

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.5.2 WORK DONE AND ENERGY TRANSFER (PACK 3)

SCORE

/33

PERCENTAGE

%

STEMUP

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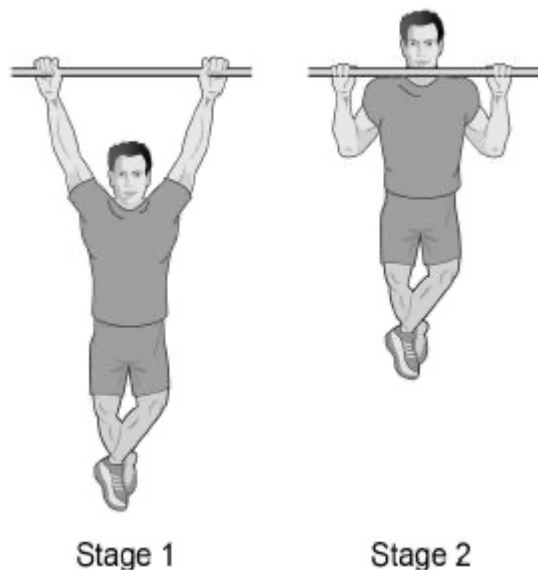
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Q1.

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 an electric wheelchair.

Figure 1



- (a) The wheelchair moves at a constant speed of 2.4 m/s for 4.5 seconds.

Calculate the distance moved by the wheelchair.

Use the equation:

$$\text{distance} = \text{speed} \times \text{time}$$

Distance = _____ m

(2)

- (b) What could be a reason for the speed of the wheelchair decreasing?

Tick **one** box.

It started going downhill.

☐

It started going uphill.

☐

Its store of kinetic energy increased.

☐

It used more power from its battery.

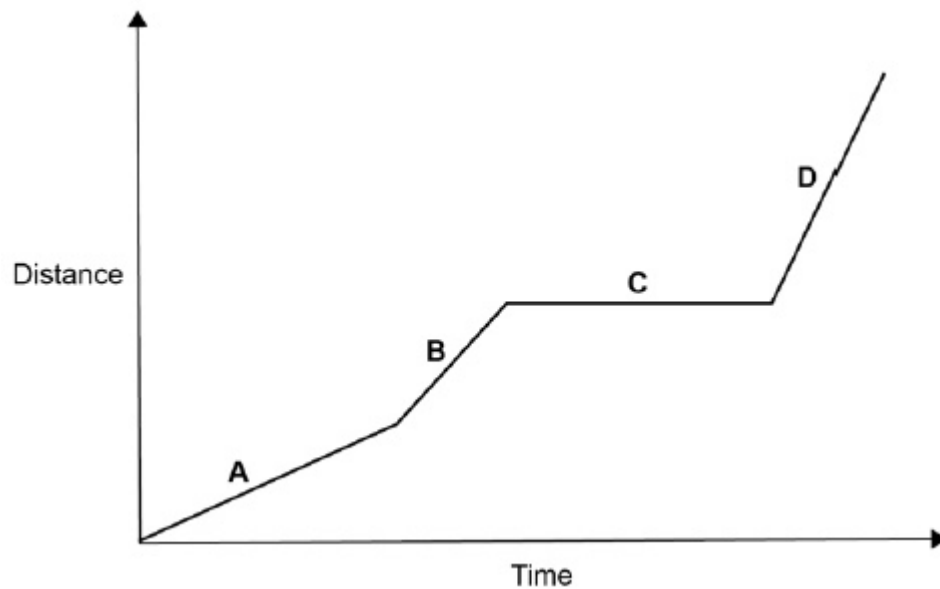
☐

(1)

A student measured how the distance travelled by the wheelchair changed over time.

Figure 2 shows a sketch-graph of the results.

Figure 2



- (c) In which section of the graph, **A**, **B**, **C**, or **D**, did the wheelchair travel fastest?

Give the reason for your answer.

Section _____

Reason _____

(2)

- (d) The student used a data logger with a distance sensor to record the data.

Give **two** advantages of using a data logger rather than using a stopclock and tape measure.

