Neap

Trial Examination 2020

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

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.

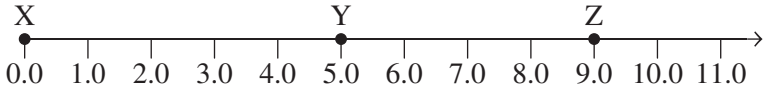
No marks will be given if more than one answer is completed for any question.

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

An object moves along a line from point X to point Z, then back to point Y and then to point Z, as shown in the diagram below.



The displacement of the object, in km, is

A. 5.0

B. 9.0

C. 13.0

D. 17.0

Question 2

An object is moving to the right at 2.0 m s^{-1}. After 2.0 s the object is moving to the left at 4.0 m s^{-1}.

The acceleration of the object for the 2.0 s is closest to

A. 1.0 m s^{-2} to the left.

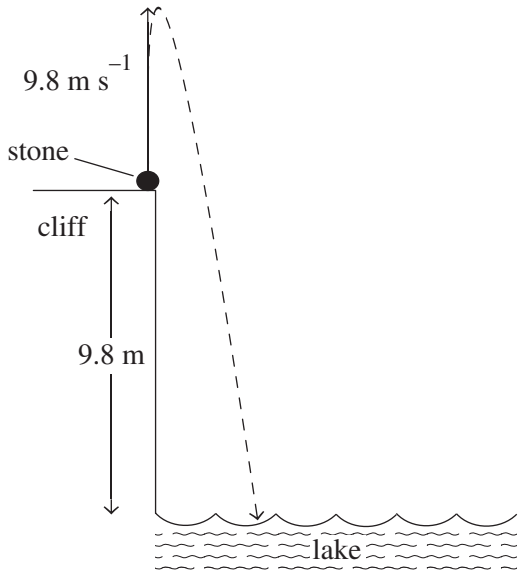
B. 1.0 m s^{-2} to the right.

C. 3.0 m s^{-2} to the left.

D. 3.0 m s^{-2} to the right.

Question 3

A stone is thrown upwards at $9.8\ \text{m s}^{-1}$ from a small cliff that is $9.8\ \text{m}$ above the surface of a lake, as shown below.



The stone's time of flight is closest to

A. 1.0 s

B. 2.0 s

C. 2.7 s

D. 3.4 s

Question 4

A parachutist of mass 60 kg is descending vertically towards the ground at a constant speed of $72\ \text{km h}^{-1}$.

The air resistance force is

A. 0 N

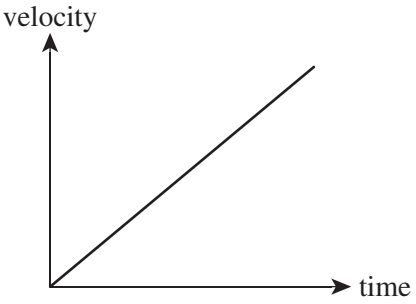
B. 588 N

C. 1200 N

D. 4320 N

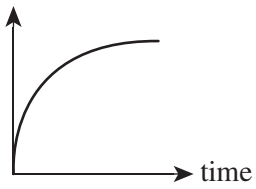
Question 5

The graph below shows how a car's velocity changes with respect to time.

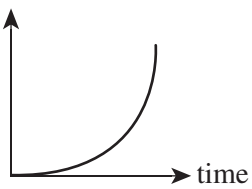


Which one of the following graphs best represents how the net force acting on a car changes with respect to time?

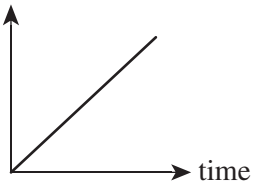
A.



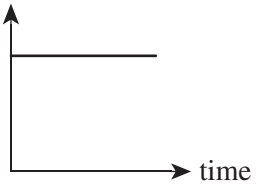
B.



C.



D.



Question 6

In a golf tournament, a competitor hits a 45.9 g golf ball. The ball travels at a speed of 70.0 m s^{-1}.

