

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.5.6.2.3 NEWTON'S THIRD LAW (PACK 1)

SCORE

/26

PERCENTAGE

%

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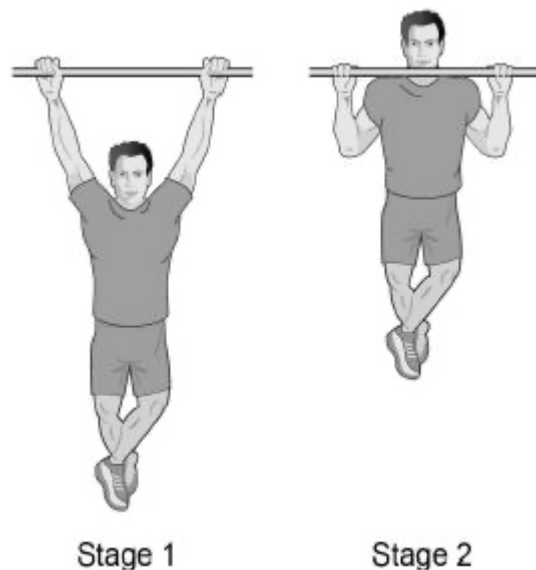
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Q1.

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



- (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:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

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)**

Use the equation:

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{Work done} = \underline{\hspace{2cm}} \text{ J}$$

(2)

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

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

$$\text{Work done} = \underline{\hspace{2cm}} \text{ J}$$

(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:

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{Force} = \underline{\hspace{2cm}} \text{ N}$$

(2)

(Total 8 marks)

Q2.

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

Figure 1



- (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.

