Neap

Trial Examination 2022

VCE Physics Unit 2

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	10	10	10
B	12	12	80
			Total 90

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, pre-written notes (one folded A3 sheet or two A4 sheets bound together by tape) and one scientific calculator.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question and answer booklet of 21 pages

Formula sheet

Answer sheet for multiple-choice questions

Additional space is available at the end of the booklet if you need extra paper to complete an answer.

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

You may keep the formula sheet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
Take the value of g to be 9.8 m s^{-2}.

Question 1

A car is travelling at 72 km h^{-1} due east. A short time later, the car travels 36 km h^{-1} due north.

Which one of the following gives the car's change in velocity?

A. 22 m s^{-1} N63°W

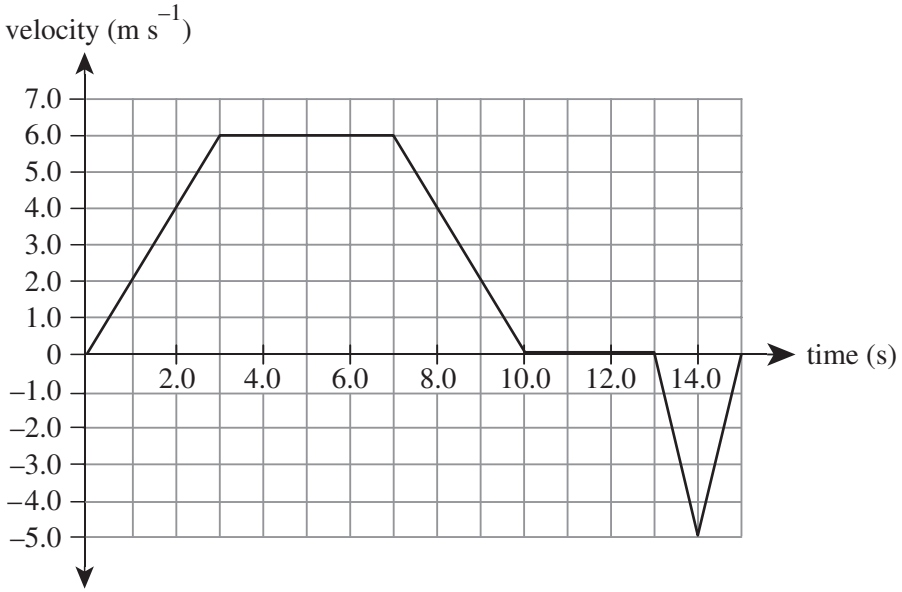
B. 22 m s^{-1} N63°E

C. 80 m s^{-1} N63°W

D. 80 m s^{-1} N63°E

Question 2

The graph below shows how velocity varies over time for an object in motion that travels in a straight line.



For the 15 seconds shown, what is the average velocity of the object's motion?

A. 0.9 m s^{-1}

B. 2.5 m s^{-1}

C. 3.1 m s^{-1}

D. 3.9 m s^{-1}

Question 3

A race car enters the straight home stretch of a track at 144 km h^{-1}. It accelerates uniformly and reaches a speed of 252 km h^{-1} in 10 seconds.

Which one of the following gives the acceleration of the race car?

A. 3 m s^{-2}

B. 11 m s^{-2}

C. 13 m s^{-2}

D. 40 m s^{-2}

Question 4

Akosua has a mass of 80.0 kg.

Which one of the following gives Akosua's weight on the Earth's surface?

A. 80.0 kg

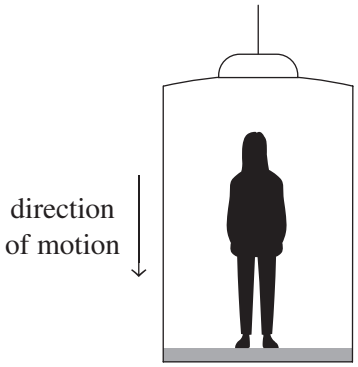
B. 80.0 N

C. 784 kg

D. 784 N

Question 5

Sung-Hoon is standing in an elevator in a department store. The elevator is travelling downwards and slows as it reaches a lower floor of the store.