The golf ball's kinetic energy is closest to

A. 1.61 J
B. 112 J
C. 16 100 J
D. 112 000 J

Question 7

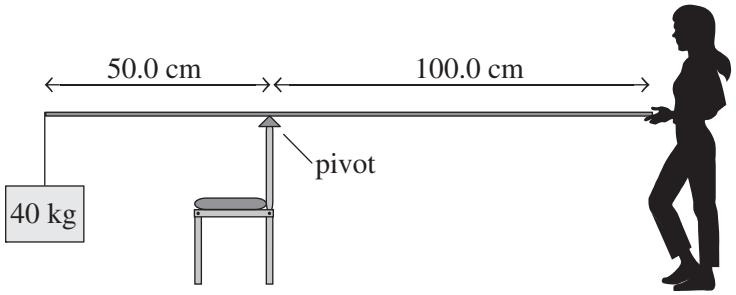
Sophie accidentally drops her mobile phone from a hot-air balloon that is 76.0 m above the ground.

If air resistance is ignored, the ratio of the phone's potential energy to its kinetic energy when the phone is 15.2 m from the ground is closest to

A. 1 : 5
B. 1 : 4
C. 1 : 2
D. 4 : 1

Question 8

Hannah holds a 40.0 kg hanging mass stationary with a 5.0 kg pole lever, using the back of a chair as the pivot, as shown below. The mass is suspended from the pole by a piece of string at a distance of 50 cm from the pivot. Hannah stands 100.0 cm from the pivot point.



The magnitude of the torque that Hannah must apply to keep the pole suspended is closest to

A. 35 N m

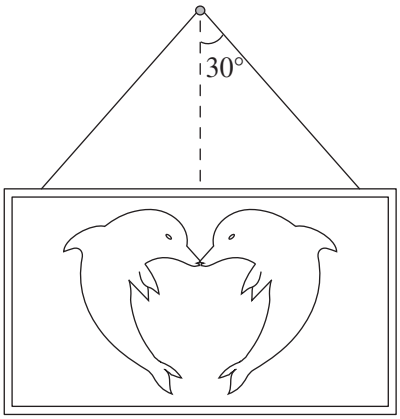
B. 184 N m

C. 196 N m

D. 392 N m

Question 9

A painting hangs on a wall, as shown in the diagram below, suspended by two wires. Each wire is at an angle of $30°$ to the vertical. The painting has a mass of 10 kg.



The tension in **one** of the wires is closest to

A. 42 N

B. 49 N

C. 57 N

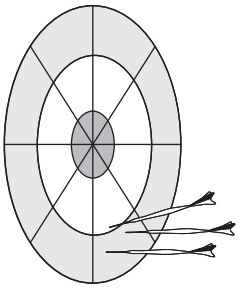
D. 98 N

Question 10

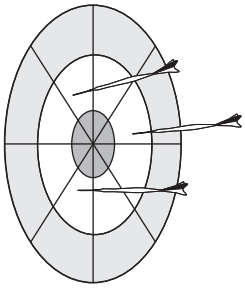
A common way of demonstrating the difference between precision and accuracy is with a dartboard.
In the game of darts, the aim is to strike the bullseye of a dartboard with a dart. A group of friends play four rounds of darts and get different results for each round.

Which one of the following results can best be described as 'not accurate but precise'?

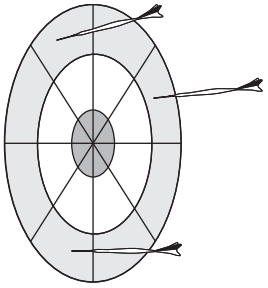
A.



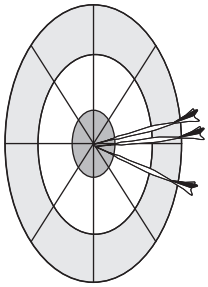
B.



C.



D.



END OF SECTION A

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided. Write using blue or black pen.

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 (15 marks)

A graph demonstrating how velocity varies with time for an object travelling in a straight line is shown in Figure 1. Travelling East is positive in direction.

