This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

# Lebanon Evangelical School

for Boys and Girls Loueizeh - Baabda

# SE02 Exam

## 15DEC2025

Do NOT write in this box. Your MARK will be placed here.

| | |
|---|---|
| Subject : | Physics |
| Class : | 9A |
| Teacher : | Dr Ruth Brett |
| Duration : | 1 hour |

The last page has some equations you may find useful. You may remove it and not replace it. Diagrams and graphs should be done in pencil. Make sure you show your working.

You are to answer the questions to this exam on : This exam paper

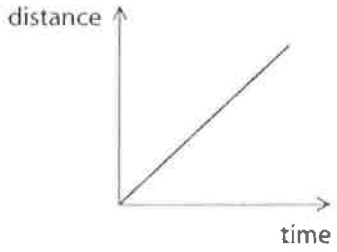
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|---|---|---|
| Your name : | | *Time taken to complete exam* |
| Your Class : | | |
| Exam Room : | | |
| How many sheets, including cover sheet : | | |

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

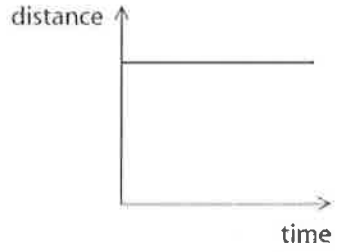
**Q1.** The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.

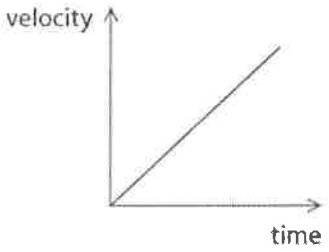
P



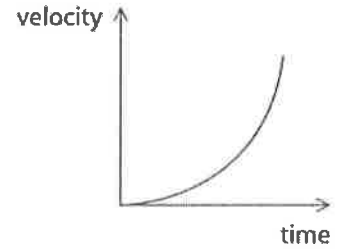

Q




R




S




The table lists some types of motion.
Place one tick (✓) in each row of the table to show which graph represents which type of motion.

(4)

| Type of motion | Graph | | | |
|---|---|---|---|---|
| | P | Q | R | S |
| constant acceleration | | | | |
| increasing acceleration | | | | |
| moving at constant velocity | | | | |
| stationary | | | | |

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

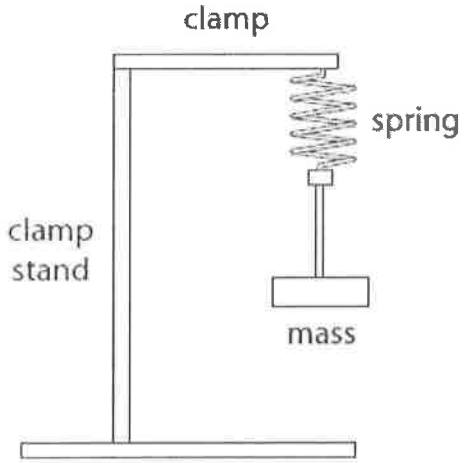
(1)

.....

**(Total for question = 5 marks)**

**Q2.** A student investigates how the extension of a spring varies when the mass attached to the spring is changed.

(a) The diagram shows most of the equipment the student uses in the investigation.




Describe a method the student could use for the investigation.
Your description should include the measurements taken and how the student could obtain accurate results.

(6)

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(b) The student calculates the force each mass applies to the spring.

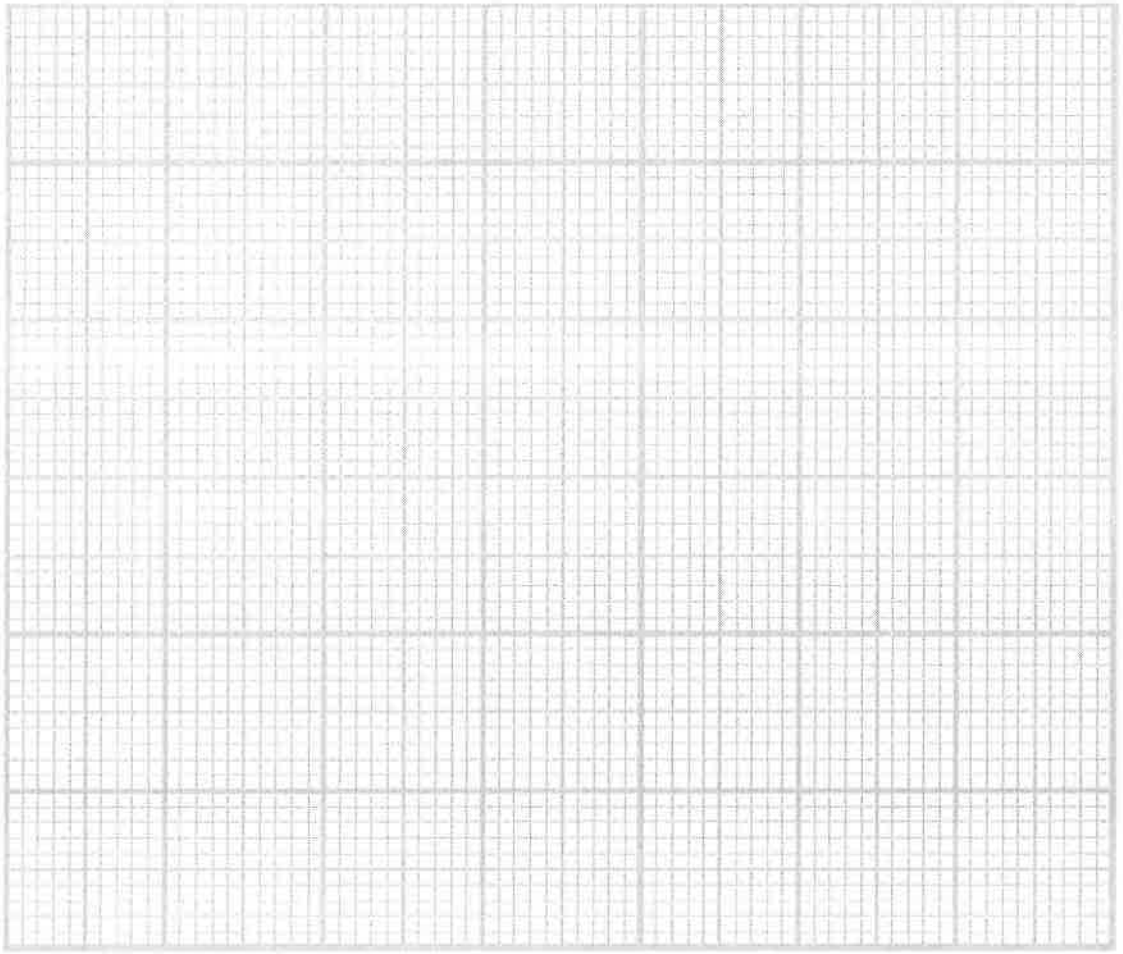
The table on the next page shows the student's results.