The force exerted by the floor of the elevator on Sung-Hoon is

A. equal to Sung-Hoon's weight.

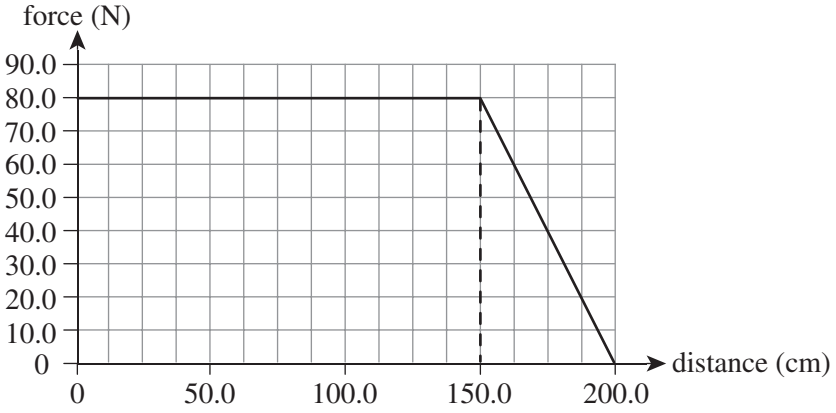
B. less than Sung-Hoon's weight.

C. more than Sung-Hoon's weight.

D. more than the force exerted by Sung-Hoon on the floor of the elevator.

Question 6

The following force versus displacement graph represents the movement of a 5.0 kg object.



If the object was initially travelling at 10.0 m s^{-1}, what is the final velocity of the object?

A. 0.0 m s^{-1}

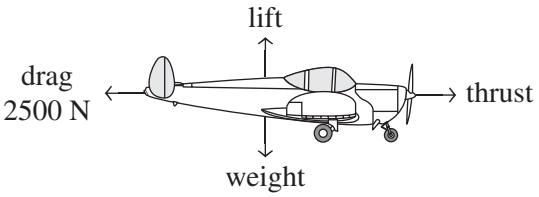
B. 2.2 m s^{-1}

C. 8.0 m s^{-1}

D. 12.5 m s^{-1}

Question 7

The diagram below shows an aircraft that is travelling at a constant speed of 360 km h^{-1} in a straight line with constant altitude. The drag acting on the aircraft is constant at 2500 N.



Which one of the following gives the power produced by the aircraft's thrust force?

A. 9.0×10^5 W

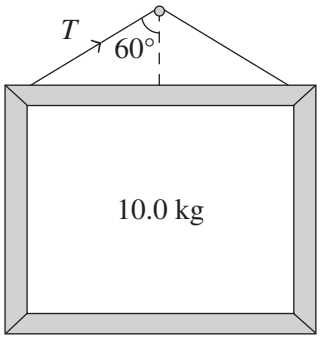
B. 2.5×10^5 W

C. 3.2×10^6 W

D. 2.5×10^1 W

Question 8

A mirror with a mass of 10.0 kg hangs on a wall, as shown in the diagram. The mirror is suspended by two wires, each at an angle of 60° to the vertical.



Which one of the following gives the tension in one of the wires, T?

A. 50.0 N

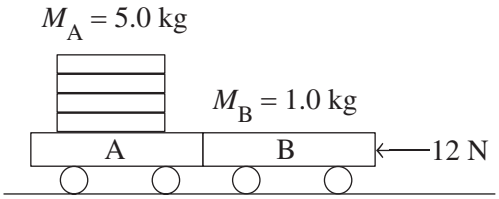
B. 98.0 N

C. 196.0 N

D. 392.0 N

Question 9

Two carts, A and B, are being pushed to the left on a smooth, frictionless surface by a 12 N force, as shown in the diagram below. Cart A has a mass of 5.0 kg and cart B has a mass of 1.0 kg.



The magnitude of the force exerted on cart B by cart A ($F_{\text{A on B}}$) is

A. 2.0 N

B. 2.4 N

C. 10 N

D. 12 N

Question 10

A Year 12 Physics student undertakes a practical investigation in the school laboratory.

In this investigation, an independent variable is one that is

A. independent of the investigation.

B. varied by the student.

C. fixed throughout the investigation.

D. measured by the student in the investigation.

END OF SECTION A

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.
Where an answer box is provided, write your final answer in the box.
If an answer box has a unit printed in it, give your answer in that unit.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
Take the value of g to be 9.8 m s^{-2}.

Question 1 (9 marks)
Figure 1 shows the displacement versus time graph of an object.

