Ecosystems (6.3.1): OCR A Level Biology Exam Questions by Topic

19 questions · 42 marks · about 50 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2018 · Q5(c)(i) · 1 mark

(c) Habitat B was situated beside a lake and showed evidence of ecological succession.

The scientist planned to investigate how the biodiversity changed from the edge of the lake to the other side of habitat B.

(i) State the collective name of the animal and plant populations that are present at the end of primary succession.

..... **[1]**

Question 2 · A level Paper 3 · June 2017 · Q4(a) · 4 marks

4 Nitrogen cycling within ecosystems is controlled by various bacterial species. The table below lists four groups of bacterium that are involved in the nitrogen cycle.

(a) Complete the table to show the locations of each type of bacterium in the cycle and the reactions they perform.

Type of bacteria	Location	Reactant(s)	Product	Oxidation or reduction of nitrogen?
Rhizobium		N_2 and H^+ ions	NH_3	reduction
Nitrosomonas	soil			oxidation
Nitrobacter	soil		NO_3^-	
Denitrifiying bacteria		NO_3^-		

[4]

Questions, mark schemes and examiners' report extracts © OCR.

Question 3 · A level Paper 2 · June 2023 · Q21(a) · 6 marks

21 The element nitrogen is recycled within ecosystems.

(a) Complete the sentences using the most appropriate terms.

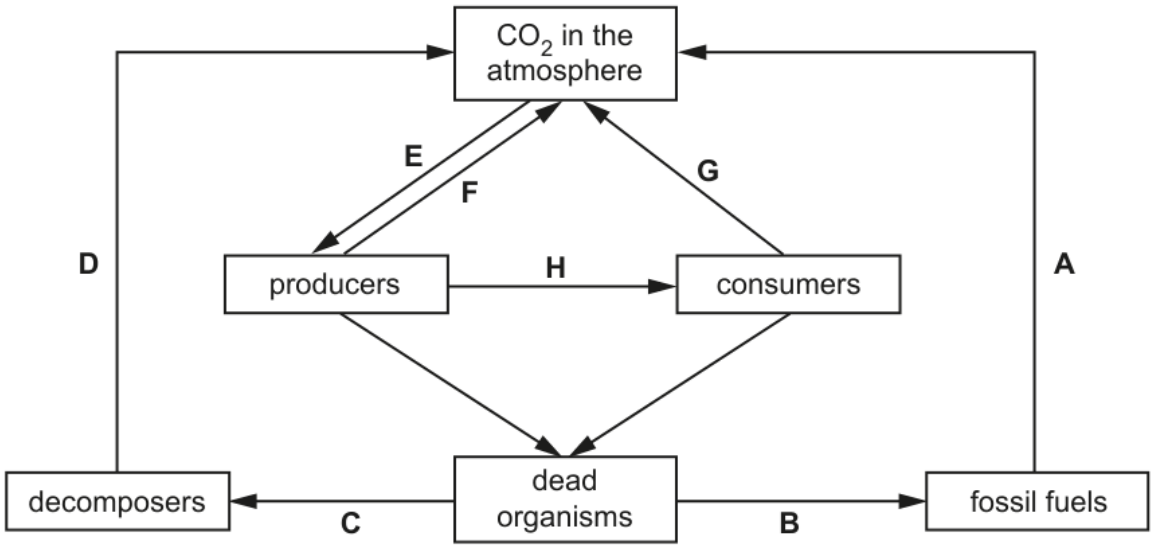
When animals die microorganisms convert nitrogen-containing molecules in the animals' bodies to ammonia in a process known as ..... . This ammonia is converted into nitrites and nitrates by ..... bacteria. The bacterium ..... converts ammonia to nitrites and the bacterium ..... converts nitrites to nitrates. Nitrates can be absorbed by plants and converted to ..... . Nitrogen gas is very unreactive but it can enter the nitrogen cycle by being converted to ammonia by ..... bacteria such as *Rhizobium*.

[6]

Question 4 · A level Paper 2 · November 2020 · Q20(a)(i) · 2 marks

20 Carbon and nitrogen are elements that are recycled.

The flow chart shows the carbon cycle.



(a) (i) Identify the processes occurring at **A** and **F**.

A ..... **F** ..... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 5 · A level Paper 2 · June 2024 · Q20(b)(iii) · 1 mark

(iii) Suggest what was present in the area that is now occupied by mixed woodland before the pioneer community arrived.

.....

