Surname	Centre Number	Candidate Number
First name(s)		2

GCE A LEVEL

1420U50-1E

Z22-1420U50-1E

FRIDAY, 6 MAY 2022 – MORNING

PHYSICS – A2 unit 5
Practical Examination

Practical Analysis Task

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**20**	
Total	**25**	

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ADDITIONAL MATERIALS

In addition to this examination paper, you will require a calculator and a **Data Booklet**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Pencil may be used to draw tables and graphs. Do not use gel pen or correction fluid.

Answer **all** questions.

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

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 total number of marks available for this task is 25.

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

You are reminded of the necessity for good English and orderly presentation in your answers.

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Answer **all** questions.

1. A spring has a spring constant, k = 240 N m^{-1} with a tolerance of ± 5 % supplied by the manufacturer. The maximum energy that the spring can store safely is 90 J. A laboratory technician uses the spring in an experimental arrangement and measures the extension with a ruler that has a resolution of ± 1 cm. The extension is recorded as 85 cm. Determine the energy stored in the spring along with its **absolute** uncertainty **and** explain why this may not be safe. [5]

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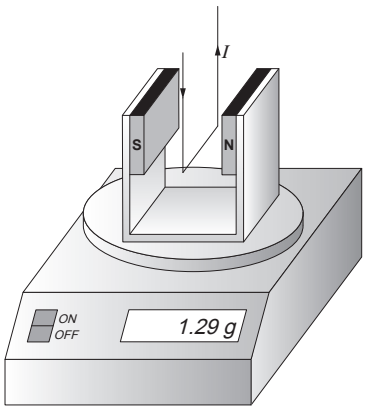
2. The following set-up was used by Eluned to investigate the force on a current-carrying wire in a magnetic field.



The current through the wire is varied and the reading on the display of the balance is recorded. Eluned's results are displayed in the table below.

Current, I / ± 0.1 A	Mass, m / g			Force, F / mN	Uncertainty in force / mN
	Reading 1	Reading 2	Mean		
0.5	0.34	0.30	0.32	3.1	0.2
1.0	0.61	0.57	0.59	5.8	0.2
1.5	0.98	0.92	0.95	9.3	0.3
2.0	1.29	1.23	.....	.....	.....
2.5	1.64	1.58	.....	.....	.....
3.0	1.92	1.88	.....	.....	.....

(a) **Complete the last three columns in the table above**. Space has been left for any calculations if needed. [3]

(b) The relationship between the force, F, and the current, I, is given by the equation:

$$F = BIl \sin\theta$$

where l is the length of the wire in the magnetic field, B is the magnetic flux density and $\theta = 90°$ for the experimental set-up shown.

Using Eluned's results plot a graph on the page opposite with F on the y–axis and I on the x-axis. Include error bars on both axes where possible and draw a line of maximum gradient and a line of minimum gradient. [5]

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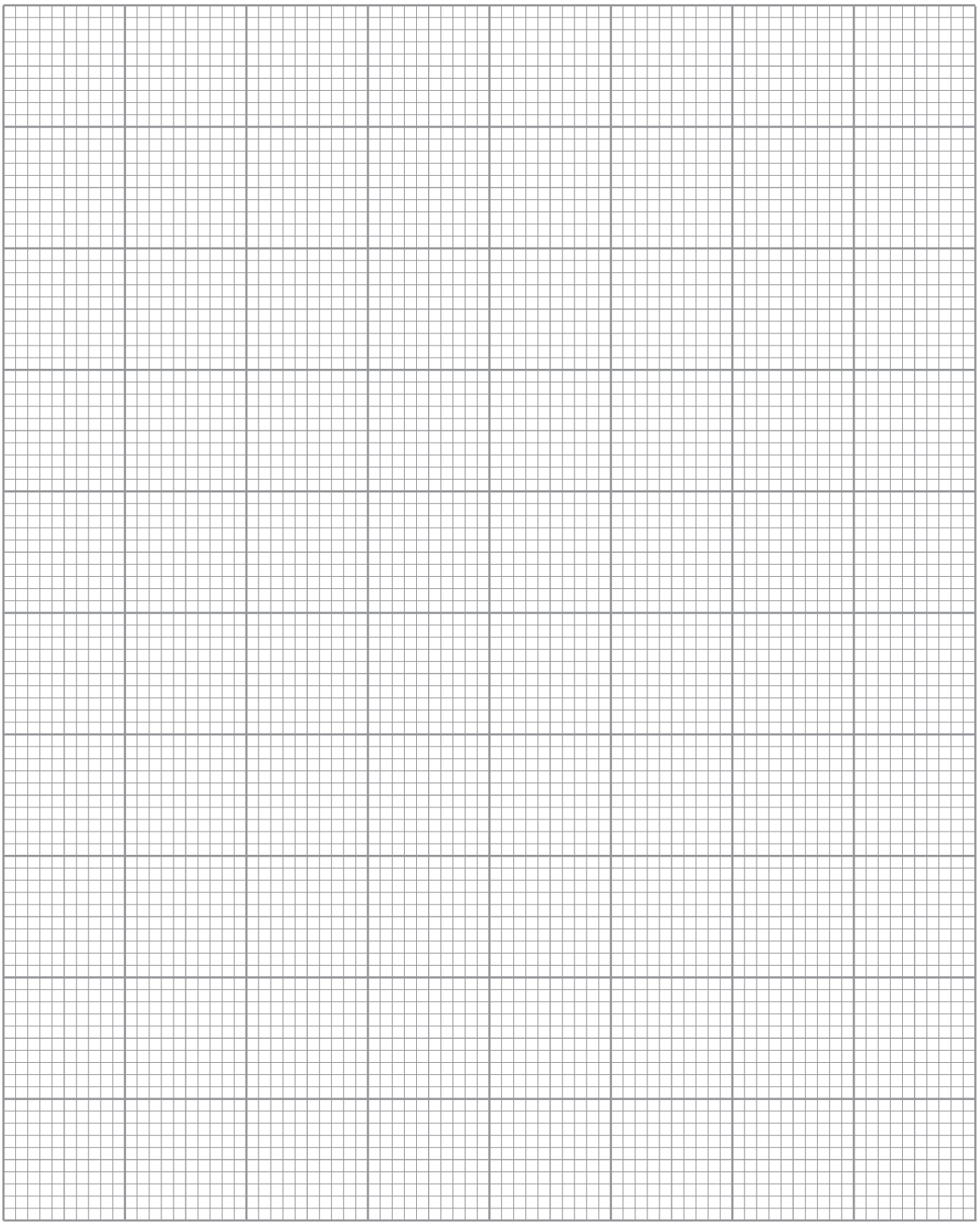

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(c) (i) Explain to what extent the data agrees with the equation: $F = BIl \sin\theta$. [3]

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(ii) Calculate the maximum and minimum gradients for your graph. [3]

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(iii) Hence, determine the mean gradient and its **percentage** uncertainty. [2]

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(d) (i) The length of the horizontal portion of the wire in the magnetic field is measured to be 52 ± 1 mm using a ruler. Determine the magnitude of the magnetic flux density along with its **absolute** uncertainty. [3]

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(ii) Describe how Eluned could change her method to reduce the uncertainty in her value for the magnitude of the magnetic flux density. [1]

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END OF PAPER

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

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