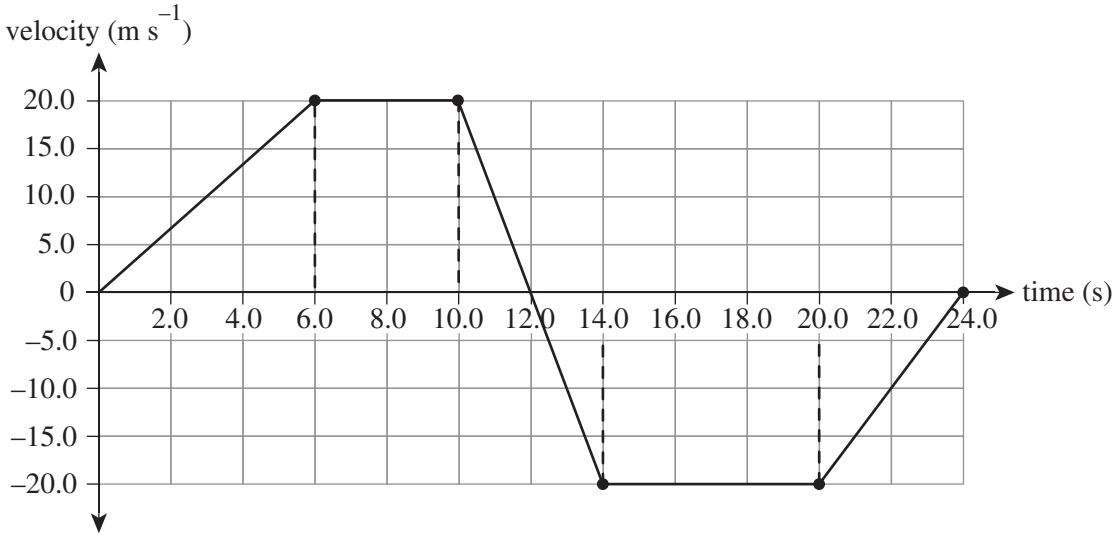


Figure 1

a. What is the object's velocity 3.0 s after the objects starts its motion? If the direction is not applicable, write NA in the answer box. 2 marks

_____

_____

m s^{-1}	

b. What is the object's acceleration 12.0 s after the object starts its motion? Show your working. If the direction is not applicable, write NA in the answer box. 3 marks

_____

_____

_____

m s^{-2}	

c. What distance does the object travel in the first 24.0 s of its motion? Show your working.
If the direction is not applicable, write NA in the answer box. 4 marks

	m	

d. What is the object's final displacement? Show your working. 2 marks

	m

e. On the grid provided below, draw a graph of acceleration versus time for the object's motion. Include axes labels and an appropriate scale and unit for each axis. 4 marks

Question 2 (5 marks)

A car is accelerated from rest at 3.0 m s^{-2}.

a. Find the velocity of the car at 6.0 s. Show your working. 2 marks

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m s^{-1}

b. Find the distance that the car travels during the fifth second of motion. Show your working. 3 marks

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m

Question 3 (3 marks)

An arrow of mass 180 g is fired at a stationary apple of mass 100 g, as shown in Figure 2. The arrow pierces the apple horizontally, and both the arrow and the apple move off together as a single unit. The arrow pierces the apple at a speed of 180 km h^{-1}.

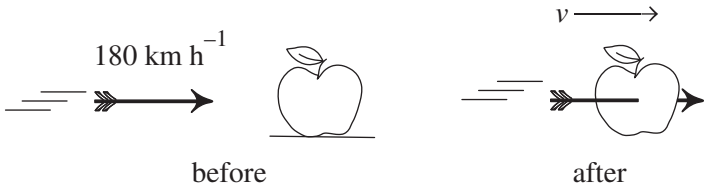

Figure 2

a. What is the speed of the arrow? 1 mark

_____

_____

m s^{-1}

b. What is the speed of the arrow and apple immediately after impact? Show your working. 2 marks

_____

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m s^{-1}

Question 4 (5 marks)

Figure 3 shows the force versus time graph for a 60.0 g tennis ball being hit by a tennis racket.