..... **[1]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 6 · information from earlier in the question

21 Algae are photosynthetic organisms that live in water.

(a) A rapid increase in the population of algae is known as an algal bloom.

Scientists studied the population of algae in a river in the UK at different times of year. Their results are shown in Fig. 21.1.

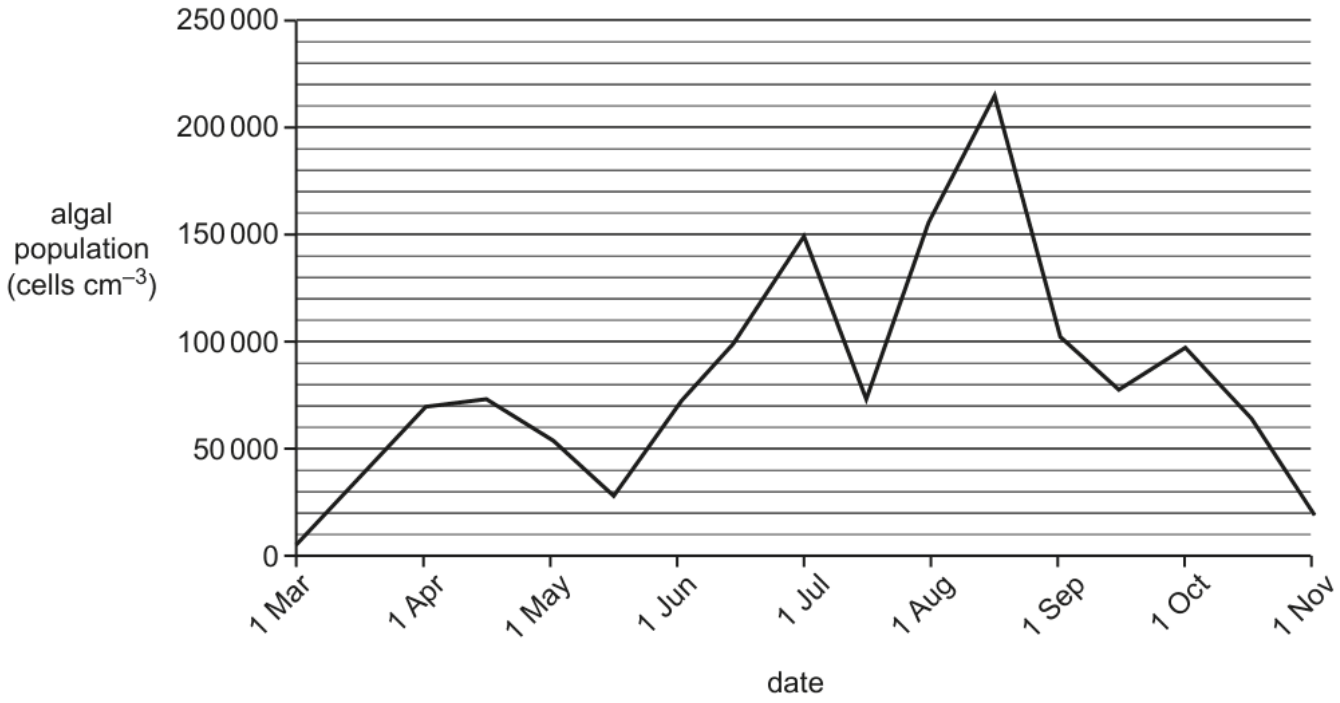


Fig. 21.1

(i) Calculate the percentage decrease in the population of algae between the peak population and 1 November.

percentage decrease = ... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 6 · A level Paper 2 · November 2020 · Q21(a)(ii) · 2 marks

(ii) The river in which the study was conducted is described as a dynamic ecosystem.

Use Fig. 21.1 to explain why this ecosystem could be described as dynamic.

.....

.....

.....

.....

..... **[2]**

Question 7 · A level Paper 2 · June 2023 · Q21(b) · 2 marks

(b) Use your knowledge of the nitrogen cycle to suggest **and** explain why plants do not grow well in soil with a low oxygen content.

.....

.....

.....

.....

