# The Morley Academy

## 5.Forces Mastery Booklet

(Physics Paper 2)

Name : _____

Teacher : _____

Date Given : _____

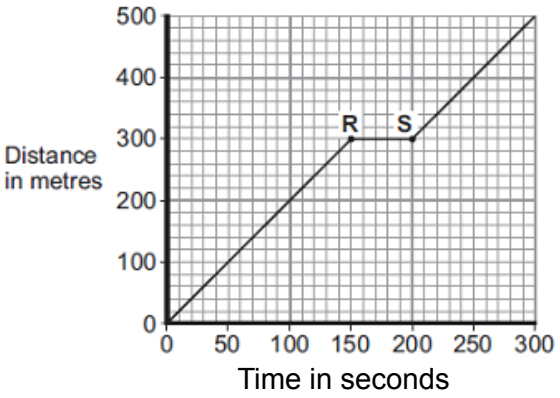
These booklets are a consolidation of your learning. They should be used in the following way – You should attempt the questions WITHOUT looking at the answers. Then mark your questions with **green pen** and add any missing marks you missed. You should then present the completed document to your teacher to show WITHIN TWO weeks of receiving the booklet.

*THIS WILL IMPROVE YOUR GRADES…!!*

## Q1.

(a) **Figure 1** shows the distance–time graph for a person walking to a bus stop.

**Figure 1**




(i) Which **one** of the following statements describes the motion of the person between points **R** and **S** on the graph?

Tick (✓) **one** box.

Not moving ☐

Moving at constant speed ☐

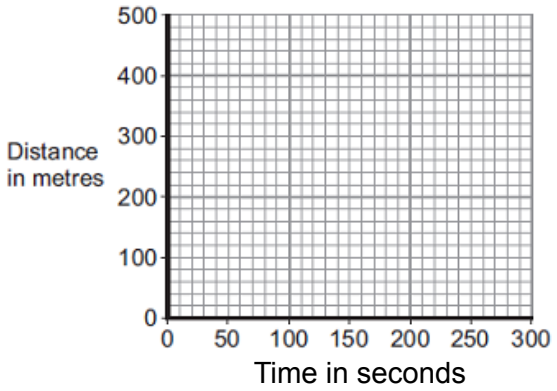
Moving with increasing speed ☐

**(1)**

(ii) Another person, walking at constant speed, travels the same distance to the bus stop in 200 seconds.

Complete **Figure 2** to show a distance–time graph for this person.

**Figure 2**



**(1)**

(b) A bus accelerates away from the bus stop at 2.5 $m/s^2$.

The total mass of the bus and passengers is 14 000 kg.

Calculate the resultant force needed to accelerate the bus and passengers.

_____

_____

_____

Resultant force = _____ N

**(2)**

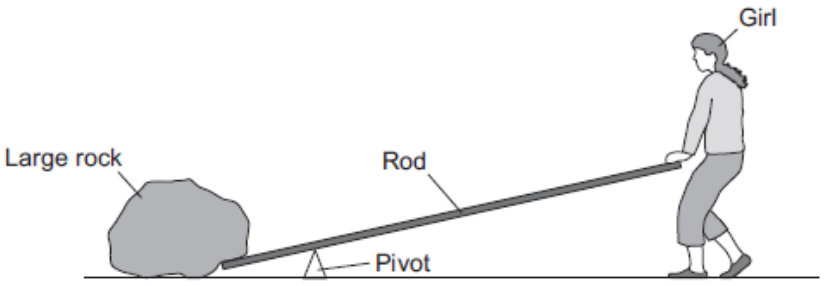
**(Total 4 marks)**

## Q2.

Levers and hydraulic systems can act as force multipliers.

(a) **Figure 1** shows a girl trying to lift a large rock using a long rod as a lever.

**Figure 1**




The girl is pushing down on the rod but is just unable to lift the rock.

Which of the following changes would allow her to lift the rock?

Tick (✓) **two** boxes.

| **Change** | **Tick (✓)** |
|---|---|
| Move the pivot away from the rock | |
| Make the rod longer | |
| Push the rod upwards | |
| Push down on the rod with a greater force | |

**(2)**

(b) Liquids are used in hydraulic systems because they are virtually incompressible.

Explain how the spacing of particles in a liquid cause it to be virtually incompressible.

_____

_____

_____

_____

**(2)**

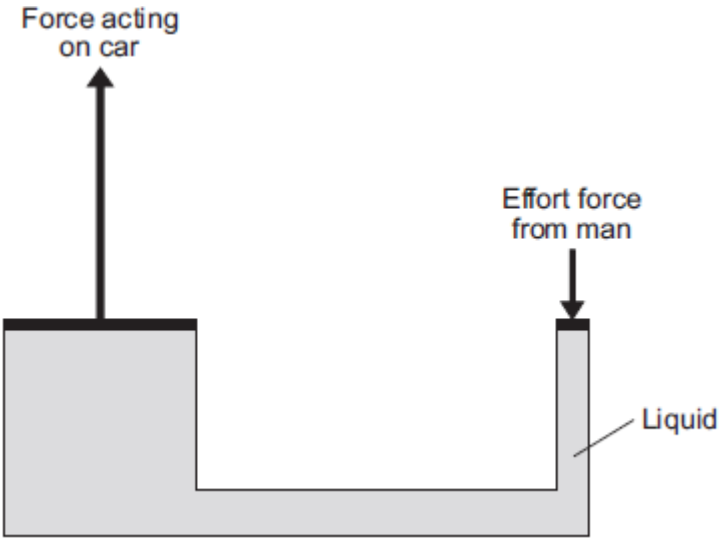
(c) **Figure 2** shows a man using a car jack to lift his car.

