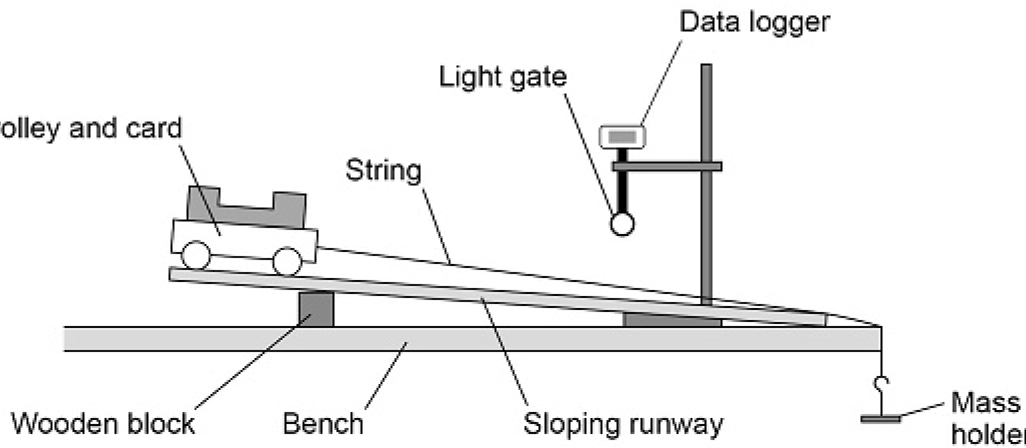
1. A student investigated the acceleration of a trolley.

The diagram below shows how the student set up the apparatus.



(a) Before attaching the mass holder the student placed the trolley at the top of the runway. The trolley rolled down the runway without being pushed.

What change to the apparatus in the diagram could be made to prevent the trolley from starting to roll down the runway?

Tick (✓) **one** box.

Move the wooden block to the left.	☐
Shorten the length of the runway.	☐
Use a taller wooden block.	☐

(1)

(b) The student attached the mass holder to the string.

The string rubbed along the edge of the bench as the mass holder fell to the floor.

Suggest what the student could do to prevent the string from rubbing.

____

____

(1)

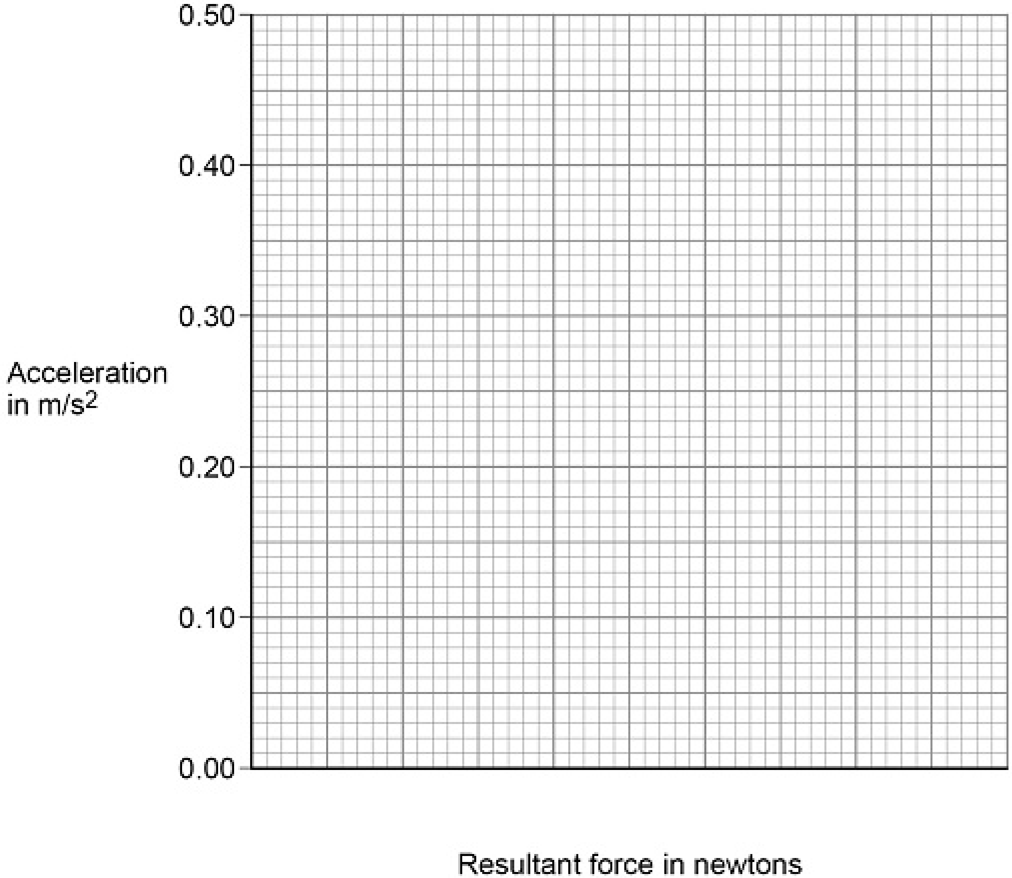
The light gate and data logger were used to determine the acceleration of the trolley.

The student increased the resultant force on the trolley and recorded the acceleration of the trolley.

The table below shows the results.

Resultant force in newtons	**Acceleration in m/s^2**
0.05	0.08
0.10	0.18
0.15	0.25
0.20	0.32
0.25	0.41

The graph below is an incomplete graph of the results.



(c) Complete the graph.

- Choose a suitable scale for the x-axis.
- Plot the results.
- Draw a line of best fit.

(4)

(d) Describe the relationship between the resultant force on the trolley and the acceleration of the trolley.

____

____

(1)

(e) Describe how the investigation could be improved to reduce the effect of random errors.

____

____

____

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(2)

(f) Write down the equation that links acceleration (*a*), mass (*m*) and resultant force (*F*).

____

(1)

(g) The resultant force on the trolley was 0.375 N.

The mass of the trolley was 0.60 kg.

Calculate the acceleration of the trolley.

Give your answer to 2 significant figures.

____

____

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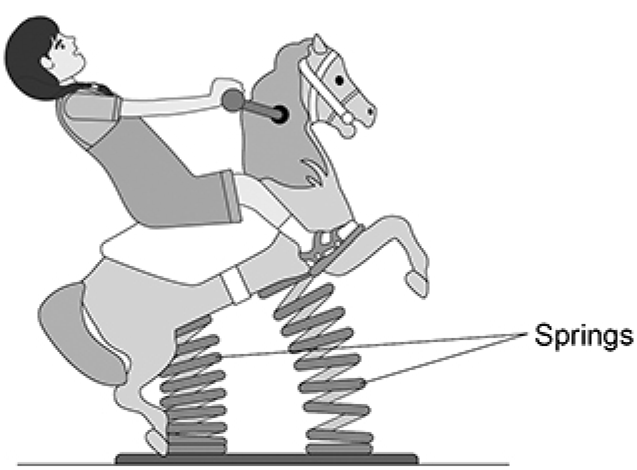
Acceleration (2 significant figures) = _______________ m/s^2

(4)

(Total 14 marks)

2. **Figure 1** below shows a child on a playground toy.

Figure 1



(a) The springs have been elastically deformed.

Explain what is meant by ‘elastically deformed’.

___

___

___

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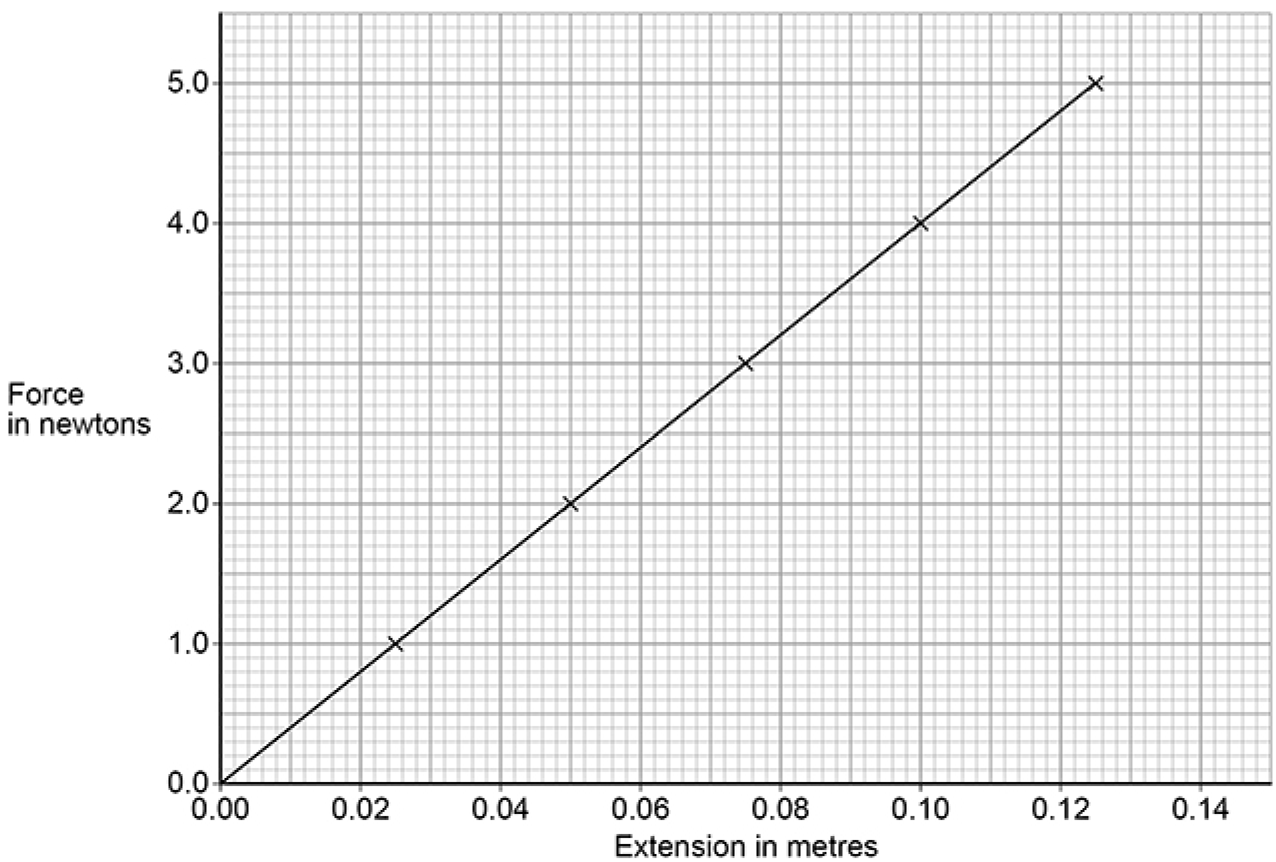
(2)

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 2 below shows the results.