..... **[2]**

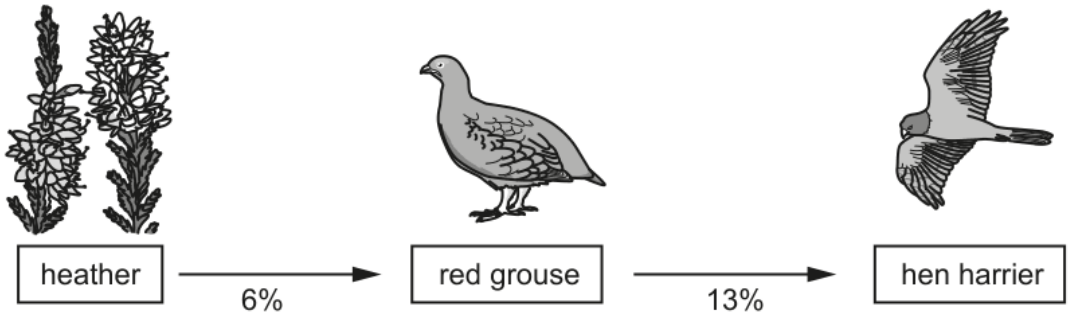
Questions, mark schemes and examiners' report extracts © OCR.

Question 8 · A level Paper 2 · November 2021 · Q17(a)(i) · 2 marks

17 Heather is a plant with a woody stem that grows on upland areas of the UK such as the North York Moors. These areas are often described as heather moorland.

Heather moorland is a habitat that is relatively common in the UK but rare elsewhere in the world.

The diagram shows an example of biomass transfer in a heather moorland ecosystem.



The numbers below the arrows represent the percentage of biomass transferred to the species shown in the next trophic level.

(a) Sunlight that can potentially be used in photosynthesis by green plants such as heather is called photosynthetically active radiation (PAR).

(i) In one year, 8.94×10^9 kJ m^{-2} of PAR fell on an area of heather moorland.

The heather plants then converted 9.08×10^7 kJ m^{-2} of this energy into biomass.

Calculate the energy in the PAR that the heather did **not** convert into biomass.

Energy = ... kJ m^{-2} **[2]**

Question 9 · A level Paper 2 · November 2021 · Q17(a)(ii) · 1 mark

(ii) Scientists were able to estimate the increase in biomass in heather plants in one year.

Suggest how the increase in biomass over time in a plant such as heather could be determined experimentally.

.....

.....

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 10 · A level Paper 2 · November 2021 · Q17(a)(iv) · 2 marks

(iv) Suggest and explain why the percentage of biomass transferred between heather and grouse is smaller than the percentage of biomass transferred between grouse and hen harrier.

.....

.....

.....

.....

..... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 11 · A level Paper 2 · November 2021 · Q17(d) · 6 marks

(d)* In a newly-available area of land, the communities change over time. The process of change is known as succession.

Outline the process of primary succession **and** explain why heather moorland is an example of deflected succession.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

15

Additional answer space if required.

.....

.....

.....

.....

.....

Questions, mark schemes and examiners' report extracts © OCR.

Turn over

Question 12 · A level Paper 2 · June 2017 · Q16(a)(i) · 2 marks

SECTION B

Answer **all** the questions.

16 The Madidi National Park, in the South American rainforest, is home to a wide variety of species. The largest predator in the area is the jaguar. These large cats are well camouflaged and hunt mostly at night. A single individual can cover a very large area.

(a) In 2007 the Wildlife Conservation Society (WCS) attempted to estimate the population of jaguars in the Madidi National Park.

- Digital camera traps were placed in areas that jaguars were likely to visit.
- If an infrared beam was broken by an animal, the camera was activated.
- The camera then took a photograph of the animal.

(i) Suggest why it was **not** appropriate to estimate the number of jaguars using the capture-recapture technique.

.....

.....

.....

..... **[2]**

Question 13 · A level Paper 2 · June 2025 · Q19(b)(i) · 1 mark

(b) Puffins, like many species on the Farne Islands, eat small fish. Their main predators are large gulls. Puffins are on the IUCN Red List for threatened species.

The puffin population can be estimated from the number of burrows that are occupied.

After the bird flu outbreak in 2023 the number of occupied burrows declined.

(i) It is important not to disturb the burrows and there is not enough money available to allow puffin burrows to be constantly monitored, either by humans or cameras.

Suggest **one other** type of evidence that could be used to infer that a burrow was being occupied by puffins.

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 14 · A level Paper 3 · June 2018 · Q5(c)(ii) · 3 marks

(ii) Suggest how the scientist could achieve the following during their investigation:

Sample all stages of succession in the habitat .....

.....

Minimise sampling bias .....

.....

Sample insect biodiversity .....

.....

[3]

Question 15 · A level Paper 3 · June 2018 · Q5(c)(iii) · 1 mark

(iii) The scientist also measured primary production in both the woodland and lake habitats.

Suggest the units the scientist should use to measure primary production in the two habitats.