**Figure 2**



**Figure 3** shows a simple diagram of a car jack.

**Figure 3**




(i) The man pushes down with an effort force. This results in a much larger force

acting upwards on the car.

Use information from **Figure 3** to explain how.

_____

_____

_____

_____

_____

_____

_____

_____

**(4)**

(ii) Which of the following statements about the forces in **Figure 3** is correct?

Tick (✓) **one** box.

| | **Tick (✓)** |
|---|---|
| The force acting on the car moves a greater distance than the effort force. | |
| The force acting on the car moves less distance than the effort force. | |
| The force acting on the car moves the same distance as the effort force. | |

**(1)**

**(Total 9 marks)**

## Q3.

A paintball gun is used to fire a small ball of paint, called a paintball, at a target.

The figure below shows someone just about to fire a paintball gun.

The paintball is inside the gun.

(a) What is the momentum of the paintball before the gun is fired?

_____

Give a reason for your answer.

_____

_____

**(2)**

(b) The gun fires the paintball forwards at a velocity of 90 m / s.

The paintball has a mass of 0.0030 kg.

Calculate the momentum of the paintball just after the gun is fired.

_____

_____

_____

Momentum = _____ kg m / s

**(2)**

(c) The momentum of the gun and paintball is conserved.

Use the correct answer from the box to complete the sentence.

| **equal to** | **greater than** | **less than** |
|---|---|---|

The total momentum of the gun and paintball just after the gun is fired

will be _____ the total momentum of the gun and

paintball before the gun is fired.

**(1)**

**(Total 5 marks)**

## Q4.

When two objects interact, they exert forces on each other.

(a) Which statement about the forces is correct?

Tick (✓) **one** box.

| | **Tick (✓)** |
|---|---|
| The forces are equal in size and act in the same direction. | |
| The forces are unequal in size and act in the same direction. | |
| The forces are equal in size and act in opposite directions. | |
| The forces are unequal in size and act in opposite directions. | |

**(1)**

(b) A fisherman pulls a boat towards land.

The forces acting on the boat are shown in **Diagram 1**.

The fisherman exerts a force of 300 N on the boat.
The sea exerts a resistive force of 250 N on the boat.

**Diagram 1**


(i) Describe the motion of the boat.

_____

_____

_____

_____

**(2)**

(ii) When the boat reaches land, the resistive force increases to 300 N.
The fisherman continues to exert a force of 300 N.

Describe the motion of the boat.

Tick (✓) **one** box.

Accelerating to the right ☐

Constant velocity to the right ☐

Stationary ☐

**(1)**

(iii) Explain your answer to part **(b)(ii)**.

_____

_____

_____

_____

**(2)**

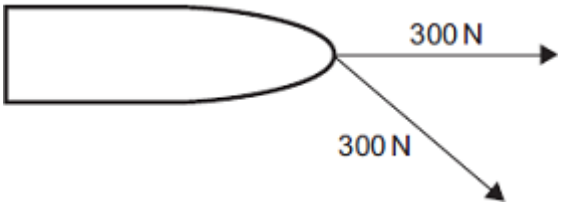
(iv) Another fisherman comes to help pull the boat. Each fisherman pulls with a force of 300 N, as shown in **Diagram 2**.

**Diagram 2** is drawn to scale.

Add to **Diagram 2** to show the single force that has the same effect as the two 300 N forces.

Determine the value of this resultant force.

**Diagram 2**




Resultant force = _____ N

**(4)**

**(Total 10 marks)**

## Q5.

Some students fill an empty plastic bottle with water.
The weight of the water in the bottle is 24 N and the cross-sectional area of the bottom of the bottle is 0.008 $m^2$.

(a) Calculate the pressure of the water on the bottom of the bottle and give the unit.

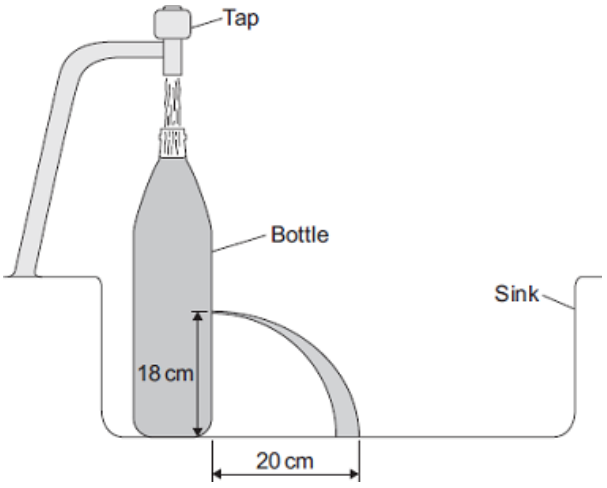
_____

_____

Pressure = _____

**(3)**

(b) The students made four holes in the bottle along a vertical line.
They put the bottle in a sink. They used water from a tap to keep the bottle filled to the top.




The students measured and recorded the vertical heights of the holes above the sink.
They also measured the horizontal distances the water landed away from the bottle.
A pair of measurements for one of the holes is shown in the diagram.

The complete data from the experiment is shown in the table.

| Hole | Vertical height in cm | Horizontal distance in cm |
|---|---|---|
| **J** | 24 | 15 |
| **K** | 18 | 20 |
| **L** | 12 | 30 |
| **M** | 6 | 40 |

(i) Which hole is shown in the diagram?

Draw a ring around the correct answer.

**J** **K** **L**

**(1)**

(ii) On the diagram, draw the path of the water coming out of hole **M**.

