AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.5.6.2.2 NEWTON'S SECOND LAW (PACK 1)

SCORE	PERCENTAGE
/89	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

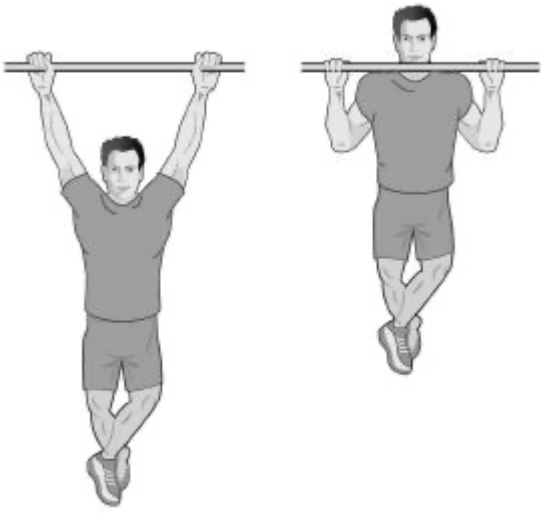
Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

The diagram below shows a man doing two stages of a pull up. In both diagrams the man is stationary.



Stage 1 Stage 2

(a) Complete the sentence.

Choose the answers from the box.

equal to	**less than**	**more than**

In stage 1 the downwards force of the man on the bar is _____

the upwards force of the bar on the man.

(1)

(b) The man has a mass of 85 kg

Gravitational field strength = 9.8 N/kg

Calculate the weight of the man.

Use the equation:

weight = mass × gravitational field strength

_____

_____

Weight = _____ N

(2)

(c) The man raises his body a vertical distance of 0.63 m to go from stage 1 to stage 2

Calculate the work done by the man.

Use your answer to part **(b)**

STEMUP.CO.UK

Use the equation:

work done = force × distance

_____

_____

Work done = _____ J

(2)

(d) The man was **not** moving at stage 2

How much work is done by the man at stage 2?

Work done = _____ J

(1)

(e) A woman uses the bar to do a pull up.

The woman has a mass of 62 kg

She accelerates at 11 m/s^2

Calculate the resultant force on the woman.

Use the equation:

force = mass × acceleration

_____

_____

Force = _____ N

(2)

(Total 8 marks)

Q2.

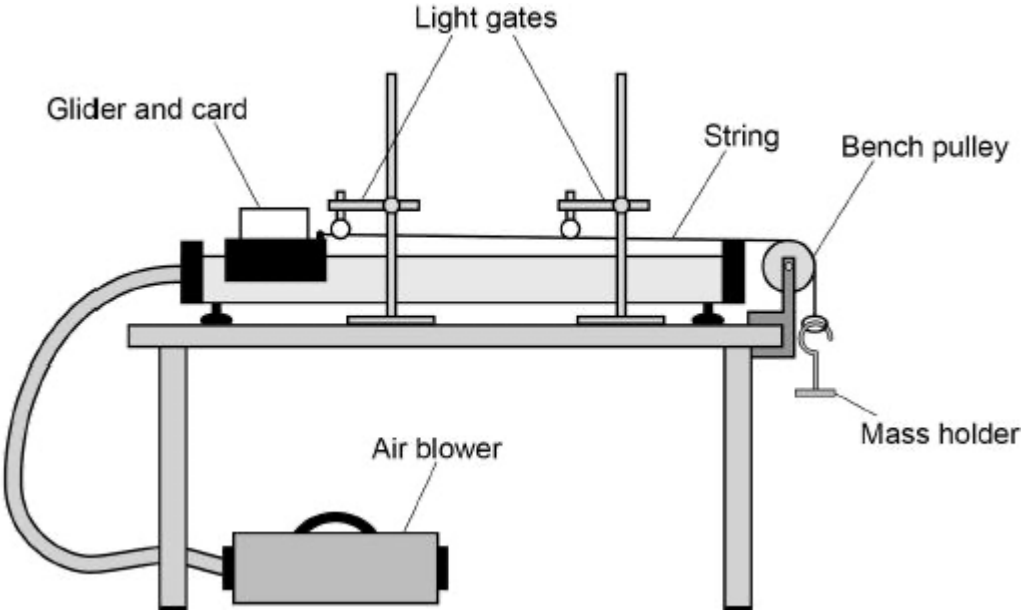
A student investigated acceleration using gliders, an air track and light gates.