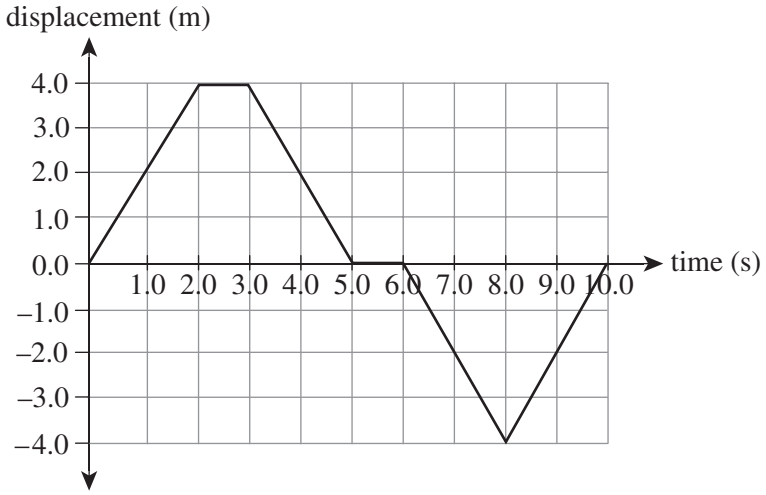


Figure 1

a. Calculate the total distance travelled by the object. Show your working. 2 marks

m

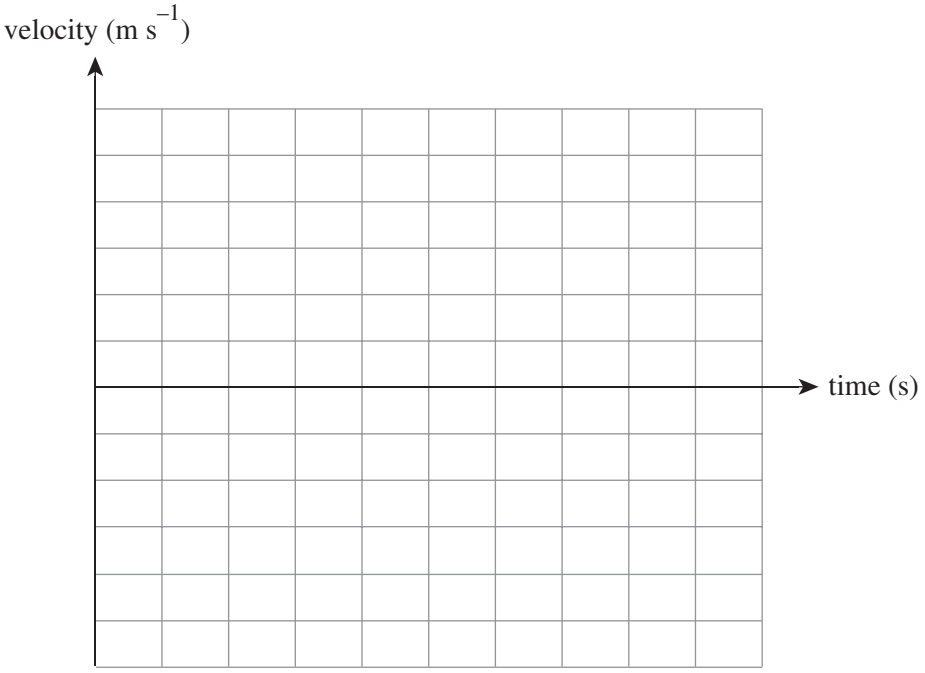
b. Identify the times at which the object is stationary. 2 marks

s s

c. Identify the times at which the object is moving towards the origin. 2 marks

s s

d. On the grid below, sketch the velocity versus time graph for the object's motion. Include appropriate scales for each axis. 3 marks



Question 2 (4 marks)
A helicopter is hovering 50.0 m above a campsite when it drops a rescue package to the campers below, as shown in Figure 2.

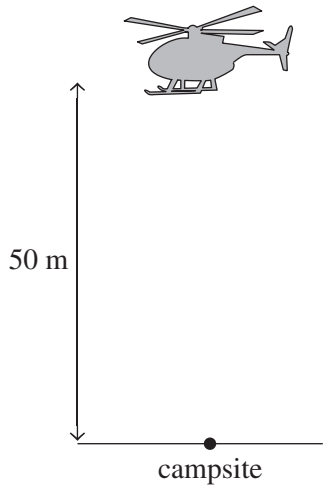


Figure 2

a. Calculate the time it takes for the package to reach the campers. Ignore the effects of friction. Show your working. 2 marks

s

b. Calculate the magnitude of the velocity of the package as it hits the ground. Ignore the effects of friction. Show your working. 2 marks

m s^{-1}

Question 3 (6 marks)

Four children are pulling ropes in a four-person game of tug-of-war. The magnitude of the forces exerted by the children is shown in Figure 3.

