

# 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	Gold Level
Booklet	Mark Scheme 1

**Time Allowed:** 53 minutes

**Score:** /53

**Percentage:** /100

**Grade Boundaries:**

**M1.(a)** more streamlined

*accept decrease surface area*

1

air resistance is smaller (for same speed)

*accept drag for air resistance*

*friction is insufficient*

1

so reaches a higher speed (before resultant force is 0)

*ignore reference to mass*

1

(b) (i) 1.7

*allow 1 mark for correct method, ie  $\frac{5}{3}$*

*or allow 1 mark for an answer with more than 2 sig figs that rounds to 1.7*

*or allow 1 mark for an answer of 17*

2

(ii) 7.5

*allow 1 mark for correct use of graph, eg  $\frac{1}{2} \times 5 \times 3$*

2

(iii) air (resistance)

*accept wind (resistance)*

*drag is insufficient*

*friction is insufficient*

1

[8]

**M2.(a)** (i) longer reaction time

*accept slower reactions*

*do **not** accept slower reaction time unless qualified*

**or** greater thinking distance

*accept greater thinking time*

**or** greater stopping distance

*accept greater stopping time*

*greater braking distance negates answer*

1

(ii) lines / slopes have the same gradient

*accept slopes are the same*

**or** velocity decreases to zero in same time / in 2.6 seconds

*accept any time between 2.4 and 2.8*

*accept braking distances are the same*

1

(iii) 12

*accept extracting both reaction times correctly for **1** mark (0.6 and 1.4)*

**or**

*time = 0.8 (s) for **1** mark*

*accept  $0.8 \times 15$  for **2** marks*

*accept calculating the distance travelled by car **A** as 28.5 m*

**or**

*the distance travelled by car **B** as 40.5 m for **2** marks*

3

(b) **Z**

1

different force values give a unique / different resistance

*only scores if **Z** chosen*

*do **not** accept force and resistance are (directly) proportional*

*accept answers in terms of why either **X** or **Y** would not be best eg*

***X** – same resistance value is obtained for 2 different force values*

*Y – all force values give the same resistance*

1

[7]

**M3.(a)** any **two** from:

- (acceleration occurs when) the direction (of each capsule) changes
- velocity has direction
- acceleration is (rate of) change of velocity

2

(b) to(wards) the centre (of the wheel)

1

(c) the greater the radius / diameter / circumference (of the wheel) the smaller the (resultant) force (required)

*accept 'the size' for radius both parts required for the mark*

1

[4]

**M4.** (a) 48

*allow for 1 mark correct method shown, ie  $6 \times 8$   
or correct area indicated on the graph*

2

(b) diagonal line from (0,0) to (6,48) / (6, their (a))

*if answer to (a) is greater than 50, scale must be changed to gain this mark*

1

horizontal line at 48m between 6 and 10 seconds

*accept horizontal line drawn at their (a) between 6 and 10 seconds*

1

[4]

- M5.** (a) (i) longer reaction time  
*accept slower reactions*  
*do **not** accept slower reaction time unless qualified*  
**or**  
greater thinking distance  
*accept greater thinking time*  
**or**  
greater stopping distance  
*accept greater stopping time*  
*greater braking distance negates answer*  
  
1
- (ii) lines / slopes have the same gradient  
*accept slopes are the same*  
**or**  
velocity decreases to zero in same time / in 2.6 seconds  
*accept any time between 2.3 and 2.8*  
*accept braking distances are the same*  
  
1
- (iii) 12  
*accept extracting both reaction times correctly for 1 mark*  
*(0.6 and 1.4 ) **or** time = 0.8(s) for 1 mark*  
*accept  $0.8 \times 15$  for 2 marks*  
*accept calculating the distance*  
*travelled by car **A** as 28.5 m **or** the distance travelled by car*  
***B** as 40.5 m for 2 marks*  
  
3
- (b) **Z**  
  
1

different force values give a unique / different resistance

only scores if **Z** chosen

do **not** accept force and resistance are (directly) proportional

accept answers in terms of why

either **X or Y** would not be the best eg

**X** – same resistance value is obtained for 2 different force values

**Y** – all force values give the same resistance

1

[7]

**M6.** (a) (i) a single force that has the same effect as all the forces combined  
accept all the forces added / the sum of the forces / overall force

1

(ii) constant speed (in a straight line)  
do **not** accept stationary

or constant velocity

1

(b) 3

allow **1** mark for correct substitution into transformed equation

accept answer 0.003 gains **1** mark

answer = 0.75 gains **1** mark

2

m/s<sup>2</sup>

1

(c) as speed increases air resistance increases  
accept drag / friction for air resistance

1

reducing the resultant force

1

[7]

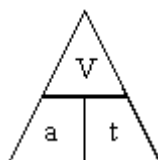
<b>M7.</b>	(a) 4	<i>allow 1 mark for extracting correct information 12</i>	2	<b>[4]</b>
	m/s <sup>2</sup>	<i>ignore negative sign</i>	1	
	(b) 9 (s)		1	
<b>M8.</b>	(a) (i) gravity/weight		1	
	(ii) 2193750000000 or $2.19 \times 10^{12}$	<i><b>not</b> <math>2.19^{12}</math></i> <i>allow 1 mark for the correct conversion to 7500 (m/s)</i> <i>allow one mark for answer 2193750(J)</i>	2	
	transferred to heat <i>ignore extras of sound and light</i> <i>accept changed to heat</i> <i>accept lost due to friction</i>		1	
	(b) (i) acceleration = $\frac{\text{change in velocity}}{\text{time (taken)}}$			

accept word speed instead of velocity

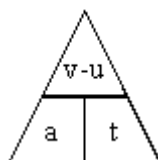
accept  $a = \frac{v - u}{t}$

or correct rearrangement

do not accept



even if subsequent calculation correct



can gain credit if subsequent calculation correct

1

(ii) 2

ignore + or – signs

m/s<sup>2</sup> 1

accept m/s/s or ms<sup>-2</sup>

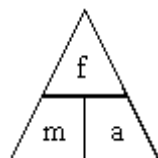
2

(c) (i) force = mass × acceleration

accept correct rearrangement

accept  $F = m \times a$

do not accept



unless subsequent calculation correct

1

(ii) 156 000



accept 78 000 × their (b)(ii)(only if (b)(i) correct)

1

[9]

**M9.** (i) force = mass × acceleration

accept  $F = m \times a$

accept upper **or** lower case letters

accept equation using correct units

accept



if subsequent method correct

1

(ii) 0.007

allow 1 mark for correct transformation or substitution

2

[3]