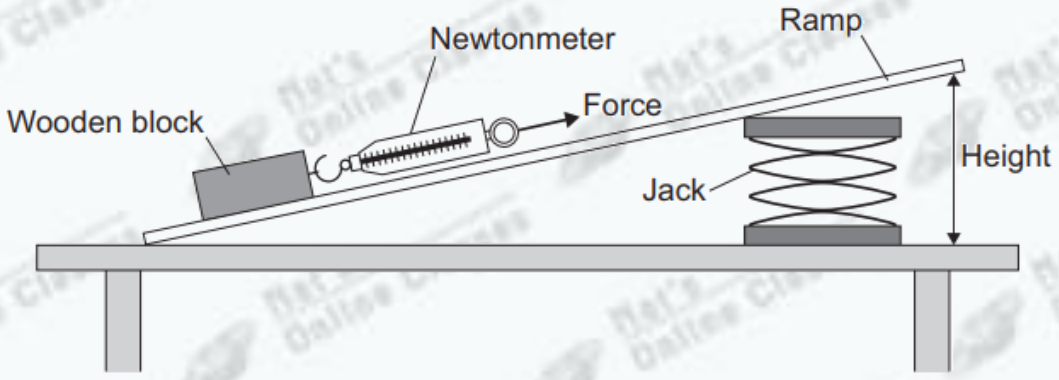
Force-Extension

Total Mark – 18

Question: 1

4 A student investigated how the height of a ramp affects the force needed to pull a wooden block up the ramp at a steady speed. **Figure 6** shows the apparatus used by the student.

Figure 6



4 (a) Complete the following sentence.

[1 mark]

To pull the wooden block up the ramp the student must do work against the force of friction and the force of _____ .

4 (b) (i) What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

The force used to pull the wooden block. ☐

The height of the ramp. ☐

The mass of the wooden block. ☐

4 (b) (ii) What was a control variable in this investigation?

[1 mark]

Tick (✓) **one** box.

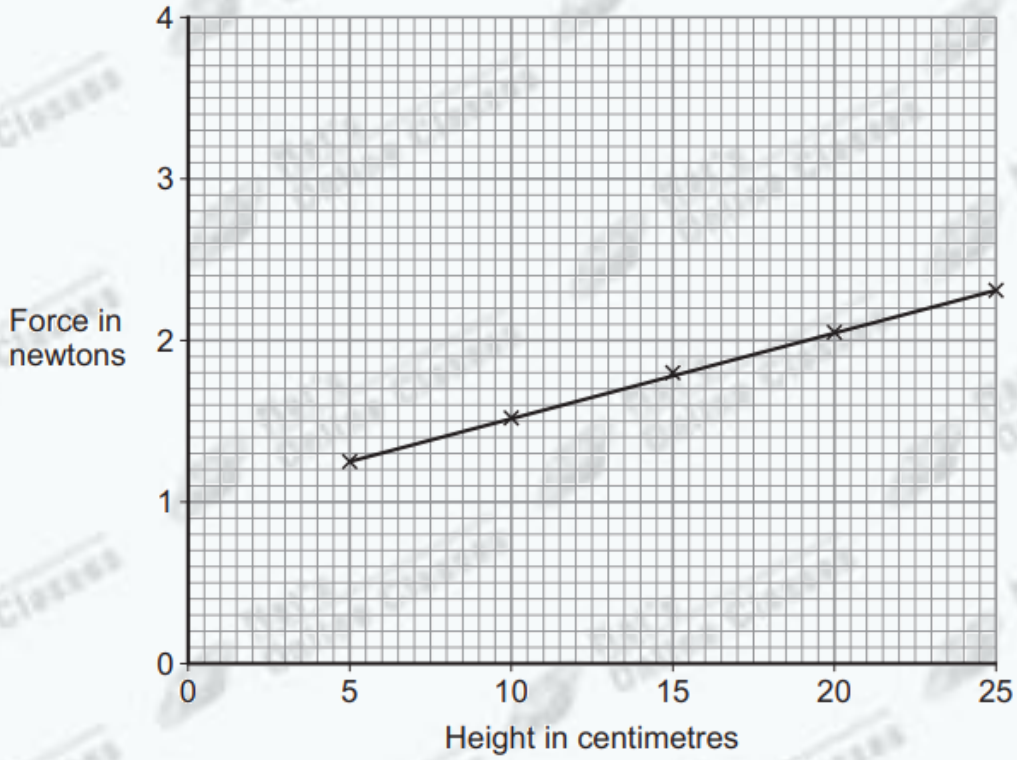
The force used to pull the wooden block. ☐

The height of the ramp. ☐

The mass of the wooden block. ☐

4 (c) The results from the investigation are plotted in **Figure 7**.

