Surname	Centre Number	Candidate Number
First name(s)		2

GCE A LEVEL

S25-1400U50-1E

1400U50-1E

FRIDAY, 28 MARCH 2025 – 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**	

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01

ADDITIONAL MATERIALS

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 a pencil for graphs and tables only.

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

Answer **all** questions.

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.

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Answer **all** questions.

1. Coffee is an important crop around the world, especially in tropical countries. Of the 124 coffee species known, only two are grown commercially, Robusta *(Coffea canephora)* and Arabica *(Coffea arabica)*. Robusta grows well in open plains while Arabica grows better at higher altitudes, where the weather is cooler and wetter, and below other, taller plants. **Image 1.1** shows shaded Arabica plants, 1–2 metres high, growing in a coffee plantation in Guatemala.

Image 1.1

Estimates suggest that 20% of all known plant species are threatened with extinction. The production of coffee beans is already much reduced in key coffee-growing countries such as Ethiopia and so an investigation was carried out to test how safe coffee species are from becoming extinct.

The threat of extinction to 110 coffee species in the wild was found by assessing their distribution and abundance i.e. the areas over which the species grew and the number of plants of each species that were growing there.

(a) Complete the risk assessment for an investigation where the distribution and abundance of plants is being assessed in the wild. [1]

Hazard	Risk	Control measure
Plants may sting/scratch	.....	.....
	.....	.....
	.....	.....

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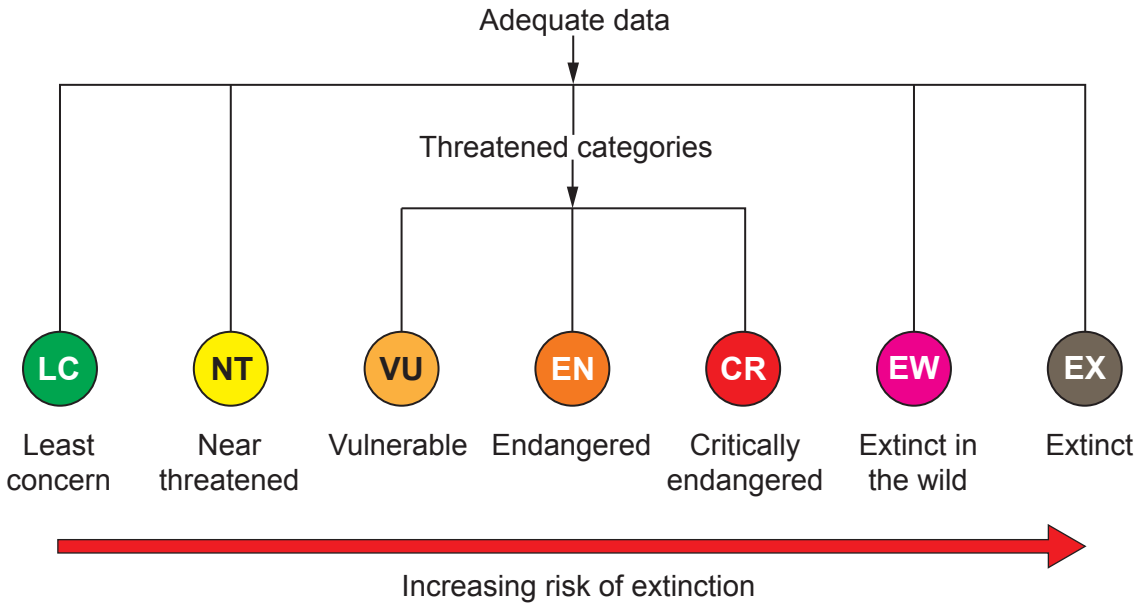
Image 1.2 shows how species are classified in terms of how likely they are to become extinct.

Image 1.2



(b) An experiment was designed to test the null hypothesis that there are equal numbers of coffee species growing in the wild in each category of risk of extinction.

(i) This null hypothesis was tested using a χ^2 (Chi^2) test.
Complete **Table 1.3** and calculate χ^2 **to three decimal places**, using the equation:

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

[3]

Table 1.3

Category	Number of species		$(O-E)$	$(O-E)^2$	$\frac{(O-E)^2}{E}$
	O	E			
Critically endangered	13	22	.....	.....	.....
Endangered	40	22	.....	.....	.....
Vulnerable	22	22	.....	.....	.....
Near threatened	10	22	.....	.....	.....
Least concern	25	22	.....	.....	.....
Total	.....	.....			.....

