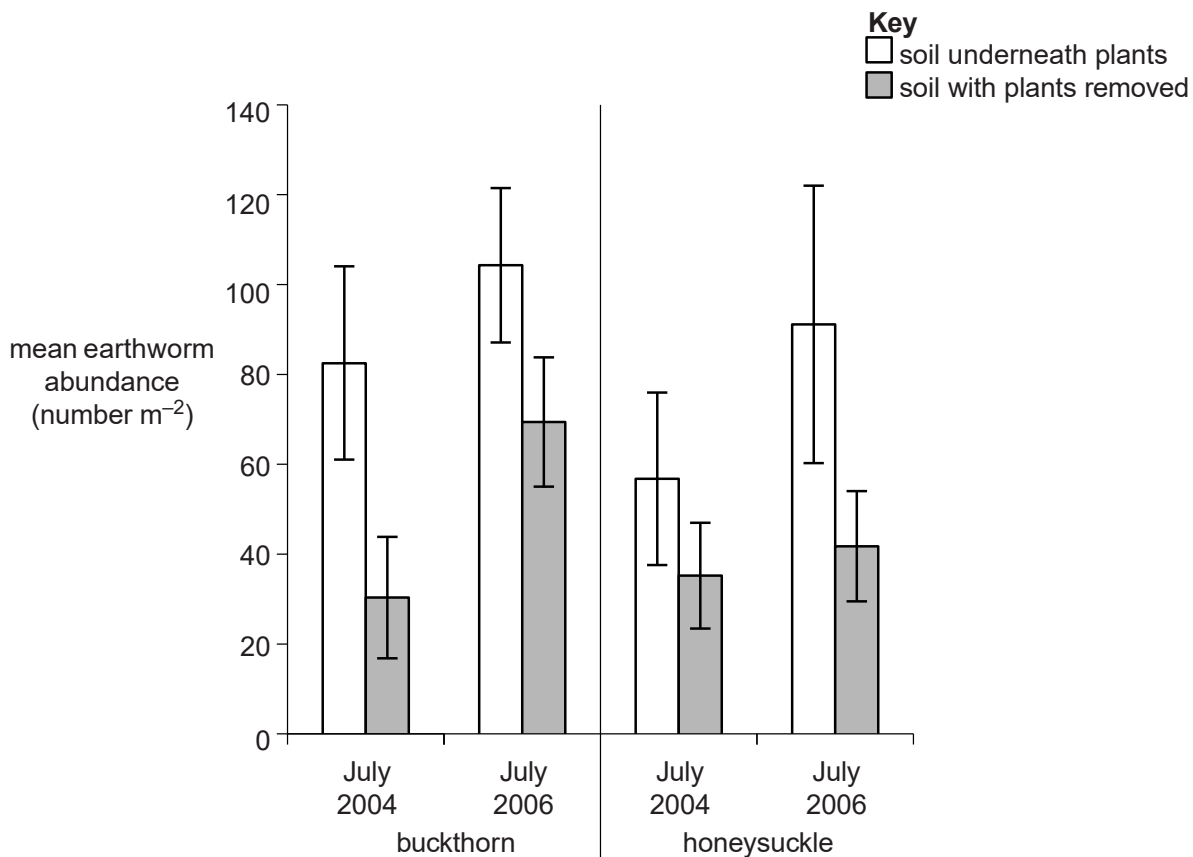
(b) One way of measuring the abundance of earthworms is as follows:

- place quadrat frames of known area onto the ground
- pour a chemical solution onto the soil to cause the earthworms to come up to the surface
- wait and then count the earthworms.

Researchers used this technique in 2004 and 2006 to compare the abundance of earthworms in four areas of soil:

- soil underneath buckthorn plants
- soil underneath honeysuckle plants
- bare soil after the removal of buckthorn plants
- bare soil after the removal of honeysuckle plants.

The results are shown in Fig. 8.2.



**Fig. 8.2**

- (i) Suggest **two** variables which the researchers should have controlled in order to make the results comparable.

[2]

- (ii) Evaluate, with reference to the error bars in Fig. 8.2, whether the data show a valid difference in the abundance of earthworms between the 'soil underneath honeysuckle' and 'soil with honeysuckle removed' sites for July 2004.

[2]

- (iii) Ecosystems can be described as dynamic.