Figure 7



4 (c) (i) How do you know from **Figure 7**, that none of the results were anomalous?

[1 mark]

_____

_____

4 (c) (ii) Use **Figure 7** to estimate the force needed to pull the wooden block along the ramp when the ramp is lying flat on the bench.

[1 mark]

Force = _____ N

4 (c) (iii) What conclusion should be made from the results shown in **Figure 7**?

[2 marks]

_____

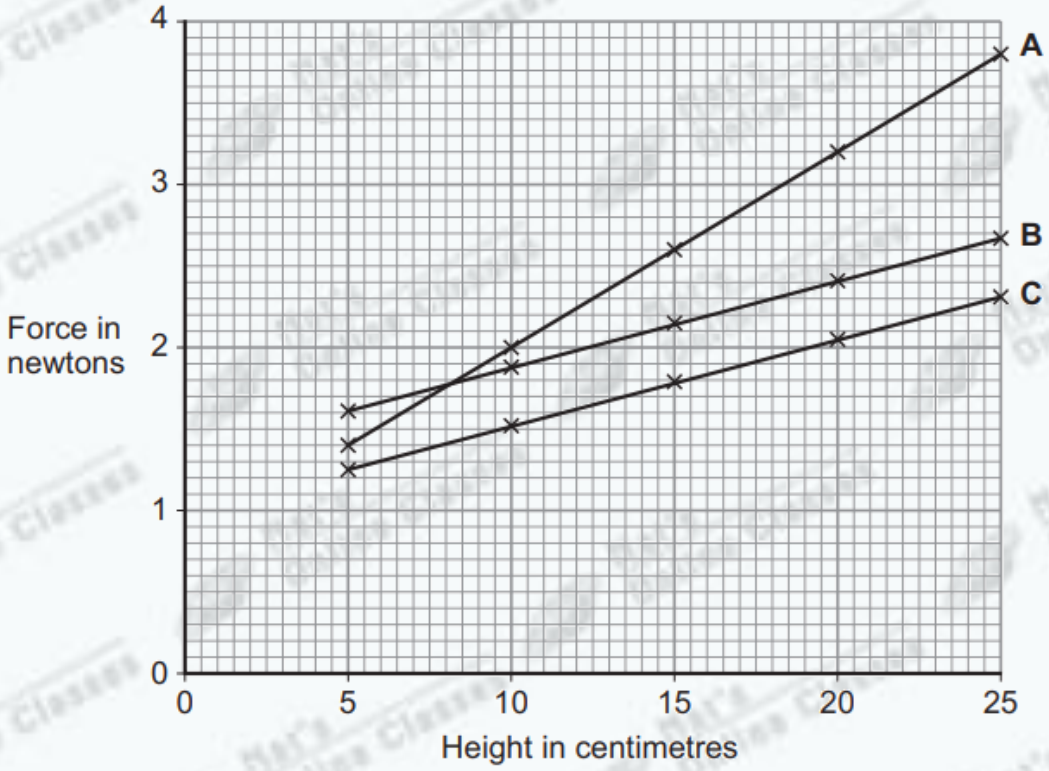
_____

_____

_____

4 (c) (iv) Another student used the same apparatus to repeat the investigation.
The student increased the force of friction by fixing a rough material to the bottom of the wooden block.

Figure 8



Which of the following, **A**, **B** or **C**, in **Figure 8**, shows the results obtained by this student?

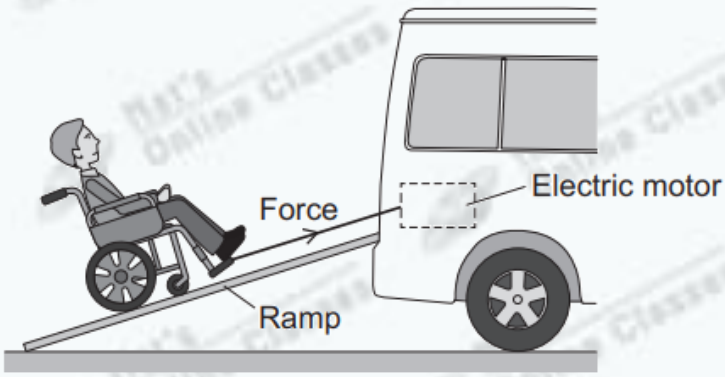
[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

4 (d) **Figure 9** shows how a ramp is used to help move a child in a wheelchair into a car. The wheelchair is pulled up the ramp by a cable attached to an electric motor.