Woodland .....

Lake .....

[1]

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 16 · A level Paper 2 · June 2022 · Q20(a)(i) · 1 mark

20 The abundance and distribution of plants can be surveyed in different ways.

Some students wanted to survey abundance and distribution of plants on a small area of grass outside the school. The area was roughly 20 m × 20 m in size.

They used the following method:

1 Lay two 20 m tape measures at right angles starting in the south east corner of the grass area.
2 Use a random number generator to select *x* and *y* coordinates.
3 While facing north, place the left-hand corner of a quadrat on the point where the coordinates meet.
4 Identify the species present in the quadrat using a key.
5 Count the number of each species present.
6 Record the information in a table.
7 Generate a new set of coordinates and repeat steps 2 to 6 until 10 quadrats have been sampled.

(a) The teacher said that this method would not allow the students to measure the distribution of plant species.

(i) Suggest an improvement to the method that would allow the distribution of plants to be measured.

.....

..... **[1]**

Question 17 · A level Paper 3 · June 2017 · Q4(c)(i) · 2 marks

(c) Many species of bacteria act as decomposers within ecosystems by breaking down organic material.

Scientists analysed the energy flow within a grassland ecosystem.

They estimated that the energy in the decomposers' trophic level was 950 000 $J\,m^{-2}\,yr^{-1}$.

The energy within the producers' trophic level was 800% greater than that of the decomposers.

(i) Calculate the energy in the producers' trophic level in **$kJ\,m^{-2}\,yr^{-1}$**.

Answer: ..... $kJ\,m^{-2}\,yr^{-1}$ **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 18 · A level Paper 3 · June 2017 · Q4(c)(ii) · 1 mark

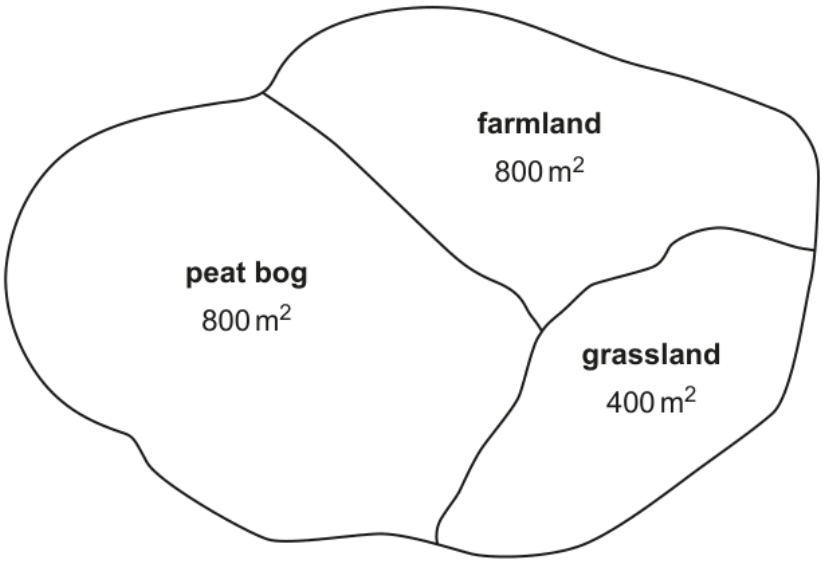
(ii) Calculate the percentage efficiency of the energy transfer from producers to decomposers.

Give your answer to **two** significant figures.

Answer: ..... % **[1]**

Question 19 · information from earlier in the question

5 Ecologists were studying an area that contained three different habitats. The area is shown in the diagram below.



(a) The ecologists sampled the area to estimate insect biodiversity.

Describe how the ecologists should choose the number and locations of their samples to ensure that the sampling is representative.

Use a calculation to support your answer.

.....

.....

.....

.....

.....

..... **[3]**

Questions, mark schemes and examiners' report extracts © OCR.

(b) Two of the insect species that were sampled were the large heath butterfly and the bog hoverfly.

The ecologists used the capture-mark-recapture technique and estimated population sizes using two different calculations: the Lincoln estimate and the Chapman estimate.

(i) Calculate the population sizes of the two insect species using each of the formulae below.

Write your answers in the table.

Lincoln estimate formula: population size = $\frac{n1 \times n2}{m}$

Chapman estimate formula: population size = $\left(\frac{(n1 + 1) \times (n2 + 1)}{(m + 1)}\right) - 1$

n = number of individuals in a particular sample

m = number of marked individuals in the second sample

Species	Number captured and marked in sample 1	Total number in sample 2	Number of marked individuals in sample 2	Population estimate (number of individuals)	
				Lincoln estimate	Chapman estimate
large heath butterfly	77	73	4		
bog hoverfly	5	6	1		

[2]

Questions, mark schemes and examiners' report extracts © OCR.