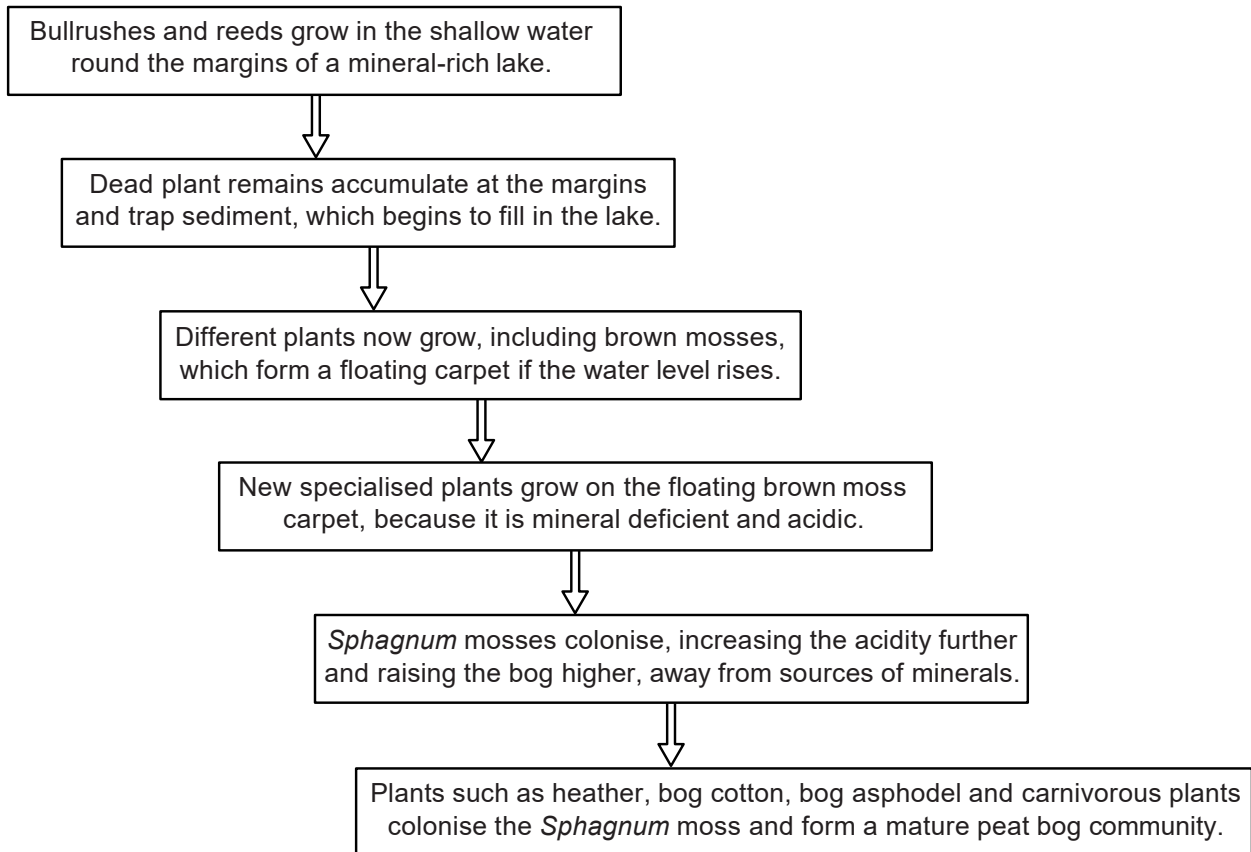
State **two** pieces of evidence from Fig. 8.2 that show that the ecosystem is dynamic.

[2]

[Total: 9]

Peat bogs are large areas of waterlogged land that support a specialised community of plants. Peat bogs take thousands of years to form.

Fig. 5.1 lists the main stages in the formation of a peat bog.



**Fig. 5.1**

(a) (i) Name the process summarised in Fig. 5.1 that changes a lake community into a peat bog community.

[1]

(ii) Using Fig. 5.1, list **two abiotic** factors that play a role in determining what species of plant can grow in an area.

[2]

(b) Most of the minerals in a peat bog are held within the living plants at all times, **not** in the soil.

- Plants like bog cotton and bog asphodel recycle the minerals they contain.
- The leaves of these plants turn orange as the chlorophyll within them is broken down.
- Minerals such as magnesium ions are transported from the leaves to the plants' roots for storage.

Describe **one** similarity and **two** differences in mineral recycling in a peat bog and in a **deciduous forest**. **[3]**

similarity

differences

(c) In Ireland in 2002, two well-preserved Iron Age human bodies were found in peat bogs. Despite having been dead for over two thousand years, the bodies had not decomposed. They still had skin, hair and muscle.

Suggest why these bodies had not decomposed. **[2]**

(d) Suggest **two** reasons why the large scale removal of peat from bogs for use in gardens is discouraged by conservation groups.

**[2]**

**[Total: 10]**

## Question 9

A small, permanent pond is the habitat for a climax community of producers (aquatic plants and algae) and consumers (bacteria, protocista, worms, snails, arthropods and small vertebrates like newts and fish).