| Force in N | Extension in cm |
|---|---|
| 0.0 | 0.0 |
| 1.0 | 2.5 |
| 2.0 | 5.0 |
| 3.0 | 9.8 |
| 4.0 | 10.0 |
| 5.0 | 12.5 |
| 6.0 | 15.5 |
| 7.0 | 17.0 |

(i) Plot the student's results. (3)

(ii) Draw a circle around the anomalous point. (1)

(iii) Draw a line of best fit. (1)



(iv) Explain whether the spring obeys Hooke's Law.

(3)

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**(Total for question = 13 marks)**

**Q3.** An aircraft travels along a runway. The aircraft starts from rest and has a constant acceleration of 4.1 $m/s^2$. Calculate the distance required to reach take-off speed of 75 m/s.

(3)

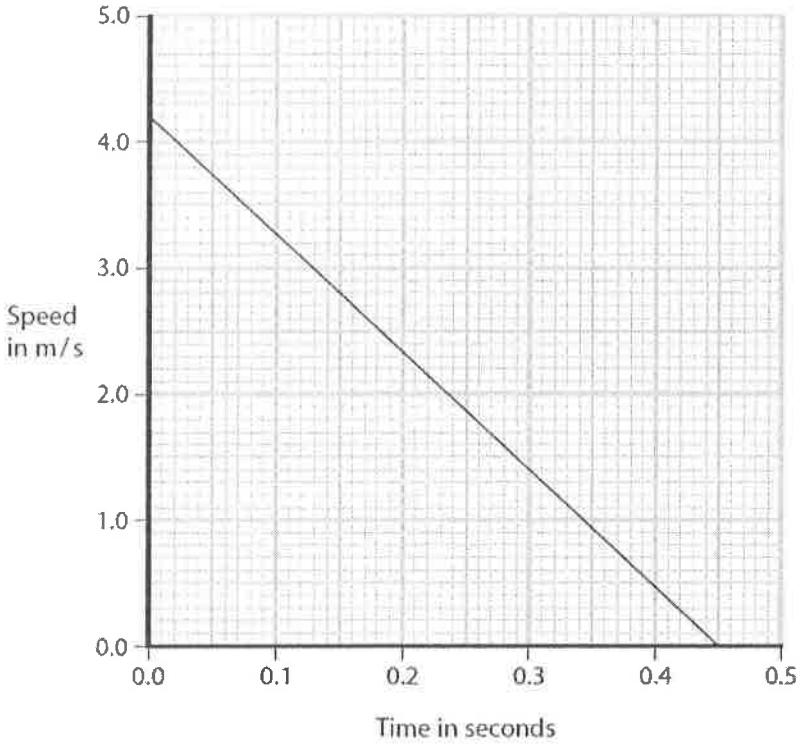
distance = ..... m

**(Total for question = 3 marks)**

**Q4.**

(a) A person throws an object vertically upwards.

The speed-time graph shows how the speed of the object varies from the time it is thrown until reaching its maximum height.




(i) Calculate the acceleration of the object.

(3)

acceleration = ..... m / $s^2$

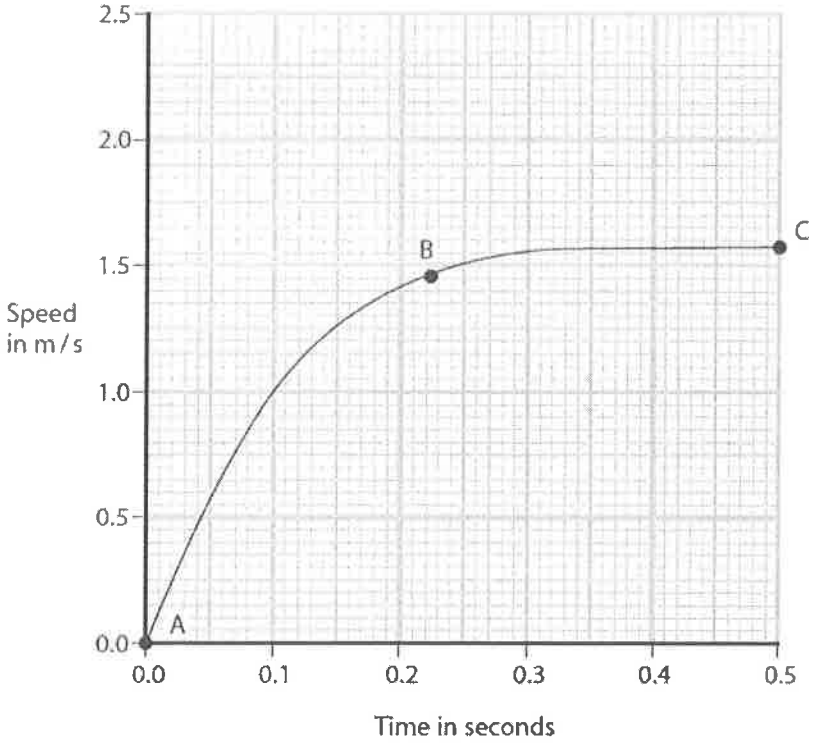
(ii) Calculate the distance the object travels to reach its maximum height.

(3)

distance = ..... m

(b) A different object is dropped from rest and begins to fall.

The graph shows how the speed of this object varies with time.




(i) Give the name of the two forces acting on the object as it falls.

**(2)**

1 .....

2 .....

