Surname	Centre Number	Candidate Number
First name(s)		2

GCE A LEVEL

Z22-1400U50-1E

1400U50-1E

FRIDAY, 13 MAY 2022 – MORNING

BIOLOGY – A2 unit 5

Practical Examination

Practical Analysis Task

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**20**	
2.	**10**	
Total	**30**	

1400U501E
01

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Do not use gel pen or correction fluid. You may use pencil for graphs and diagrams.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions in the spaces provided

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The maximum mark for this paper is 30.

Answer **all** questions.

1. Owls are predatory birds and their prey includes small rodents such as wood mice and field voles. There are five native owl species in Wales, including the tawny owl (*Strix aluco*), shown in **Image 1.1**.

Image 1.1

A tawny owl swallows its food whole and indigestible material collects in the gizzard, a muscular sac that is part of the digestive system. Once or twice a day, an owl regurgitates this indigestible material in an 'owl pellet'. These are found at the base of the tree in which the owl nests. **Image 1.2** shows an owl pellet containing indigestible material.

Image 1.2

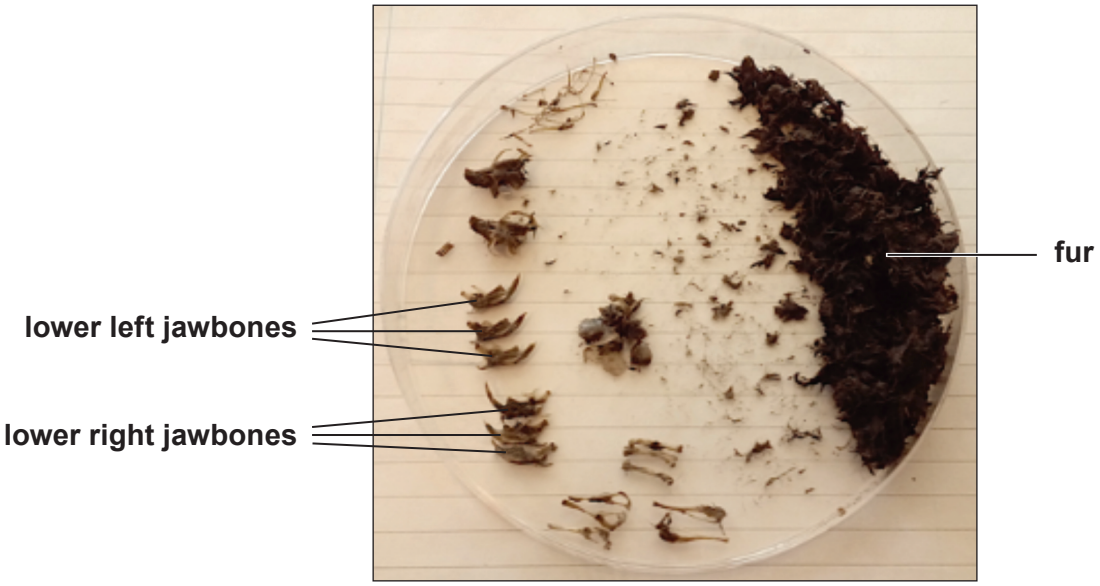
10 mm

One way to investigate the diet of owls is to examine the contents of owl pellets. Prey animals are identified from their skeletons.

Examiner only

Image 1.3 shows a 90 mm diameter Petri dish containing a dissected owl pellet.

Image 1.3



(a) (i) Explain why fur and jawbones are found in an owl pellet, but muscle and fat are not. [1]

.....

.....

(ii) Using the number of jawbones in **Image 1.3**, suggest the number of small rodents that have been eaten. Explain your answer. [2]

.....

.....

.....

.....

1400U501E
03

Turn over.

Examiner only

(b) A study was carried out in 0.5 km^2 of ash woodland in north-east Wales, to investigate the diet of tawny owls. Ten owl pellets were collected from the bases of trees in which tawny owls nested. The pellets were dissected, and the prey animals were identified from their remains.

(i) Complete the risk assessment below for this investigation. [1]

Hazard	Risk	Control measure
Plants have sharp thorns	.....	.....
	.....	.....

(ii) Sampling in woodland often involves placing a 0.25 m^2 quadrat at randomly chosen co-ordinates. Use the information above and your knowledge of biology to suggest **one** reason why this is **not** a suitable sampling method for collecting owl pellets. [1]

.....

.....

Examiner only

(c) A student suggested the following null hypothesis for this study:

'There is no significant difference in the numbers of field voles and wood mice eaten.'

The χ^2 test was used to test this null hypothesis.

(i) Give **one** reason why the χ^2 test is a suitable statistical test for this study. [1]

.....

.....

(ii) The table below shows the number of field voles and wood mice counted in the pellets. Complete the table to calculate the value of χ^2 to **2 decimal places**, using the equation: [3]

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Species	Observed (O)	Expected (E)	$O - E$	$(O - E)^2$	$\frac{(O-E)^2}{E}$
Field vole	17	.....	.....	.....	.....
Wood mouse	7	.....	.....	.....	.....
Total	24	24			χ^2 = ...