Figure 2



(b) Describe a method the student could use to obtain the results given in **Figure 2**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

(6)

(c) Which equation links extension (e), force (F) and spring constant (k).

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

force = spring constant × extension ☐

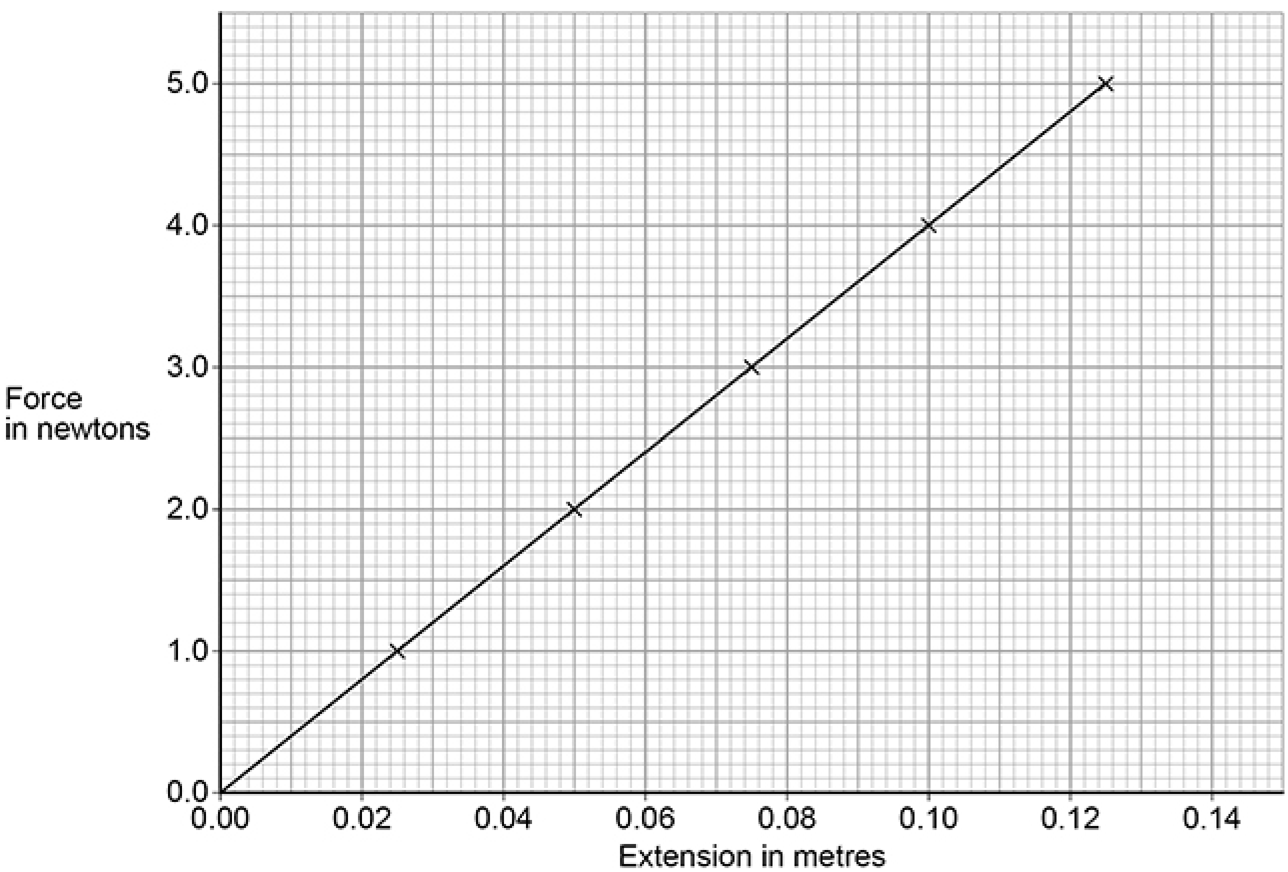
force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

(1)

Figure 2 is repeated below.

Figure 2



(d) Determine the spring constant of the spring.

Use **Figure 2**.

Spring constant = _______________ N/m

(3)

(e) The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 2** supports the student's conclusion.

(2)

(f) The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

Elastic potential energy = _______________ J

(3)

(Total 17 marks)

3. The thinking distance and braking distance for a car vary with the speed of the car.

(a) Explain the effect of **two** other factors on the **braking** distance of a car.

Do **not** refer to speed in your answer.

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___

___

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(4)

(b) Which equation links acceleration (a), mass (m) and resultant force (F).

Tick (✓) **one** box.

resultant force = mass × acceleration	☐
resultant force = mass × acceleration^2	☐
resultant force = $\frac{\text{mass}}{\text{acceleration}^2}$	☐
resultant force = $\frac{\text{mass}}{\text{acceleration}}$	☐

(1)

(c) The mean braking force on a car is 7200 N.

The car has a mass of 1600 kg.

Calculate the deceleration of the car.

____

____

____

____

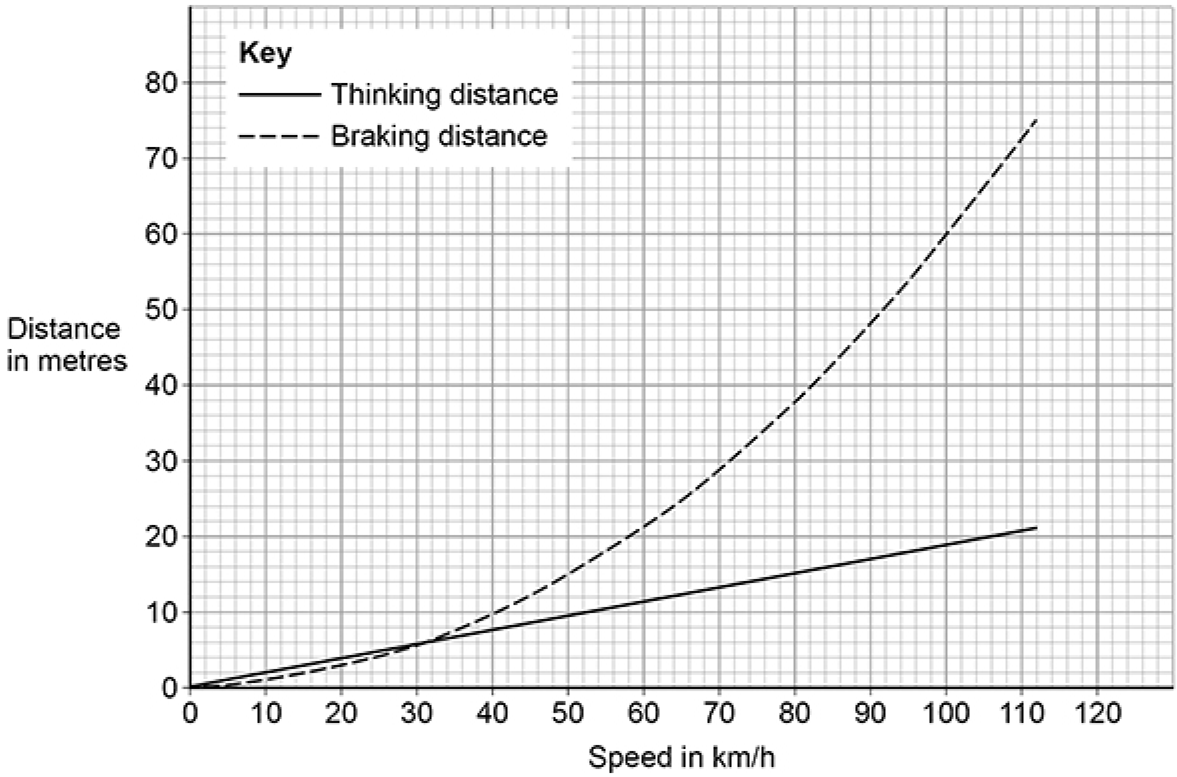
____

Deceleration = ________________ m/s^2

(3)

(d) **Figure 1** below shows how the thinking distance and braking distance for a car vary with the speed of the car.

Figure 1



Determine the stopping distance when the car is travelling at 80 km/h.

____

____

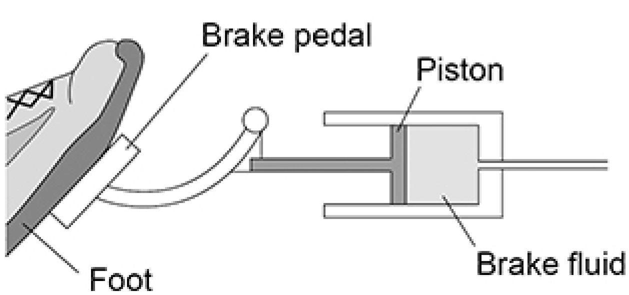
____

Stopping distance = ________________ m

(2)

Figure 2 below shows part of the braking system for a car.

Figure 2



(e) Which equation links area of a surface (A), the force normal to that surface (F) and pressure (p)?

Tick (✓) **one** box.

$p = F \times A$ ☐

$p = F \times A^2$ ☐

$p = \frac{F}{A}$ ☐

$p = \frac{A}{F}$ ☐

(1)

(f) When the brake pedal is pressed, a force of 60 N is applied to the piston.

The pressure in the brake fluid is 120 000 Pa.

Calculate the surface area of the piston.

Give your answer in standard form.

Give the unit.

____

____

____

____

____

____

____

____

____

Surface area (in standard form) = ________________ Unit ___________

(5)

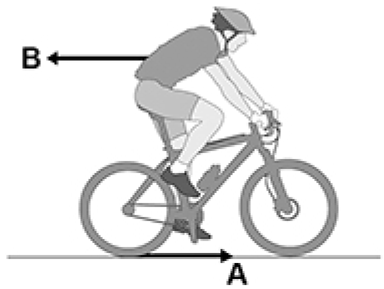
(Total 16 marks)

4. **Figure 1** shows a cyclist on a bicycle.

The cyclist is moving at a constant velocity.

Arrows **A** and **B** represent the horizontal forces acting on the bicycle and cyclist.

Figure 1



(a) What is force **A**?

Tick (✓) **one** box.

Air resistance ☐

Friction ☐

Tension ☐

Upthrust ☐

(1)

(b) What is force **B**?

Tick (✓) **one** box.

Air resistance ☐

Magnetic ☐

Tension ☐

Upthrust ☐

(1)

(c) What is the relationship between force **A** and force **B** when the cyclist travels at a constant velocity?

Tick (✓) **one** box.