χ^2 = ...

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(ii) Explain why E, the expected number for each category, is 22. [1]

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(iii) Use **Table 1.4** to find the critical value of χ^2, using an appropriate value for **p**. [1]

Table 1.4

Degrees of freedom	Probability (p)				
	0.5	0.1	0.05	0.01	0.005
1	0.455	2.706	3.841	6.635	7.879
2	1.386	4.605	5.991	9.210	10.597
3	2.366	6.251	7.815	11.345	12.838
4	3.357	7.779	9.488	13.277	14.860
5	4.351	9.236	11.070	15.086	16.750

Critical value of χ^2 = ...

(iv) State and explain what may be concluded as a result of this χ^2 test. [3]

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(c) The abundance of plants can be assessed using a quadrat. A 0.5 m × 0.5 m quadrat is often used for this purpose.
Explain why a 10 m × 10 m quadrat is more suitable in this experiment, assessing the abundance of coffee trees. [1]

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(d) Plant distribution can be examined using a belt transect.

(i) Describe how you might use a belt transect to assess the species richness and the population density of different coffee species over a distance of 1500 m down a mountain. [4]

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(ii) State **two** abiotic factors associated with the soil which might affect plant growth in the sample areas. [2]

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(e) The Sidama region of Ethiopia is famous for the high quality of its coffee. Three areas of Sidama are described in **Table 1.5**.

Table 1.5

Area of Sidama	Height above sea level / m	Mean annual rainfall / mm	Mean annual temperature / °C
Kolla	Below 1500	400–799	20.0–24.9
Gamoojje	Between 1500 and 2500	1200–1599	15.0–19.9
Aliicho	Above 2500	1600–1999	15.0–19.9

(i) Use the information given on page 3 and in **Table 1.5** to state and explain in which of the three areas of Sidama Arabica coffee is most likely to be grown. [3]

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(ii) Suggest why Arabica grows best in mixed plantations. [1]

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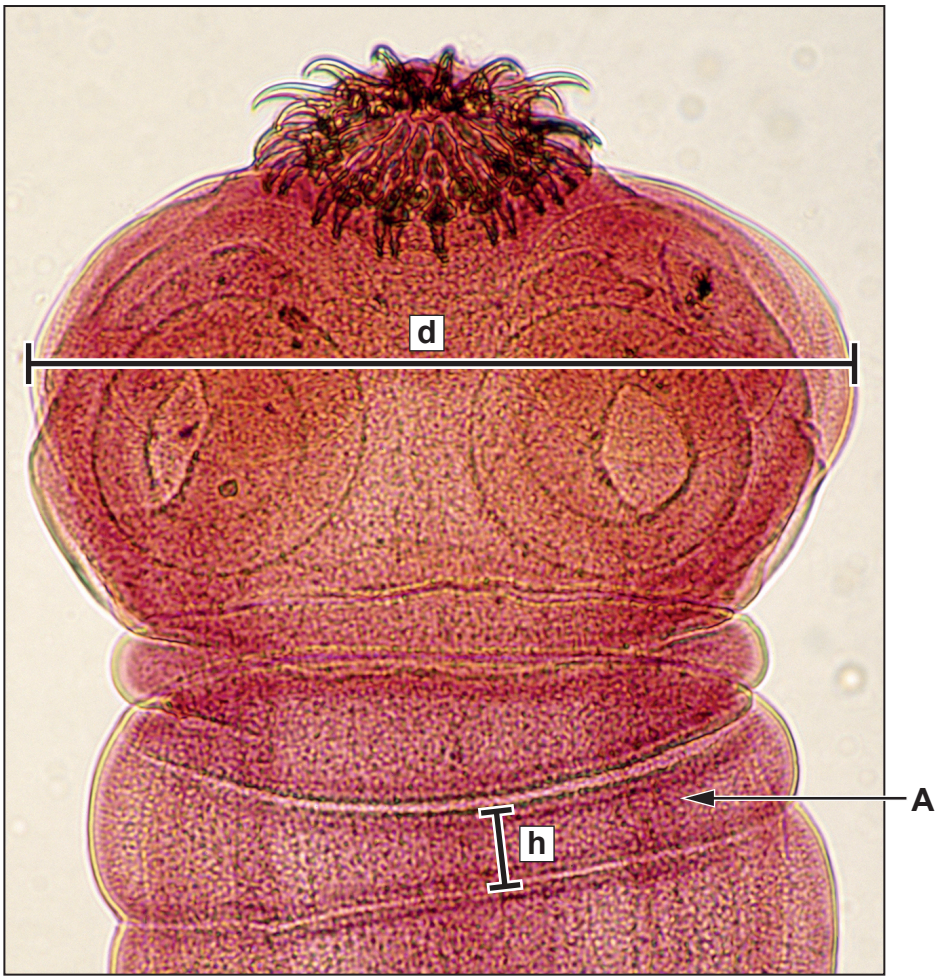
2. **Image 2.1** shows the scolex and immature proglottids of *Taenia solium*, a tapeworm that infects pigs and humans.

