

Newton's Second Law

Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Newton's Second Law
Difficulty Level	Bronze Level
Booklet	Question Paper

Time Allowed: 47 minutes

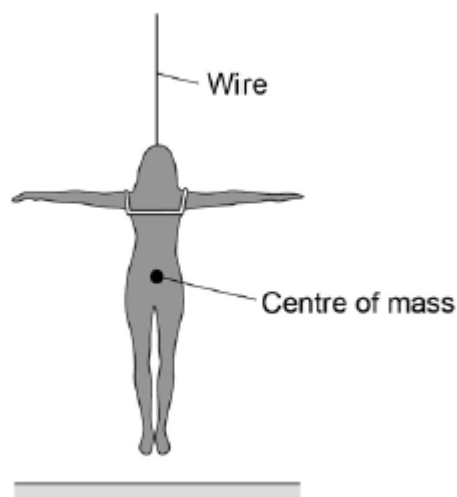
Score: /46

Percentage: /100

Grade Boundaries:

Q1. An actor is attached to a wire so that she can hang above the stage.

Look at the figure below.



(a) On The figure above draw two arrows to show the forces acting on the actor.

(2)

(b) Which **two** forces are acting on the actor?

Tick **two** boxes.

Air resistance force

☐

Electrostatic force

☐

Gravitational force

☐

Magnetic force

☐

Tension force

☐

(2)

(c) The actor hangs above the stage in a stationary position.

What is the resultant force on the actor?

Resultant force = N

(1)

- (d) The actor has a mass of 70 kg.

Gravitational field strength = 9.8 N / kg

Use the following equation to calculate the weight of the actor.

Weight = mass \times gravitational field strength

Give your answer to 2 significant figures.

.....
.....
.....

Weight of actor = N

(2)

- (e) A motor pulls vertically upwards on the wire with a force of 720 N.

Calculate the resultant force on the actor.

.....

Resultant force = N

(1)

- (f) Another actor has a mass of 65 kg.

This actor is attached to the wire and the motor pulls her vertically upwards.

The resultant force on the actor is 25 N.

Write down the equation that links acceleration, mass and resultant force.

Equation

(1)

- (g) Calculate the acceleration of the actor.

.....

.....

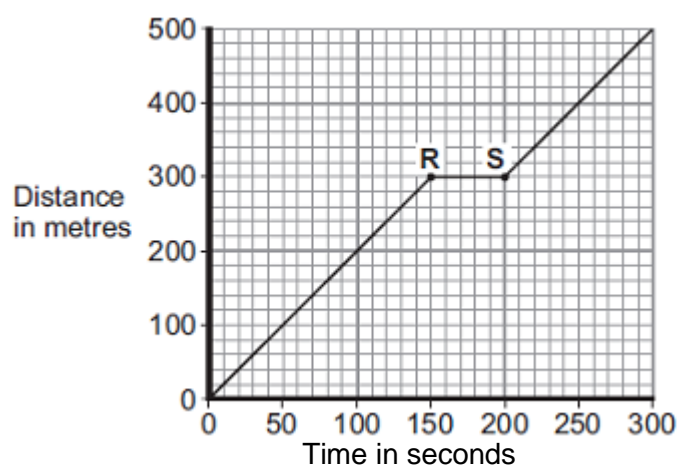
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Acceleration of actor = m / s^2

(3)
(Total 12 marks)

- Q2.(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

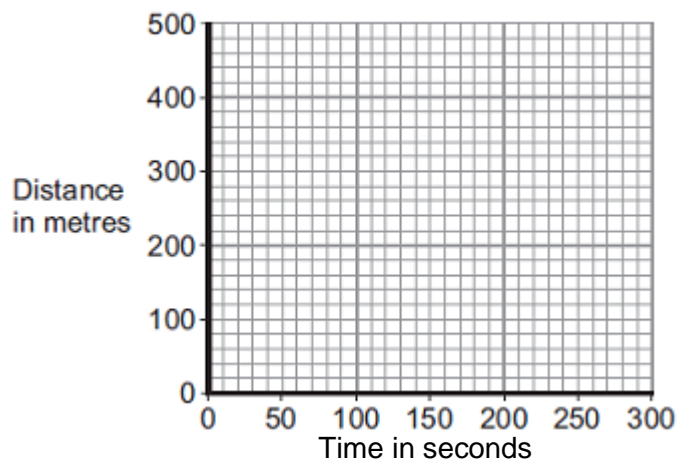
☐

(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)

- Q3.(a)** The diagrams, **A**, **B** and **C**, show the horizontal forces acting on a **moving** car.

Draw a line to link each diagram to the description of the car's motion at the moment when the forces act.