The air track reduces friction between the glider and the track to zero.

Figure 1 shows the apparatus.

Figure 1

STEMUP.CO.UK



The glider was released from rest and moved along the track.

The mass holder hit the ground before the card passed through the second light gate.

(a) Which **two** statements describe the effect this would have on the glider?

Tick **two** boxes.

Its acceleration would decrease to zero. ☐

Its acceleration would increase. ☐

The resultant force on it would decrease to zero. ☐

The resultant force on it would increase. ☐

Its speed would increase. ☐

(2)

(b) The mass holder should **not** hit the ground before the card passes through the second light gate.

Suggest **one** way that the student could stop this happening.

_____

_____

(1)

The student increased the resultant force acting on the glider by adding more masses to the mass holder.

STEMUP.CO.UK

She calculated the acceleration of the glider for each resultant force.

Each test was done three times.

Table 1 shows the results.

Table 1

Resultant force in N	Acceleration in m/s^2			Mean acceleration in m/s^2
	Test 1	Test 2	Test 3	
0.20	1.3	1.2	1.3	1.26667
0.39	2.6	2.5	2.6	2.6
0.59	3.8	3.8	3.9	3.8
0.78	5.1	5.1	5.1	5.1
0.98	6.4	7.2	6.4	6.7

(c) The student made **two** mistakes in the mean acceleration column.

Identify the mistakes the student made.

Suggest how each mistake can be corrected.

Mistake _____

_____

Correction _____

_____

Mistake _____

_____

Correction _____

_____

(4)

(d) Write a conclusion for this investigation.

Use the data in **Table 1**

_____

_____

(1)

(e) The student used a constant resultant force to accelerate the glider.

The student changed the mass of the glider and calculated the new acceleration.

STEMUP.CO.UK

She repeated this for different masses of the glider, keeping the resultant force constant.