(a) Why might ecologists call this a 'climax community'? [1]

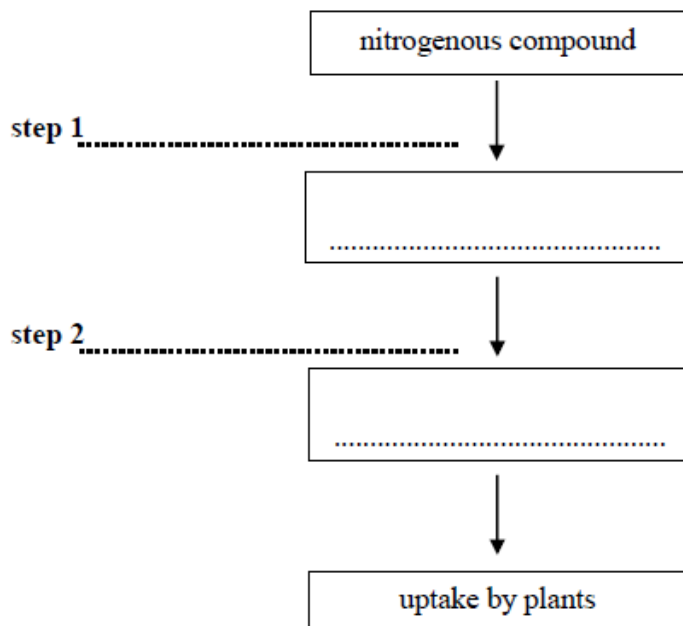
(b) The protocist *Paramecium caudatum* is usually between 200 and 300  $\mu\text{m}$  in length. An accurate measurement would help in the correct identification of a specimen from this pond.

What laboratory equipment would you select to make an accurate measurement of the length of *Paramecium caudatum*? [2]

(c) An animal fell into the pond. It drowned and decayed. Within a year the biological compounds in its body had been completely recycled.

(i) What nitrogenous excretory molecule from the decomposers would pass to the next stage of the nitrogen cycle? [1]

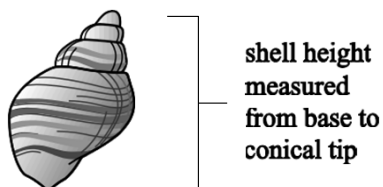
(ii) Complete the flow chart to show what happens to this nitrogenous compound, and name the groups of bacteria involved at steps 1 and 2, as it is converted to a form that plants can take up and use. [4]



[Total: 8]

## Question 10

The effect of wave action on the height of the shells of the dog whelk (*Nucella lapillus*) was investigated by comparing an exposed shore and a sheltered shore.



- A random sampling technique was used to collect 50 shells from an exposed shore.
- The shell height was measured from the base to the conical tip. The whelk was returned to its location.
- The process was repeated for the sheltered shore.
- All the results were recorded in **Table 3.1**.

Location	Height of shell (mm)										Range	Mean	SD
Sheltered shore	26	28	27	26	28	23	28	23	26	28	16	31.3	4.1
	29	29	29	29	29	28	29	29	29	29			
	30	31	30	29	32	29	30	29	30	32			
	33	35	34	32	35	32	34	32	33	35			
	37	39	38	37	39	35	38	36	37	39			
Exposed shore	15	17	16	15	23	15	23	16	13	15	15	20.0	4.2
	17	24	18	17	17	14	17	18	16	17			
	19	19	20	24	18	20	19	20	18	20			
	23	14	24	14	21	20	23	17	21	23			
	25	25	28	26	25	27	25	28	25	27			

**Table 3.1**

(a) The  $t$  test can be used to determine the significance of the differences between shell height on the exposed shore and the sheltered shore.

(i) Calculate the  $t$  value for the data using the formula:

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

where,

$|\bar{x}_1 - \bar{x}_2|$  is the difference in mean values of sample 1 and sample 2

$s_1^2$  and  $s_2^2$  are the squares of the standard deviations of the samples

$n_1$  and  $n_2$  are the sample sizes.

Give your answer to **two** decimal places.

[2]

- (ii) The null hypothesis is that there is no difference between the means of the two shell populations.

The critical values at 98 degrees of freedom are shown in **Table 3.2**.

Degrees of freedom	$p = 0.10$	$p = 0.05$	$p = 0.01$	$p = 0.001$
98	1.67	2.00	2.64	3.41

**Table 3.2**

Using the table of critical values, explain whether the student would be able to accept or reject the null hypothesis as a result of the  $t$  value you calculated in part (i).

