

Acceleration

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Acceleration
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 60 minutes

Score: /59

Percentage: /100

Grade Boundaries:

M1.(a) acceleration = change in velocity / time taken

allow $a = \Delta v / t$

1

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

1

$-0.33 \text{ (m / s}^2\text{)}$

1

allow 0.33 m / s^2 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]

M2. (a) 750

allow 1 mark for correct substitution, ie 75×10 provided no subsequent step shown

2

newton(s) / N

*do **not** accept n*

1

- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the Marking Guidance, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a brief attempt to explain why the velocity / speed of the parachutist changes.

or

the effect of opening the parachute on velocity/speed is given.

Level 2 (3-4 marks)

The change in velocity / speed is clearly explained in terms of force(s)

or

a reasoned argument for the open parachute producing a lower speed.

Level 3 (5-6 marks)

There is a clear and detailed explanation as to why the parachutist reaches terminal velocity **and** a reasoned argument for the open parachute producing a lower speed

examples of the physics points made in the response to explain first terminal velocity

- on leaving the plane the only force acting is weight (downwards)
accept gravity for weight throughout

- as parachutist falls air resistance acts (upwards)
accept drag / friction for air resistance
- weight greater than air resistance
or resultant force downwards
- (resultant force downwards) so parachutist accelerates
- as velocity / speed increases so does air resistance
- terminal velocity reached when air resistance = weight
accept terminal velocity reached when forces are balanced

to explain second lower terminal velocity

- opening parachute increases surface area
- opening parachute increases air resistance
- air resistance is greater than weight
- resultant force acts upwards / opposite direction to motion
- parachutist decelerates / slows down
- the lower velocity means a reduced air resistance

air resistance and weight become equal but at a lower (terminal) velocity

6

(c) (i) any **one** from:

- mass of the (modelling) clay
accept size/shape of clay size/amount/volume/shape of clay
accept plasticine for (modelling)clay
- material parachute made from
accept same (plastic) bag
- number / length of strings

1

(ii) **C**

reason only scores if C is chosen

1

smallest (area) so falls fastest (so taking least time)
accept quickest/quicker for fastest

if **A** is chosen with the reason given as 'the largest area so falls slowest' this gains 1 mark

1

[12]

M3. (a) 2.75

allow 1 mark for correct substitution, ie $\frac{11}{4}$
 $\frac{23 - 12}{4}$
or $\frac{23 - 12}{4}$
 provided no subsequent step shown

2

m/s²

1

(b) driving force increases

1

frictional force increases

accept air resistance / drag for frictional force

1

driving force > frictional force

1

[6]

M4. (a) 96

allow 1 mark for correct substitution
 ie 80×1.2

2

newton or N

allow Newton

*do **not** allow n*

1

(b) (i) direction

1

(ii) velocity and time are continuous (variables)

answers must refer to both variables

accept the variables are continuous / not categoric

accept the data / 'it' is continuous

accept the data / 'it' is not categoric

1

(iii) **C**

1

velocity is not changing

*the **2** marks for reason may be scored even if **A** or **B** are chosen*

accept speed for velocity

accept speed is constant (9 m/s)

*accept **not** decelerating*

*accept **not** accelerating*

accept reached terminal velocity

1

forces must be balanced

accept forces are equal

accept arrows are the same length / size

or

resultant force is zero

*do **not** accept the arrows are equal*

1

- M5.**
- (a) (i) 4.5
allow 1 mark for correct substitution i.e. $9 \div 2$ 2
- (ii) m/s^2
accept answer given in (a)(i) if not contradicted here 1
- (iii) speed 1
- (iv) straight line from the origin passing through (2s, 9m/s)
allow 1 mark for straight line from the origin passing through to $t = 2$ seconds
allow 1 mark for an attempt to draw a straight line from the origin passing through (2,9)
allow 1 mark for a minimum of 3 points plotted with no line provided if joined up would give correct answer. Points must include (0,0) and (2,9) 2
- (b) (i) **B**
*if **A** or **C** given scores 0 marks in total* 1
- smallest (impact) force 1
- on all/ every/ any surfaces
these marks are awarded for comparative answers 1
- (ii) (conditions) can be repeated
or

difficult to measure forces with human athletes

*accept answers in terms of variations in human athletes e.g.
athletes may have different weights area / size of feet may
be different difficult to measure forces athletes run at
different speeds*

*accept any answer that states or implies that with humans
the conditions needed to repeat tests may not be constant
e.g.*

*athletes unable to maintain constant speed during tests (or
during repeat tests)*

*do **not** accept the robots are more accurate*

removes human error is insufficient

fair test is insufficient

1

[10]

M6. (a) gravity

accept weight

*do **not** accept mass*

accept gravitational pull

1

(b) (i) Initially force L greater than force M

accept there is a resultant force downwards

1

(as speed increases) force M increases

accept the resultant force decreases

1

when $M = L$, (speed is constant)

accept resultant force is 0

accept gravity/weighty for L

accept drag/ upthrust/resistance/friction for M

*do **not** accept air resistance for M but penalise only once*

1

(ii) terminal velocity 1

(iii) 0.15
accept an answer between 0.14 – 0.16
an answer of 0.1 gains no credit
allow 1 mark for showing correct use of the graph 2

[7]

M7. (a) (i) accelerating
accept getting faster
accept speed / velocity increasing 1

(ii) acceleration increases
accept velocity / speed increases more rapidly
do **not** accept velocity / speed increases 1

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

$$\text{accept } a = \frac{v - u}{t} \text{ or } a = \frac{v_1 - v_2}{t}$$

do **not** accept velocity for change in velocity
do **not** accept change in speed

$$\text{do **not** accept } a = \frac{v}{t}$$

1

(ii) 15
allow 1 mark for an answer of 900 or for correct use of 540 seconds 2

(iii) velocity includes direction

accept velocity is a vector (quantity)
accept converse answer

1

[6]