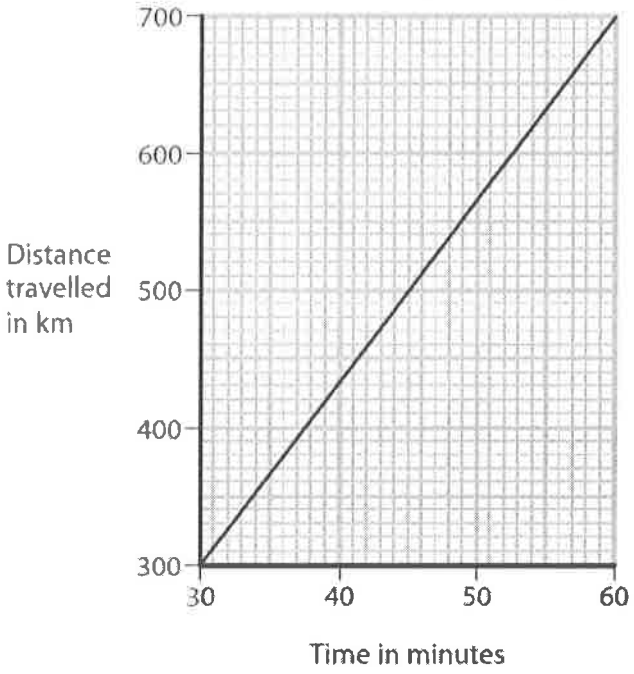
(ii) Draw arrows on the diagram to show the forces acting on the object at B.

**(3)**

object

**(Total for question = 11 marks)**

**Q5.** The graph shows how the distance travelled by an aeroplane changes during part of its journey.




(a) Calculate the average speed of the aeroplane during this part of its journey.

Give a suitable unit (km/h or m/s).

(4)

average speed = ..... unit .....

**(Total for question = 4 marks)**

**Q6.** (a) Diagram 1 shows a van accelerating along a horizontal road.
The horizontal forces acting on the van are shown.

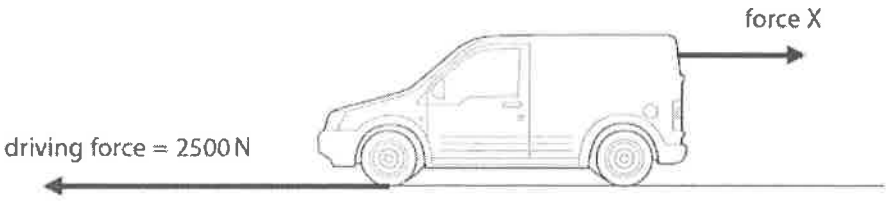



**Diagram 1**

(i) Force X opposes the motion of the van.
State the name of force X.

(1)

.....

(ii) The resultant force acting on the van is 1500 N.
Calculate the magnitude of force X.
[assume X is the only horizontal force opposing the motion of the van]

(1)

force X = ..... N

(b) Later in its journey, the van is travelling at a speed of 18 m/s before the driver applies the brakes and the van comes to a stop.

Calculate the distance travelled by the van while it is braking, given that the deceleration is 7.4 $m/s^2$.

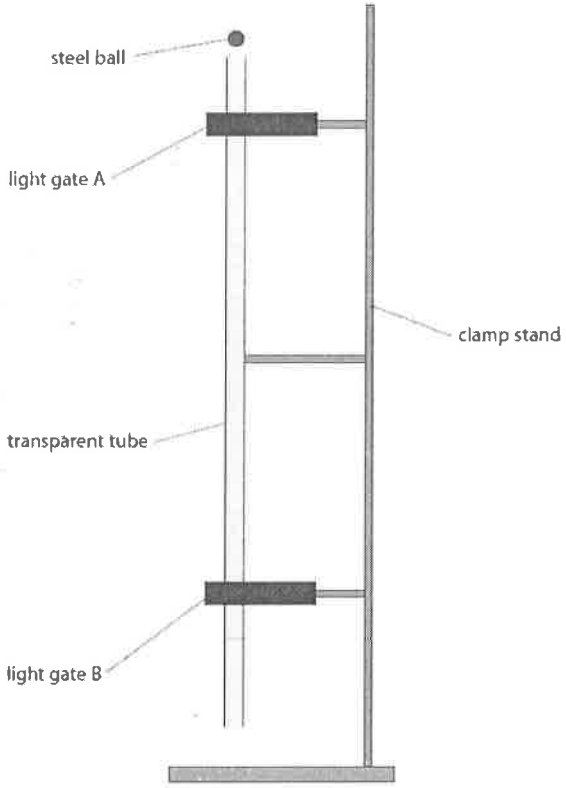
(3)

distance travelled = ..... m

**(Total for question = 5 marks)**

**Q7.** A student does an experiment to determine the acceleration due to gravity, $g$.

The diagram shows the apparatus used.




This is the student's method.

- connect both light gates to a data logger
- drop a steel ball from rest at the top of the transparent tube
- record the speed of the ball at each light gate
- record the time taken for the ball to fall from light gate A to light gate B

The box shows the data recorded by the data logger.

| |
|---|
| speed at A = 1.45 m/s |
| speed at B = 4.20 m/s |
| time from A to B = 0.286 s |

(a) (i) Show that the acceleration of the steel ball is approximately 9.6 $m/s^2$.

(2)

acceleration = ..... $m / s^2$

(ii) Calculate the distance between the light gates.

(3)

distance = ..... m

(b) The student changes the distance between the light gates by varying the position of light gate B.

The student measures the time taken for the steel ball to fall from light gate A to light gate B when the light gates are different distances apart.

The table on the next page shows the student's results.