[1]

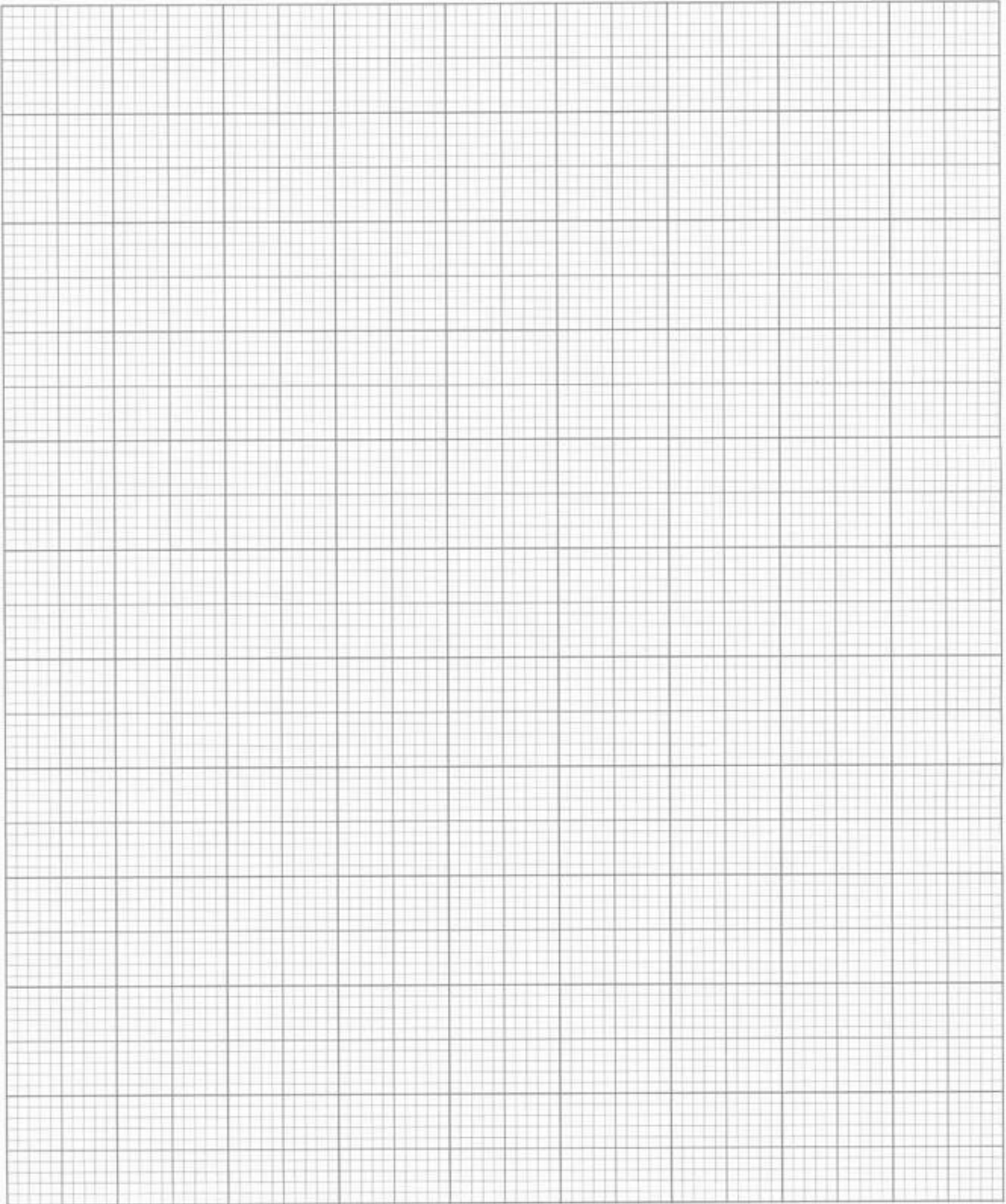
- (b) The students organised the data from **Table 3.1** into classes.

The organised data is shown in **Table 3.3**.

Sheltered shore			Exposed shore		
Height (mm)	Tally	Total	Height (mm)	Tally	Total
23–26	III	5	11–14	III	4
27–30	III III III III II	22	15–18	III II	7
31–34	III III I	11	19–22	III III II	12
35–38	III III	9	23–26	III III II	12
39–42	III	3	27–30	III	4

**Table 3.3**

Plot the most suitable graph of the data given in **Table 3.3**.



[4]



- (c) Use the data and graph to discuss any correlation between the height of the whelk shell and the type of shore.

Suggest explanations for your findings. [3]

- (d) Suggest a limitation of the procedure used to gather the data in this experiment and recommend how you could improve this. [2]

- (e) How could the students improve the accuracy of their data? [1]

- (f) Discuss the validity of the conclusions you have made during this experiment. [3]

**[Total: 16]**