Use the information in the table to help you.

**(2)**

(c) Suggest **one** problem that might arise from trying to collect data from a fifth hole with a vertical height of 1 cm above the sink.

_____

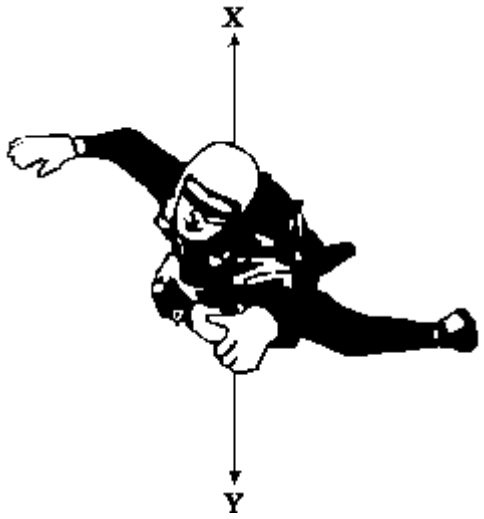
_____

**(1)**

**(Total 7 marks)**

## Q6.

The diagram shows a sky-diver in free fall. Two forces, **X** and **Y**, act on the sky-diver.




(a) Complete these sentences by crossing out the **two** lines in each box that are wrong.

(i) Force **X** is caused by

| |
|---|
| friction |
| gravity |
| weight |

.

**(1)**

(ii) Force **Y** is caused by

| |
|---|
| air resistance |
| friction |
| gravity |

.

**(1)**

(b) The size of force **X** changes as the sky-diver falls. Describe the motion of the sky-diver when:

(i) force **X** is smaller than force **Y**,

_____

_____

**(2)**

(ii) force **X** is equal to force **Y**.

_____

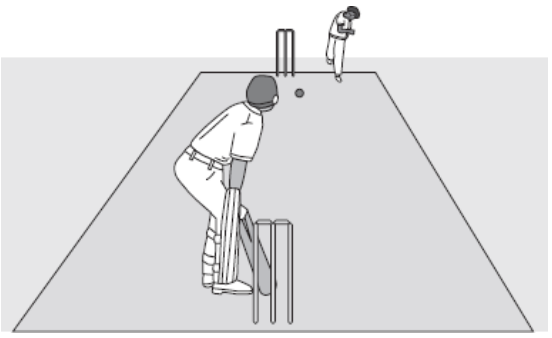
_____

**(1)**

**(Total 5 marks)**

## Q7.

The picture shows players in a cricket match.



(a) A fast bowler bowls the ball at 35 m/s. The ball has a mass of 0.16 kg.

Use the equation in the box to calculate the kinetic energy of the cricket ball as it leaves the bowler's hand.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

_____

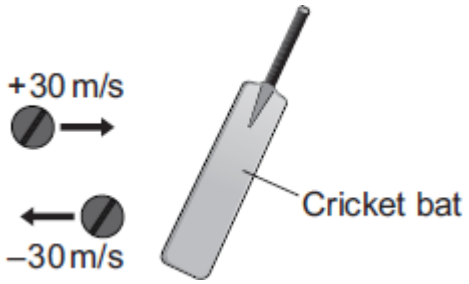
_____

_____

Kinetic energy = _____ J

**(2)**

(b) When the ball reaches the batsman it is travelling at 30 m/s. The batsman strikes the ball which moves off at 30 m/s in the opposite direction.




(i) Use the equation in the box to calculate the change in momentum of the ball.

momentum = mass × velocity

Show clearly how you work out your answer.

_____

_____

Change in momentum = _____ kg m/s

**(2)**

(ii) The ball is in contact with the bat for 0.001 s.

Use the equation in the box to calculate the force exerted by the bat on the ball.

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken for change}}$$

Show clearly how you work out your answer.

_____

_____

Force = _____ N

**(1)**

(c) A fielder, as he catches a cricket ball, pulls his hands backwards.

Explain why this action reduces the force on his hands.

_____

_____

_____

_____

_____

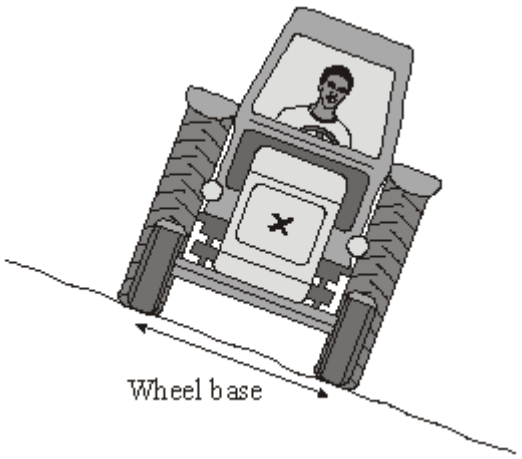
**(2)**

**(Total 7 marks)**

## Q8.

Tractors are often used on sloping fields, so stability is important in their design.

On the diagram, the centre of the **X** marks the centre of mass of the tractor.




(a) Explain why the tractor has **not** toppled over. You may add to the diagram to help you to explain.

_____

_____

_____

_____

_____

_____

**(3)**

(b) Give **two** features of the tractor which affect its stability and state how each feature could be changed to increase the tractor's stability.

Feature 1

_____

_____

Feature 2

_____

_____

**(2)**

**(Total 5 marks)**

## Q9.

A cyclist travelling along a straight level road accelerates at 1.2 $m/s^2$ for 5 seconds. The mass of the cyclist and the bicycle is 80 kg.