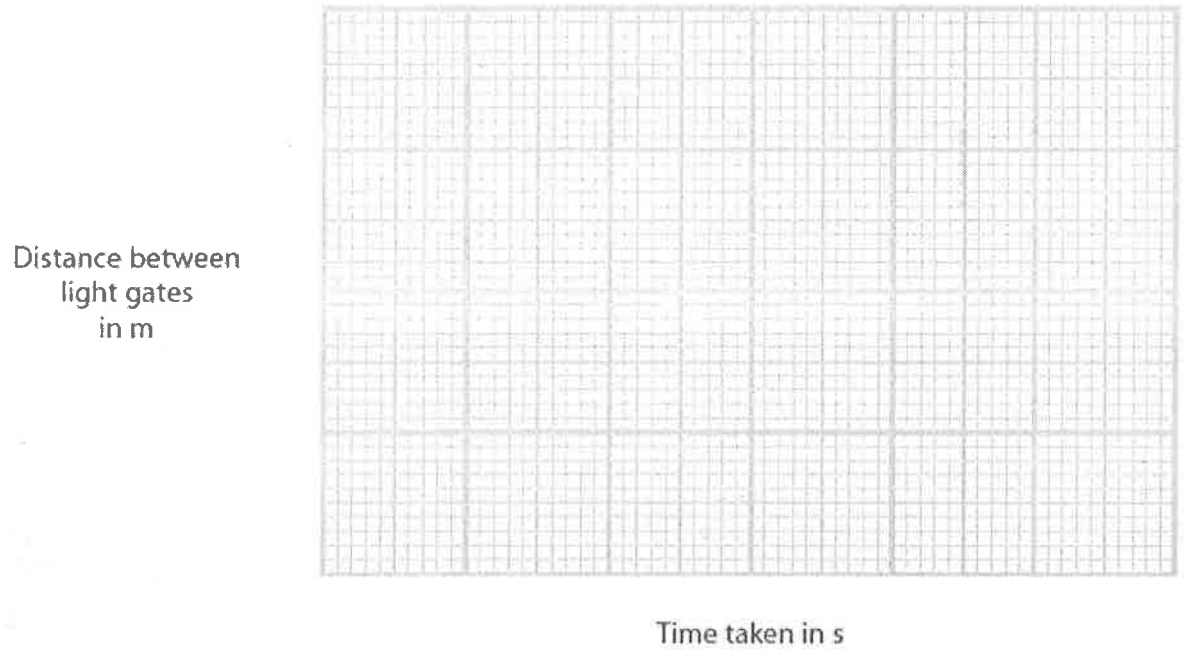
| Distance between light gates in m | Time taken in s |
|---|---|
| 0.10 | 0.058 |
| 0.20 | 0.103 |
| 0.30 | 0.141 |
| 0.40 | 0.175 |
| 0.50 | 0.205 |
| 0.60 | 0.233 |
| 0.70 | 0.260 |

(i) Plot a graph of the student's results on the grid.

(2)

(ii) Draw the curve of best fit.

(1)




(iii) Explain how the graph shows that the steel ball is not falling at a constant speed.

(1)

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**(Total for question = 9 marks)**

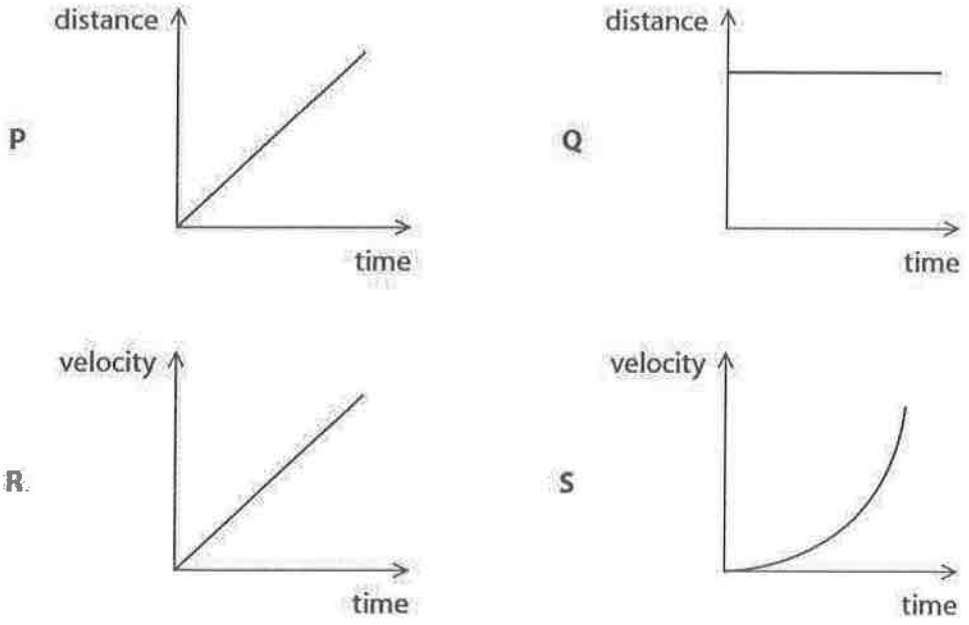
**You may find these formulae useful.**

You may remove this page and NOT staple it back into the booklet.

| **1. Forces and Motion** |
| --- |
| average speed = $\frac{\text{distance moved}}{\text{time taken}}$ |
| acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$ $\qquad a = \frac{(v-u)}{t}$ |
| (final speed)$^2$ = (initial speed)$^2$ + (2 × acceleration × distance moved) $\qquad v^2 = u^2 + (2 \times a \times s)$ |

**Q1.** The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.




The table lists some types of motion.
Place one tick (✓) in each row of the table to show which graph represents which type of motion.

**(4)**

| Type of motion | Graph | | | |
|---|---|---|---|---|
| | P | Q | R | S |
| constant acceleration | | | ✓ (1) | |
| increasing acceleration | | | | ✓ (1) |
| moving at constant velocity | ✓ (1) | | | |
| stationary | | ✓ (1) | | |

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

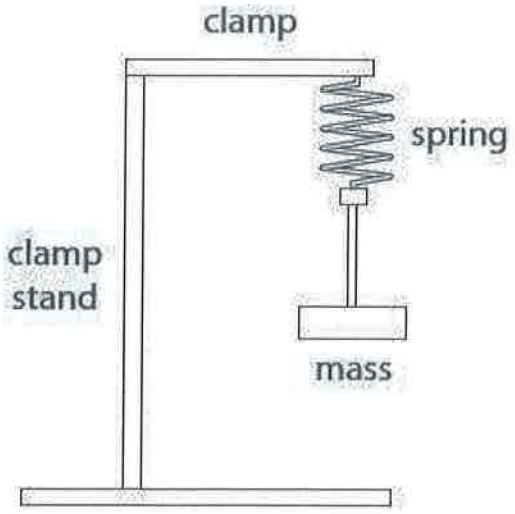
**(1)**

Area under the line (1)

**(Total for question = 5 marks)**

**Q2.** A student investigates how the extension of a spring varies when the mass attached to the spring is changed.

(a) The diagram shows most of the equipment the student uses in the investigation.