A = **B** ☐

A > **B** ☐

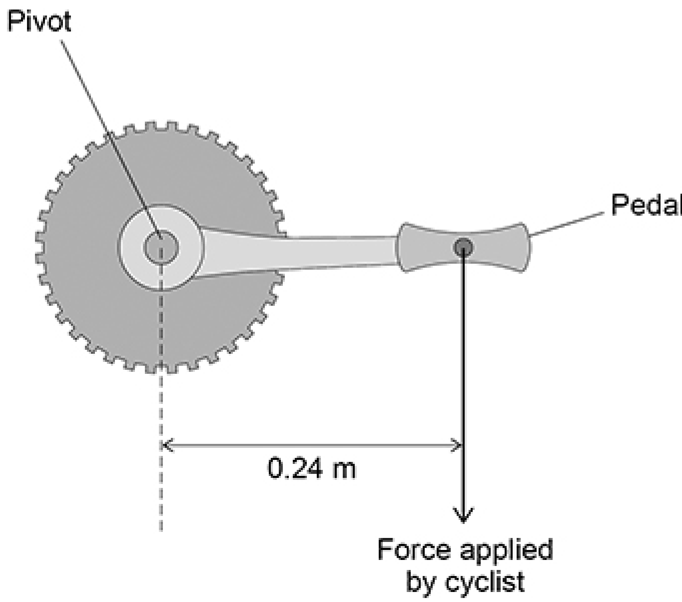
A < **B** ☐

(1)

(d) The cyclist applies a force of 150 N to one of the bicycle pedals.

Figure 2 shows the distance between the force applied and the pivot.

Figure 2



Calculate the moment about the pivot caused by the force applied to the pedal in **Figure 2**.

Use the equation:

moment of a force = force × distance

___

___

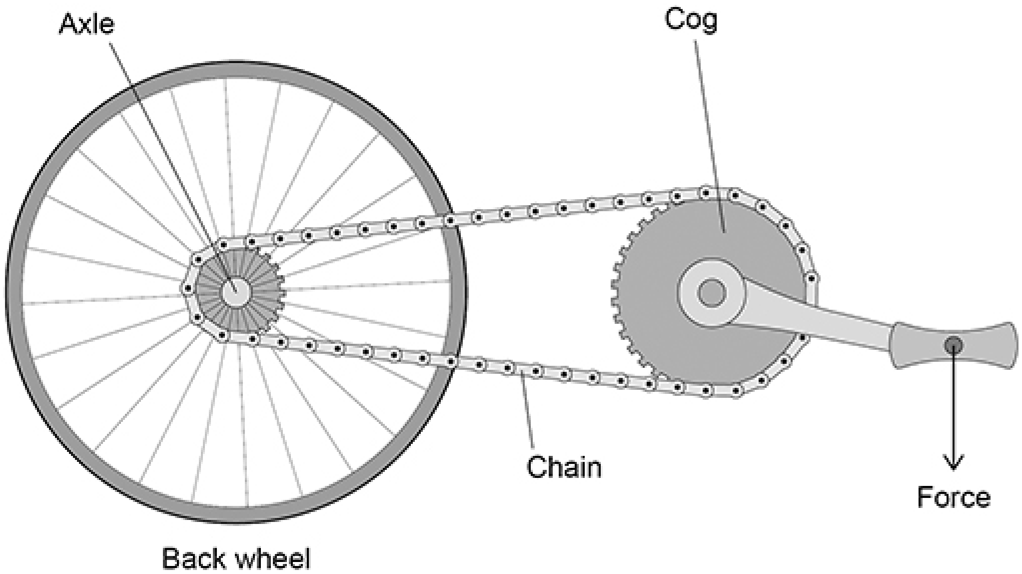
___

Moment = ________________ N m

(2)

(e) **Figure 3** shows how the pedal is connected to the back wheel of the bicycle.

Figure 3



Complete the sentence.

Choose the answer from the box.

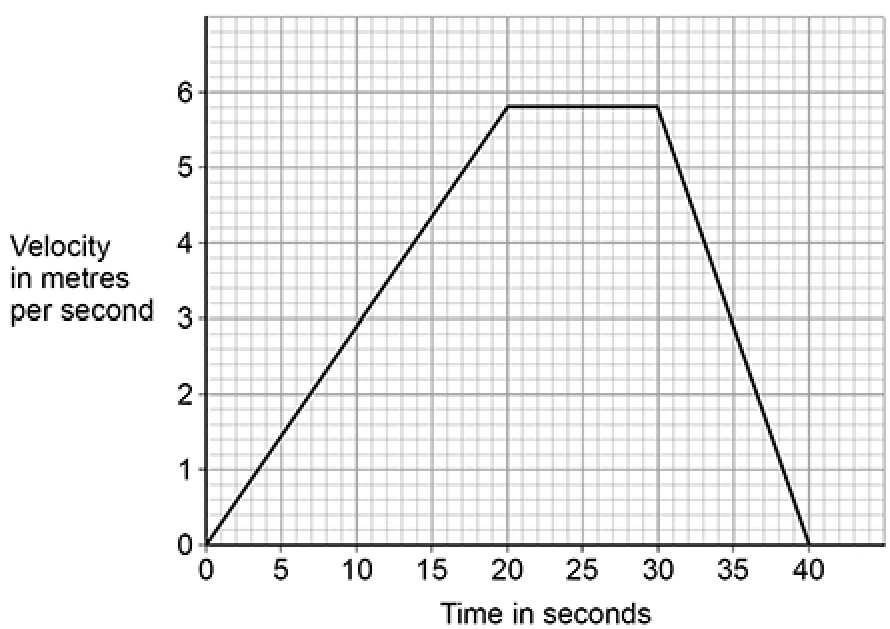
axle	**chain**	**cog**

The force from the cyclist pushing down on the pedal is transmitted to the back wheel by the _______________.

(1)

Figure 4 shows how the velocity of the cyclist changes during a journey.

Figure 4



(f) What is the change in velocity of the cyclist in the first 20 seconds of the journey?

Tick (✓) **one** box.

5.2 m/s ☐

5.4 m/s ☐

5.6 m/s ☐

5.8 m/s ☐

(1)

(g) Determine the acceleration of the cyclist during the first 20 seconds of the journey.

Use your answer from part (f)

Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

____

____

____

Acceleration of the cyclist = _______________ m/s^2

(2)

(h) Complete the sentence.

Choose the answer from the box.

deceleration	**speed**	**velocity**

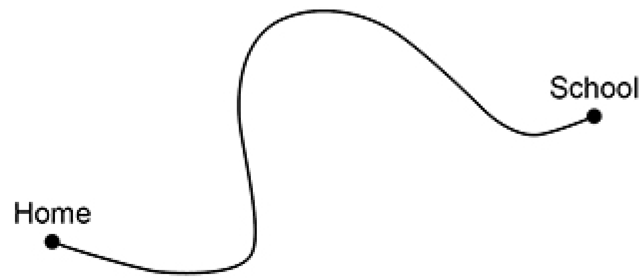
Between 30 and 40 seconds the cyclist moves with a constant _______________.

(1)

(i) The cyclist travels from home to school.

Figure 5 shows the route the cyclist followed.

Figure 5



Draw an arrow on **Figure 5** to show the displacement of the cyclist.

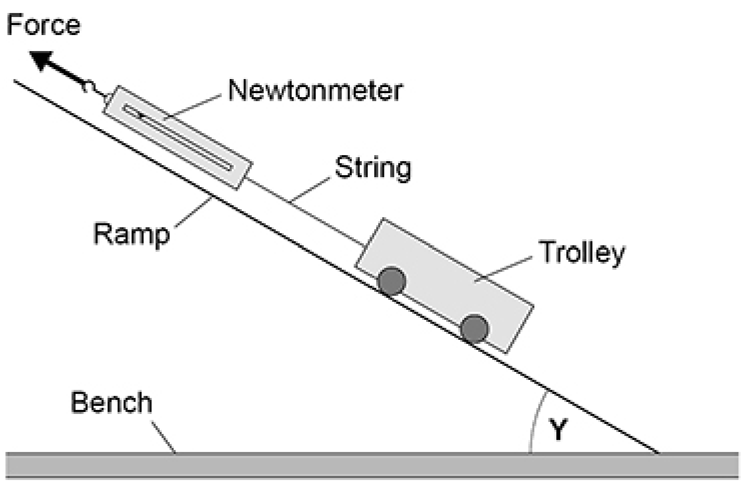
(1)

(Total 11 marks)

5. A student investigated how the angle of a ramp affects the force required to hold a trolley stationary on the ramp.

Figure 1 shows the equipment used.

Figure 1



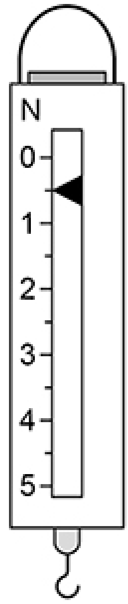
(a) Measure the angle **Y** in **Figure 1**

Angle **Y** = _______________ degrees

(1)

Figure 2 shows the newtonmeter before the investigation started.

Figure 2



(b) What type of error is shown on the newtonmeter in **Figure 2**?

Tick (✓) **one** box.

Human error ☐

Random error ☐

Zero error ☐

(1)

(c) How can this error be corrected after the measurements have been taken?

Tick (✓) **one** box.

Add 0.5 N to each measurement ☐

Multiply each measurement by 0.5 N ☐

Subtract 0.5 N from each measurement ☐

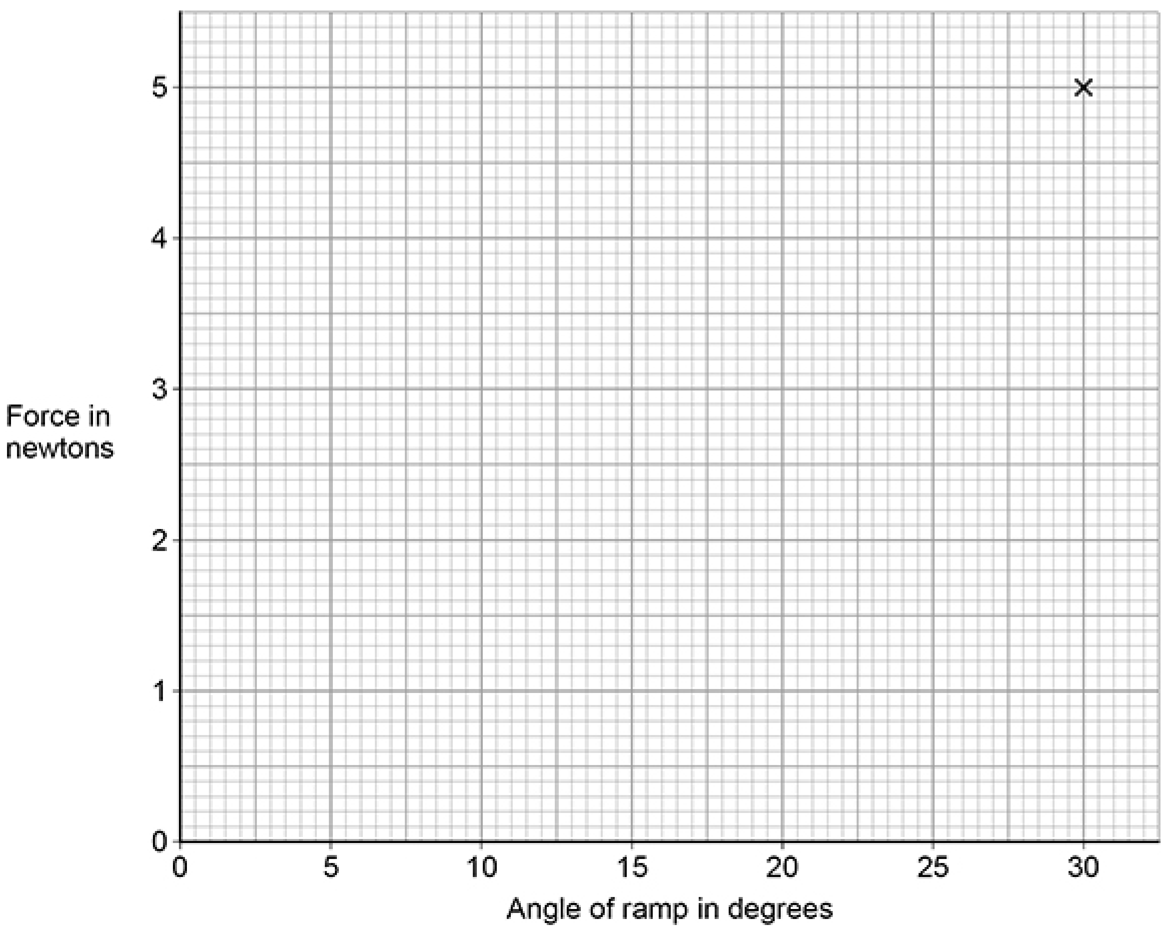
(1)

