

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.5.6.1.5 ACCELERATION (PACK 2)

SCORE

/83

PERCENTAGE

%

STEMUP

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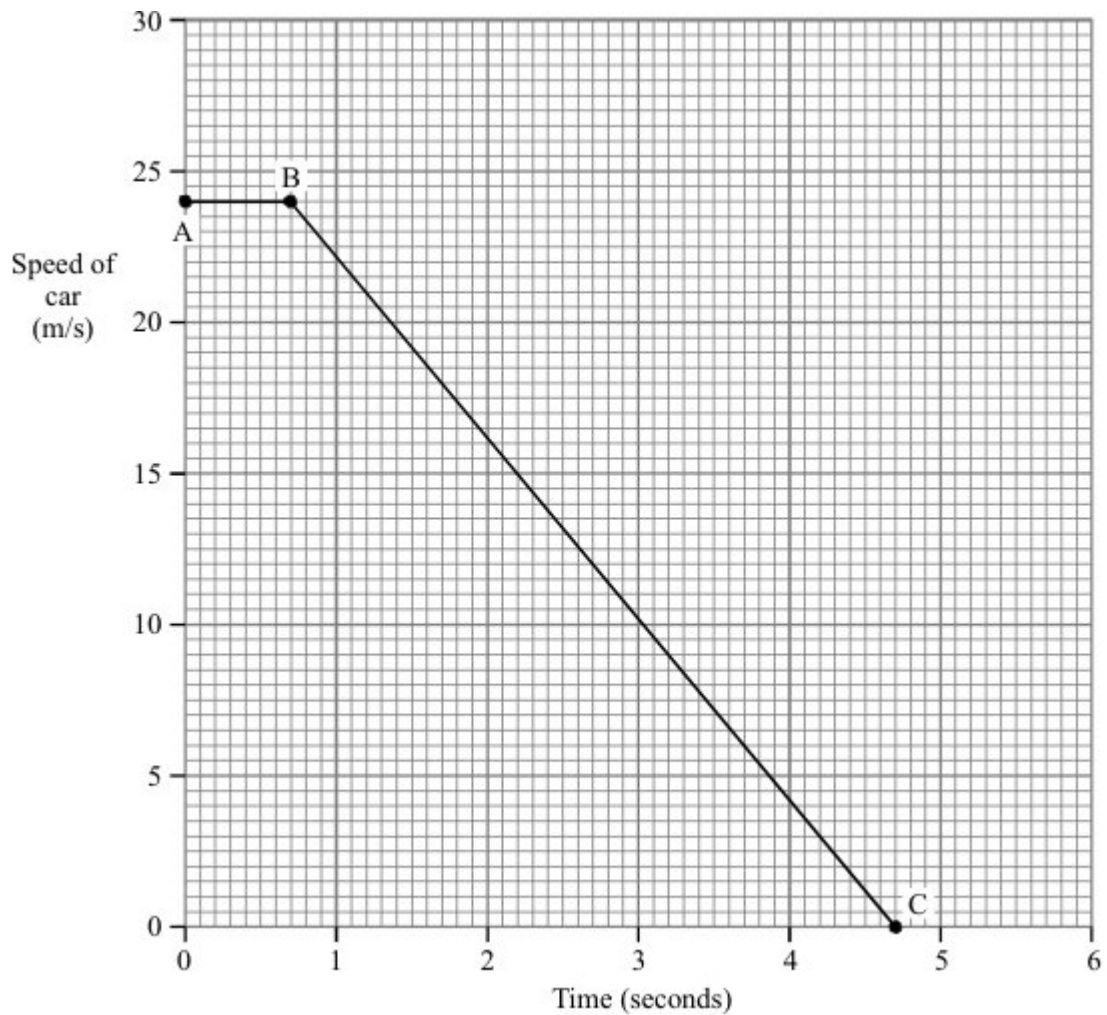
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Q1.

A car driver sees a dog on the road ahead and has to make an emergency stop.

The graph shows how the speed of the car changes with time after the driver first sees the dog.