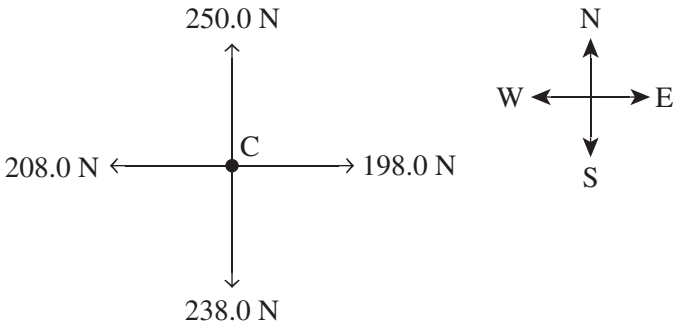


Figure 3

Calculate the magnitude and indicate the direction of the net force acting at the centre, C. Show your working.

N	

Question 4 (5 marks)

Cart A has a mass of 3.0 kg and is moving to the right along a horizontal, frictionless surface at a speed of 4.0 m s^{-1}. Cart B has a mass of 1.0 kg and is moving to the left on the same surface, towards cart A, at a speed of 2.5 m s^{-1}. The two carts collide. After the collision, cart A is still moving to the right with a reduced speed of 1.0 m s^{-1}.

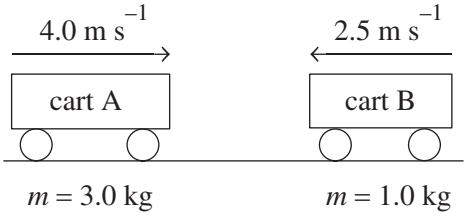


Figure 4

a. What is the speed of cart B after the collision? Show your working. 2 marks

m s^{-1}

b. The collision between the two carts takes 50 milliseconds.

Calculate the magnitude and indicate the direction of the average force exerted on cart A by cart B. Show your working. 3 marks

N

Question 5 (10 marks)
A 5.0 kg box rests on a smooth horizontal table and is attached to a 3.0 kg mass by a light string via a frictionless pulley, as shown in Figure 5.

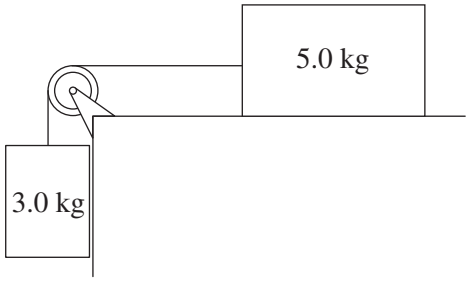


Figure 5

a. On Figure 5, draw the forces acting on each mass. 4 marks

b. Determine the magnitude of the acceleration of the 3.0 kg box. Show your working. 4 marks

m s^{-2}

c. If the 3.0 kg box was initially at rest 1.0 m above the ground, how long would it take for the box to reach the ground? Show your working. 2 marks

s

Question 6 (9 marks)
A tennis ball of mass 60.0 g approaches a tennis racquet at a speed of 25.0 m s^{-1} to the right. The tennis ball collides with the tennis racquet. After the collision, the speed of the tennis ball is 35.0 m s^{-1} to the left, as seen in Figure 6.

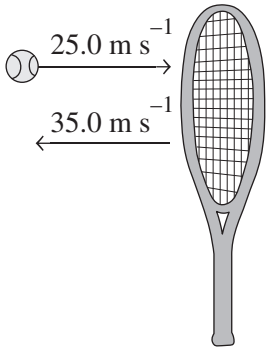


Figure 6

a. Calculate the magnitude of the change in momentum of the tennis ball. Include a unit in your answer. Show your working. 3 marks

b. Calculate the magnitude and indicate the direction of the impulse given to the tennis ball. Show your working. 2 marks

N s

c. Calculate the magnitude and indicate the direction of the impulse given to the tennis racquet. Show your working. 2 marks

N s

d. Explain the physics of how a tennis player could increase the final velocity of the ball. 2 marks

Question 7 (2 marks)

A Physics textbook is at rest on a bench, as shown in Figure 7. The two forces acting on the textbook are the normal force and weight force.