Mark schemes

Question 1 · A level Paper 3 · June 2018 · Q5(c)(i) · 1 mark

c	i	climax community ✓	1

Question 2 · A level Paper 3 · June 2017 · Q4(a) · 4 marks

4 a

Type of bacteria	Location	Reactant	Product	Oxidation or reduction of nitrogen?
Rhizobium	root nodules / leguminous roots	N_2 and H^+ ions	NH_3	reduction
Nitrosomonas	soil	NH_4^+ / ammonium , ions / compounds	NO_2^- / nitrites	oxidation
Nitrobacter	soil	NO_2^- / nitrites	NO_3^-	oxidation
Denitrifiying bacteria	soil	NO_3^-	N_2 / nitrogen gas	reduction
	✓	✓	✓	✓

4 **AWARD** one mark per correct column

IGNORE references to oxygen in the reactant and product columns.

DO NOT ACCEPT incorrect formulae or charge

ACCEPT NH_3 /ammonia for *Nitrosomonas* reactant

Questions, mark schemes and examiners' report extracts © OCR.

Question 3 · A level Paper 2 · June 2023 · Q21(a) · 6 marks

21	(a)	ammonification ✓ nitrifying ✓ *Nitrosomonas* ✓ *Nitrobacter* ✓ amino acids ✓ nitrogen-fixing ✓	6	1.1 1.2	**ALLOW** lower case letters for all generic names **ACCEPT** phonetic equivalent spelling **ACCEPT** phonetic equivalent spelling **ALLOW** protein **ALLOW** nucleic acids

Question 4 · A level Paper 2 · November 2020 · Q20(a)(i) · 2 marks

20	(a)	(i)	A = combustion ✓ F = respiration ✓	2	1.2	**ALLOW** burning **IGNORE** aerobic / anaerobic

Question 5 · A level Paper 2 · June 2024 · Q20(b)(iii) · 1 mark

20	(b)	(iii)	bare ground / rock / water / mud / sand / glacier / lava ✓			

1		2.5 Element	**IGNORE** empty land **DO NOT CREDIT** incorrect answers, e.g., soil			

Questions, mark schemes and examiners' report extracts © OCR.

Question 6 · A level Paper 2 · November 2020 · Q21(a)(ii) · 2 marks

(ii)	*idea of* changes over time ✓ figs with units to illustrate population change ✓		

2	2.8	**ALLOW** calculated change / ref to answer to part (i)

Question 7 · A level Paper 2 · June 2023 · Q21(b) · 2 marks

(b)	increased denitrification / decreased nitrification ✓ conditions favour (named) denitrifying bacteria ✓ (more) nitrate / NO_3^-, converted to nitrogen / N_2 , gas ✓	**2**	2.5

ALLOW descriptions of either

IGNORE refs to nitrifying bacteria

ALLOW reduces availability (to plants) of NO_3^-

Question 8 · A level Paper 2 · November 2021 · Q17(a)(i) · 2 marks

17	**(a)**	**(i)**	**FIRST CHECK ON ANSWER LINE** **If answer = 8.85 x 10^9 award 2 marks** 8.94 x 10^9 - 9.08 x 10^7 correct ✓	**2**

2.6	*If answer incorrect…* **ALLOW** max 1 mark for 8.8492 x 10^9 / 8.84 x 10^9 / correct answer not in standard form

Question 9 · A level Paper 2 · November 2021 · Q17(a)(ii) · 1 mark

	(ii)	measuring changes in dry mass over time / AW ✓	**1** 3.3	**ALLOW** e.g, dry leaves after 24h and weigh them then repeat at different times of year.

Questions, mark schemes and examiners' report extracts © OCR.

Question 10 · A level Paper 2 · November 2021 · Q17(a)(iv) · 2 marks

(iv)	*idea that* heather is less easily digested ✓ **ora** (because of) cellulose (cell walls) / lignin (in woody parts) ✓

2	2.5	**ALLOW** only part of the plant is eaten

Questions, mark schemes and examiners' report extracts © OCR.