- (a) Which part of the graph represents the “reaction time” or “thinking time” of the driver?

_____ (1)

- (b) (i) What is the thinking time of the driver?

Time _____ seconds (1)

- (ii) Calculate the distance travelled by the car in this thinking time.

Distance _____ m

(3)

- (c) Calculate the acceleration of the car after the brakes are applied.

Acceleration _____

(4)

- (d) Calculate the distance travelled by the car during braking.

Distance _____ m

(3)

- (e) The mass of the car is 800 kg. Calculate the braking force.

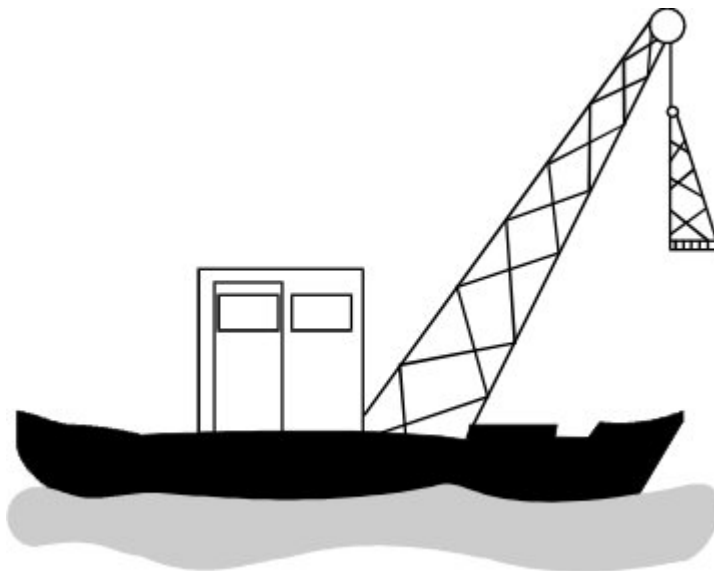
Braking force _____ N

(3)

(Total 15 marks)

Q3.

A crane on a barge lifts a girder and then carries it along the river.



The girder has a weight of 1 000 000 N and is lifted to a height of 1500 cm.

- (a) Complete the sentence.

The weight of the girder is caused by the Earth's gravitational field strength acting on its _____.

(1)

- (b) Calculate the work done in lifting the girder.

Write the equation you are going to use.

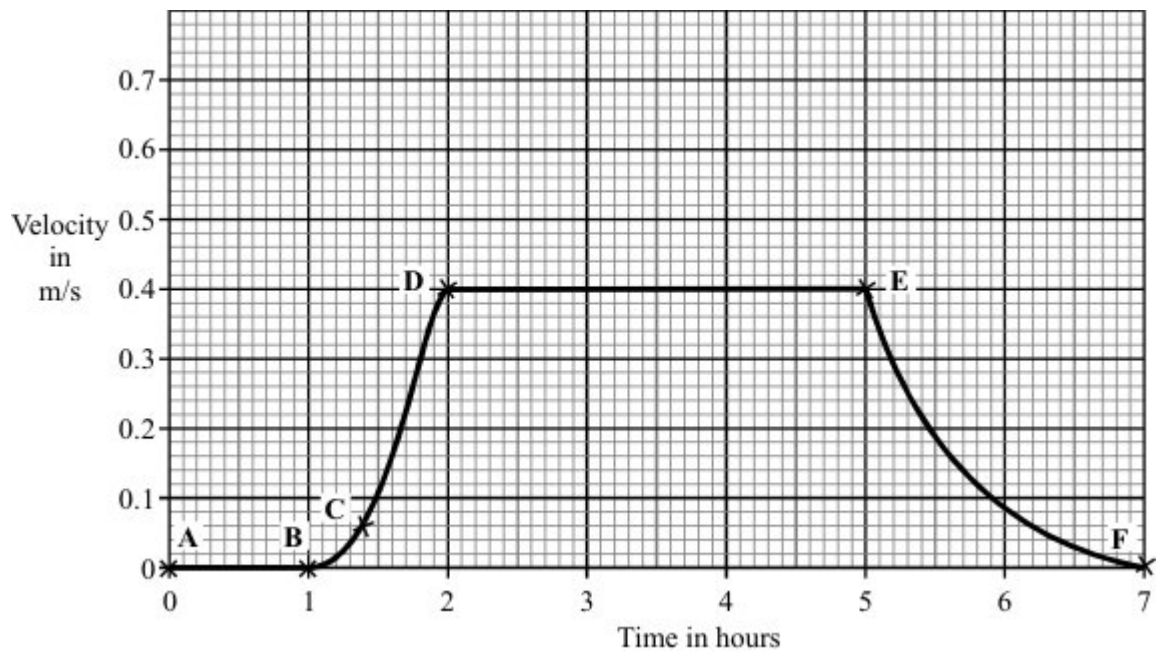
(1)