Draw only **three** lines.

stationary



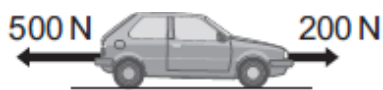
A

constant speed



B

slowing down

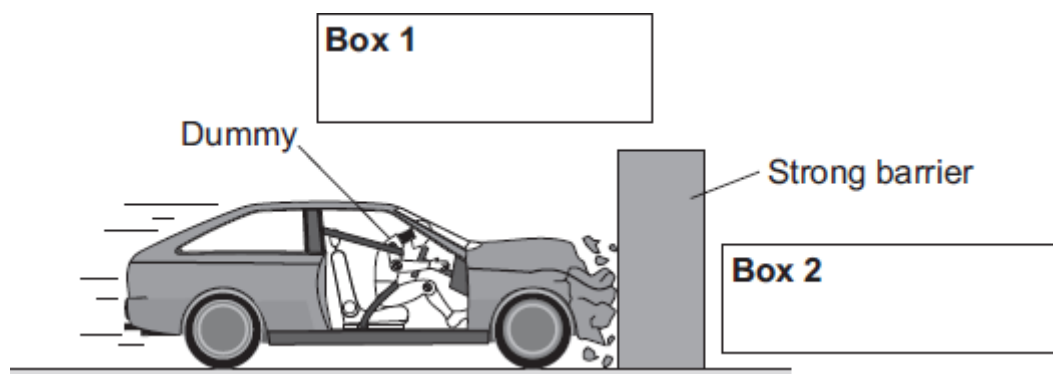


C

accelerating forwards

(3)

- (b) The front crumple zone of a car is tested at a road traffic laboratory. This is done by using a remote control device to drive the car into a strong barrier. Electronic sensors are attached to a dummy inside the car.



- (i) Draw an arrow in **Box 1** to show the direction of the force that the car exerts on the barrier.

(1)

- (ii) Draw an arrow in **Box 2** to show the direction of the force that the barrier exerts on the car.

(1)

- (iii) Complete the following by drawing a ring around the correct line in the box.

The car exerts a force of 5000 N on the barrier. The barrier does not move.
The force

exerted by the barrier on the car will be

more than
equal to
less than

5000 N.

(1)

- (iv) Which **one** of the following gives the most likely reason for attaching electronic sensors to the dummy?

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

To measure the speed of the car just before the impact.

☐

To measure the forces exerted on the dummy during the impact.

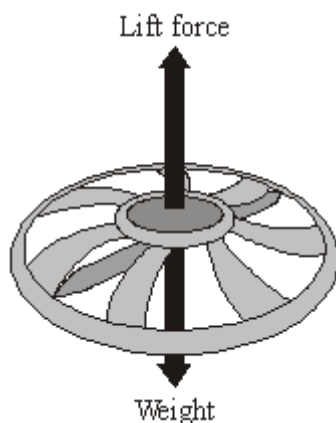
☐

To measure the distance the car travels during the impact.

☐

(1)
(Total 7 marks)

Q4. The diagram shows the forces on a small, radio-controlled, flying toy.



- (a) (i) The mass of the toy is 0.06 kg.
Gravitational field strength = 10 N/kg

Calculate the weight of the toy.

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

.....
.....

Weight =

(3)

- (ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the toy is hovering stationary in mid-air, the lift force is

bigger than	
the same as	
smaller than	

the weight of the toy.

(1)

- (b) When the motor inside the toy is switched off, the toy starts to *accelerate* downwards.

- (i) What does the word *accelerate* mean?

.....

(1)

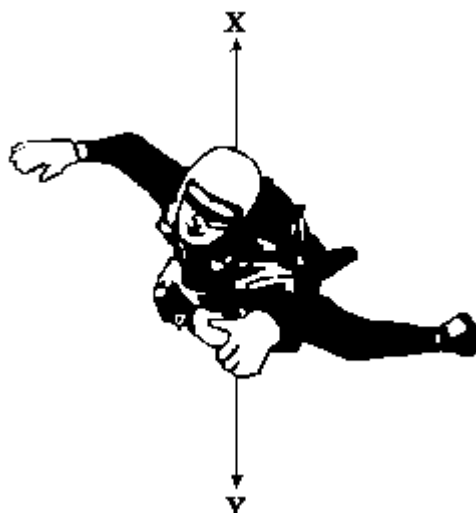
- (ii) What is the direction of the resultant force on the falling toy?

.....

(1)

(Total 6 marks)

- Q5.** 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)

Q6. (a) Two skydivers jump from a plane. Each holds a different position in the air.



A



B

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Complete the following sentence.