The results are shown in **Table 2**

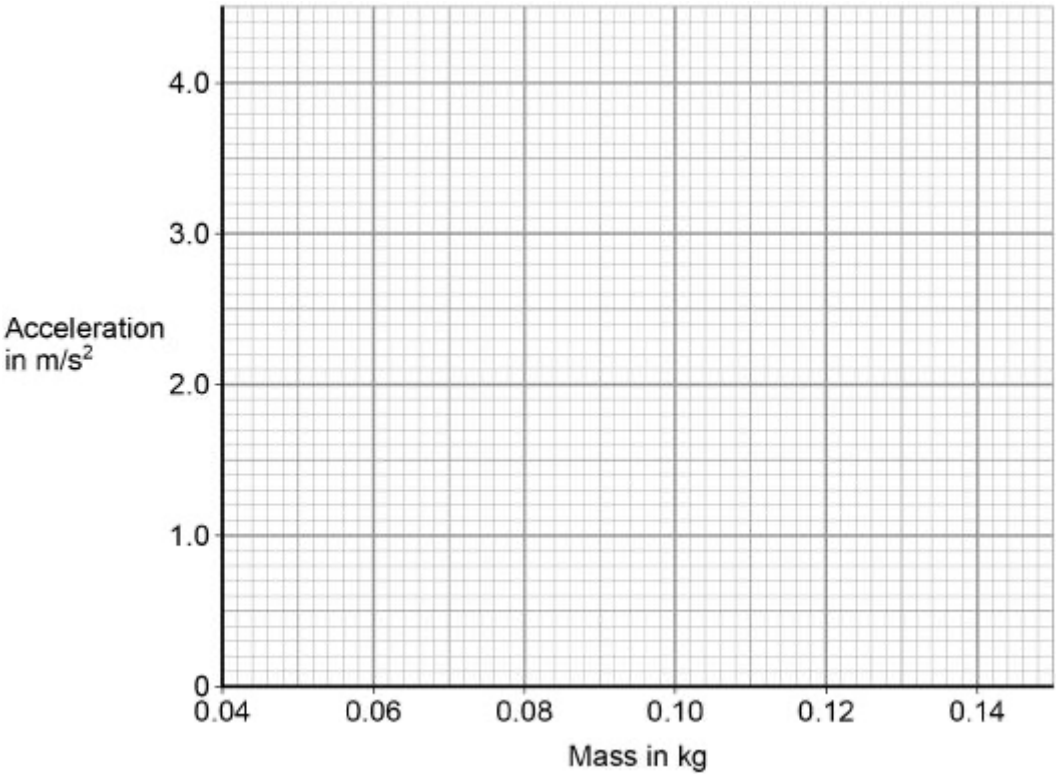
Table 2

Mass of the glider in kg	**Acceleration in m/s²**
0.060	3.5
0.080	2.6
0.10	2.0
0.12	1.7
0.14	1.4

Plot the results on **Figure 2**

Draw a line of best fit.

Figure 2



(3)

(f) Describe the relationship between mass and acceleration.

_____

_____

(1)

STEMUP.CO.UK

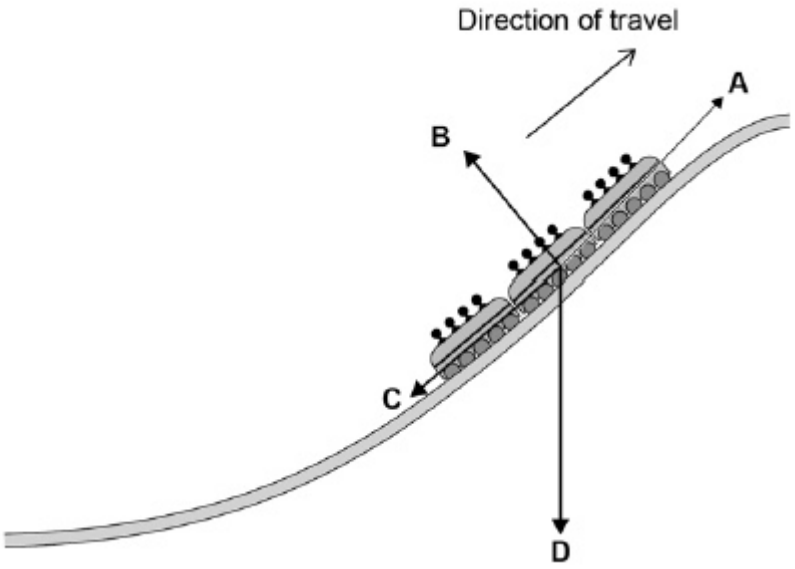
(Total 12 marks)

Q3.

Figure 1 shows a rollercoaster train as it is pulled up a slope on the track.

The arrows, **A**, **B**, **C** and **D**, represent the forces acting on the rollercoaster train.

Figure 1



(a) Give **two** ways that the force arrows show that forces are vector quantities.

1. _____

2. _____

(2)

(b) Which arrow shows the weight of the rollercoaster train?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) Which arrow shows the normal contact force?

Tick **one** box.