Figure 9



A force of 260 N is used to pull the child and wheelchair up the ramp.
The ramp is 1.2 m long.

Calculate the work done to pull the child and wheelchair up the ramp.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Work done = _____ J

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	gravity	accept weight accept gravitational attraction / pull do not accept gravitational potential	1	AO1 2.2.1f
4(b)(i)	The height of the ramp.		1	AO2 HSW
4(b)(ii)	the mass of the wooden block		1	AO2 HSW
4(c)(i)	all points fit the pattern	accept all points are on the line	1	AO3 HSW
4(c)(ii)	1(.0) (N)	accept 0.9 to 1.0 inclusive	1	AO2 HSW
4(c)(iii)	the greater the height (of the ramp) the greater the force (required) but not in direct proportion	accept steeper ramp for height accept positive correlation accept line does not go through the origin allow it is a linear (pattern) accept a numerical example of increase in force and height	1 1	AO3 HSW
4(c)(iv)	B		1	AO3 HSW
4(d)	312	allow **1** mark for correct substitution ie W = 260 x 1.2 provided no subsequent step	2	AO2 2.2.1a/b
Total			**10**	

Question: 2

3 (a) When a force is applied to a spring, the spring extends by 0.12 m. The spring has a spring constant of 25 N/m.

Calculate the force applied to the spring.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

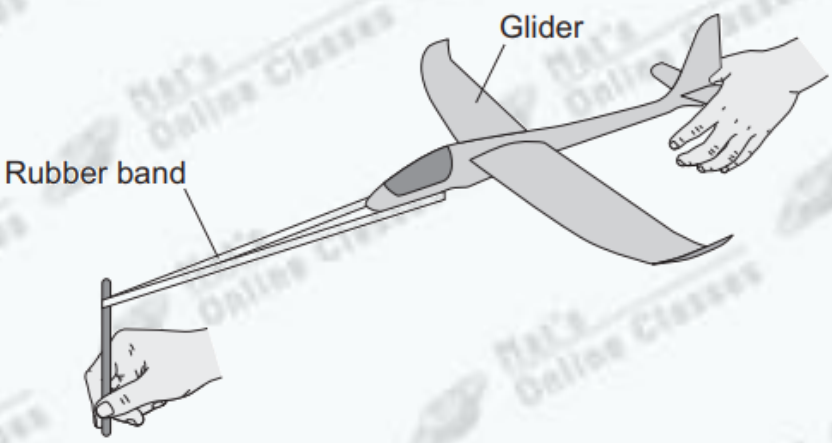
.....

.....

Force = ... N

3 (b) **Figure 2** shows a toy glider. To launch the glider into the air, the rubber band and glider are pulled back and then the glider is released.

Figure 2



3 (b) (i) Use the correct answers from the box to complete the sentence.