(a) Calculate the resultant force needed to produce this acceleration.

Show clearly how you work out your answer and give the unit.

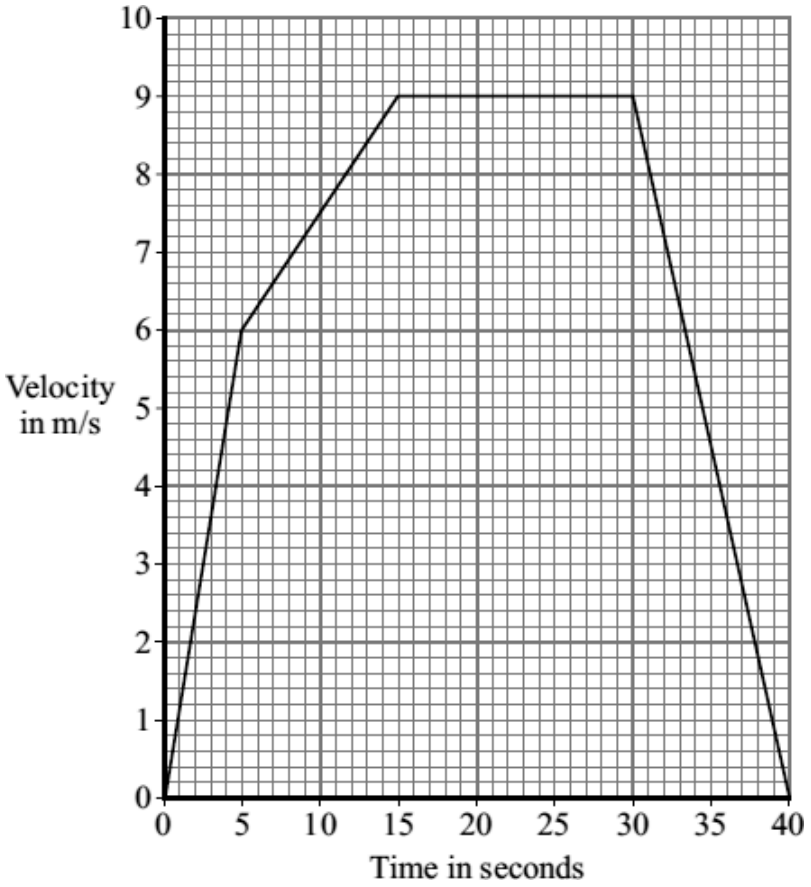
_____

_____

Resultant force = _____

**(3)**

(b) The graph shows how the velocity of the cyclist changes with time.




(i) Complete the following sentence.

The velocity includes both the speed and the _____ of the cyclist.

**(1)**

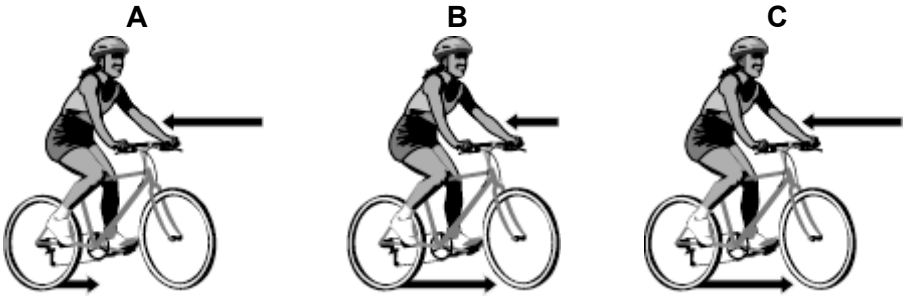
(ii) Why has the data for the cyclist been shown as a line graph instead of a bar chart?

_____

_____

**(1)**

(iii) The diagrams show the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.




Which **one** of the diagrams, **A**, **B** or **C**, represents the forces acting when the cyclist is travelling at a constant 9 m/s?

_____

Explain the reason for your choice.

_____

_____

_____

_____

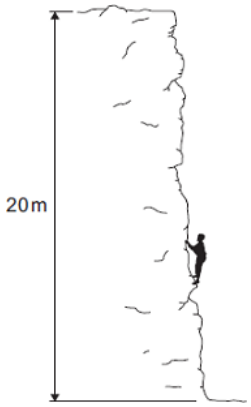
_____

**(3)**

**(Total 8 marks)**

## Q10.

The diagram shows a climber part way up a cliff.




(a) Complete the sentence.

When the climber moves up the cliff, the climber

gains gravitational _____ energy.

**(1)**

(b) The climber weighs 660 N.

(i) Calculate the work the climber must do against gravity, to climb to the top of the cliff.

_____

_____

Work done = _____ J

**(2)**

(ii) It takes the climber 800 seconds to climb to the top of the cliff.
During this time the energy transferred to the climber equals the work done by the climber.

Calculate the power of the climber during the climb.

_____

_____

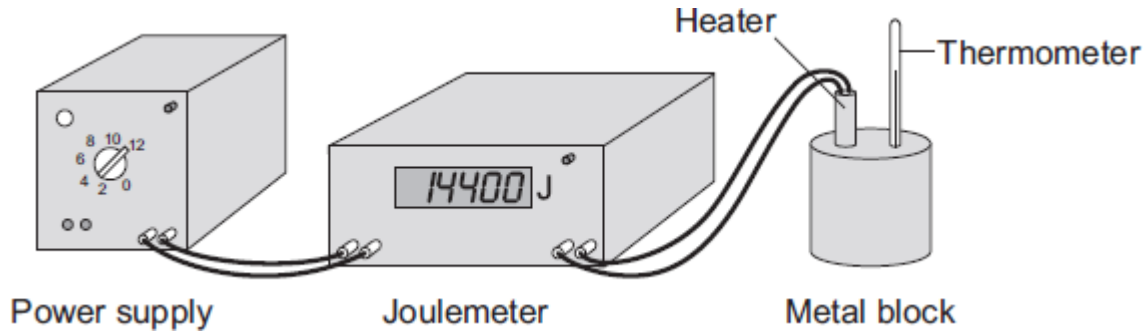
Power = _____ W

**(2)**

**(Total 5 marks)**

## Q11.

A student used an electric heater to heat a metal block. The student measured the energy input to the heater with a joulemeter.