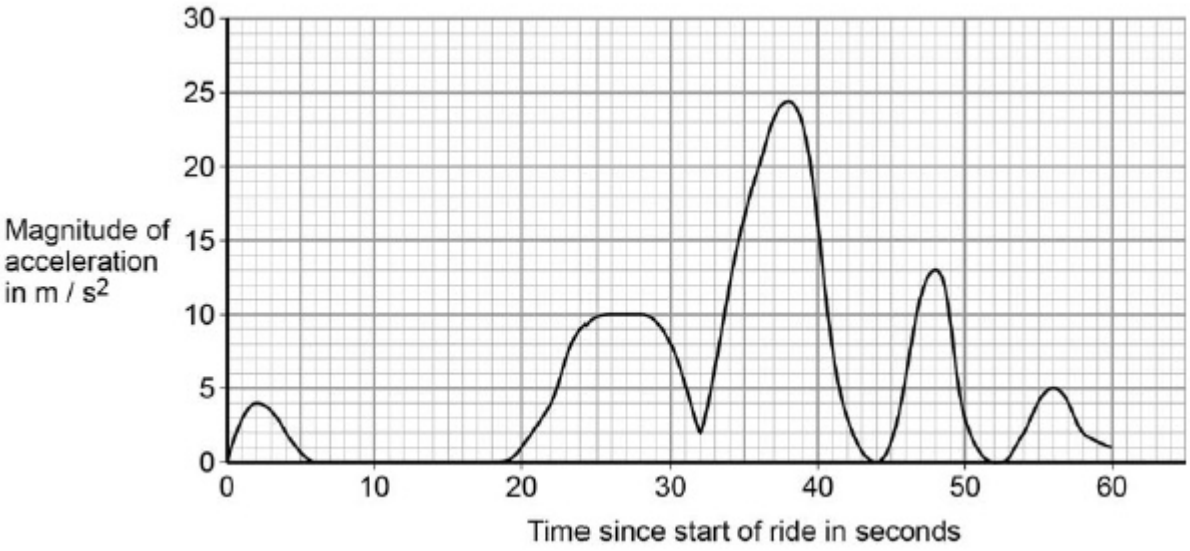
A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

Figure 2 shows the magnitude of the acceleration of the rollercoaster train during the ride.

Figure 2

STEMUP.CO.UK



(d) Why has a line graph been drawn instead of a bar chart?

Tick **one** box.

Acceleration is a control variable. ☐

Both variables are continuous. ☐

Line graphs are easier to read. ☐

Time is a categoric variable. ☐

(1)

(e) What conclusion can be made from **Figure 2** about the motion of the rollercoaster train between 10 and 15 seconds?

Tick **one** box.

It is moving at a constant velocity. ☐

Its velocity is decreasing. ☐

Its velocity is increasing. ☐

(1)

(f) What is the maximum acceleration of the rollercoaster train?

Use **Figure 2**.

Acceleration = _____ m/s^2

(1)

(g) The maximum safe acceleration for most people is 5 times the acceleration due to gravity.

STEMUP.CO.UK

Acceleration due to gravity = 9.8 m/s^2

Explain whether the acceleration of this rollercoaster train is safe for most people

_____

_____

_____

_____

_____

_____

(3)

(h) One of the passengers on the rollercoaster train has a mass of 58 kg

Calculate the maximum force experienced by the passenger during the ride.

Use the equation:

force = mass × acceleration

Give the unit.

_____

_____

_____

_____

_____

_____

Maximum force = _____ Unit _____

(3)

(Total 13 marks)

Q4.

Figure 1 shows a cyclist with a trailer attached to his bike.

Figure 1



STEMUP.CO.UK

(a) Describe how Newton's Third Law applies to the forces between the bike and the trailer.

_____

_____

_____

_____

(2)

(b) A student investigated how the stopping distance of the bike was affected by the mass of the load.

The same person rode the same bike throughout the investigation.

Give **two** other variables which the student should have controlled.