Describe a method the student could use for the investigation.
Your description should include the measurements taken and how the student could obtain accurate results.

**(5)**

Use a ruler (1) to measure the original length (1) of the spring. Add a mass and measure the new length of the spring. Calculate the extension using new length - original length. (1)
Increase the mass and determine the new extension. (1)

To make the results accurate, the student should have the meter rule close to the spring (1) and take the reading at eye level. (1)
Check the ruler is vertical using a set square. (1)
Repeat the whole experiment and find the mean (average) extension for each mass. (1)

MAXIMUM 5

(b) The student calculates the force each mass applies to the spring.

The table on the next page shows the student's results.

| Force in N | Extension in cm |
|---|---|
| 0.0 | 0.0 |
| 1.0 | 2.5 |
| 2.0 | 5.0 |
| 3.0 | 9.8 |
| 4.0 | 10.0 |
| 5.0 | 12.5 |
| 6.0 | 15.5 |
| 7.0 | 17.0 |

(i) Plot the student's results.

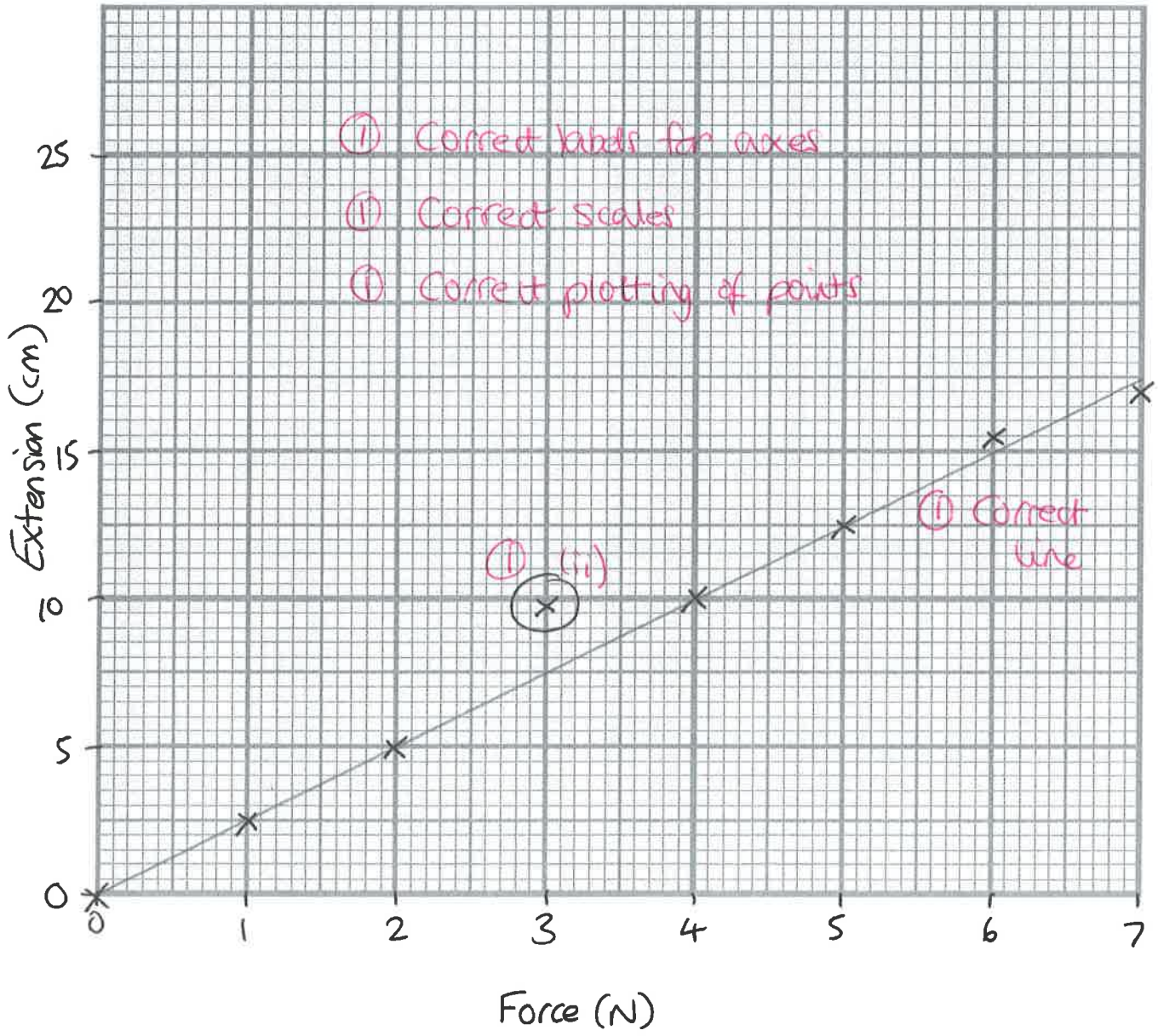
**(3)**

(ii) Draw a circle around the anomalous point.

**(1)**

(iii) Draw a line of best fit.

**(1)**



(iv) Explain whether the spring obeys Hooke's Law.

**(3)**

Hooke's law states that extension is proportional to the force. (1)

The graph is a straight line (1) through the origin (1) therefore it obeys Hooke's law.

**(Total for question = 13 marks)**

**Q3.** An aircraft travels along a runway. The aircraft starts from rest and has a constant acceleration of 4.1 $m/s^2$. Calculate the distance required to reach take-off speed of 75 m/s.