Before starting the experiment, the student reset the joulemeter to zero. The student switched the power supply on for exactly 10 minutes. During this time, the reading on the joulemeter increased to 14 400.

(a) (i) Calculate the energy transferred each second from the power supply to the heater.

Show clearly how you work out your answer.

_____

_____

Energy transferred each second = _____ J/s

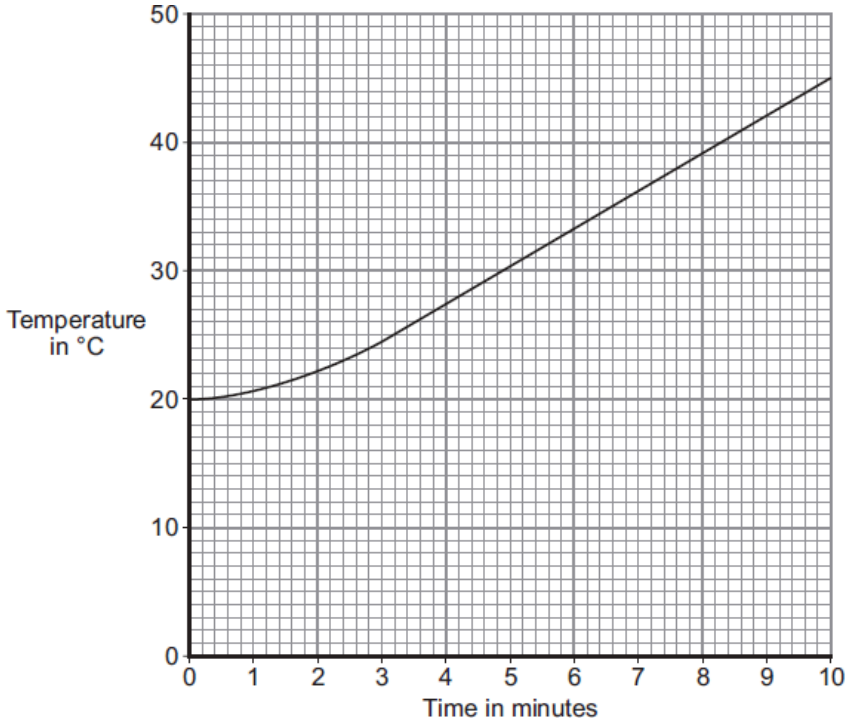
**(2)**

(ii) What is the power of the heater?

_____

**(1)**

(b) The student measured the temperature of the metal block every minute. The data obtained by the student is displayed in the graph.




(i) What range of temperatures did the student measure?

From _____ °C to _____ °C

**(1)**

(ii) Before starting the experiment, the student had calculated that the temperature of the block would go up by 36 °C.

The student's data shows a smaller increase.

Which **one** of the following statements gives the most likely reason for this?

Put a tick (✓) in the box next to your answer.

The student does not read the thermometer accurately. ☐

The block transfers energy to the surroundings. ☐

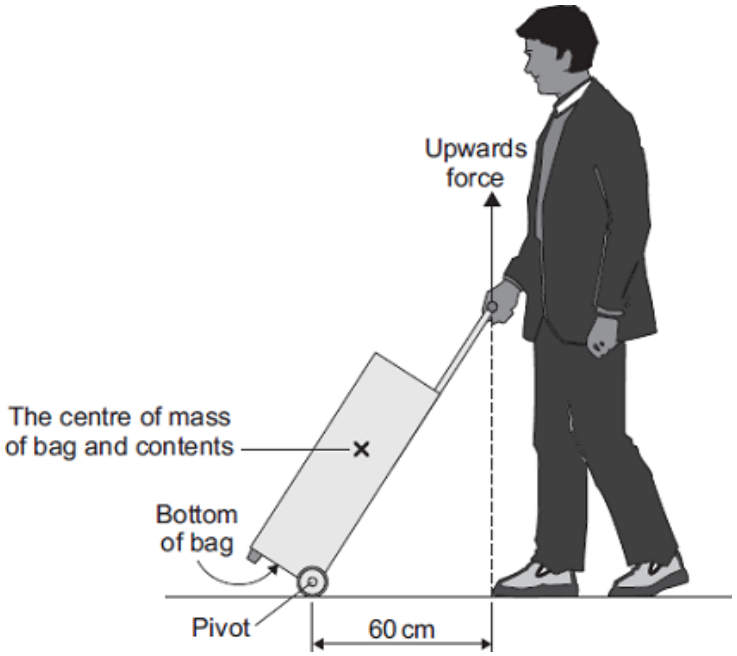
The power supply is not connected correctly to the joulemeter. ☐

**(1)**

**(Total 5 marks)**

## Q12.

The diagram shows a man standing in an airport queue with his wheeled bag.




(a) The man applies an upward force to the handle of his bag to stop the bag from falling.
The moment of this force about the pivot is 36 Nm.

Calculate the upward force the man applies to the handle of his bag.