The table below shows the corrected results.

Angle of ramp in degrees	Force in newtons
5	0.9
10	1.7
15	2.6
20	3.4
25	4.2
30	5.0

Figure 3 is an incomplete graph of the results

Figure 3

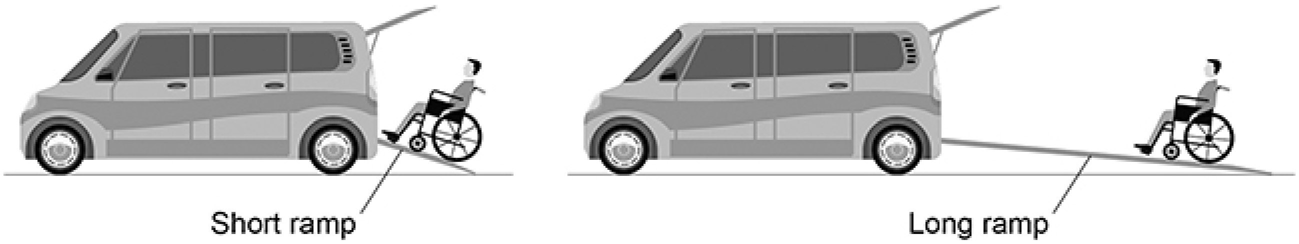


(d) Plot the missing results from the table above on **Figure 3**.

(2)

(e) **Figure 4** shows a person in a wheelchair using two different ramps to enter a van.

Figure 4



The ramps are at different angles to the ground.

Explain **one** advantage of using the long ramp compared with using the short ramp.

____

____

____

____

(2)

(f) A force of 160 N is used to move the wheelchair up the long ramp.

The ramp is 2.5 m long.

Calculate the work done to move the wheelchair up the ramp.

Use the equation:

work done = force × distance

____

____

____

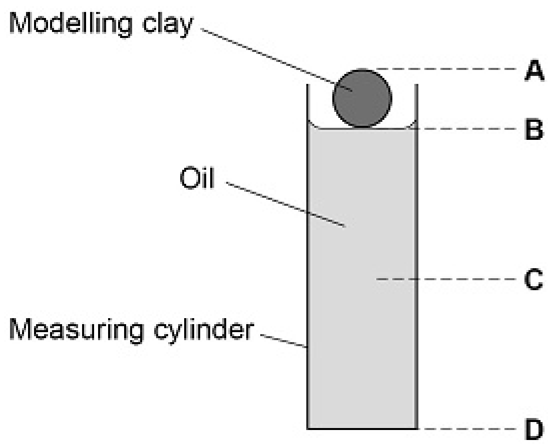
Work done = _______________ J

(2)

(Total 9 marks)

6. A student dropped a piece of modelling clay into oil.

The diagram below shows the modelling clay just before it was dropped into the oil.



(a) What was the distance fallen by the modelling clay?

Tick (✓) **one** box.

from A to C ☐

from A to D ☐

from B to C ☐

from B to D ☐

(1)

(b) What measuring instrument should be used to measure the distance fallen?

____

(1)

The student dropped four pieces of modelling clay, each with a different shape.

For each piece the student measured the time taken to fall the same distance through the oil.

(c) The student removed each piece of modelling clay from the oil before dropping the next piece.

Suggest **one** reason why.

____

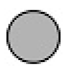
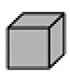
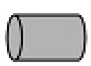
____

____

(1)

The student repeated the measurements and calculated mean values.

The table below shows the results.

Shape	Time taken in seconds			
	Drop 1	Drop 2	Drop 3	Mean
 Sphere	47	38	41	42
 Cube	68	49	57	58
 Cylinder	34	37	34	**X**
 Cone	29	23	26	26

(d) Calculate value **X** in the table above.

____

____

____

X = ________________ s

(2)

(e) Each piece of modelling clay had the same mass.

Which shape in the table above had the smallest resistive force acting against it as it fell?

Tick (✓) **one** box.

Give **one** reason for your answer.

Cone ☐

Cube ☐

Cylinder ☐

Sphere ☐

Reason ____

____

(2)

(f) How would the time taken to fall change if the modelling clay was dropped through air instead of through oil?

Tick (✓) **one** box.

Time through air would be less. ☐

Time through air would be more. ☐

Time through air would be the same. ☐

(1)

(g) The mass of a piece of modelling clay was 0.050 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the piece of modelling clay.

Use the equation:

weight = mass × gravitational field strength

___

___

Weight = ___ N

(2)

(h) Weight causes the modelling clay to fall through the oil.

Weight is a non-contact force.

Which of the following are also non-contact forces?

Tick (✓) **two** boxes.

Air resistance	☐
Electrostatic force	☐
Friction	☐
Magnetic force	☐
Tension	☐

(2)
(Total 12 marks)

7. (a) An aircraft travels at a constant velocity.

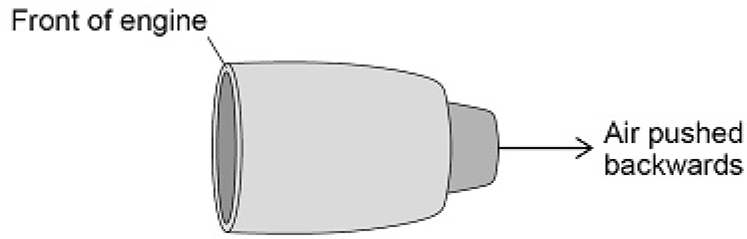
How is the velocity of the aircraft different to the speed of the aircraft?

___

___

(1)

(b) The diagram below shows one of the engines on the aircraft.



Air is taken into the front of the engine and pushed out of the back of the engine.

Explain the effect this has on the engine.

____

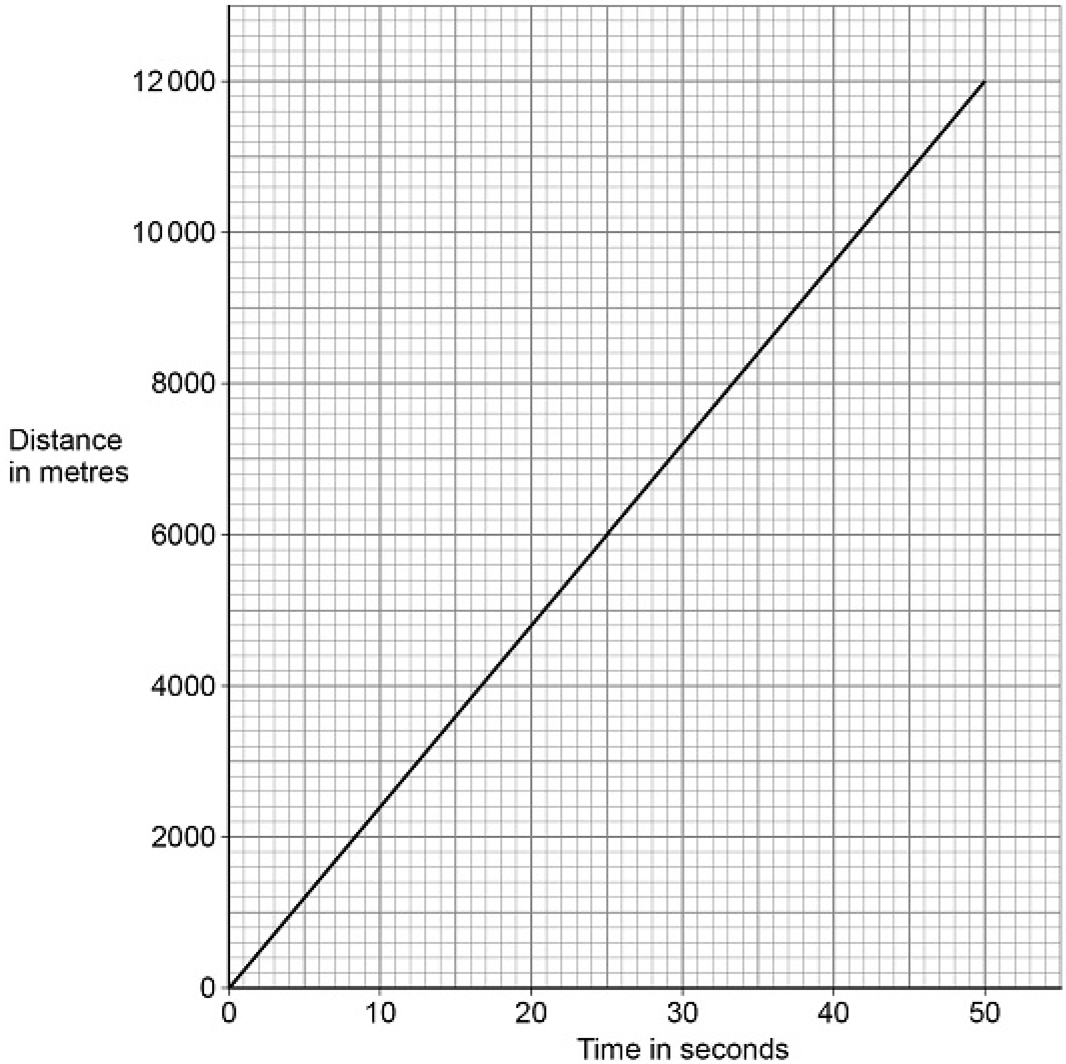
____

____

____

(2)

(c) The graph below shows a distance-time graph for the aircraft.