17	(d)*		*Please refer to the marking instructions on page 4 of t*
			Level 3 (5–6 marks) Describes some stages of succession with reference to general principals and key terms **AND** explains why heather moorland is deflected succession. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Describes some stages of succession with reference to general principles **OR** describes one stage of succession with reference to general principles **AND** explains why heather moorland is deflected succession **OR** describes some stages of succession **AND** explains why heather moorland is deflected succession. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Mentions some stages of succession **OR** outlines the general principles **OR** explains why heather moorland is deflected succession.
			There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant. **0 marks** *No response or no response worthy of credit.*

Question	Answer

this mark scheme for guidance on how to mark this question.

6	1.2 2.5	**Indicative points may include** *AO1.2* *Stages* Pioneer community • begins with bare rock

Questions, mark schemes and examiners' report extracts © OCR.

Question 12 · A level Paper 2 · June 2017 · Q16(a)(i) · 2 marks

16	(a)	(i)	estimate will be inaccurate (because of low numbers) ✓ dangerous (for collector or jaguar) ✓	2

IGNORE refs to conspicuousness of tags **ALLOW** catching one more jaguar will make a big difference to the calculated number **ALLOW** the technique only works well with large populations **IGNORE** difficult to catch **ALLOW** the jaguars might die **IGNORE** inhumane / cruel / stressful

Question 13 · A level Paper 2 · June 2025 · Q19(b)(i) · 1 mark

Question			Answer
19	(b)	(i)	(puffin) footprints / feathers / eggshell / fish bones / droppings (near burrow entrance) / presence of predators ✓

Mark	AO	Guidance
1	2.1	**IGNORE** thermal imaging **IGNORE** eggs / nests

Questions, mark schemes and examiners' report extracts © OCR.

Question 14 · A level Paper 3 · June 2018 · Q5(c)(ii) · 3 marks

ii	belt / line, transect / described **or** stratified sampling / described ✓ random selection of transect sites	**3**
	or systematic sampling / place quadrats at, set / pre-determined, intervals along the transect **or** random sampling using quadrats in, selected areas / strata ✓ pooter / sweep nets / pitfall traps / light traps / tree-beating ✓	

e.g. ' lay tape from edge of lake and sample along it'

(N.B. only allow random sampling in context of stratified sampling)

ALLOW any suitable method of trapping insects

IGNORE capture mark recapture

Questions, mark schemes and examiners' report extracts © OCR.

Question 15 · A level Paper 3 · June 2018 · Q5(c)(iii) · 1 mark

iii	Woodland = (k)g m^{-2} yr^{-1} / (k)J m^{-2} yr^{-1} **AND** Lake = (k)g m^{-3} yr^{-1} / (k)J m^{-3} yr^{-1} ✓	**1**

ALLOW (k)g h^{-1} yr^{-1} / (k)J h^{-1} yr^{-1} / tonnes h^{-1} yr^{-1} / (k)g (k)m^{-2} yr^{-1} / (k)J (k)m^{-2} yr^{-1}

ALLOW (k)g (d)m^{-3} yr^{-1} / (k)J (d)m^{-3} yr^{-1} / (k)g (k)m^{-3} yr^{-1} / (k)J km^{-3} yr^{-1}

ALLOW hectare $^{-1}$ for h^{-1}
ALLOW y for yr
DO NOT ALLOW 'per'
ALLOW '/' instead of $^{-1}$

Question 16 · A level Paper 2 · June 2022 · Q20(a)(i) · 1 mark

20	**(a)**	**(i)**	(description of) systematic sampling / transect ✓	**1**	1.2	**IGNORE** stratified

Question 17 · A level Paper 3 · June 2017 · Q4(c)(i) · 2 marks

c	**i**	8550 (kJ m^{-2} yr^{-1}) ✓✓	**2**	**AWARD** one mark for 8 550 000 (J m^{-2} yr^{-1}) **OR** **AWARD** one mark for 9 x 950 000 **OR** **AWARD** one mark for 7600 (kJ m^{-2} yr^{-1})

Question 18 · A level Paper 3 · June 2017 · Q4(c)(ii) · 1 mark

ii	11 (%) ✓	**1**	**ACCEPT ECF from c (i)** (look for 950(000) divided by answer to c(i)and a correct calculation to 2 sig figs) e.g. if calculated 7600 (kJ m^{-2} yr^{-1}) then answer would be 13(%)

Questions, mark schemes and examiners' report extracts © OCR.

b	**i**	large heath butterfly	1405 **and** 1153 ✓	**2**	2.8	
		bog hoverfly	30 **and** 20 ✓			

Answers must be rounded to nearest whole number

Questions, mark schemes and examiners' report extracts © OCR.