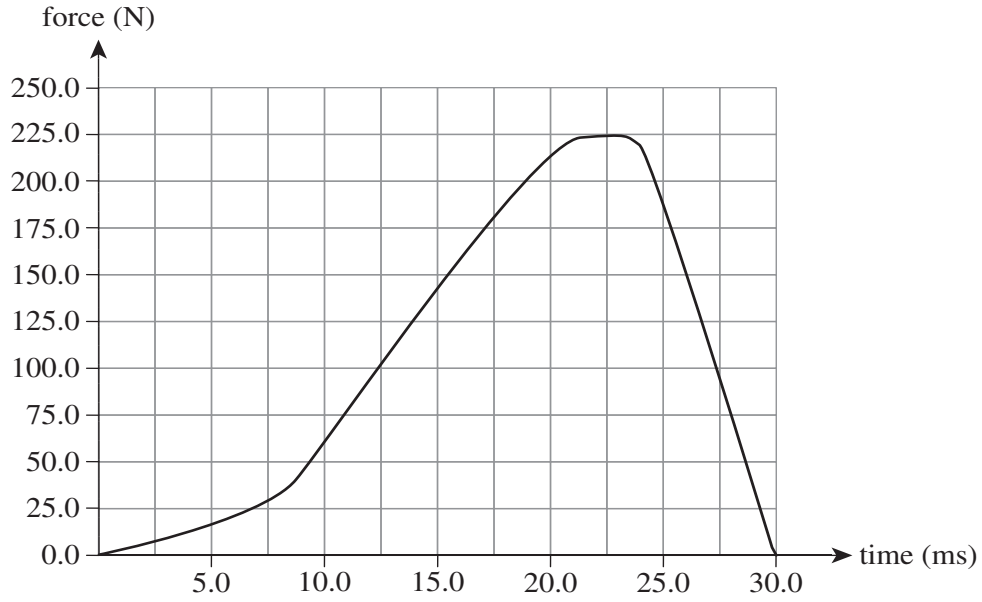

Figure 3

a. What is the magnitude of the impulse given to the tennis ball? Show your working. 3 marks

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_____

N s

b. What is the magnitude of the final velocity of the ball? Show your working. Assume the ball was stationary before being hit by the racquet. 2 marks

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_____

m s^{-1}

Question 5 (4 marks)

Four Physics students are pulling ropes in a four person tug-of-war, as shown in Figure 4.

The students pull their ropes with the following amounts of force:

- Mackenzie pulls her rope with a force of 220.0 N.
- Mia pulls her rope with a force of 210.0 N.
- Zac pulls his rope with a force of 200.0 N.
- Jack pulls his rope with a force of 180.0 N.

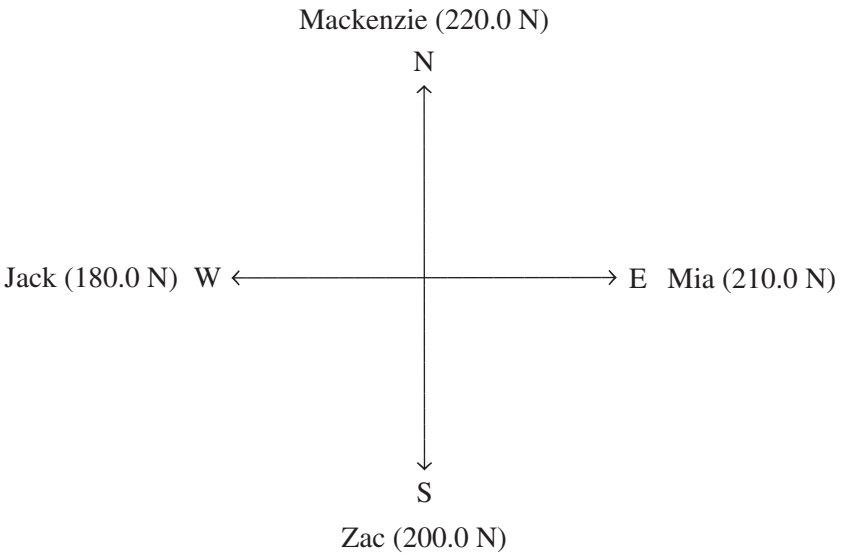

Figure 4

a. Draw a vector diagram showing the net force (F_{net}) at the centre of the ropes. 1 mark

b. What is the magnitude **and** direction of the net force (F_{net}) at the centre of the ropes?
Show your working. 3 marks

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N	

Question 6 (6 marks)

Zixuan pushes two large boxes to the right with a force of 300.0 N along a smooth surface, as shown in Figure 5. Ignore the effects of friction.