(iii) The critical value of χ^2 at one degree of freedom and p = 0.05 is 3.84.

I. The number of degrees of freedom in this study is given by $n - 1$.

Explain what is represented by n in this study. [1]

.....

II. State and explain the conclusion you can draw from your calculated value of χ^2. [3]

.....

.....

.....

.....

.....

.....

1400U501E
05

Examiner only

(d) Tawny owls are found most frequently in deciduous woodlands, such as ash woodlands, although some use mature coniferous woodlands as a habitat. Since 2012, a fungus has infected ash trees in the UK, causing ash dieback disease. This kills young ash trees and weakens older ash trees. In Wales, 80 % of the country has infected ash trees.

To compare ash and coniferous woodlands as tawny owl habitats, a second study was performed in 0.5 km^2 of a mature coniferous plantation, in the west of the Brecon Beacons National Park.

(i) State why the type of woodland is described as a biotic factor. [1]

.....

.....

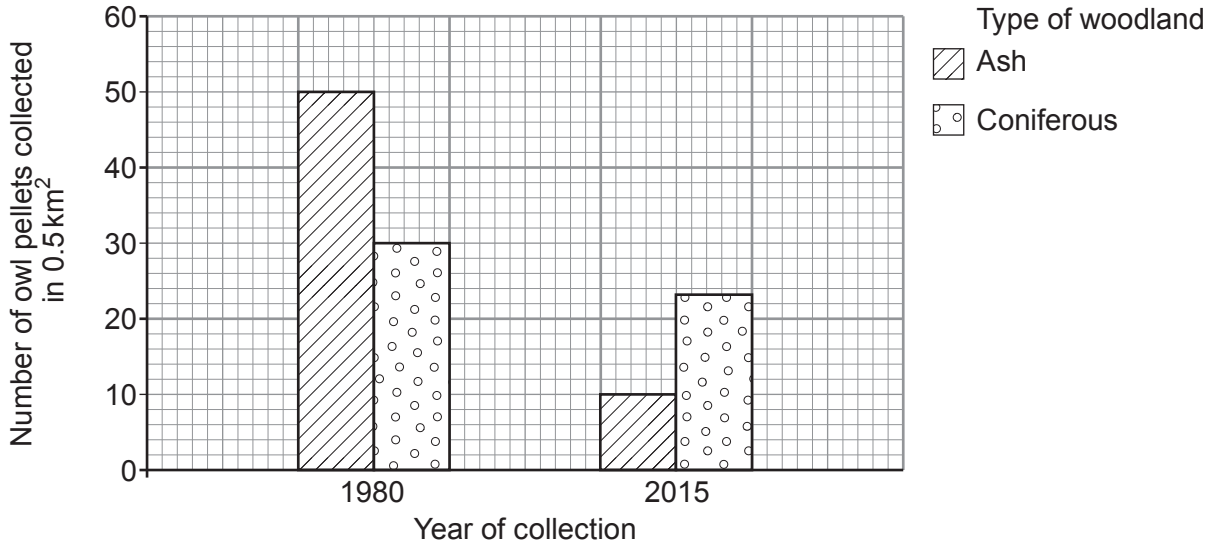
(ii) To ensure a valid comparison between the studies in the ash and coniferous woodlands, abiotic factors must be controlled. Complete the table below to explain why the factors stated must be controlled. [2]

Abiotic factor	Explanation for control
Studies carried out at the same time of year	....
Studies carried out at the same time of day	....

Examiner only

(iii) **Image 1.4** shows the number of owl pellets collected in 0.5 km^2 of ash woodland and in 0.5 km^2 of a coniferous woodland, in 1980 and in 2015.

Image 1.4



Use the information given and your own knowledge to describe and explain the trends in the data between 1980 and 2015. [4]

.....

.....

.....

.....

.....

.....

.....

.....

20

2. **Image 2.1** shows a longitudinal section of a root tip. The diagrams show drawings of root cells, found at two distances from the root tip (**drawn to the same scale**).