1. _____

_____

2. _____

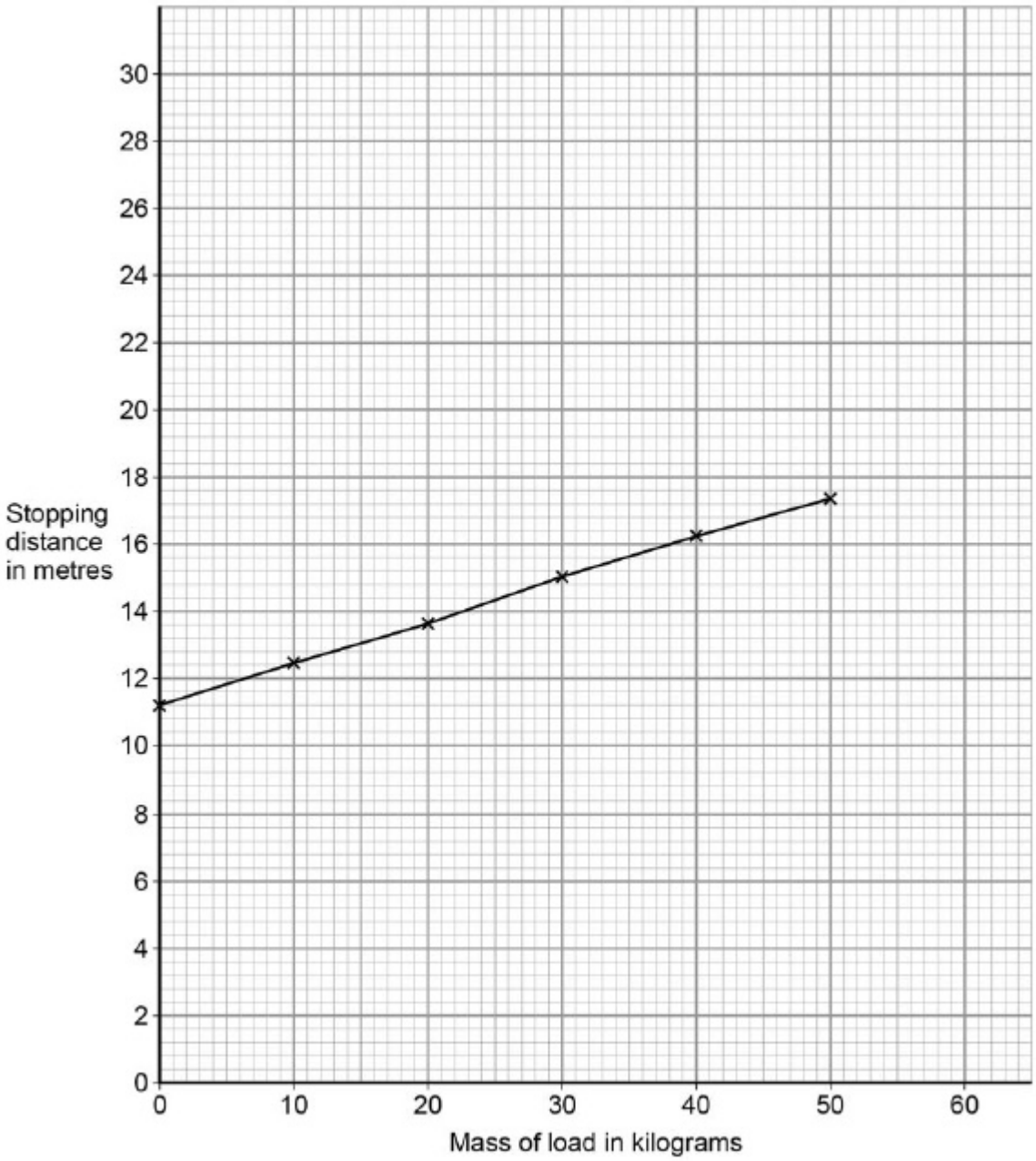
_____

(2)

(c) **Figure 2** shows the results of the investigation.

Figure 2

STEMUP.CO.UK



Draw a line on **Figure 2** to show how the stopping distance would be different if a heavier cyclist rode the bike.

(1)

(d) At one time in the investigation the cyclist was distracted.

The distraction increased the stopping distance of the bike but did **not** affect the braking distance.

Explain why the stopping distance increased.

STEMUP.CO.UK

_____

_____

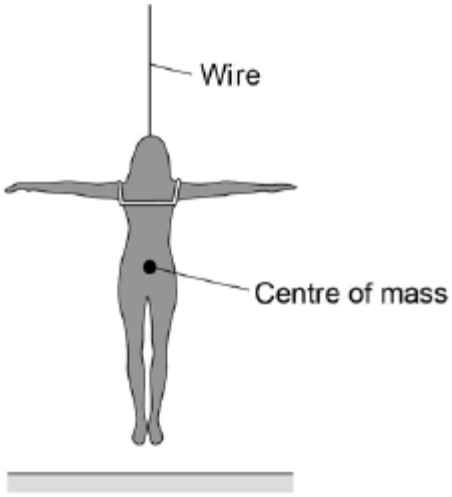
(3)

(Total 8 marks)

Q5.

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?

STEMUP.CO.UK

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 × 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.