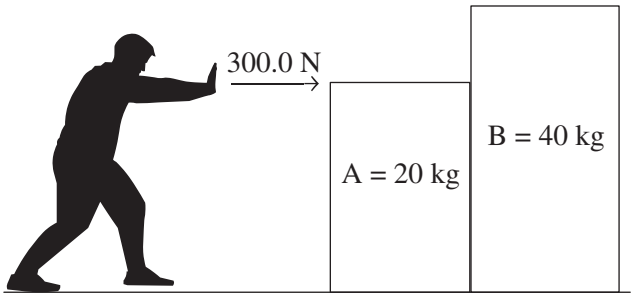

Figure 5

a. What is the magnitude of the acceleration of the boxes? Show your working. 2 marks

_____

_____

_____

	m s^{-2}

b. Calculate the magnitude of the force on box B by box A ($F_{A \text{ on } B}$). Show your working. 2 marks

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_____

_____

	N

c. Calculate the magnitude and direction of the force on box A by box B ($F_{B \text{ on } A}$). Show your working. 2 marks

_____

_____

_____

	N	

Question 7 (5 marks)
The pulley system shown in Figure 6 is set up with a 4.0 kg block on one side and a 5.0 kg block on the other side, connected with fishing wire. The two blocks are held stationary and then released to move.

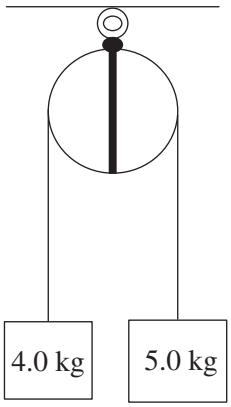

Figure 6

a. Calculate the acceleration of the 4.0 kg block. Include a direction in your answer. Show your working. 3 marks

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_____

_____

_____

_____

m s^{-2}	

b. Calculate the tension in the fishing wire. Show your working. 2 marks

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N

Question 8 (9 marks)

Kegan is sliding down a slide inclined at 30.0° to the ground, as shown in Figure 7. There is a constant frictional force of 100.0 N that acts on Kegan. Kegan has mass of 80 kg.

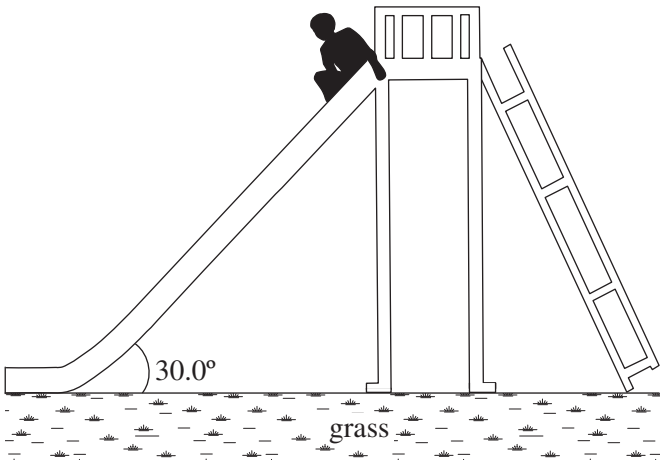

Figure 7

a. On Figure 7, sketch and label the forces acting on Kegan. 3 marks

b. What is the magnitude of the normal force acting on Kegan? Show your working. 2 marks

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_____

_____

_____

N

c. What is the magnitude of the net force acting on Kegan? Show your working. 2 marks

_____

_____

_____

_____

N

d. What is the magnitude of Kegan's net acceleration? Show your working. 2 marks

_____

_____

_____

_____

$m\ s^{-2}$

Question 9 (4 marks)

'Sprung floors' are used in sport halls. They use simple coil springs to absorb shock and reduce injuries. The force (F) versus compression (Δx) graph of a sprung floor is shown in Figure 8.