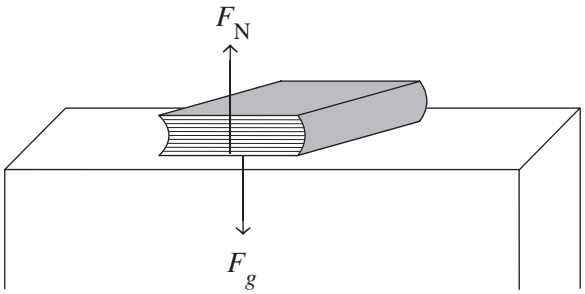


Figure 7

a. Outline why the normal force and force due to gravity acting on the textbook are **not** an action–reaction pair in terms of Newton's third law. 1 mark

b. If the normal force is taken as the 'action' force, identify the corresponding 'reaction' force and give its direction. 1 mark

Question 8 (8 marks)

A roller coaster cart with a mass of 1.00 tonne is moving along a horizontal section of the track at a speed of 5.00 m s^{-1}, as shown is Figure 8.

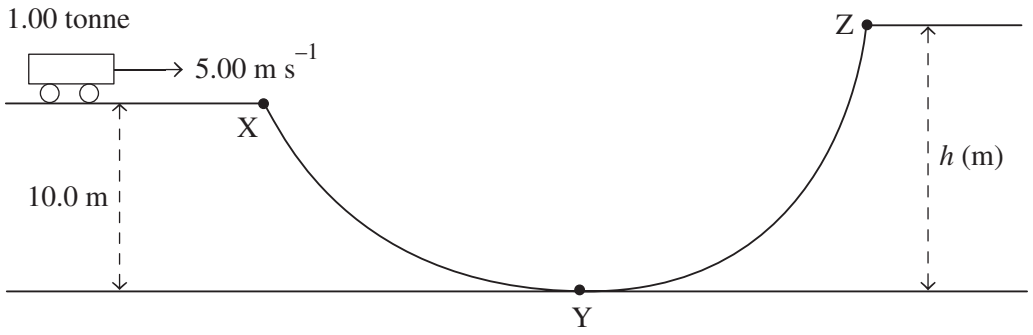


Figure 8

Point X is at the edge of the horizontal section of the track and has a height of 10.0 m. Point Y is the lowest point of the track. The track is designed so that the roller coaster cart will come to rest at point Z. Ignore the effects of friction.

a. What is the kinetic energy of the roller coaster cart at point X? Show your working. 2 marks

J

b. What is the speed of the cart at point Y? Show your working. 3 marks

m s^{-1}

c. What is the vertical height, h, of point Z above point Y? Show your working. 3 marks

m

Question 9 (6 marks)

A spring rests horizontally against a wall. Estefanía holds a block of mass 1.0 kg stationary against the spring, compressing it by 10.0 cm, as shown in Figure 9a.

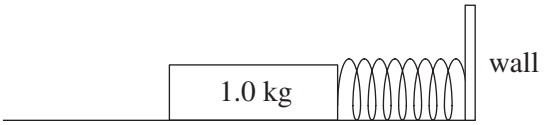


Figure 9a

Estefanía releases the block and it leaves the spring with a kinetic energy of 2.0 J, as shown in Figure 9b.

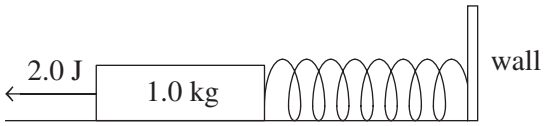


Figure 9b

a. Calculate the speed of the block as it leaves the spring. Ignore the effects of friction.
Show your working. 2 marks

m s^{-1}

b. Calculate the work done on the block by the spring. Ignore the effects of friction.
Show your working. 1 mark

J

c. Calculate the spring constant, k, of the spring. Assume that the spring obeys Hooke's law. Show your working. 3 marks

$\mathrm{N\ m^{-1}}$

Question 10 (5 marks)

A student holds a mass of 10.0 kg stationary over a fence using a metre ruler. The mass is suspended from the end of the ruler by a piece of string at a distance of 20.0 cm from the fence, as shown in Figure 10. Assume that the mass of the ruler is negligible.