Image 2.1



(a) **Draw lines** to identify **two different** structures that allow the tapeworm to attach firmly to its host. **Label each structure.** [2]

(b) On **Image 2.1**, an immature proglottid is labelled **A** and its height is labelled **h**. The actual diameter of the scolex **d** is 0.980 mm.
Use this information to calculate the actual height of proglottid **A**.
Give your answer to the nearest µm. [3]

Height of proglottid **A** = ... µm

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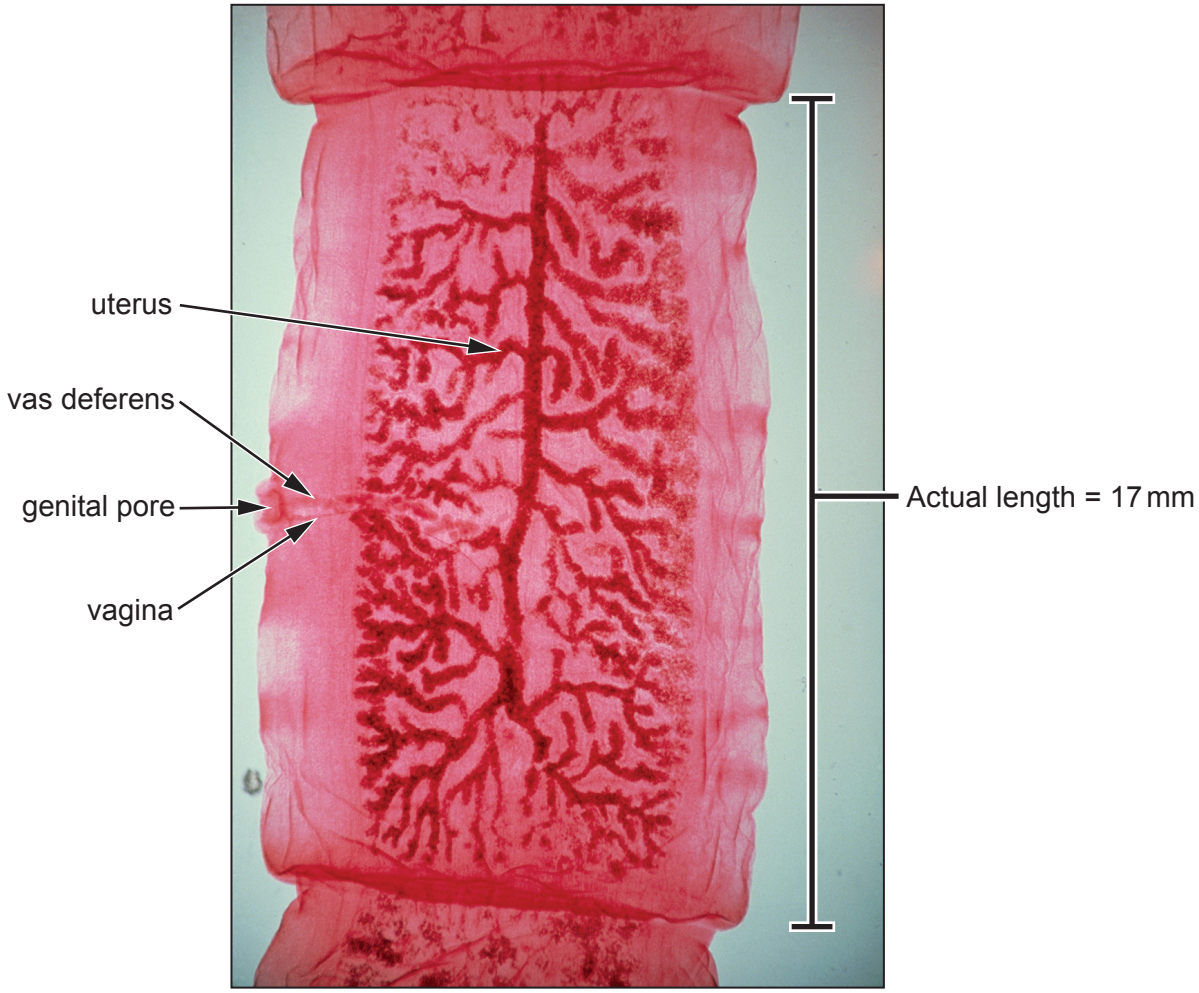
(c) *Taenia solium* proglottids are hermaphrodite, which means they contain both male and female reproductive organs. The proglottids furthest from the scolex are described as 'gravid', which means they are full of eggs. Gravid proglottids are much longer than immature proglottids because the uterus is much enlarged to contain so many eggs. **Image 2.2** shows a light microscope view of a gravid proglottid and its actual size.