_____

_____

_____

Acceleration of actor = _____ m / s^2

(3)

(Total 12 marks)

Q6.

Four students tested their reaction times using a computer program.

STEMUP.CO.UK

When a green light appeared on the screen the students had to press a key.

Table 1 shows their results.

Table 1

Student	Reaction time in s			Mean reaction time in s
	Test 1	Test 2	Test 3	
Boy 1	0.28	0.27	0.26	0.27
Boy 2	0.28	0.47	0.22	0.29
Girl 1	0.31	0.29	0.27	0.29
Girl 2	0.32	0.30	0.29	0.30

(a) What is meant by 'reaction time' in this experiment?

_____

_____

(1)

(b) Boy 2 had an anomalous result in **Test 2**.

Suggest a reason why.

_____

_____

(1)

(c) Give **one** conclusion that can be made from the results in **Table 1**.

_____

_____

(1)

(d) Suggest further evidence that you could collect to support your conclusion.

_____

_____

(1)

(e) Reaction time is important at the start of a race.

Table 2 shows the time taken by a boy to run different distances.

Table 2

Distance in m	Time in s

STEMUP.CO.UK

100	12.74
200	25.63
800	139.46

Reaction time is more important in a 100 m race than in an 800 m race.

Explain why.

_____

_____

_____

_____

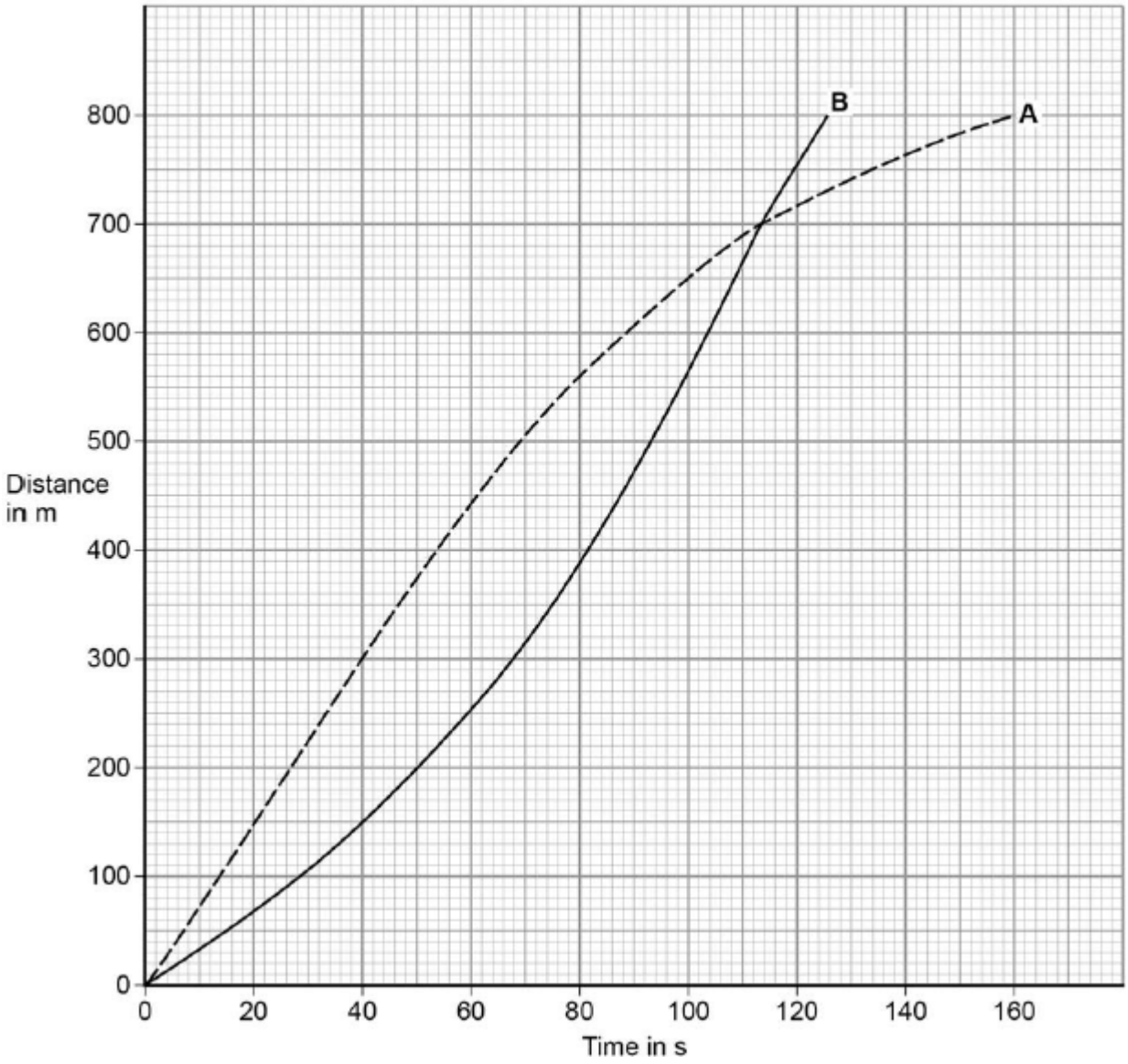
_____

(2)

(f) Two girls, **A** and **B**, ran an 800 m race.