**(3)**

$u = 0 \quad a = 4.1 \quad s = ? \quad v = 75$

$v^2 = u^2 + (2 \times a \times s)$ (1)

$75^2 = 0 + (2 \times 4.1 \times s)$

$s = \frac{5625}{8.2} = 685.98$ (1)

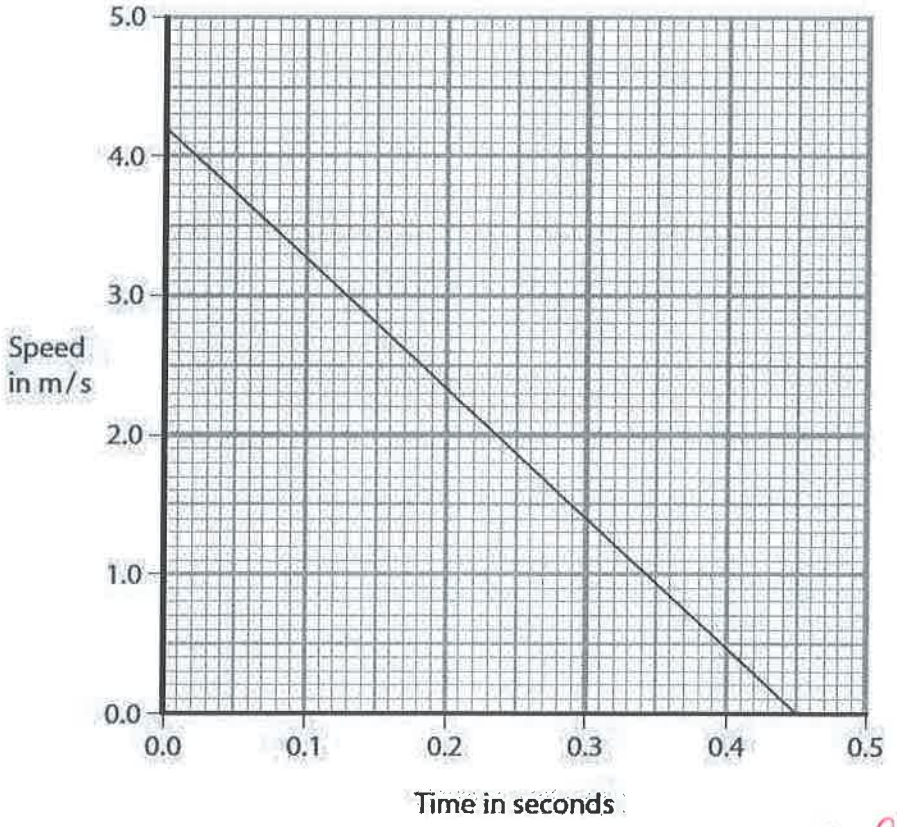
distance = 686 (1) m

**(Total for question = 3 marks)**

**Q4.**

(a) A person throws an object vertically upwards.

The speed-time graph shows how the speed of the object varies from the time it is thrown until reaching its maximum height.




(i) Calculate the acceleration of the object.

(1) attempt at finding gradient

$$\text{Acceleration} = \text{gradient} = \frac{4.2 - 0}{0 - 0.45} = \frac{4.2}{-0.45} = -9.33 \text{ m/s}^2$$

(3)

(1) correct numbers

acceleration = $-9.3$ (1) m / s$^2$

(ii) Calculate the distance the object travels to reach its maximum height.

$$\text{Distance} = \text{area} = \frac{1}{2} \times 0.45 \times 4.2 = 0.945 \text{ m}$$

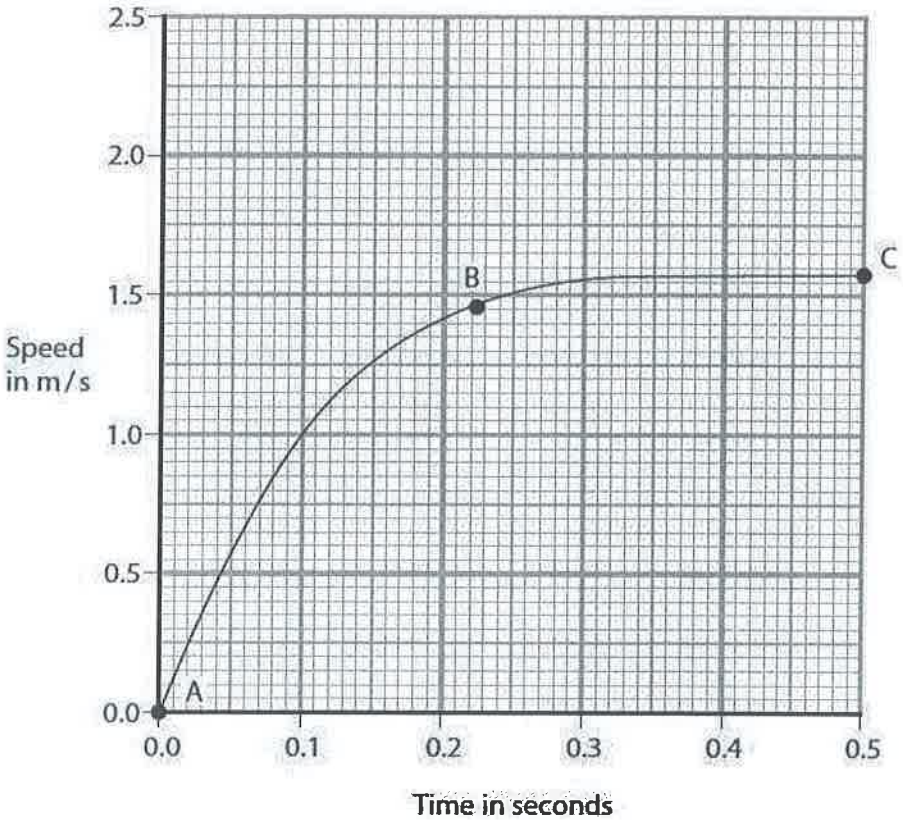
(1) (1)

distance = $0.95$ (1) m

**(3)**

(b) A different object is dropped from rest and begins to fall.

The graph shows how the speed of this object varies with time.




(i) Give the name of the two forces acting on the object as it falls.

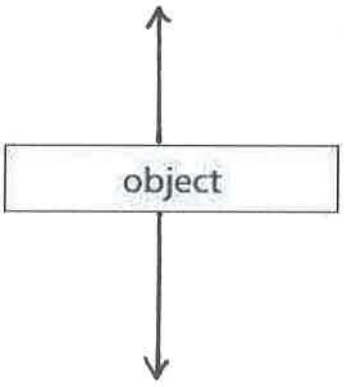
**(2)**

1 Weight (1)

2 Air resistance (1)

(ii) Draw arrows on the diagram to show the forces acting on the object at B.