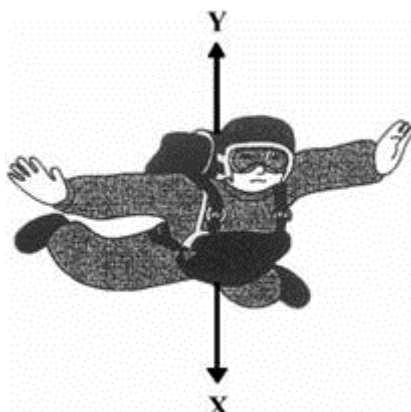
Skydiver will fall faster because.....

.....

.....

(2)

The diagram shows the direction of the forces acting on one of the skydivers.



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(b) In the following sentences, cross out in each box the **two** lines that are wrong.

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

air resistance
friction
gravity

(1)

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

air resistance
gravity
weight

(1)

(iii) When force **X** is bigger than force **Y**, the speed of the

skydiver will

go up stay the same go down

(1)

(iv) After the parachute opens, force **X**

goes up stays the same goes down
--

(1)

(c) How does the area of an opened parachute affect the size of force **Y**?

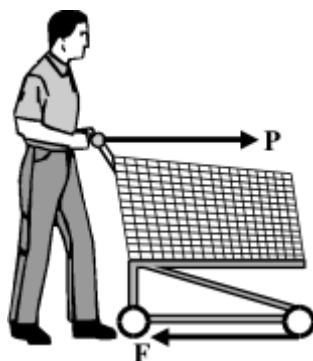
.....

.....

(1)

(Total 7 marks)

Q7. (a) A shopping trolley is being pushed at a constant speed. The arrows represent the horizontal forces on the trolley.

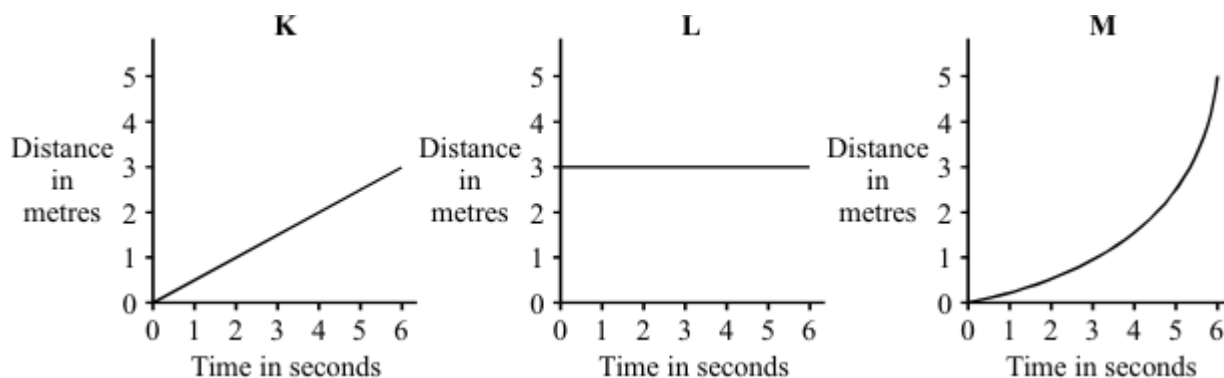


(i) How big is force **P** compared to force **F**?

.....

(1)

- (ii) Which **one** of the distance-time graphs, **K**, **L** or **M**, shows the motion of the trolley? Draw a circle around your answer.



(1)

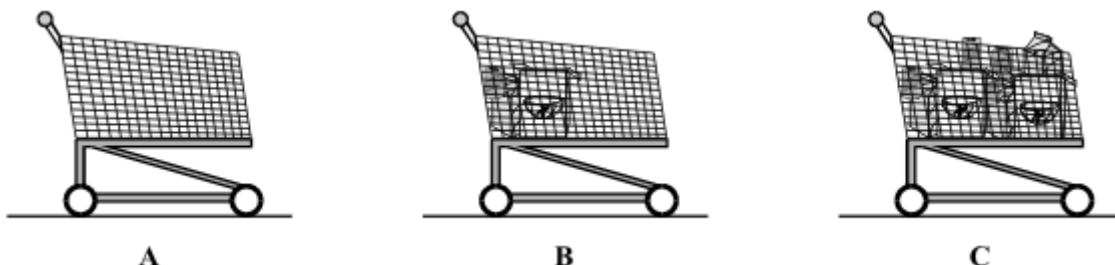
- (b) Complete the sentence by crossing out the **two** words in the box that are wrong.

energy.
speed.
velocity.

Acceleration is the rate of change of

(1)

- (c) Three trolleys, **A**, **B** and **C**, are pushed using the same size force. The force causes each trolley to accelerate.



Which trolley will have the smallest acceleration?

.....

Give a reason for your answer.

.....

(2)
(Total 5 marks)