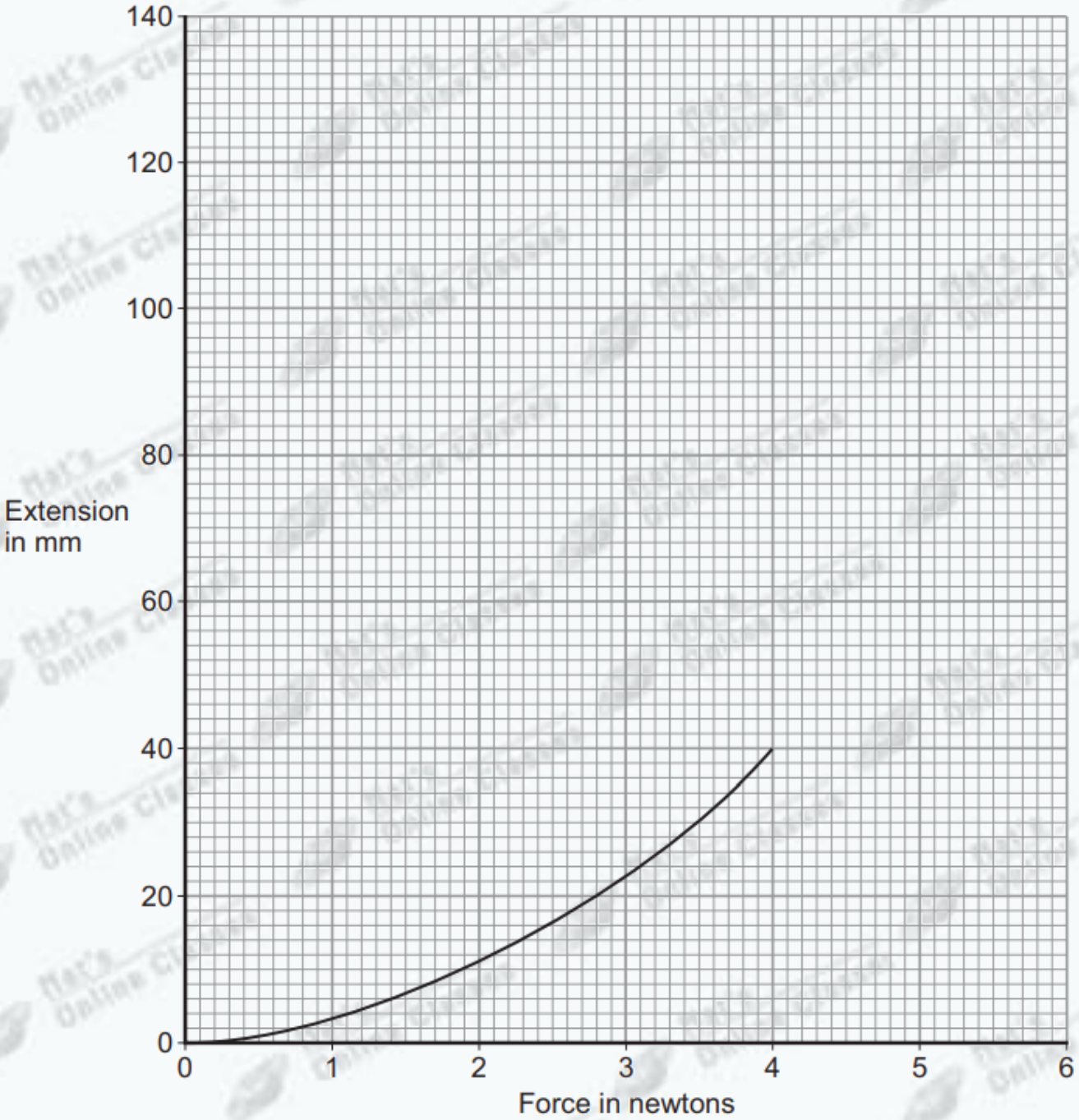
[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When the glider is released, the ..... energy stored in the rubber band decreases and the glider gains ..... energy.

3 (b) (ii) **Figure 3** shows how the extension of the rubber band varies with the force applied to the rubber band.

Figure 3



What can you conclude, from **Figure 3**, would happen to the extension of the rubber band if the force applied to the rubber band was increased to 6 N?

The rubber band does **not** break.

[2 marks]

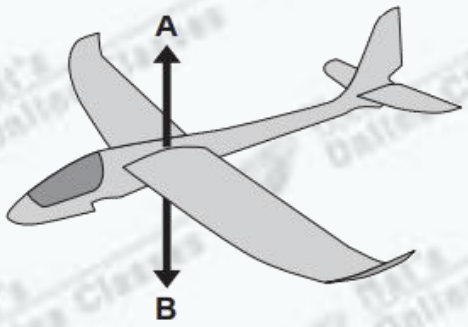
.....

.....

.....

3 (c) **Figure 4** shows the vertical forces, **A** and **B**, acting on the glider when it is flying.

Figure 4



3 (c) (i) What name is given to the force labelled **B**?

[1 mark]

Draw a ring around the correct answer.

drag **friction** **weight**

3 (c) (ii) Which **one** of the following describes the downward speed of the glider when force **B** is greater than force **A**?

[1 mark]

Tick (✓) **one** box.

Downward speed increases ☐

Downward speed is constant ☐

Downward speed decreases ☐

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
3(a)	3 (.0)	allow **1** mark for correct substitution i.e. 25 x 0.12 provided no subsequent step	2	AO2 2.1.5d	**E**
3(b)(i)	elastic potential kinetic	correct order only	1 1	AO1 2.1.5c 2.2	**G**
3(b)(ii)	increases to 80(mm) (or more)	 accept any number greater than 75 an answer 'it (more than) doubles' gains both marks	1 1	AO3 2.1.5a	**E**
3(c)(i)	weight		1	AO1 2.1	**A**
3(c)(ii)	Downward speed increases		1	AO1 2.1.1e	**A**
Total			**8**		