**(3)**



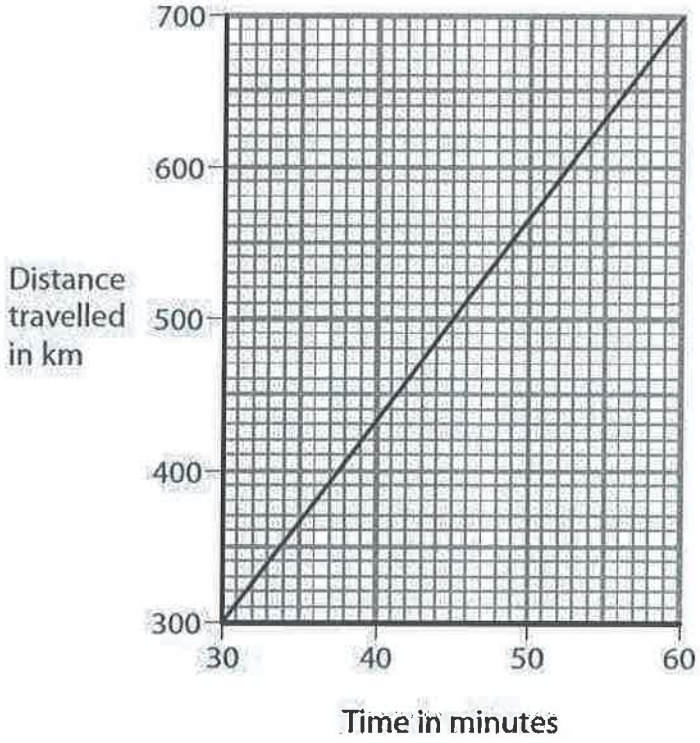

(1) One arrow up and one arrow down

(1) Arrows touch the object

(1) 'Down' arrow is longer than 'up' arrow

**(Total for question = 11 marks)**

**Q5.** The graph shows how the distance travelled by an aeroplane changes during part of its journey.




(a) Calculate the average speed of the aeroplane during this part of its journey.

Give a suitable unit (km/h or m/s).

(4)

Speed = gradient = $\frac{700\text{ km} - 300\text{ km}}{60\text{ minutes} - 30\text{ minutes}}$ (1) $= \frac{400\text{km}}{30\text{minutes}}$ (1)

or 13·3 km/minutes

Either 30 minutes = $\frac{30}{60} = 0{\cdot}5$ hour so speed = $\frac{400\text{ km}}{0{\cdot}5\text{ h}}$

speed = 800km/h

Or 30 minutes = 30x60 = 1800 seconds

so speed = $\frac{400\,000\text{ m}}{1800\text{ s}} = 222\text{ m/s}$

average speed = ..... 800 (1) unit ..... km/h (1)

or 222 (1) m/s (1)

**(Total for question = 4 marks)**

**Q6.** (a) Diagram 1 shows a van accelerating along a horizontal road.
The horizontal forces acting on the van are shown.

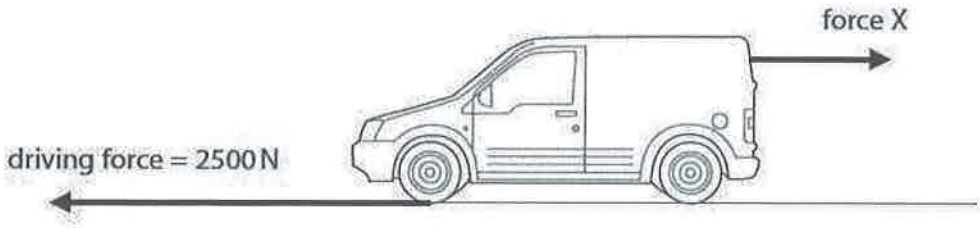



**Diagram 1**

(i) Force X opposes the motion of the van.
State the name of force X.

(1)

Drag / air resistance / friction (1)

(ii) The resultant force acting on the van is 1500 N.
Calculate the magnitude of force X.
[assume X is the only horizontal force opposing the motion of the van]

(1)

$2500 - X = 1500$

$X = 1000N$

force X = 1000 (1) N

(b) Later in its journey, the van is travelling at a speed of 18 m/s before the driver applies the brakes and the van comes to a stop.

Calculate the distance travelled by the van while it is braking, given that the deceleration is 7.4 m/s$^2$.

(3)

$u = 18m/s \quad v = 0 \quad s = ? \quad a = -7.4m/s^2$

$v^2 = u^2 + (2 \times a \times s)$

$0 = 18^2 + (2 \times (-7.4) \times s)$ (1)

$0 = 324 - 14.8s$

$14.8s = 324$

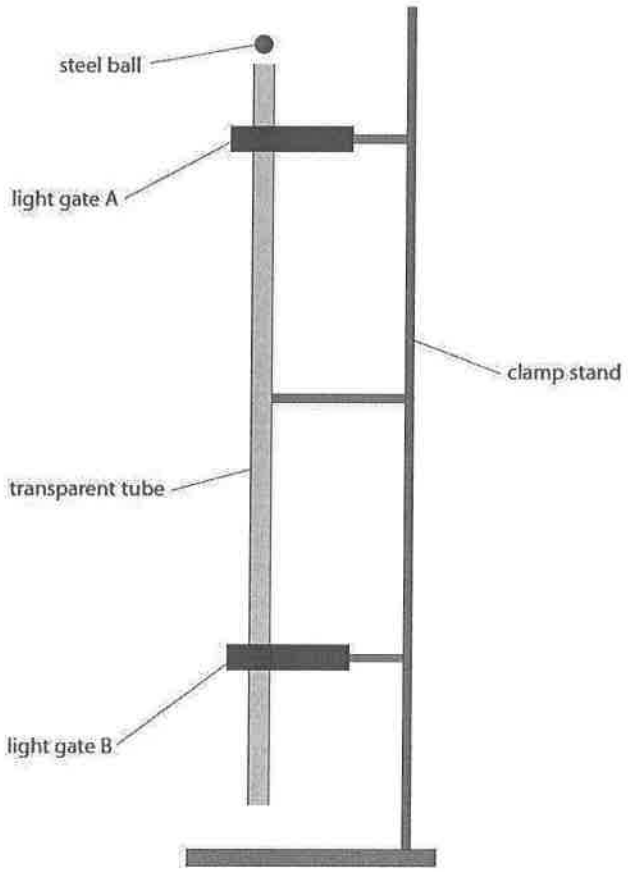
$s = \frac{324}{14.8} = 21.89m$ (1)

distance travelled = 21.9 (1) m

**(Total for question = 5 marks)**

**Q7.** A student does an experiment to determine the acceleration due to gravity, *g*.

The diagram shows the apparatus used.