Determine the speed of the aircraft.

___

___

___

___

___

Speed = ________________ m/s

(3)

(d) Write down the equation that links acceleration (a), change in velocity (Δv) and time taken (t).

___

(1)

(e) At a different stage of the flight, the aircraft was travelling at a velocity of 250 m/s.

The aircraft then decelerated at 0.14 m/s^2.

Calculate the time taken for the aircraft to decelerate from 250 m/s to 68 m/s.

Time = ________________ s

(4)

(f) Write down the equation that links distance (*s*), force (*F*) and work done (*W*).

(1)

(g) When the aircraft landed, it travelled 2000 m before stopping.

The work done to stop the aircraft was 140 000 000 J.

Calculate the mean force used to stop the aircraft.

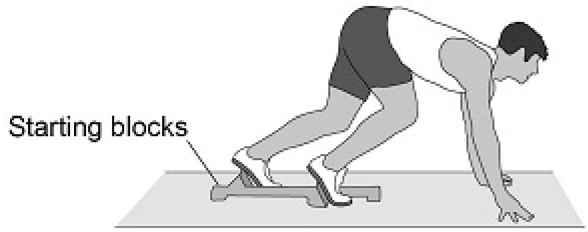
Mean force = ________________ N

(3)

(Total 15 marks)

8. **Figure 1** shows an athlete on starting blocks waiting to start a 100 metre race.

Figure 1



(a) Complete the sentence.

Choose the answer from the box.

equal to	**greater than**	**less than**

The force from the athlete pushing backwards on the starting blocks

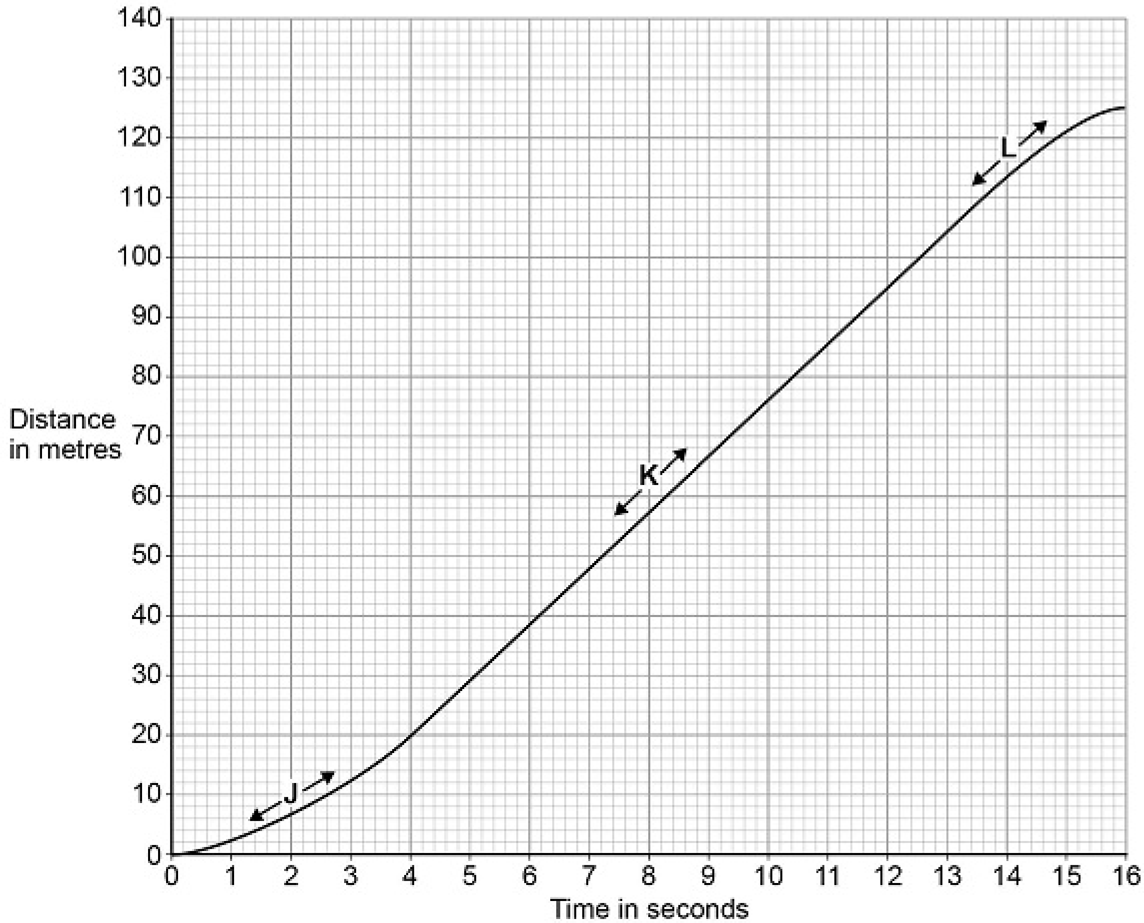
is ________________________________ the force from the starting

blocks pushing forwards on the athlete.

(1)

Figure 2 shows a distance-time graph for the athlete from the moment the race starts.

Figure 2



(b) Three parts of the distance-time graph are labelled **J**, **K** and **L**.

Draw **one** line from **each** of the labels to the correct description of the athlete's motion for that part of the graph.

Labels	Description of motion
	not moving
J	constant speed
K	decreasing speed
L	increasing speed

(2)

(c) What distance does the athlete travel after the end of the race before stopping?

Distance = ______________________________ m

(1)

(d) Calculate the average speed of the athlete between the start and finish of the 100 metre race.

Use the equation:

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

____

____

____

Average speed = ____________________________ m/s

(2)

(e) The athlete runs faster than a typical person.

What is the average running speed of a typical person in metres per second?

Tick (✓) **one** box.

1.5 ☐

3.0 ☐

4.5 ☐

6.0 ☐

(1)
(Total 7 marks)

9. The following statements describe parts of a short train journey between two railway stations.

Part A: The train accelerates at a constant rate from 0 m/s to 20 m/s in 40 s

Part B: The train travels at a constant velocity for 260 s

Part C: The train decelerates at a constant rate coming to a stop in 60 s

(a) During which part of the journey is the resultant force on the train zero?

Tick (✓) **one** box.

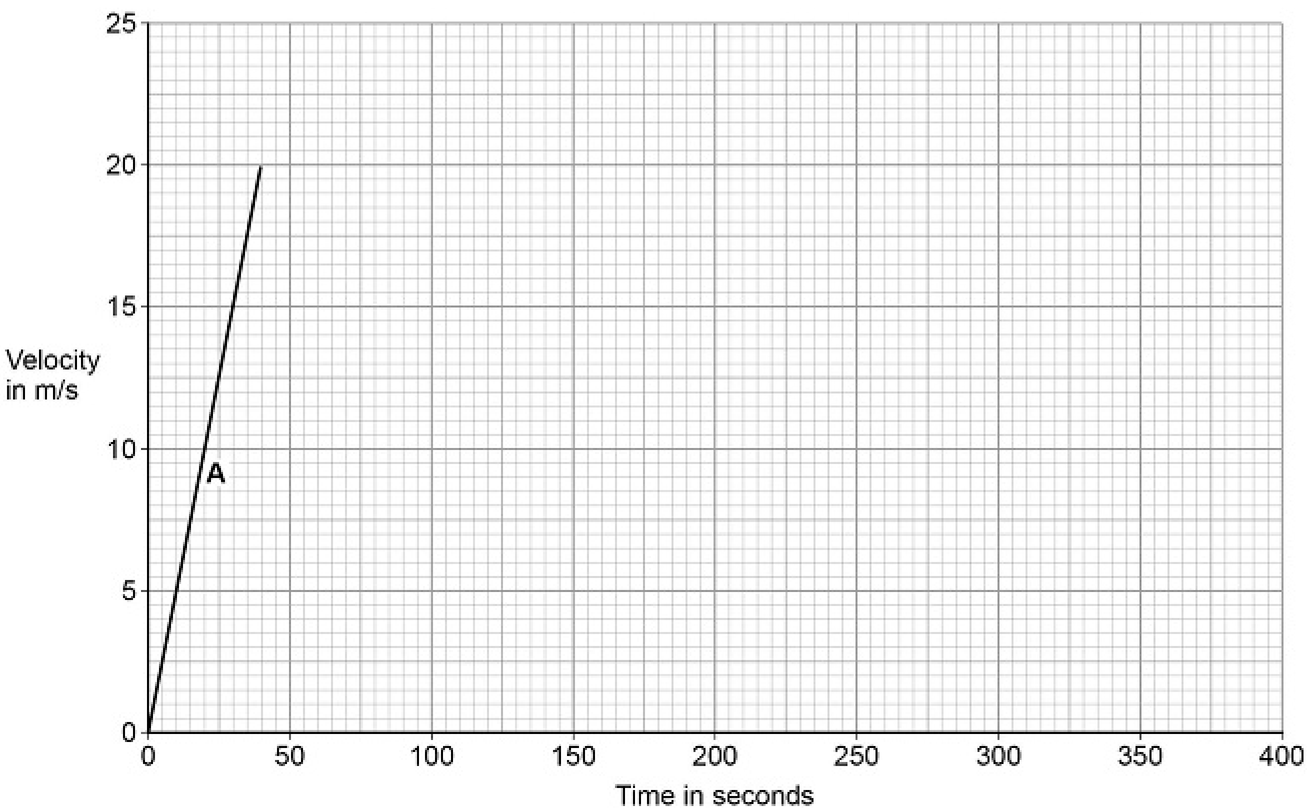
A ☐ **B** ☐ **C** ☐

(1)

(b) **Figure 1** shows part of the velocity-time graph for the train journey.

Complete **Figure 1** showing part **B** and part **C** of the train journey.

Figure 1



(3)

(c) Write down the equation which links acceleration, change in velocity and time taken.

____

(1)

(d) Another train accelerated at 1.15 m/s^2 for 22.0 s

Calculate the increase in velocity of the train.