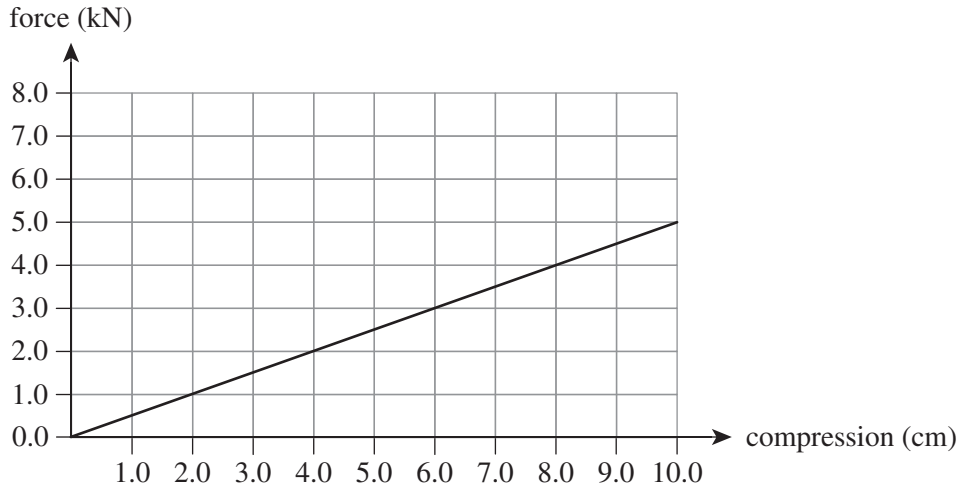


Figure 8

a. Show that the spring constant is 50 000 N m^{-1}. 2 marks

b. Calculate the elastic potential energy stored in the sprung floor when it is compressed by 5.0 cm. 2 marks

J

Question 10 (10 marks)

A car is travelling at 20.0 m s^{-1} on a road with a 60 km h^{-1} speed limit.

a. Is the car speeding? Include a calculation to support your answer. 2 marks

_____

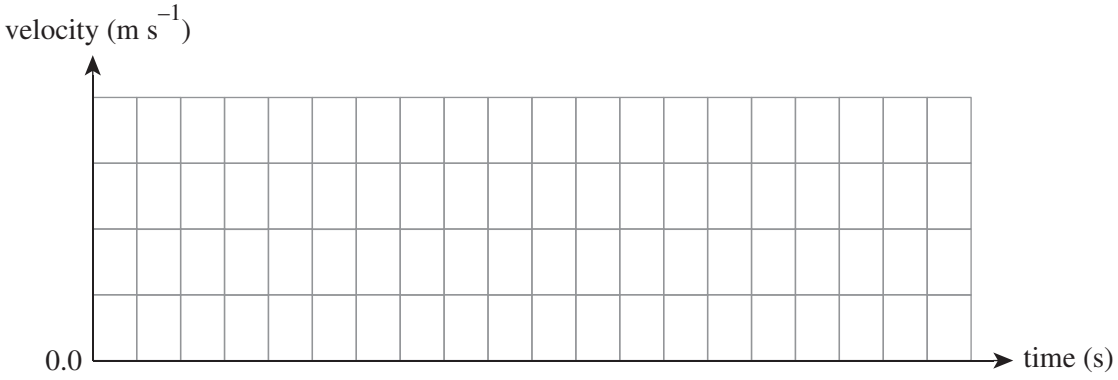
_____

_____

_____

The car passes a police vehicle that is initially at rest. The police vehicle immediately starts to accelerate in pursuit of the car at 3.0 m s^{-2}, until it reaches 30.0 m s^{-1}.

b. On the axes below, sketch the velocity versus time graph for both the car and the police vehicle. Show all relevant speed and time values of importance. 3 marks



c. How long will it take the police vehicle to draw even with the car? Show your working. 3 marks

_____

_____

_____

s

d. How far will the police vehicle travel from the time it starts accelerating to the time it draws even with the car? Show your working. 2 marks

_____

_____

_____

_____

m

Question 11 (2 marks)

Tim stands on a 4.0 m plank of mass of 120 kg at position X, as shown in Figure 9. Position X is 1.0 m from support Q. Tim has a mass of 70 kg.