The figure below shows how the distance changed with time.

STEMUP.CO.UK



Compare the motion of runners **A** and **B**.

Include data from the figure above.

STEMUP.CO.UK

_____

(6)

(g) Use above **Figure** to determine Girl **B**'s speed at 60 s.

Show how you use the graph to obtain your answer.

_____

_____

_____

Speed = _____ m / s

(3)

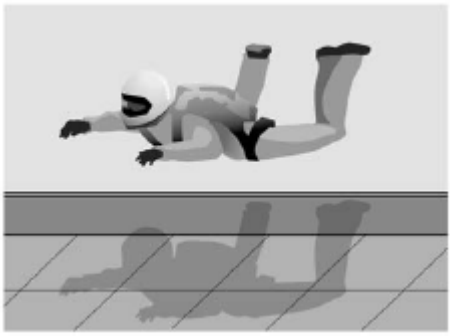
(Total 15 marks)

Q7.

Figure 1 shows a skydiver training in an indoor wind tunnel.

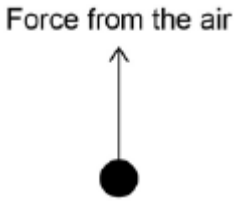
Large fans below the skydiver blow air upwards.

Figure 1



(a) The skydiver is in a stationary position.

Complete the free body diagram for the skydiver.



(2)

STEMUP.CO.UK

(b) The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.

Explain why straightening his legs cause the skydiver to accelerate upwards.

_____

_____

_____

_____

(2)

(c) A small aeroplane used for skydiving moves along a runway.

The aeroplane accelerates at 2 m / s^2 from a velocity of 8 m / s.

After a distance of 209 m it reaches its take-off velocity.

Calculate the take-off velocity of the aeroplane.

_____

_____

_____

Take-off velocity = _____ m / s

(3)

(d) A skydiver jumps from an aeroplane.