___

___

___

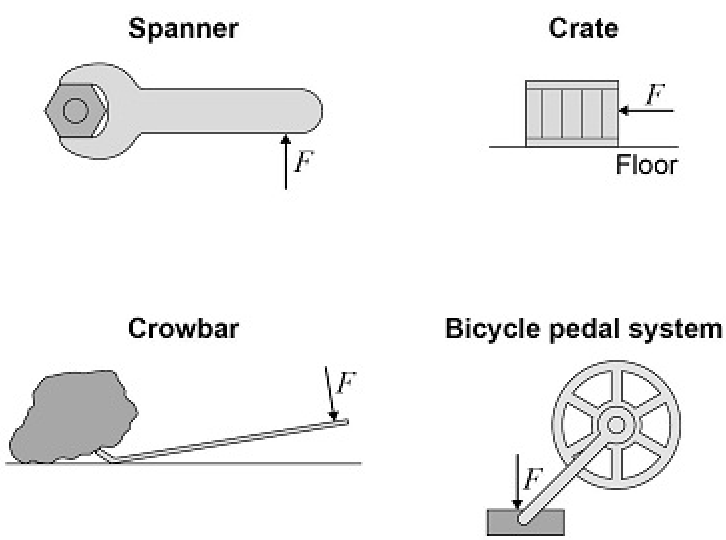
Increase in velocity = ____________ m/s

(3)

(Total 8 marks)

10. (a) **Figure 1** shows four examples of a force causing an object to move.

Figure 1



Which object is **not** likely to rotate?

Tick (✓) **one** box.

Bicycle pedal system	☐
Crate	☐
Crowbar	☐
Spanner	☐

(1)

Figure 2 shows a simple device that can be used as a weighing scale.

Figure 3 shows the device being used to measure a quantity of rice.

The weight of the device is balanced by the weight of the rice and basket.

Figure 2

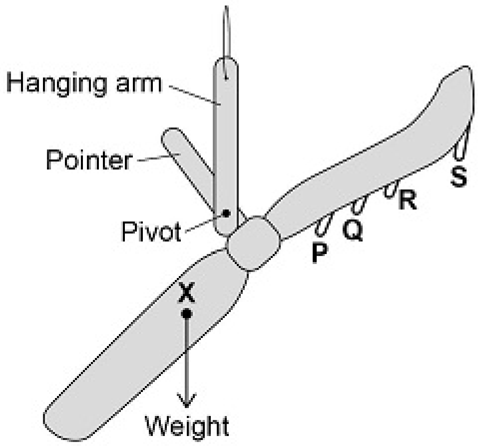
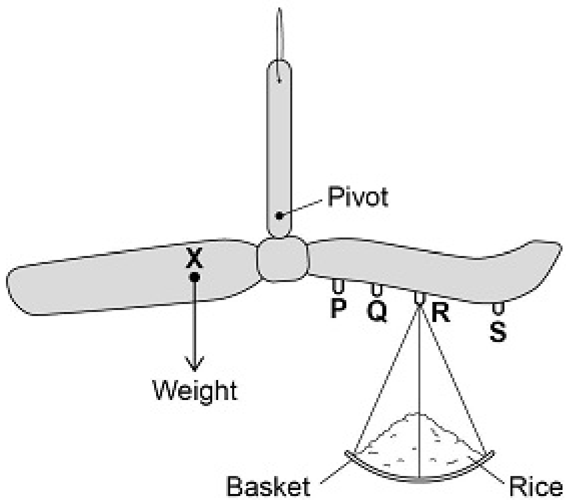


Figure 3



(b) The weight of the device acts through the point labelled **X**.

What is point **X** called?

Tick (✓) **one** box.

Centre of balance	☐
Centre of mass	☐
Centre of weight	☐

(1)

(c) How does **Figure 3** show that the weight of the device is balanced by the weight of the rice and basket?

____

____

____

(1)

(d) The basket can hang from different points on the device.

Where should the basket hang to measure the largest quantity of rice?

Tick (✓) **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

(e) Write down the equation which links distance, force and moment of a force.

____

(1)

(f) In **Figure 3**, the weight of the device causes an anticlockwise moment of 0.15 Nm about the pivot.

The weight of the rice and basket acts 0.06 m from the pivot.

Calculate the weight of the rice and basket.

____

____

____

____

Weight of rice and basket = ____________________ N

(3)

(g) Write down the equation which links gravitational field strength, mass and weight.

____

(1)

(h) The basket has a mass of 0.04 kg

gravitational field strength = 9.8 N/kg

Calculate the mass of rice in the basket.

___

___

___

___

Mass = ______________________ kg

(3)

(Total 12 marks)

11. (a) The driver of a vehicle sees a hazard on the road.

The driver uses the brakes to stop the vehicle.

Explain the factors that affect the distance needed to stop a vehicle in an emergency.

___

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___

(6)

(b) Write down the equation which links distance, force and work done.

___

(1)

(c) The work done by the braking force to stop a vehicle was 900 000 J

The braking force was 60 000 N

Calculate the braking distance of the vehicle.

___

___

___

___

Braking distance = ______________________ m

(3)

(d) The greater the braking force, the greater the deceleration of a vehicle.

Explain the possible dangers caused by a vehicle having a large deceleration when it is braking.

___

___

___

___

___

___

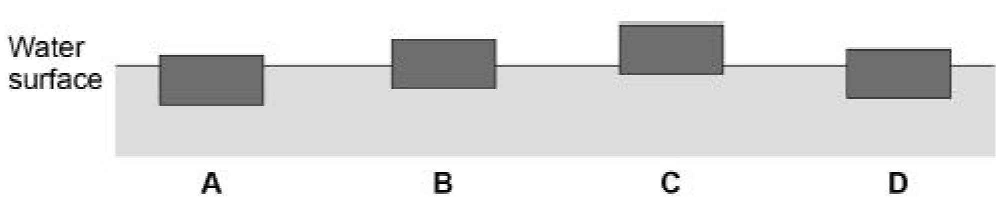
(2)

(Total 12 marks)

12. **Figure 1** shows four blocks of different materials floating on water.

The four blocks are the same volume.

Figure 1



(a) Which of the blocks has the smallest weight?

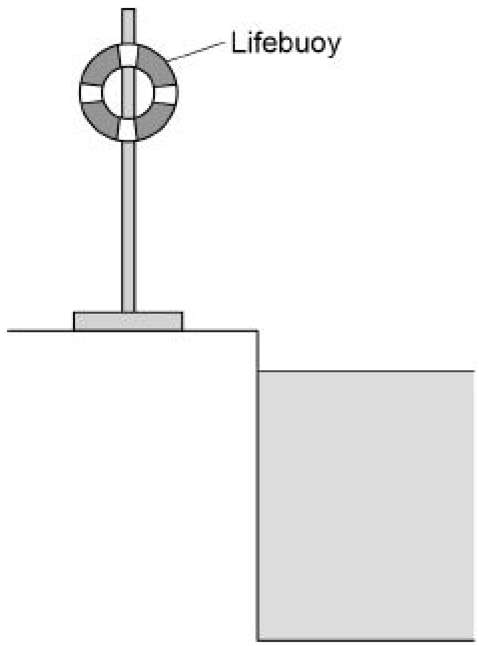
Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

Figure 2 shows a lifebuoy next to a deep swimming pool.

Figure 2



(b) The lifebuoy has a mass of 2.5 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the lifebuoy.

Use the equation:

weight = mass × gravitational field strength

____

____

____

____

Weight = ______________________ N

(2)

(c) When thrown into the water the lifebuoy floats. The two forces acting on the lifebuoy are the weight of the lifebuoy downwards and upthrust upwards.

How big is the upthrust on the lifebuoy compared to the weight of the lifebuoy?

Tick **one** box.

The upthrust is greater than the weight.	☐
The upthrust is less than the weight.	☐
The upthrust is the same as the weight.	☐

(1)

(d) Write down the equation which links acceleration, mass and resultant force.

____

(1)

(e) A rope is used to pull the lifebuoy to the side of the swimming pool.

A resultant force of 4.0 N acts on the lifebuoy.

The mass of the lifebuoy is 2.5 kg.

Calculate the acceleration of the lifebuoy.

____

____

____

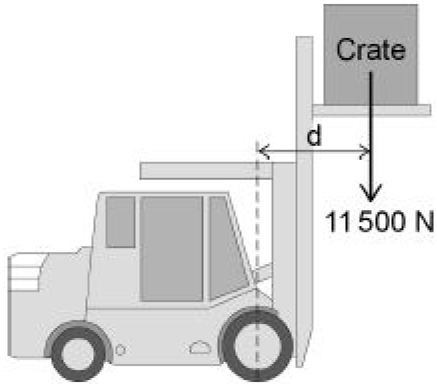
____

Acceleration = ________________________ m/s^2

(3)

(Total 8 marks)

13. The diagram below shows a fork-lift truck lifting a heavy crate.



(a) The crate weighs 11 500 N and is lifted vertically 2.60 m.

Calculate the work done to lift the crate.

Use the equation:

work done = force × distance

____

____

____

Work done = ____________________ J

(2)

The weight of the crate causes a clockwise moment of 13 800 Nm about the centre of the front wheel of the fork-lift truck.

(b) The weight of the fork-lift truck and driver cause an anticlockwise moment.

What is the minimum size of the anticlockwise moment needed so that the fork-lift truck does **not** topple over?

____

(1)

(c) Write down the equation which links distance, force and moment of a force.

____

(1)

(d) Calculate the distance '**d**' marked on the diagram above.

____

____

____

____

Distance '**d**' = ______________________ m

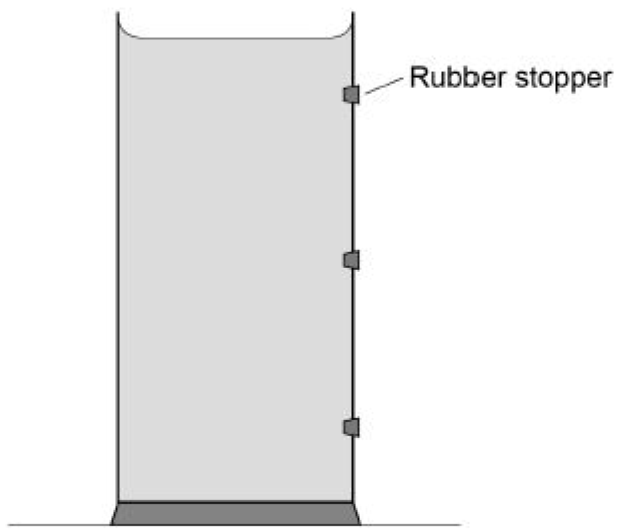
(3)

(Total 7 marks)

14. **Figure 1** shows a container filled with water.

The three holes in the side of the container are sealed with rubber stoppers.

Figure 1



(a) The water exerts a force of 27 N on the bottom of the container.
The cross-sectional area of the bottom of the container is 0.009 m^2.

Calculate the pressure exerted by the water on the bottom of the container.