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

Work done = _____

(3)

- (c) The velocity–time graph represents the motion of the barge after the girder had been lifted.



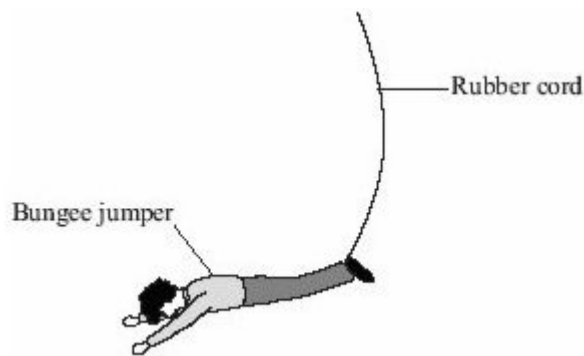
To gain full marks in this question you should write your ideas in good English. Put them in a sensible order and use the correct scientific words.

Describe the motion of the barge over this period of seven hours. You must refer to the points **A**, **B**, **C**, **D**, **E** and **F** in your description.

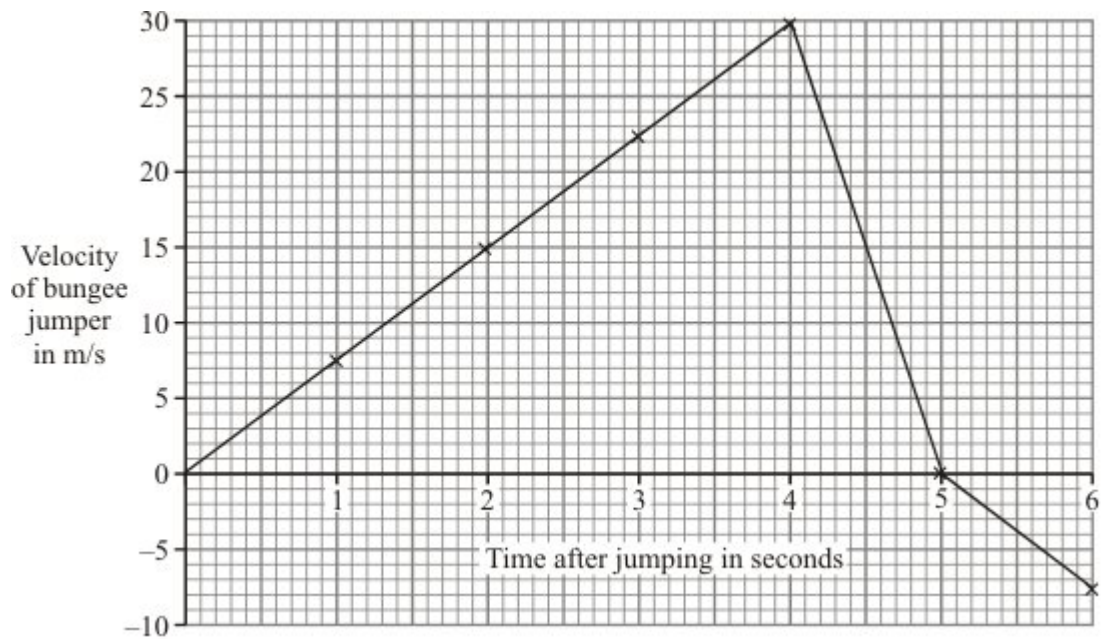
(5)
(Total 10 marks)

Q4.