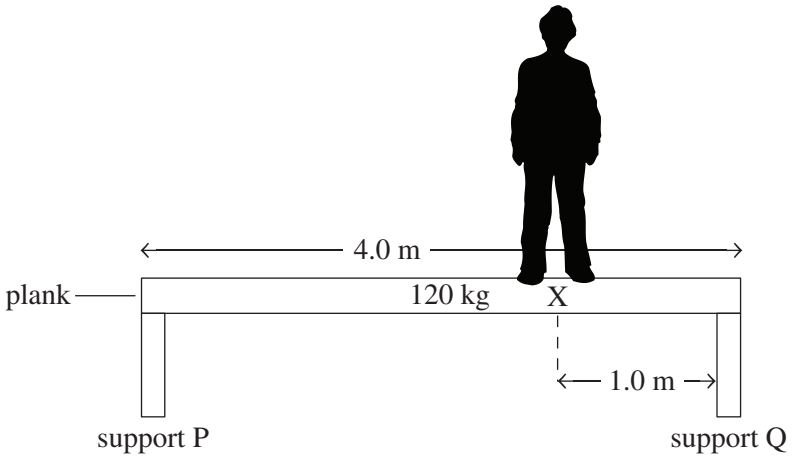


Figure 9

Calculate the magnitude of the force exerted on the plank by support Q. Show your working.

_____

_____

_____

_____

N

Question 12 (12 marks)

Kelly and Samasidh are investigating Newton's second law. In their experiment, a falling mass pulls a cart that is connected to it via a pulley, as shown in Figure 10. The total mass of the cart and falling mass is recorded with its corresponding acceleration. A motion sensor is used to record the cart's acceleration. The experiment is repeated several times; the falling mass is kept constant.

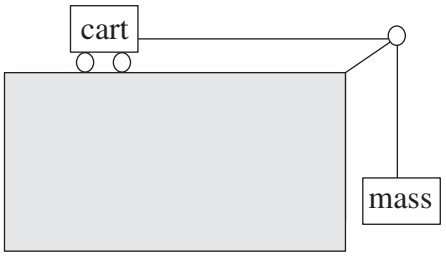


Figure 10

a. The results of Kelly and Samasidh's investigation are shown in the table below.

Fill in the **two** missing entries in the table below. 2 marks

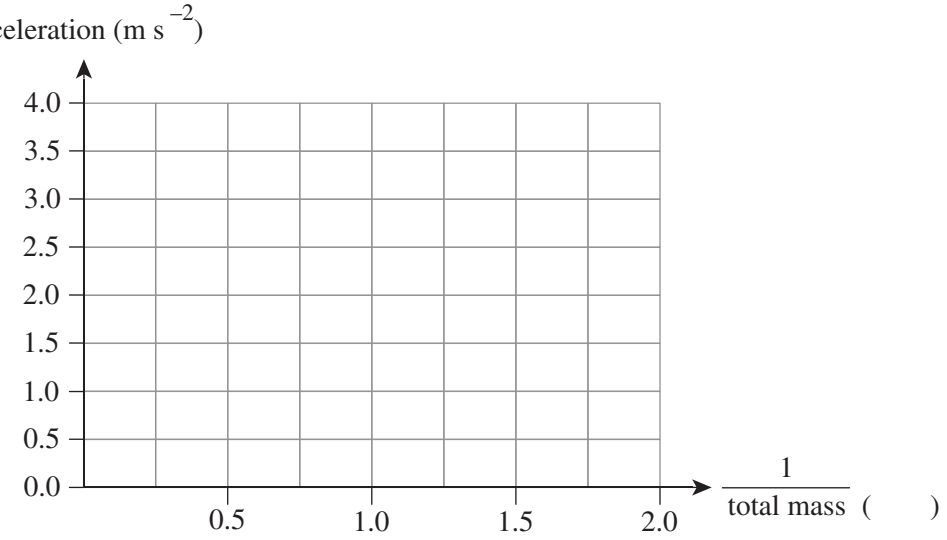
Total mass (kg)	**Acceleration (m s^{-2})**	$\frac{\mathbf{1}}{\textbf{total mass}}$ **( )**
0.500	3.9	2.0
0.750	2.7	
1.000	2.0	1.0
1.250	1.6	0.8
1.500	1.3	0.7
1.750	1.1	0.6

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

Classification	**Variable**
controlled	
dependent	
independent	

c. Using the data provided in the table in **part a.**: 3 marks

- plot a graph of acceleration versus $\frac{1}{\text{total mass}}$
- draw a line of best fit
- include a unit for the horizontal axis.



d. Find the gradient of the line of best fit. Show your working. 2 marks

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_____

_____

_____

e. Given the gradient calculated in **part d.**, what is the magnitude of the constant force applied? Show your working. 2 marks

_____

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N

END OF QUESTION AND ANSWER BOOKLET