Use the equation:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Choose the unit.

kg/m^3	**N/m**	**Pa**

____

____

____

____

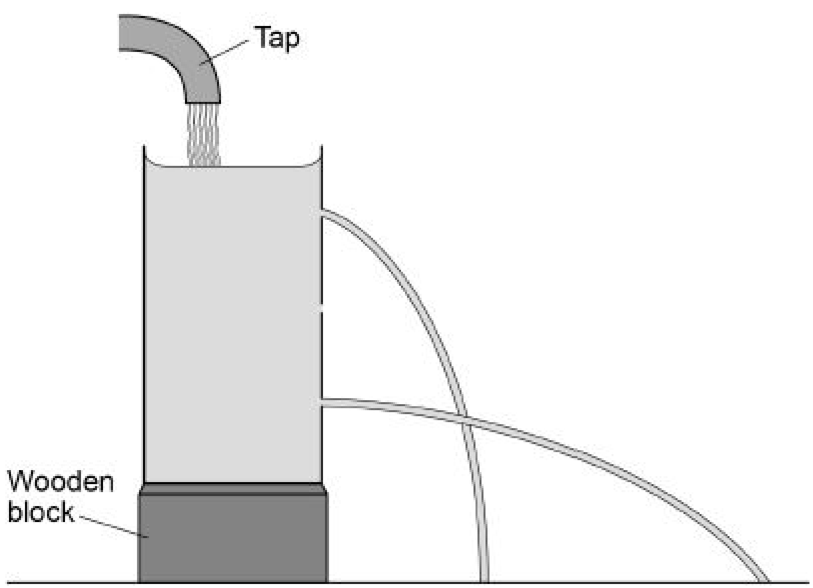
Pressure = ____________________ Unit = __________

(3)

The container is put under running water from a tap and the three rubber stoppers removed.

Figure 2 shows the path taken by the water escaping from the top and bottom holes.

Figure 2



(b) Complete **Figure 2** to show the path taken by the water escaping from the centre hole.

(1)

(c) What can be concluded from **Figure 2** about the pressure in a liquid?

___

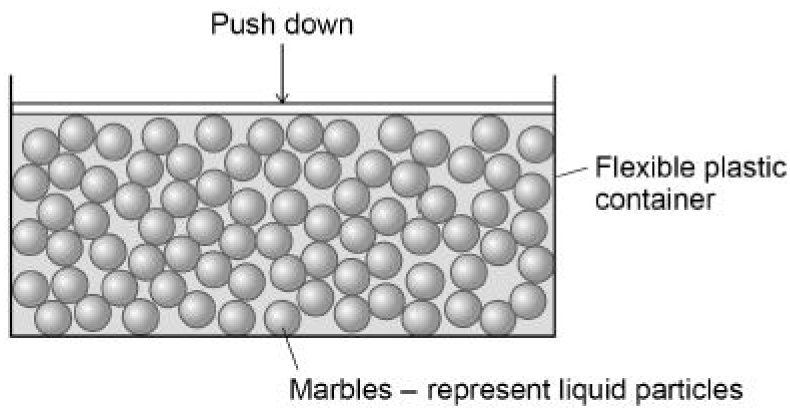
___

(1)

(d) **Figure 3** shows a simple model of a liquid.

When a force pushes down on the marbles, the marbles push the sides and bottom of the container outwards.

Figure 3



What can be concluded from this model about the pressure in a liquid?

___

___

(1)

(Total 6 marks)

15. A student carried out an investigation to determine the spring constant of a spring.

The table below gives the data obtained by the student.

Force in N	**Extension in cm**
0	0.0
2	3.5
4	8.0
6	12.5
8	16.0
10	20.0

(a) Describe a method the student could have used to obtain the data given in the table above.

Your answer should include any cause of inaccuracy in the data.

Your answer may include a labelled diagram.

(6)

(b) The student measured the extension for five different forces rather than just measuring the extension for one force.

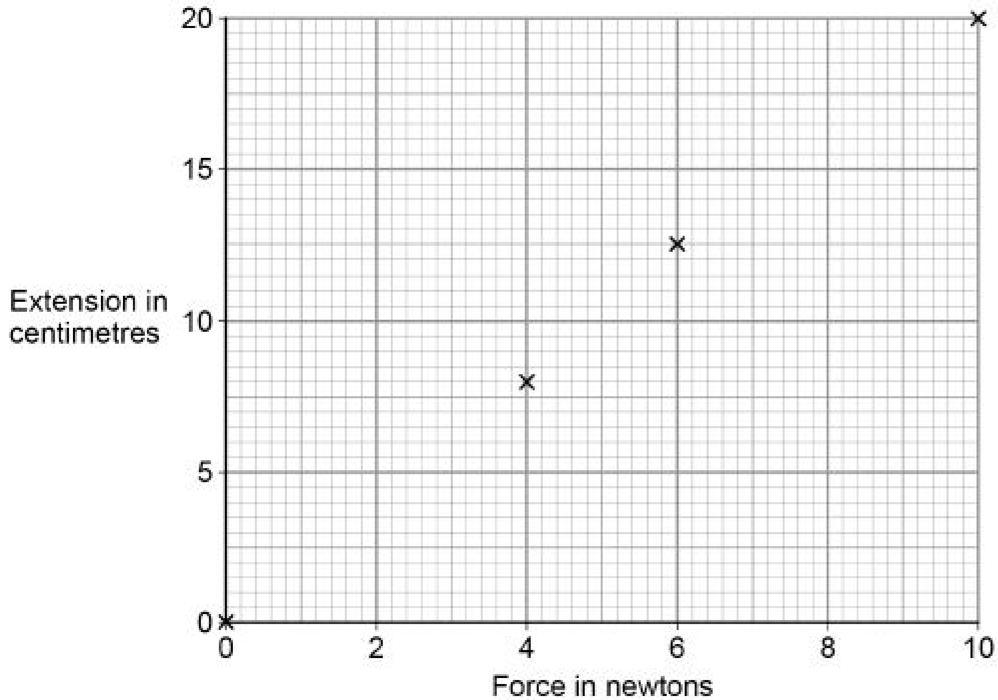
Suggest why.

___

___

(1)

The diagram below shows some of the data obtained by the student.



(c) Complete the diagram above by plotting the missing data from the table above.

Draw the line of best fit.

The table above is repeated here to help you answer this question.

Force in N	**Extension in cm**
0	0.0
2	3.5
4	8.0
6	12.5
8	16.0
10	20.0

(2)

(d) Write down the equation that links extension, force and spring constant.

____

(1)

(e) Calculate the spring constant of the spring that the student used.

Give your answer in newtons per metre.

___

___

___

___

Spring constant = ___ N/m

(4)

(f) Hooke's Law states that:
'The extension of an elastic object is directly proportional to the force applied, provided the limit of proportionality is not exceeded.'

The student concluded that over the range of force used, the spring obeyed Hooke's Law.

Explain how the data supports the student's conclusion.

___

___

___

___

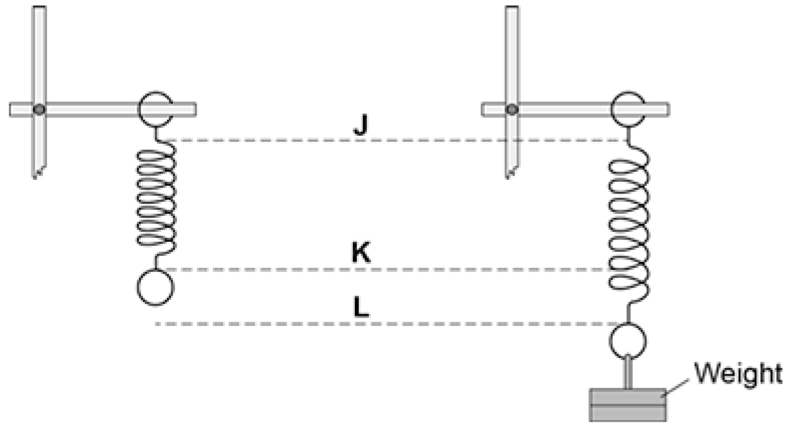
(2)

(Total 16 marks)

16. A student suspended a spring from a laboratory stand and then hung a weight from the spring.

Figure 1 shows the spring before and after the weight is added.

Figure 1



(a) Which distance gives the extension of the spring?

Tick **one** box.

from **J** to **K** ☐

from **K** to **L** ☐

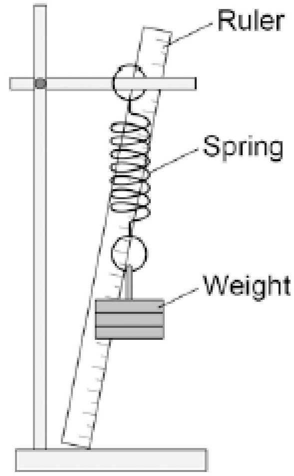
from **J** to **L** ☐

(1)

(b) The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Figure 2 shows that the ruler is in a tilted position and not upright as it should be.

Figure 2



How would leaving the ruler tilted affect the weight and extension data to be recorded by the student?

Use answers from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

greater than	**the same as**	**smaller than**

The weight recorded by the student would be ____________________ the actual weight.

The extension recorded by the student would be ____________________ the actual extension of the spring.

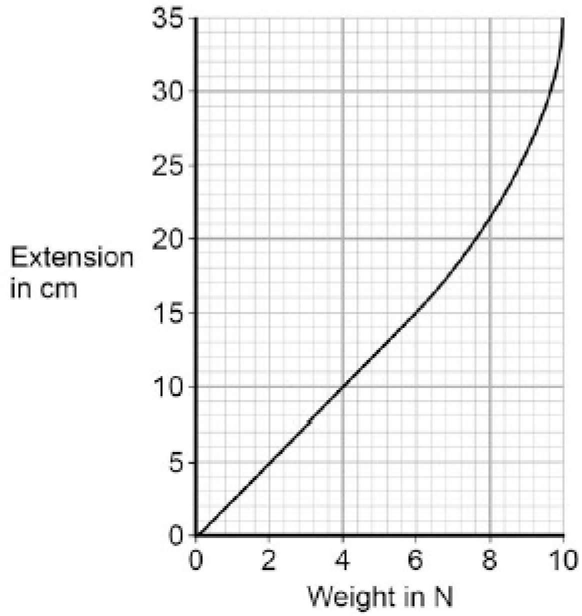
(2)

(c) The student moves the ruler so that it is upright and not tilted.

The student then completed the investigation and plotted the data taken in a graph.

The student's graph is shown in **Figure 3**.

Figure 3



Use **Figure 3** to determine the additional force needed to increase the extension of the spring from 5cm to 15cm.