In bungee jumping, a fixed rubber cord is fastened to the jumper's ankles.



The graph shows how the bungee jumper's velocity changes during part of the jump.



- (a) Calculate the acceleration of the bungee jumper between 2 and 4 seconds. Show your working.

Acceleration = _____ m/s²

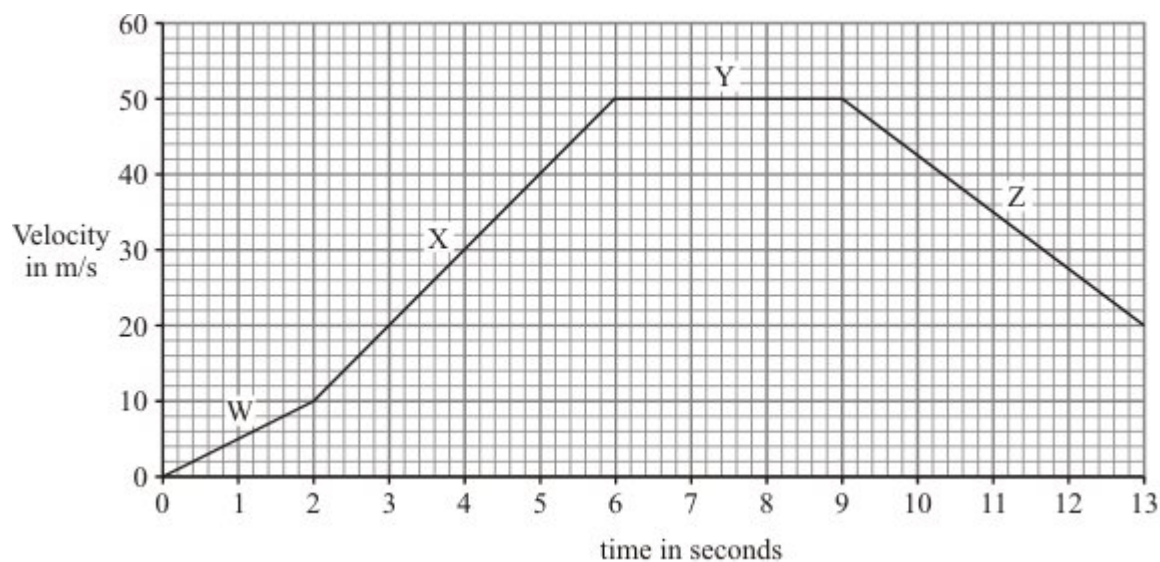
(3)

- (b) Describe, in as much detail as you can, what happens to the bungee jumper after 4 seconds.

(3)
(Total 6 marks)

Q5.

The graph shows changes in the velocity of a racing car.



(a) Describe the motion of the racing car during:

(i) the period labelled **W**; _____

(1)

(ii) the period labelled **Y**. _____

(1)

(b) Calculate the acceleration of the racing car during the period labelled **X**.
Show clearly how you work out your answer and give the unit.

Acceleration = _____

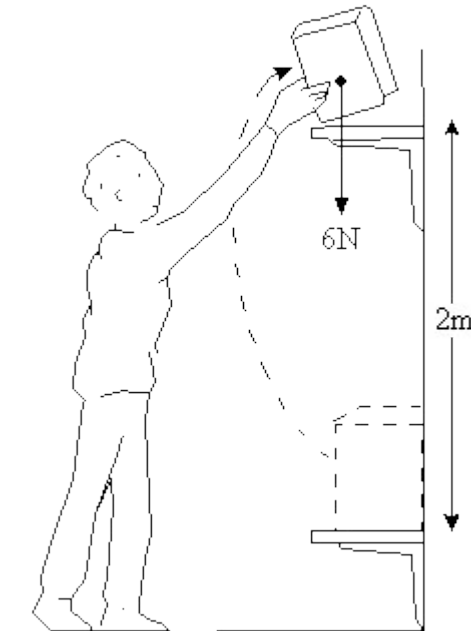
(4)

(Total 6 marks)

Q6.