Image 2.1

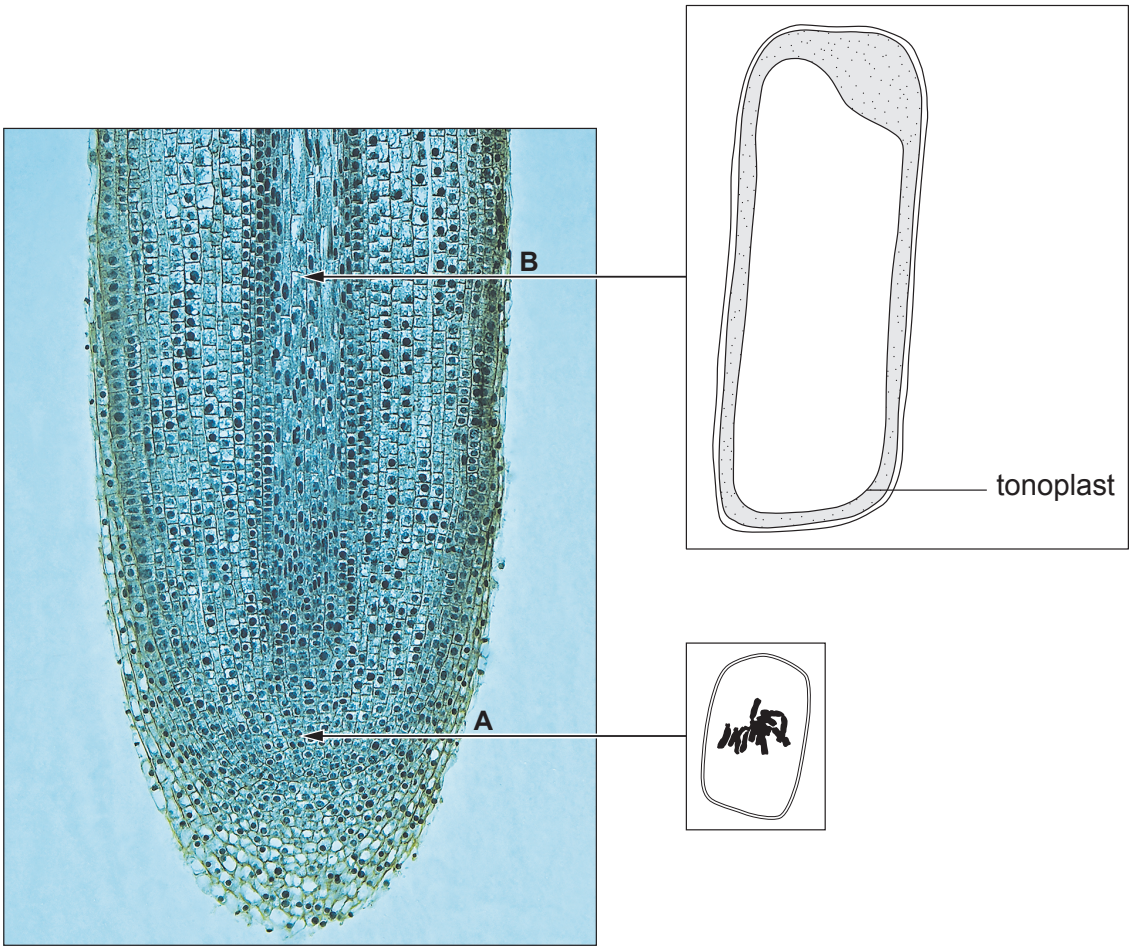


Image 2.2 shows a root tip cell at metaphase. This cell is located at position **A** on **Image 2.1**.

Image 2.2

Examiner only

(a) **Image 2.2** was taken using a ×40 objective lens. Explain why a ×10 objective lens was not used. [1]

.....

.....

(b) (i) Calculate the actual length (**X**) of the cell in **Image 2.2**, in μm. [2]

Length = ... μm

(ii) The diagrams in **Image 2.1** show cells at two different distances from the root tip. One cell at position **B** is 90 μm long. Use your answer from (b)(i) to calculate the ratio of lengths of the cell at **B** to the cell at **A**. [1]

Ratio = ... : 1

(iii) Cells at position **B** are not undergoing mitosis, but the root is still growing in this region. Use **Image 2.1** to suggest an explanation for this observation. [1]

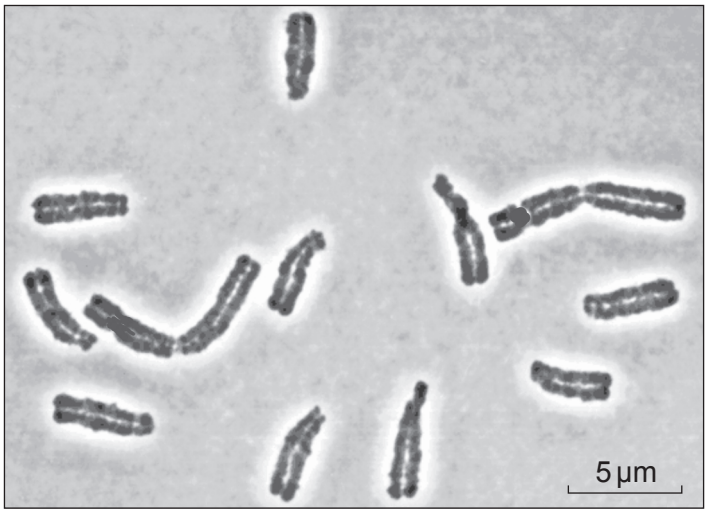
.....

.....

Examiner only

(c) **Image 2.3** shows the chromosomes of a root tip cell of Vicia faba.

Image 2.3



On **Image 2.3**, label: [2]

(i) a centromere

(ii) a chromatid

Examiner only

(d) The chromosomes in **Image 2.3** have been stained.

(i) Explain why it is necessary to stain chromosomes to view them with a light microscope. [1]

.....

.....

(ii) Name a suitable stain for preparing plant cell chromosomes to be viewed in a light microscope. [1]

.....

(iii) To view root tip chromosomes in the light microscope using a ×40 objective, a root fragment must be squashed. Explain why a specimen must be very flat to be viewed in the microscope. [1]

.....

.....

.....

10

END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

Examiner only