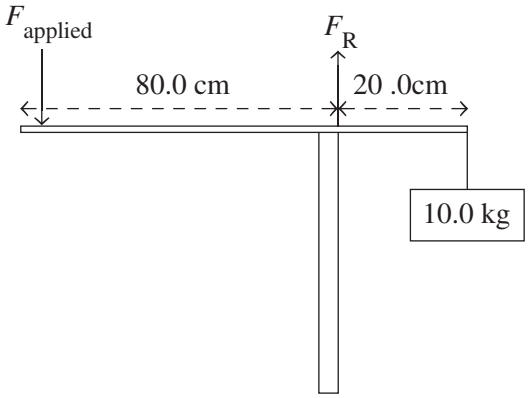


Figure 10

a. Given that the student is standing at a distance of 80.0 cm from the fence, what is the magnitude of the force that the student must apply to the metre ruler to support the 10.0 kg mass? Show your working. 2 marks

N

b. What is the magnitude and direction of the reaction force, F_R, that the fence exerts on the metre ruler? Show your working. 3 marks

N

Question 11 (6 marks)

At a toy workshop, a gift box is at rest on an inclined plane that is at an angle of 30° to the horizontal, as shown in Figure 11. The friction between the object and the surface of the plane is 15.0 N.

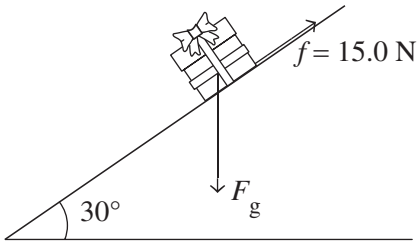


Figure 11

a. Calculate the minimum mass that the gift box must have to slide down the plane. Show your working. 3 marks

kg

b. The weight force and frictional force acting on the gift box are shown in Figure 11.

Draw the normal force on Figure 11. 1 mark

c. Calculate the magnitude of the normal force acting on the gift box. Show your working. 2 marks

N

Question 12 (10 marks)

Two students conduct an experiment to investigate the relationship between the force applied to and the acceleration of a glider on a frictionless linear air track. Table 1 shows some of the data for the experiment.

Table 1

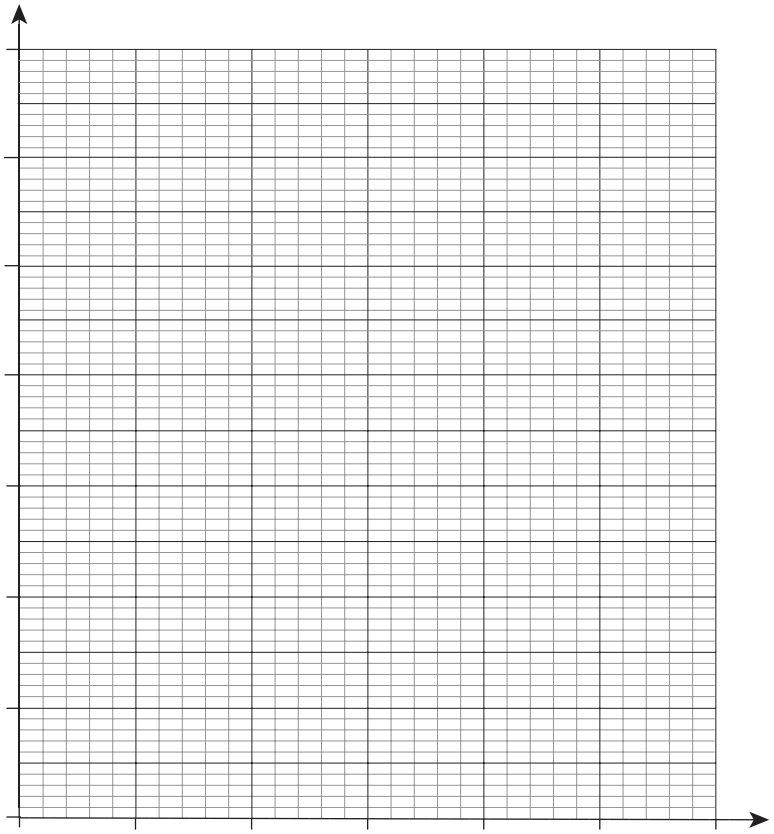
Force (± 0.1 N)	**Acceleration (± 0.1 m s^{-2})**
0.5	1.0
1.0	2.5
1.5	3.5
2.0	4.7
2.5	6.2

a. In the table below, identify the variables involved in this experiment. 3 marks

Classification	**Variable**
independent	
dependent	
controlled	

b. Using the grid provided below, plot an acceleration versus force graph for the data given in Table 1. In your graph:

- include uncertainty bars
- draw a straight line of best fit through the plotted points. 5 marks



c. Using the gradient from the graph plotted in **part b.**, calculate the approximate mass of the glider. Show your working. 2 marks

kg

END OF QUESTION AND ANSWER BOOKLET