A book weighs 6 newtons.

A librarian picks up the book from one shelf and puts it on a shelf 2 metres higher.



- (a) Calculate the work done on the book. [Show your working].

(3)

- (b) The next person to take the book from the shelf accidentally drops it.

The book accelerates at 9.8m/s^2 .

Use this information to calculate the mass of the book. [Show your working].

Answer _____ kg.

(3)

- (c) If the book was dropped from an aeroplane high in the sky, it would accelerate to begin with. Eventually it would fall at a steady speed.

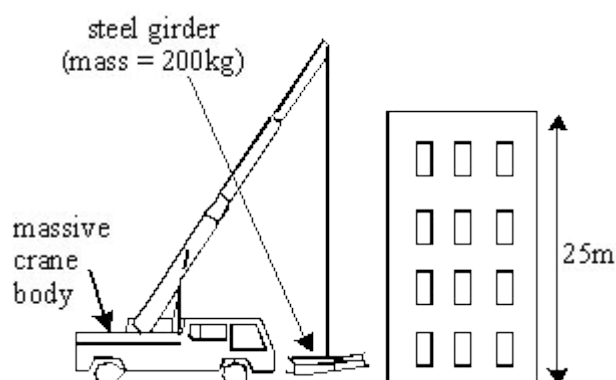
Explain, in as much detail as you can, why this happens.

(3)

(Total 9 marks)

Q7.

A crane is used to lift a steel girder to the top of a high building.



When it is lifted by the crane:

- the girder accelerates from rest to a speed of 0.6 m/s in the first 3 seconds;
- it then rises at a steady speed.

(a) Calculate the **acceleration** of the girder.

(Show your working.)

(3)

(b) (i) What is the **weight** of the steel girder?

Answer _____ N

(1)

(ii) Calculate the **power** of the crane motor as it lifts the girder at a steady speed of 0.6 m/s.

(Show your working. You can ignore the weight of the cable and hook which is small compared to the weight of the girder.)

Answer _____ W

(2)

- (c) A new motor is fitted to the crane. This motor accelerates the girder at 0.3 m/s^2 .

Calculate the **force** which the crane applies to the girder to produce this acceleration.

(Show your working.)

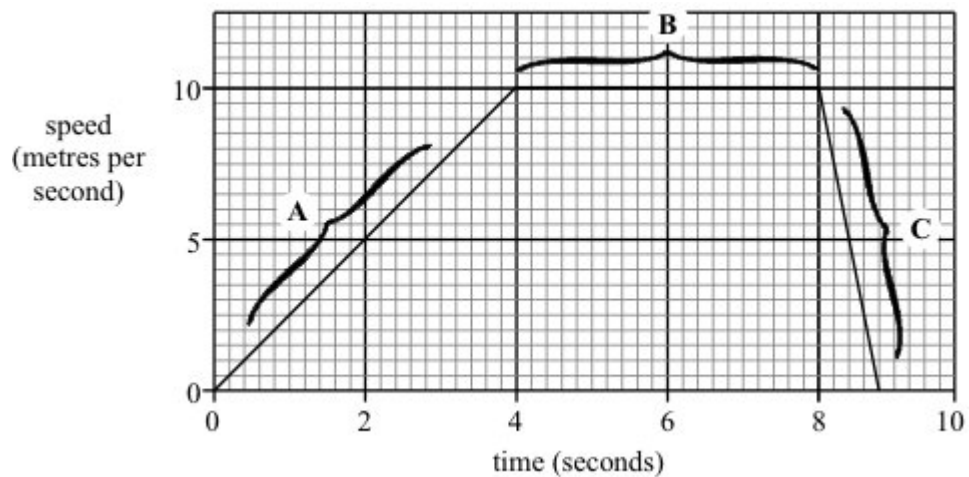
Answer _____ N

(3)

(Total 9 marks)

Q8.