_____

_____

_____

_____

Force = _____ N

**(2)**

(b) When the man lets go of the bag handle, the bag falls and hits the floor.

Explain why.

_____

_____

_____

_____

_____

_____

**(2)**

**(Total 4 marks)**

## Q13.

(a) In any collision, the total momentum of the colliding objects is usually conserved.

(i) What is meant by the term 'momentum is conserved'?

_____

_____

**(1)**

(ii) In a collision, momentum is **not always** conserved.

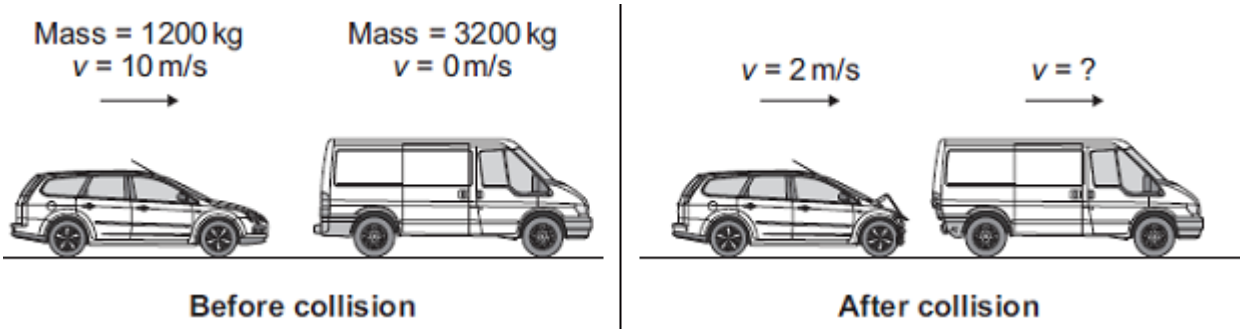
Why?

_____

_____

**(1)**

(b) The diagram shows a car and a van, just before and just after the car collided with the van.




(i) Use the information in the diagram to calculate the **change** in the momentum of the car.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

_____

Change in momentum = _____

**(3)**

(ii) Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

_____

_____

_____

Velocity = _____ m/s forward

**(2)**

**(Total 7 marks)**

## Q14.

A car has an oil leak. Every 5 seconds an oil drop falls from the bottom of the car onto the road.

(a) What force causes the oil drop to fall towards the road?

_____

**(1)**

(b) The diagram shows the spacing of the oil drops left on the road during part of a journey


Describe the motion of the car as it moves from **A** to **B**.

_____

Explain the reason for your answer.

_____

_____

_____

_____

**(3)**

(c) When the brakes are applied, a braking force slows down and stops the car.

(i) The size of the braking force affects the braking distance of the car.

State **one** other factor that affects the braking distance of the car.

_____

**(1)**

(ii) A braking force of 3 kN is used to slow down and stop the car in a distance of 25 m.

Calculate the work done by the brakes to stop the car and give the unit.

_____

_____

_____

Work done =_____

**(3)**

**(Total 8 marks)**

## Q15.

Forces have different effects.

(a) (i) Use the correct answer from the box to complete the sentence.

| | | |
|---|---|---|
| **slowing** | **stretching** | **turning** |

The moment of a force is the _____ effect of the force.

**(1)**

(ii) What is meant by the centre of mass of an object?

_____

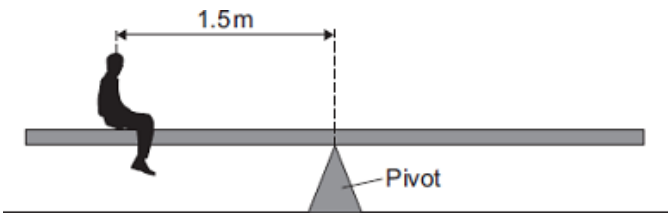
_____

**(1)**

(b) Some children build a see-saw using a plank of wood and a pivot.
The centre of mass of the plank is above the pivot.

**Figure 1** shows a boy sitting on the see-saw. His weight is 400 N.

**Figure 1**




Calculate the anticlockwise moment of the boy in Nm.

_____

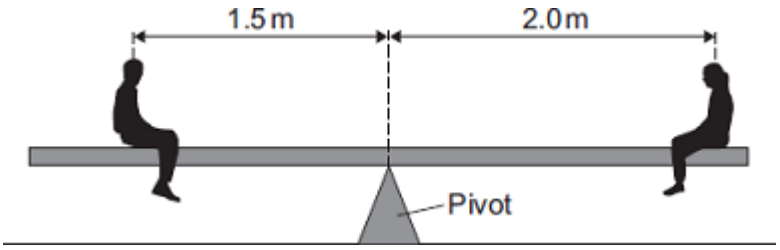
_____

Anticlockwise moment = _____ Nm

**(2)**

(c) **Figure 2** shows a girl sitting at the opposite end of the see-saw. Her weight is 300 N.

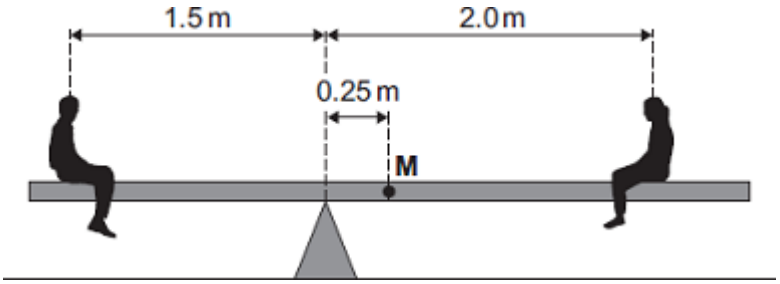
**Figure 2**




The see-saw is now balanced.