Additional force = ________________________ N

(1)

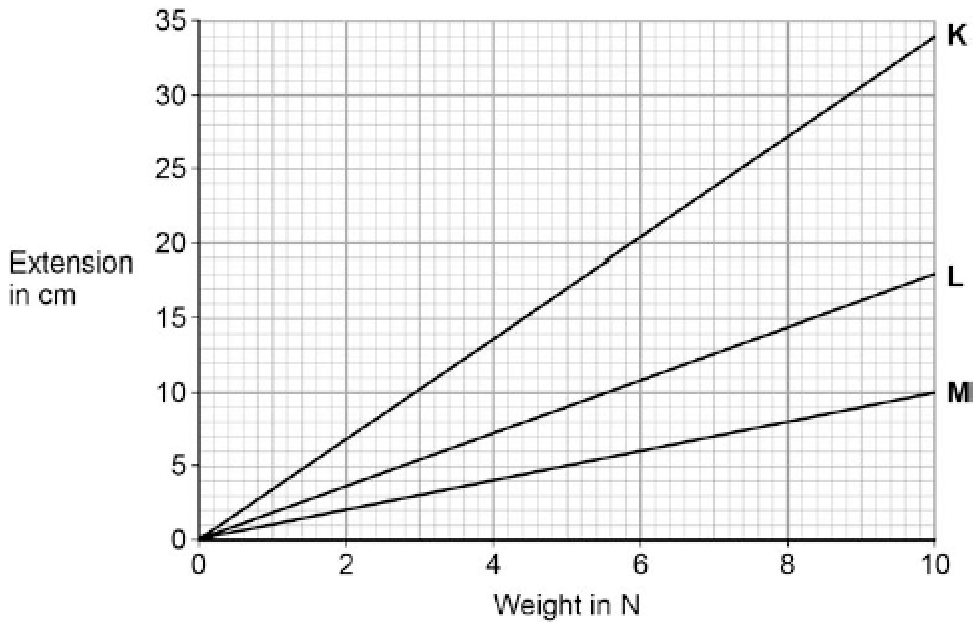
(d) What can you conclude from **Figure 3** about the limit of proportionality of the spring?

(1)

(e) The student repeated the investigation with three more springs, **K**, **L** and **M**.

The results for these springs are given in **Figure 4**.

Figure 4



All three springs show the same relationship between the weight and extension.

What is that relationship?

Tick **one** box.

The extension increases non-linearly with the increasing weight.	☐
The extension is inversely proportional to the weight.	☐
The extension is directly proportional to the weight.	☐

(1)

(f) Which statement, **A**, **B** or **C**, should be used to complete the sentence?

Write the correct letter, **A**, **B** or **C**, in the box below.

A a lower spring constant than

B the same spring constant as

C a greater spring constant than

From **Figure 4** it can be concluded that spring **M** has ☐ the other two springs.

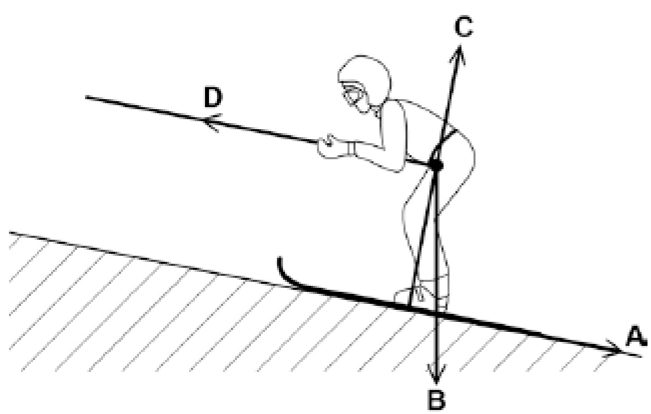
(1)
(Total 7 marks)

17. **Figure 1** shows a skier using a drag lift.

The drag lift pulls the skier from the bottom to the top of a ski slope.

The arrows, **A**, **B**, **C** and **D** represent the forces acting on the skier and her skis.

Figure 1



(a) Which arrow represents the force pulling the skier up the slope?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(b) Which arrow represents the normal contact force?

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

(1)

(c) The drag lift pulls the skier with a constant resultant force of 300N for a distance of 45 m.

Use the following equation to calculate the work done to pull the skier up the slope.

work done = force × distance

____

____

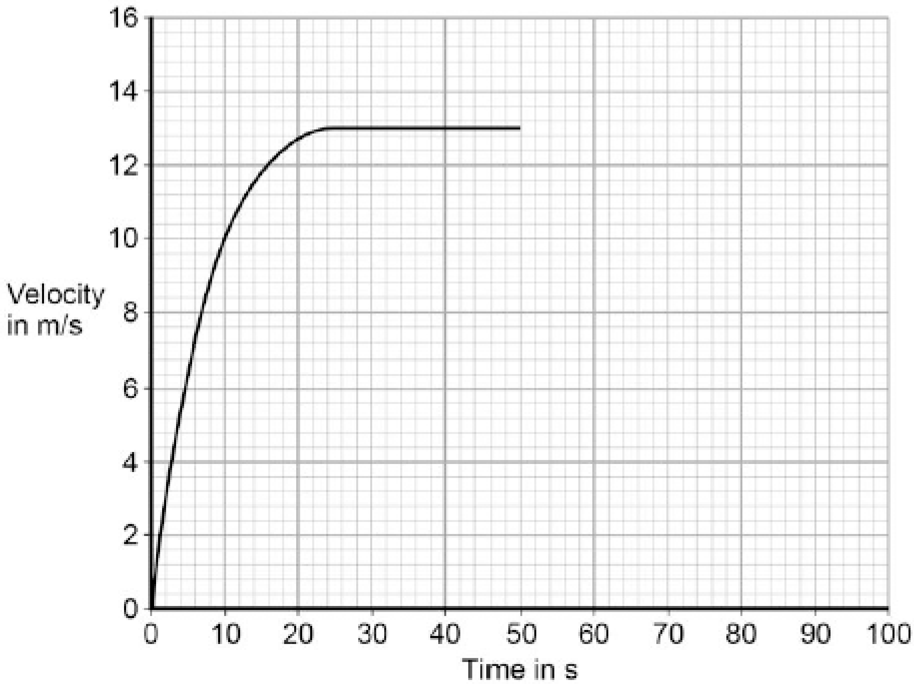
Work done = ___________________________ J

(2)

(d) At the top of the slope the skier leaves the drag lift and skis back to the bottom of the slope.

Figure 2 shows how the velocity of the skier changes with time as the skier moves down the slope.

Figure 2



After 50 seconds the skier starts to slow down.

The skier decelerates at a constant rate coming to a stop in 15 seconds.

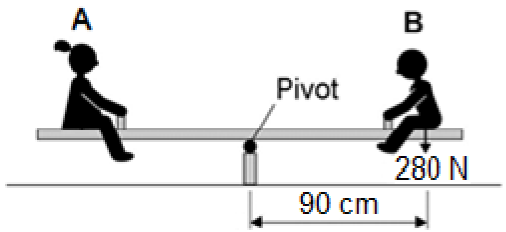
Draw a line on **Figure 2** to show the change in velocity of the skier as she slows down and comes to a stop.

(2)

(Total 6 marks)

18. Two children, **A** and **B**, are sitting on a see-saw, as shown in the figure below.

The see-saw is balanced.



(a) Use the following equation to calculate the moment of child **B** about the pivot of the see-saw.

moment of a force = force × distance

Give your answer in newton-metres

___

___

___

Moment = ______________ Nm

(2)

(b) Use the idea of moments to explain what happens when child **B** moves closer to the pivot.

___

___

___

___

___

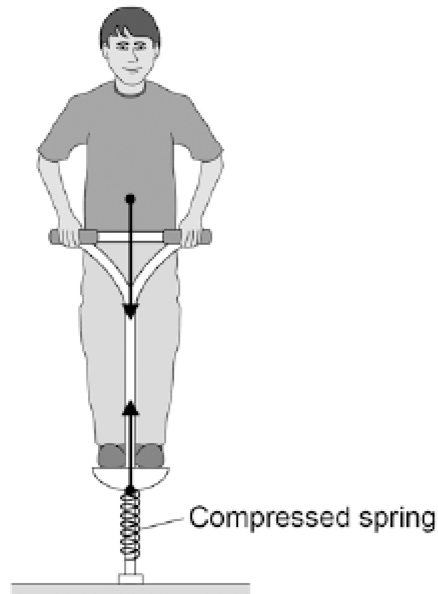
___

(3)

(Total 5 marks)

19. The figure below shows the forces acting on a child who is balancing on a pogo stick.

The child and pogo stick are not moving.



(a) The downward force of the child on the spring is equal to the upward force of the spring on the child.

This is an example of which one of Newton's Laws of motion?

Tick **one** box.

First Law ☐

Second Law ☐

Third Law ☐

(1)

(b) Complete the sentence.

Use an answer from the box.

elastic potential	**gravitational potential**	**kinetic**

The compressed spring stores ______________________ energy.

(1)

(c) The child has a weight of 343 N.

Gravitational field strength = 9.8 N / kg

Write down the equation which links gravitational field strength, mass and weight.

____

(1)

(d) Calculate the mass of the child.

____

____

____

Mass = ___________________________ kg

(3)

(e) The weight of the child causes the spring to compress elastically from a length of 30cm to a new length of 23cm.

Write down the equation which links compression, force and spring constant.

____

(1)

(f) Calculate the spring constant of the spring.

Give your answer in newtons per metre.

____

____

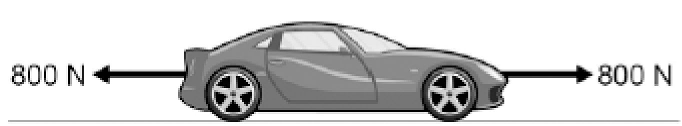
____

Spring constant = ___________________________ N / m

(4)

(Total 11 marks)

20. The figure below shows the horizontal forces acting on a car.



(a) Which **one** of the statements describes the motion of the car?

Tick **one** box.

It will be slowing down. ☐

It will be stationary. ☐

It will have a constant speed. ☐

It will be speeding up. ☐

(1)

(b) During part of the journey the car is driven at a constant speed for five minutes.

Which one of the equations links distance travelled, speed and time?

Tick **one** box.

distance travelled = speed + time ☐

distance travelled = speed × time ☐

distance travelled = speed − time ☐

distance travelled = speed ÷ time ☐

(1)

(c) During a different part of the journey the car accelerates from 9 m/s to 18 m/s in 6 s.

Use the following equation to calculate the acceleration of the car.

$$\text{acceleration} = \frac{\text{change in velociy}}{\text{time taken}}$$

____

____

acceleration = ______________________ m/s^2

(d) Which equation links acceleration, mass and resultant force?

Tick **one** box.

resultant force = mass + acceleration ☐

resultant force = mass × acceleration ☐

resultant force = mass − acceleration ☐

resultant force = mass ÷ acceleration ☐

(1)

(e) The mass of the car is 1120 kg. The mass of the driver is 80 kg.

Calculate the resultant force acting on the car and driver while accelerating.

___

___

Resultant force = ___ N

(2)

(f) Calculate the distance travelled while the car is accelerating.

Use the correct equation from the Physics Equation Sheet.

___

___

___

Distance = ___ m

(3)

(g) A car driver sees a fallen tree lying across the road ahead and makes an emergency stop.

The braking distance of the car depends on the speed of the car.

For the same braking force, explain what happens to the braking distance if the speed doubles.

You should refer to kinetic energy in your answer.

____

____

____

____

____

____

____

____

(4)

(Total 14 marks)