The graph shows the speed of a runner during an indoor 60 metres race.



- (a) Choose words from this list to complete the sentences below.

moving at a steady speed

slowing down

speeding up

stopped

Part **A** of the graph shows that the runner is _____

Part **B** of the graph shows that the runner is _____

Part **C** of the graph shows that the runner is _____

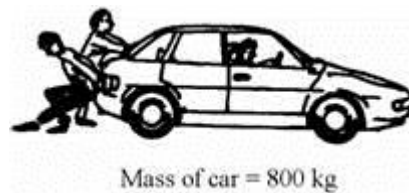
(3)

- (b) Calculate the acceleration of the runner during the first four seconds.
(Show your working.)

(3)
(Total 6 marks)

Q9.

A man's car will not start, so two friends help him by pushing it.



By pushing as hard as they can for 12 seconds they make the car reach a speed of 3 metres per second.

- (a) Calculate the acceleration they give to the car.

Answer _____ m/s²

(2)

- (b) Whilst pushing the car the two friends together do a total of 2400 joules of work.
Calculate their total power.

Answer _____ watts

(2)

- (c) Another motorist has the same problem. The two friends push his car along the same stretch of road with the same force as before.

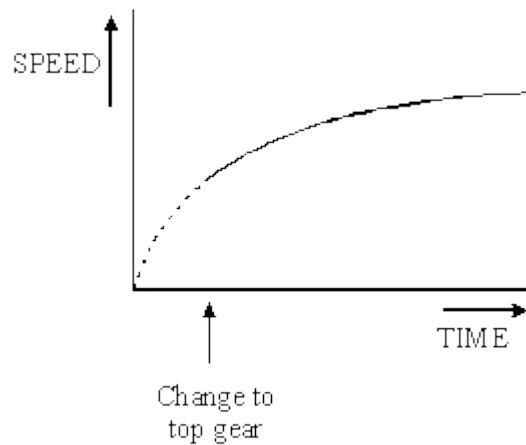
It takes them 18 seconds to get the second car up to a speed of 3 metres per second.

What does this tell you about the mass of the second car?
(You can ignore forces of friction.)

(2)

- (d) On a flat stretch of a motorway a lorry driver changes into top gear. He then makes the lorry go as fast as he can.

The graph shows what happens to the speed of the lorry.



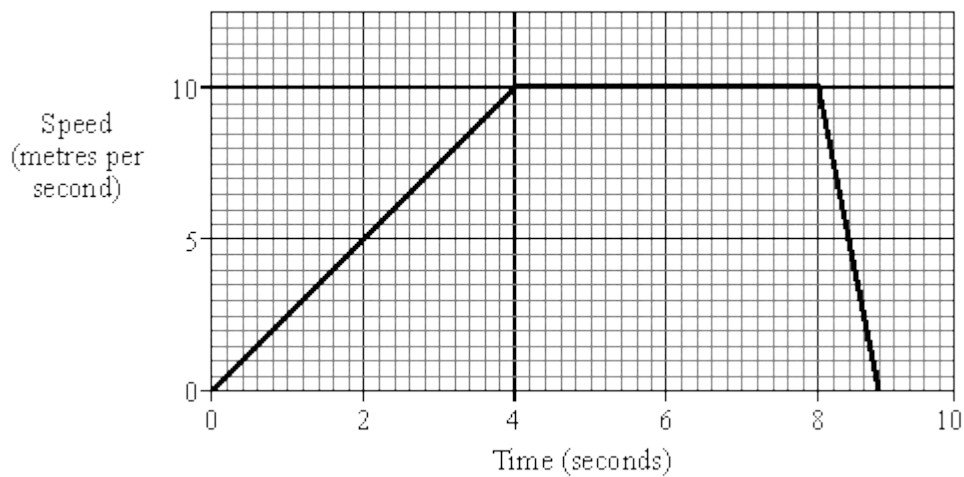
Explain why the speed of the lorry increases at first but then levels out.

(3)

(Total 9 marks)

Q10.

The graph shows the speed of a runner during an indoor 60 metres race.