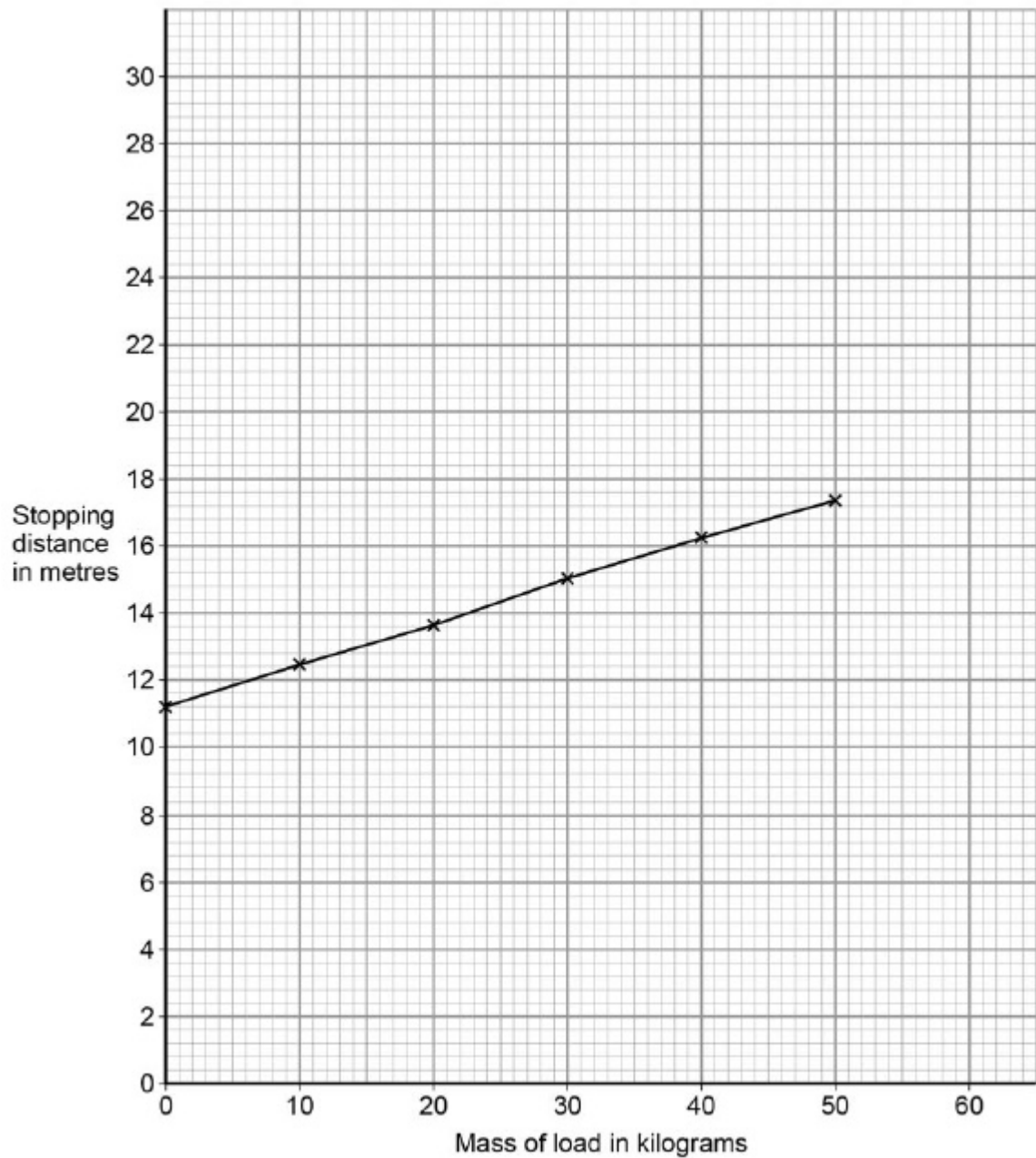
1. _____

2. _____

(2)

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

Figure 2



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.

(3)
(Total 8 marks)

Q3.

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



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 / s²

(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.

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)

Mark schemes

Q1.

- (a) equal to 1
- (b) $\text{weight} = 85 \times 9.8$ 1
- $\text{weight} = 833 \text{ (N)}$
- allow weight = 830 (N)* 1
- an answer of 833 (N) or 830 (N) scores 2 marks*
- (c) $\text{work done} = 833 \times 0.63$
- allow their calculated value from part (b) $\times 0.63$* 1
- $\text{work done} = 525 \text{ (J)}$
- allow an answer that is consistent with their calculated value from part (b)* 1
- an answer that rounds to 525 (J) scores 2 marks*
- (d) $\text{work done} = 0 \text{ (J)}$ 1
- (e) $\text{force} = 62 \times 11$ 1
- $\text{force} = 682 \text{ (N)}$
- allow force = 680 (N)* 1
- an answer of 682 (N) or 680 (N) scores 2 marks*

[8]

Q2.

- (a) the forces of the bike on the trailer and the trailer on the bike are equal in size
- allow the force of tension acts on the bike and the trailer* 1
- and opposite in direction 1
- (b) any **two** from:
- the same trailer should be used
 - the weather conditions should be the same
 - allow a description of this, eg the wind should be the same*
 - the same road (surface) should be used
 - the same gradient road should be used
 - the same speed should be used
 - the cyclist should be at the same level of alertness throughout the experiment
 - allow a description of a cause of this eg the cyclist should not*

drink coffee between experiments

2

(c) straight line drawn above the original line, sloping upwards

1

(d) the cyclist's reaction time increased

1

so the thinking distance increased

1

stopping distance is thinking distance plus braking distance

1

[8]

Q3.

(a) acceleration = change in velocity / time taken

allow $a = \Delta v / t$

1

(b) $= \frac{(3 - 5)}{6}$

1

−0.33 (m / s²)

1

allow 0.33 m / s² with no working shown for 2 marks

(c) force = mass × acceleration

allow $F = m a$

1

(d) 70×0.33

allow ecf from 4.3

1

23.1 (N)

allow 23.1 with no working shown for 2 marks

1

(e) before throwing the bag the momentum of the skater and bag is zero

1

when it is thrown the bag has momentum forwards

1

because momentum before = momentum after

1

the skater has equal backwards momentum so will move backwards

1

[10]

Examiner reports

Q1.

- (a) Only 21% identified the downwards force of the man on the bar as being equal to the upwards force of the bar on the man. Many believed it to be more than.
- (b) Nearly 90% of students were able to substitute the correct numbers into the given equation and calculate the correct value of weight.
- (c) 68% took their answer from part **(b)** and multiplied by 0.63 m to obtain the correct answer for work done. Many incorrect answers were given when students used $9.8 \text{ N/kg} \times 0.63 \text{ m}$ and a significant minority multiplied the part **(b)** by 0.32 m.
- (d) Just over 40% demonstrated they understood that when the man was not moving the work done would be 0 J. Many put in their calculated values from other parts of the question.
- (e) 85% gained two marks with most students able to substitute the correct numbers into the equation given.