1. _____

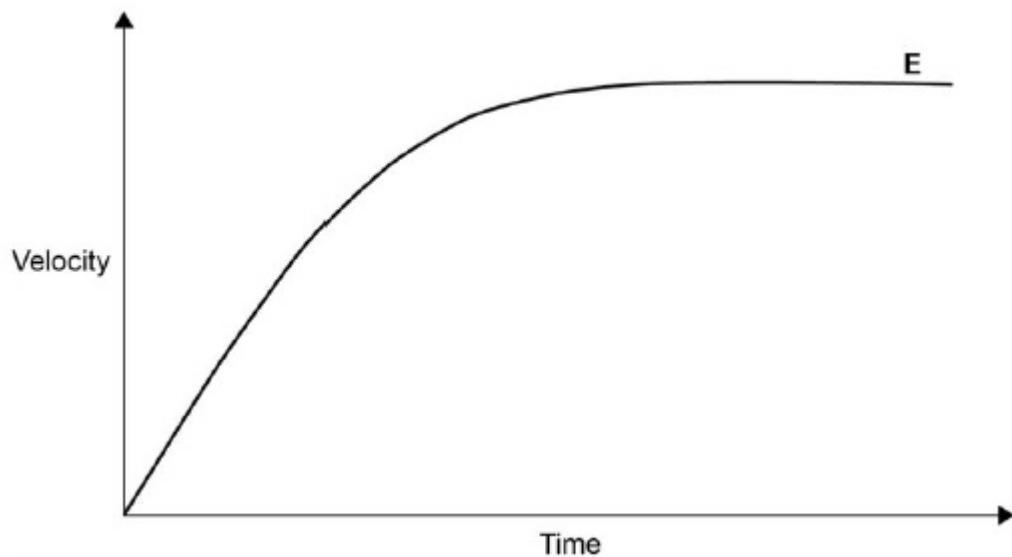
2. _____

(2)

The velocity of the wheelchair changes as it accelerates to its top speed.

Figure 3 shows a sketch-graph of the changes.

Figure 3



- (e) The forward force on the wheelchair is constant as it accelerates on flat ground.
Which force reduces the acceleration?

Tick **one** box.

Air resistance

☐

Magnetism

☐

Tension

☐

Weight

☐

(1)

- (f) Explain the acceleration of the wheelchair at point **E** on **Figure 3**.

(2)

- (g) The wheelchair starts from rest.

It accelerates at a constant rate until it has a speed of 1.5 m/s

The wheelchair travels a distance of 2.0 m while it is accelerating.

Calculate the acceleration of the wheelchair.

Using the Physics Equations Sheet.

Acceleration = _____ m/s²

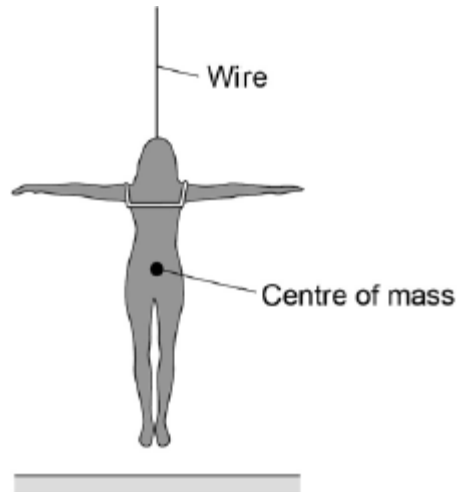
(3)

(Total 13 marks)

Q3.

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.

Acceleration of actor = _____ m / s²

(3)

(Total 12 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) $\text{distance} = 2.4 \text{ m/s} \times 4.5 \text{ s}$ 1
- $\text{distance} = 10.8 \text{ (m)}$
an answer of 10.8 m scores 2 marks 1
- (b) It started going uphill. 1
- (c) **D** 1
- the line has the largest gradient
allow it is steepest
allow it travels the furthest distance in the shortest amount of time

1

(d) any **two** from:

- the data logger records time more accurately
- the data logger can take readings more frequently
- there is less chance for human error when using a data logger
- the data logger automatically records data

allow the converse of each argument, eg there is a human reaction time error when using a stopclock

2

(e) air resistance

1

(f) acceleration is zero

1

because the resultant force is zero

*allow because the forward force equals the air resistance
there is too much air resistance is insufficient*

1

(g) $v^2 - u^2 = 2as$
 $1.5^2 - 0^2 = 2 \times a \times 2$

1

$$a = \frac{1.5^2}{2 \times 2}$$

1

$$a = 0.56(25) \text{ m/s}^2$$

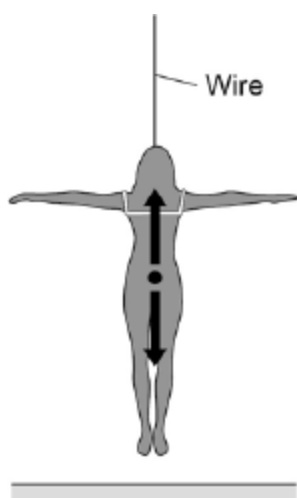
an answer of 0.56(25) (m/s²) scores 3 marks

1

[13]

Q3.

(a)



arrow pointing vertically upwards

1

arrow pointing vertically downwards

1

(b)	Gravitational force	
	<i>if more than two boxes ticked apply list principle</i>	1
	Tension force	1
(c)	0 (N)	1
(d)	weight = 70×9.8 (= 686)	1
	weight = 690 (N)	1
	<i>allow 690 (N) with no working shown for 2 marks</i>	
	<i>allow 686 (N) with no working shown for 1 mark</i>	
(e)	34 (N) / 30 (N)	
	<i>allow ecf from 05.4 correctly calculated</i>	1
(f)	resultant force = mass $\times$ acceleration	
	<i>accept $F = ma$</i>	1
	<i>accept equation correctly rearranged for a</i>	
(g)	$25 = 65 \times a$	1
	$a = 25 / 65$	1
	$a = 0.38(4615\dots)$ (m / s ²)	1
	<i>allow 0.38 (m / s²) with no working for 3 marks</i>	
		[12]

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.