- (a) Calculate the acceleration of the runner during the first four seconds.
(Show your working.)

(3)

- (b) How far does the runner travel during the first four seconds?
(Show your working.)

(3)

- (c) At the finish, a thick wall of rubber foam slows the runner down at a rate of 25 m/s^2 .
The runner has a mass of 75 kg .
Calculate the average force of the rubber foam on the runner.
(Show your working.)

Answer _____ newtons (N)

(2)

(Total 8 marks)

Q11.

The diagram shows a shuttlecock that is used for playing badminton.



The shuttlecock weighs very little.
When you drop it from a height of a few metres, it accelerates at first but soon reaches a steady speed.

Explain, as fully as you can:

- (a) why the shuttlecock accelerates at first,

(2)

- (b) why the shuttlecock reaches a steady speed.

(3)
(Total 5 marks)

Mark schemes

Q1.

(a) AB

for 1 mark

1

(b) (i) 0.7

for 1 mark each

1

(ii) 16.8

gains 2 marks

2

but correct working

($d = v.t$, $d = 24 \times 0.7$, or in terms of area under graph)

gains 1 mark

1

(c) $a = (v-u)/t$
 $= 24/4$
 $= 6$
 m/s^2

(see marking of calculations)

(can work in terms of graph gradient)

4

(d) $d = v.t$
 $= 24/2 \times 4$
 $= 48$

(see marking of calculations)

(can work in terms of area under graph)

3

(e) $F = ma$
 $= 800 \times 6$
 $= 4800$

(see marking of calculations)

3

[15]

Q3.

(a) mass

1

(b) work (done) = force (applied) $\times$ distance (moved in the direction of the force)

*do **not** accept correctly substituted figures for this equation mark*

*accept $W = Fs$ **or** $W = Fd$ **or** $W = Fh$ (well done) = force $\times$ height)*

mark formula independently

1

$$1\,000\,000 \times 15$$

$$\text{allow } 1\,000\,000 \times \frac{15}{1000}$$

1

$$= 15\,000\,000$$

$$= 15\,000$$

1

J / joules

KJ / kilojoules

1

$$\text{allow } 1\,000\,000 \times 1500$$

$$= 15\,000\,000\,000 \text{ for 1 mark}$$

only – no unit mark

allow 3 marks for correct answer if no working / correct working is shown

(c) **Quality of written communication**

The answer to this question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme

Max.4 if ideas not well expressed

A – B not movingaccept stationary **or** at rest

1

B - C acceleration **or C – D**

acceleration

accept increases speed / velocity accept gets faster

1

comparison made that the acceleration

B – C is less than **C – D**

accept comparison made that the

acceleration **C-D** is greater than **B-C**

1

D – E constant velocityaccept steady speed **or** at 0.4 m/s

1

E – F deceleration

accept decreases speed / velocity

accept gets slower

1

[10]**Q4.**

(a) 7.5

correct answer with no working = 3 if incorrect allow 1 mark
for (change in velocity from graph =) 15

1 mark for $\frac{\text{change in velocity}}{\text{time taken}}$

2 marks for $\frac{15}{2}$

N.B. correct answer from the incorrectly recalled relationship

$\frac{\text{distance}}{\text{time}} = 2 \text{ marks}$

3

(b) (4 – 5 seconds) the bungee jumper slows down (decelerates)

1

(the rubber cord) stops the fall

1

(5 – 6 seconds) the bungee jumper starts moving (accelerating) upwards
(in the opposite direction)

max 2 marks if no correct indication of time

1

[6]

Q5.

(a) (i) acceleration / speeding up

do not accept acceleration increases

1

(ii) constant / steady velocity

accept constant / steady speed

1

(b) 10

3

m/s² or ms⁻²

reject ms²

if answer not correct then allow 1 mark for

acceleration = $\frac{\text{change in velocity}}{\text{time taken for change}}$

and allow 1 mark for $\frac{40 \text{ (m/s)}}{4 \text{ (s)}}$

1

[6]

Q6.