This is the student's method.

- connect both light gates to a data logger
- drop a steel ball from rest at the top of the transparent tube
- record the speed of the ball at each light gate
- record the time taken for the ball to fall from light gate A to light gate B

The box shows the data recorded by the data logger.

| |
|---|
| speed at A = 1.45 m/s |
| speed at B = 4.20 m/s |
| time from A to B = 0.286 s |

(a) (i) Show that the acceleration of the steel ball is approximately 9.6 m/s$^2$ . (2)

$u = 1{\cdot}45\,m/s \quad v = 4{\cdot}20\,m/s \quad t = 0{\cdot}286\,s \quad a = ?$

$a = \frac{(v-u)}{t} = \frac{(4{\cdot}2 - 1{\cdot}45)}{0{\cdot}286}$ (1) $= \frac{2{\cdot}75}{0{\cdot}286} = 9{\cdot}615$

acceleration = 9.62 (1) m / s$^2$

(ii) Calculate the distance between the light gates. (3)

$v^2 = u^2 + 2 \times a \times s$

$4{\cdot}2^2 = 1{\cdot}45^2 + (2 \times 9{\cdot}62 \times s)$ (1)

$17{\cdot}64 = 2{\cdot}10 + 19{\cdot}24\,s$

$19{\cdot}245 = 15{\cdot}54$

$s = \frac{15{\cdot}54}{19{\cdot}24} = 0{\cdot}808\,m$ (1)

distance = 0.81 (1) m

(b) The student changes the distance between the light gates by varying the position of light gate B.

The student measures the time taken for the steel ball to fall from light gate A to light gate B when the light gates are different distances apart.

The table on the next page shows the student's results.

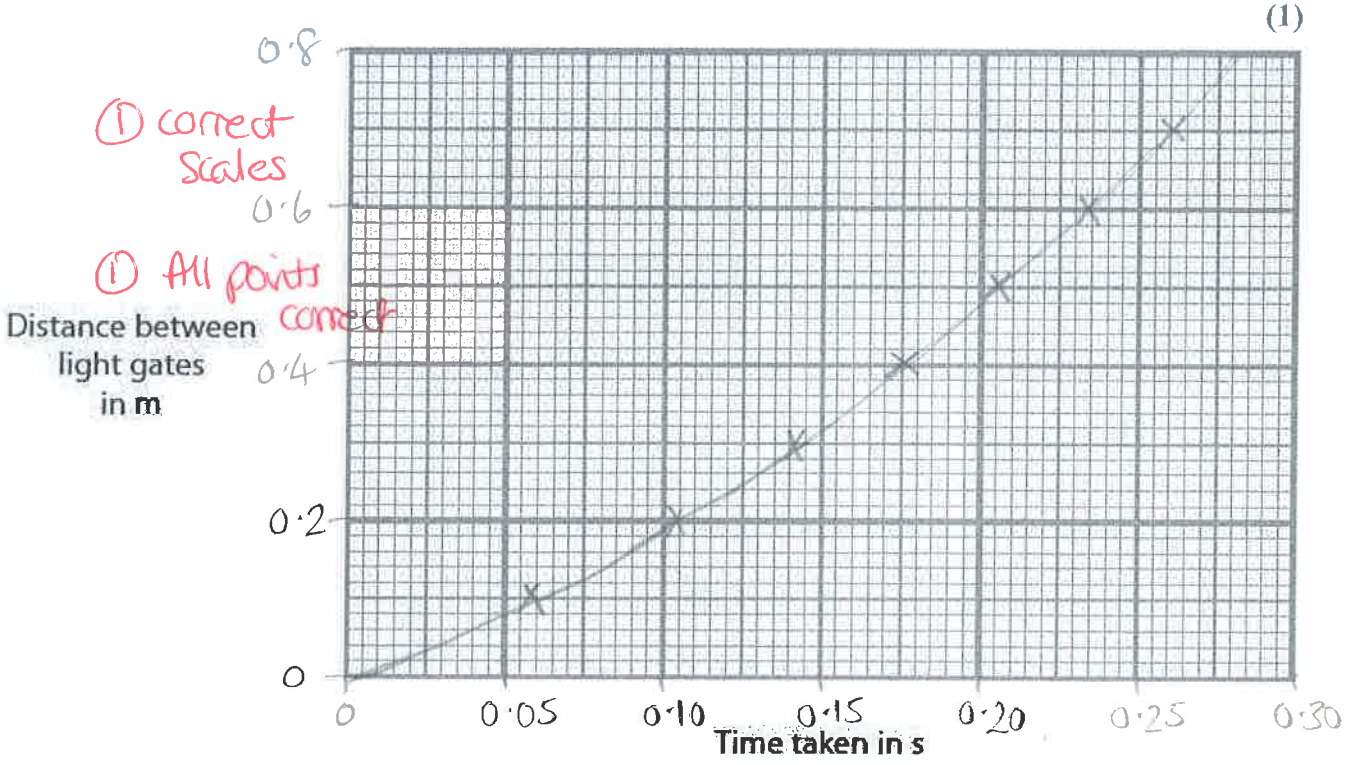
| Distance between light gates in m | Time taken in s |
|---|---|
| 0.10 | 0.058 |
| 0.20 | 0.103 |
| 0.30 | 0.141 |
| 0.40 | 0.175 |
| 0.50 | 0.205 |
| 0.60 | 0.233 |
| 0.70 | 0.260 |

(i) Plot a graph of the student's results on the grid.

**(2)**

(ii) Draw the curve of best fit. ① Smooth curve

**(1)**




(iii) Explain how the graph shows that the steel ball is not falling at a constant speed.

**(1)**

The curve is getting steeper ①

**(Total for question = 9 marks)**

**You may find these formulae useful.**

You may remove this page and NOT staple it back into the booklet.

| 1. Forces and Motion |
| --- |
| average speed = $\frac{\text{distance moved}}{\text{time taken}}$ |
| acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$ $\qquad a = \frac{(v-u)}{t}$ |
| (final speed)$^2$ = (initial speed)$^2$ + (2 × acceleration × distance moved) $\qquad v^2 = u^2 + (2 \times a \times s)$ |