Image 2.2



(i) Calculate the factor by which the proglottid in **Image 2.2** has lengthened compared with the height (**h**) of the immature proglottid (**A**), that you calculated in (b). [1]

Factor = × .....

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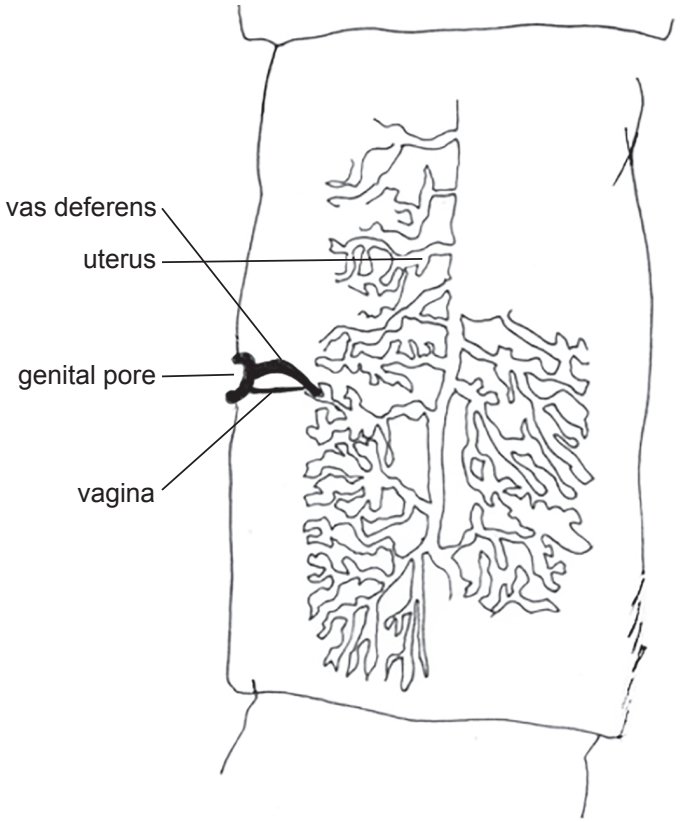
A student drew a low power plan of the gravid proglottid. This is shown in **Image 2.3**.

Image 2.3



(ii) Suggest which **objective lens** would be most suitable for viewing the gravid proglottid in order to draw the low power plan. [1]

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(iii) State **two** ways in which the low power plan in **Image 2.3** could be improved. [2]

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(iv) Suggest how the large number of eggs in mature proglottids provides an advantage to the tapeworm. [1]

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END OF PAPER

10

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

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