(a) WD = force × distance **or** 6 × 2

gains 1 mark

but 12 *gains 2 marks*
units J/joules [credit Nn]
for 1 mark

3

- (b) 0.6 (i.e. using the **recalled** 10N/kg)
gains 1 mark

but evidence of force = mass × acceleration
or of correct substitution e.g. 6/9.8
gains 2 marks

but 0.61 (2...)
gains 3 marks

3

- (c) *any reference to*
initial acceleration due to gravity
(force due to) friction/air resistance
each for 1 mark

ideas that
this increases as speed increases
forces eventually balance
each for 1 further mark

9

[9]

Q7.

- (a) *evidence of acceleration = $\frac{\text{change in speed}}{\text{time}}$ or $\frac{0.6}{3}$
gains 1 mark

but 0.2
gains 2 marks

units m/s²
for 1 mark

3

- (b) (i) 2000 **or** 1960
for 1 mark

1

- (ii) evidence of power = $\frac{\text{work done}}{\text{time taken}}$ or weight × speed (*credit figures*) $\frac{25}{0.6}$

- (iii) $\frac{25}{0.6}$
gains 1 mark

but 1200/1176 **or** figure consistent with (b)(i)
gains 2 marks

2

- (c) evidence of force = mass $\times$ acceleration **or** 200×0.3
gains 1 mark

but 60
gains 2 marks

but 60 + weight of girder (2060/2020*) (or figure consistent with (b)(i))
gains 3 marks

3

[9]

Q8.

- (a) A = speeding up
[Accept 'accelerating / acceleration / going faster']

B = moving at a steady speed
[Accept 'constant speed']

C = slowing down
[Accept 'going slower' / decelerating]
each for 1 mark

3

- (b) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

NB if formula given must be correct

$\frac{10}{4}$
or
gains 1 mark

but 2.5
gains 2 marks

unit m/s^2 **or** metres per second squared
or metres per second per second
for 1 mark

or m/s^{-2}
[Credit even if no / an incorrect numerical answer is given]

3

[6]

Q9.

- (a) evidence of $\frac{\text{change in speed}}{\text{time taken}}$ or $\frac{3}{12}$
gains 1 mark

but 0.25 or $\frac{1}{4}$

gains 2 marks

2

- (b) evidence of $\frac{\text{work done}}{\text{time taken}}$ or $\frac{2400}{12}$
gains 1 mark

but 200

gains 2 marks

2

- (c) idea that

second car has a bigger mass
(allow bigger weight/heavier)

gains 1 mark

but

second car has 1.5 times bigger mass

or

second car has mass of 1200 kg

gains 2 marks

2

- (d) friction/resistance increases with speed

gains 1 marks

but

friction with/resistance of air increases with speed

gains 2 marks

- increase in speed because driving force greater than friction
- steady speed when friction = driving force

or

increases in speed until friction = driving force

each for 1 further mark to maximum of 3

3

[9]

Q10.

- (a) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

$\frac{10}{4}$
or

gains 1 mark
do not penalise if both of these present
but 'change in' omitted from formula

but
 2.5

gains 2 marks

unit m/s² **or** metres per second squared

or metres per second per second

or ms⁻²
for 1 mark

3

- (b) *evidence* of using area under graph or distance average speed × time
or

$$10 \times 4 \times \frac{1}{2}$$

gains 1 mark

but
 20

gains 2 marks

units metres / m⁻²
for 1 mark

3

- (c) force = mass × acceleration **or** 75 × 25
gains 1 mark

but
 1875

gains 2 marks

**NB Correct unit to be credited even if numerical answer wrong or absent.*

2

[8]

Q11.

- (a) reference to
- weight / force of gravity / acting downwards
 - unbalanced (by any upwards force)
- for 1 mark each*

2

- (b) *ideas that* forces balance(d)
gains 1 mark

but

weight / force of gravity / downwards force balanced by friction / air resistance / drag / upwards force

gains 2 marks

latter increases with speed

(*accept* arrows or relevant length and direction if clearly labelled, as answers to parts (a) and (b))

for 1 further mark

3

[5]