

Velocity

Mark Scheme 1

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

Time Allowed: 59 minutes

Score: /59

Percentage: /100

Grade Boundaries:

M1.(a)	(i)	100 (m)	1
	(ii)	stationary	1
	(iii)	accelerating	1
	(iv)	tangent drawn at $t = 45$ s	1
		<i>attempt to determine slope</i>	1
		speed in the range 3.2 – 4.2 (m / s) <i>dependent on 1st marking point</i>	1
(b)	(i)	500 000 (J) <i>ignore negative sign</i>	1
	(ii)	20 000 (N) <i>ignore negative sign</i> <i>allow 1 mark for correct substitution, ie</i> $500\,000 = F \times 25$ <i>or their part (b)(i) = $F \times 25$</i> <i>provided no subsequent step</i>	2

(iii) (kinetic) energy transferred by heating

1

to the brakes

ignore references to sound energy

if no other marks scored allow k.e. decreases for 1 mark

1

[11]

M2.(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]

M3.(a) D – E

reason only scores if D – E chosen

1

shallowest slope / gradient
accept smallest distance in biggest time
accept longest time to travel the same distance
accept the line is not as steep accept it is a less steep line
*do **not** accept the line is not steep*

1

(b) 80 000

*allow 1 mark for correct substitution, ie $16\,000 \times 5$ provided
no subsequent step shown*

2

(c) (i) straight line starting at origin
accept within one small square of the origin

1

passing through $t = 220$ and $d = 500$

1

(i) 186
accept any value between 180 and 188
accept where their line intersects given graph line correctly
read ± 4 s

1
[7]

M4.(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 0.8×15 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]

M5.(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]

M6. (a) 48

allow for 1 mark correct method shown, ie 6×8

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]

M7. (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 0.8×15 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]

M8. (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/s²

1

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

1

reducing the resultant force

1

[7]

M9. (a) 4

allow 1 mark for extracting correct information 12

2

m/s²

ignore negative sign

1

(b) 9 (s)

1

[4]