The children move the plank. Its centre of mass, **M**, is now 0.25 m from the pivot as shown in **Figure 3**.

**Figure 3**




The boy and girl sit on the see-saw as shown in **Figure 3**.

(i) Describe **and** explain the rotation of the see-saw.

_____

_____

_____

_____

_____

_____

_____

**(3)**

(ii) The boy gets off the see-saw and a bigger boy gets on it in the same place. The girl stays in the position shown in **Figure 3**. The plank is balanced. The weight of the plank is 270 N.

Calculate the weight of the bigger boy.

_____

_____

_____

_____

_____

_____

Weight of the bigger boy = _____ N

**(3)**

**(Total 10 marks)**

Mark schemes

## Q1.

(a) (i) not moving

1

(ii) straight line from origin to (200,500)

*ignore a horizontal line after (200,500)*

1

(b) 35 000

*allow **1** mark for correct substitution, ie 14 000 × 2.5 provided no subsequent step*

*an answer of 87 500 indicates acceleration (2.5) has been squared and so scores zero*

2

**[4]**

## Q2.

(a) make the rod longer

1

push down on the rod with a greater force

1

(b) particles are close together

1

*so no room for more movement*

*dependent on 1st marking point*

1

(c) (i) downward force produces pressure in liquid

*reference to compression of liquid negates this mark*

1

*this* pressure is the same at all points in a liquid
***or***
*this pressure is transmitted equally through the liquid*

*and P = F / A **or** F = P × A*

1

area (at load) bigger *(so force bigger)*

1

(ii) the force acting on the car moves less distance than the effort force

1

**[9]**

## Q3.

(a) Zero / 0

*Accept none*

*Nothing is insufficent*

1

velocity / speed = 0

*accept it is not moving*

*paintball has not been fired is insufficient*

1

(b) 0.27

*allow **1** mark for correct substitution, ie p = 0.003(0) × 90 provided no subsequent step*

2

(c) equal to

1

**[5]**

## Q4.

(a) the forces are equal in size and act in opposite directions

1

(b) (i) forwards / to the right / in the direction of the 300 N force

*answers in either order*

1

accelerating

1

(ii) constant velocity to the right

1

(iii) resultant force is zero

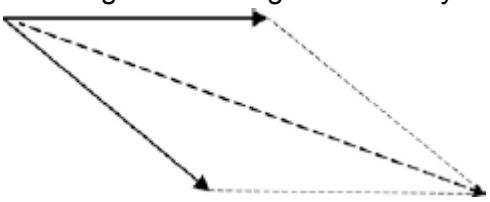
*accept forces are equal / balanced*

1

so boat continues in the same direction at the same speed

1

(iv) parallelogram or triangle is correctly drawn with resultant



3

value of resultant in the range 545 N – 595 N

*parallelogram drawn without resultant gains **1** mark*

*If no triangle or parallelogram drawn:*

*drawn resultant line is **between** the two 300 N forces gains **1** mark*

*drawn resultant line is between and longer than the two 300 N forces gains **2** marks*

1

**[10]**

## Q5.

(a) 3000

*correct substitution of 24 / 0.008 gains **1** mark provided no subsequent steps are shown*

**2**

N / $m^2$ or Pa

**1**

(b) (i) K

*accept ringed K in table*

**1**

(ii) water exiting bottle one-third of vertical height of K

*allow less than half vertical height of spout shown, judged by eye*

**1**

water landing twice the distance of the spout shown in the diagram

*accept at least one and a half times further out than spout shown, judged by eye*

*do **not** accept water hitting the side of the sink*

*ignore trajectory*

**1**

(c) water will land on the (vertical) side of the sink

*accept sink **not** long / wide / big enough*

**or**

water will dribble down very close to the bottle

**or**

that part of the bottle is curved

*do **not** accept goes out of the sink*

**1**

**[7]**

## Q6.

(a) (i) friction

*accept any way of indicating the correct answer*

**1**

(ii) gravity

*accept any way of indicating the correct answer*

**1**

(b) (i) accelerates **or** <u>speed</u> / velocity increases

*accept faster <u>and</u> faster (1 mark)*

*do **not** accept faster pace / falls faster*
*or suggestions of a greater but constant speed*

**1**

downwards / falls

*accept towards the Earth / ground*

*this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts*

**1**

(ii) constant speed / velocity **or** terminal velocity / speed or zero acceleration

*stays in the same place negates credit*

**1**

**[5]**

## Q7.

(a) 98

*allow **1** mark for correct substitution*

*ie ½ × 0.16 × 35 × 35 provided no subsequent step shown*

*an answer of 98 000 scores 0*

**2**

(b) (i) 9.6

*allow **1** mark for (change in velocity =) 60*

*ignore negative sign*

**2**

(ii) 9600

*ignore negative sign*

**or**

their (b)(i) ÷ 0.001 correctly calculated, unless (b) (i) equals 0

**1**

(c) increases the time

**1**

to reduce/change momentum (to zero)

*only scores if 1st mark scored*

*decreases rate of change of momentum scores both marks provided there are no contradictions*

*accept decreased acceleration/deceleration*

*equations on their own are insufficient*

**1**

**[7]**

## Q8.

(a) (line of action of) its weight

**1**

falls inside its wheel base

*accept 'falls between the wheels'*

*the first **two** points may be credited by adding a vertical line*

*from the centre of the X on the diagram (1)*
*and labelling it weight / force / with a downwards arrow (1)*
*provided there is no contradiction between what is added to the diagram and anything which may be written*