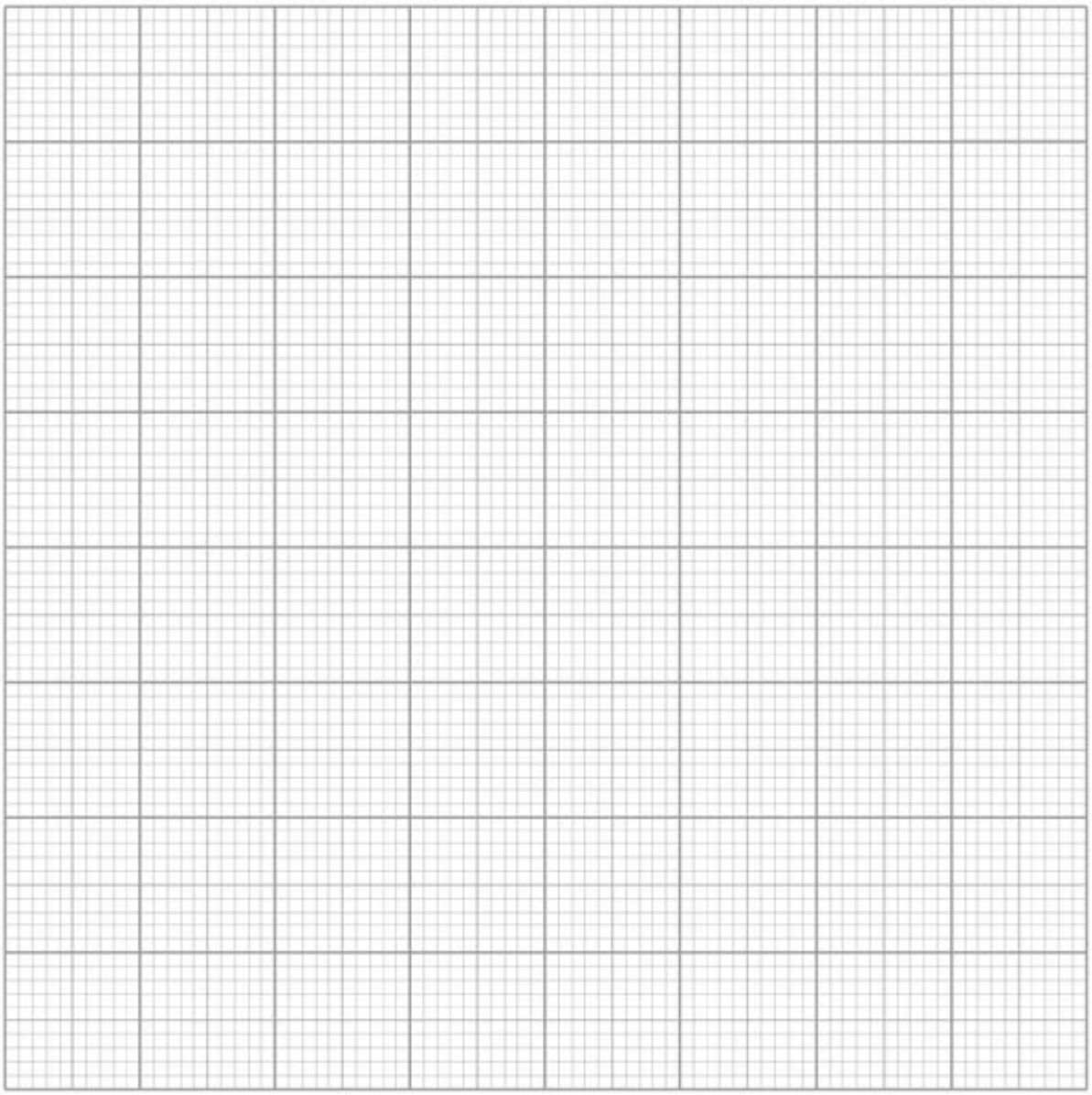
There is a resultant vertical force of 300 N on the skydiver.

There is a horizontal force from the wind of 60 N.

Draw a vector diagram on **Figure 2** to determine the magnitude and direction of the resultant force on the skydiver.

Figure 2

STEMUP.CO.UK



Magnitude of resultant force = _____ N

(5)

(Total 12 marks)

Q8.

The figure below shows an ice skater standing on the ice.

STEMUP.CO.UK



Mass
70 kg

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

_____

(1)

(b) As the skater pushes away across the ice there is a small frictional force.

After pushing, the skater starts to move with a velocity of 5 m / s.

He slows to 3 m / s in 6 seconds.

Calculate the acceleration of the skater.

_____

_____

_____

Acceleration = _____ m / s^2

(2)

(c) Write down the equation that links acceleration, force and mass.

_____

(1)

(d) Friction reduces the speed of the skater.

Calculate the frictional force acting on the skater to slow him down.

_____

_____

_____

Frictional force = _____ N

(2)

(e) The skater stands still on the ice.

STEMUP.CO.UK

He throws his bag to a friend.

As he throws his bag forwards, the skater moves backwards across the ice.

Use the idea of conservation of momentum to explain why he moves backwards.

(4)

(Total 10 marks)

STEMUP.CO.UK