**1**

(so there is) no (resultant / clockwise) moment / turning effect

**1**

(b) centre of mass should be lower

*accept '… centre of gravity'*
*accept 'weight / mass low down'*
***not** just 'lower the roof'*

**1**

wheel base should be wider

*accept 'long axle(s)' for 'wide wheel base'*
*allow bigger / larger wheel base*
*do **not** credit 'long wheel base'*
*responses in either order*

**1**

**[5]**

## Q9.

(a) 96

*allow **1** mark for correct substitution*
*ie 80 × 1.2*

**2**

newton or N

*allow Newton*
*do **not** allow n*

**1**

(b) (i) direction

**1**

(ii) velocity and time are continuous (variables)

*answers must refer to both variables*
*accept the variables are continuous / not categoric*
*accept the data / 'it' is continuous*
*accept the data / 'it' is not categoric*

**1**

(iii) **C**

**1**

velocity is not changing

*the **2** marks for reason may be scored even if **A** or **B** are chosen*
*accept speed for velocity*
*accept speed is constant (9 m/s)*
*accept **not** decelerating*

*accept **not** accelerating*

*accept reached terminal velocity*

**1**

forces must be balanced

*accept forces are equal*

*accept arrows are the same length / size*

**or**

resultant force is zero

*do **not** accept the arrows are equal*

**1**

**[8]**

## Q10.

(a) potential

**1**

(b) (i) 13 200

*allow **1** mark for correct substitution, ie 660 × 20 provided no subsequent step shown*

**2**

(ii) 16.5

*allow 1 mark for correct*

**or**

$\frac{\text{their (b)(i)}}{800}$ correctly calculated

*substitution, ie* $\frac{13\,200}{800}$ ***or*** $\frac{\text{their (b)(i)}}{800}$

*provided no subsequent step shown*

**2**

**[5]**

## Q11.

(a) (i) 24

*allow **1** mark for converting time to 600 seconds*

***or** showing method ie 14400/10*

***or*** $\frac{14400}{10 \times 60}$

*provided no further steps shown*

**2**

(ii) 24

*ignore any unit*

**or**

their (a)(i)

**1**

(b) (i) 20 45

***both** required – either order*

1

(ii) the block transfers energy to the surroundings

1

**[5]**

## Q12.

(a) 60

*allow **1** mark for correct substitution (with d in metres),*
*ie 36 = F × 0.6*
*an answer of 0.6 **or** 6 gains **1** mark*

2

(b) the line of action of the weight lies outside the base / bottom (of the bag)

*accept line of action of the weight acts through the side*
*accept the weight (of the bag) acts outside the base / bottom (of the bag)*

1

a resultant / overall / unbalanced moment acts (on the bag)

*accept the bag is not in equilibrium*
*do **not** accept the bag is unbalanced*

1

**[4]**

## Q13.

(a) (i) momentum before = momentum after

*accept no momentum is lost*
*accept no momentum is gained*

**or**
(total) momentum stays the same

1

(ii) an external force acts (on the colliding objects)

*accept colliding objects are not isolated*

1

(b) (i) 9600

*allow 1 mark for correct calculation of momentum before or after ie 12000 or 2400*
***or***
*correct substitution using change in velocity = 8 m/s*
*ie 1200 × 8*

2

kg m/s
**or**
Ns

*this may be given in words rather than symbols*
*do **not** accept nS*

1

(ii) 3 or their (b)(i) 3200 correctly calculated

*allow 1 mark for stating momentum before = momentum after*

**or**

clear attempt to use conservation of momentum

2

**[7]**

## Q14.

(a) gravitational / gravity / weight

*do **not** accept gravitational potential*

1

(b) accelerating

*accept speed / velocity increases*

1

the distance between the drops increases

1

but the time between the drops is the same

*accept the time between drops is (always) 5 seconds*
*accept the drops fall at the same rate*

1

(c) (i) any **one** from:

- speed / velocity
- (condition of) brakes / road surface / tyres
- weather (conditions)

*accept specific examples, eg wet / icy roads*
*accept mass / weight of car friction is insufficient*
*reference to any factor affecting thinking distance negates this answer*

1

(ii) 75 000

*allow **1** mark for correct substitution, ie 3000 × 25 provided no subsequent step shown*
***or** allow **1** mark for an answer 75*
***or** allow **2** marks for*
*75 k(+ incorrect unit), eg 75 kN*

2

joules / J

*do **not** accept j*
*an answer 75 kJ gains **3** marks*
*for full marks the unit and numerical answer must be consistent*

1

**[8]**

## Q15.

(a) (i) turning

*accept turning ringed in the box*

1

(ii) point at which mass (or weight) may be thought to be concentrated

*accept the point from which the weight appears to act*

*allow focused for concentrated*

*do **not** accept most / some of the mass*

*do **not** accept region / area for point*

1

(b) 600 (Nm)

*400 × 1.5 gains **1** mark provided no subsequent steps shown*

2

(c) (i) plank rotates clockwise

*accept girl moves downwards*

*do **not** accept rotates to the right*

1

(total) CM > (total) ACM

*accept moment is larger on the girl's side*

1

weight of see-saw provides CM

*answer must be in terms of moment*

*maximum of **2** marks if there is no reference to the weight of the see-saw*

1

(ii) W = 445 (N)

*W × 1.5 = (270 × 0.25) + (300 × 2.0) gains **2** marks*

*allow for **1** mark:*

*total CM = total ACM either stated or implied*

***or***

*(270 × 0.25) + (300 × 2.0)*

*if no other marks given*

3

**[10]**