

Distance and Displacement

Mark Scheme 1

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

Time Allowed: 56 minutes

Score: /56

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) (i) 9.5

accept ± 1 mm

1

10.5

1

(ii) 9.5

ecf from (a)(i)

1

(iii) 190

$20 \times (a)(ii)$ ecf

1

(iv) medium

ecf from (a)(iii)

1

(b) (i) any **two** from:

- position of ball before release
- same angle **or** height of runway
- same ball
- same strip of grass

2

- (ii) long
or
longer than in part (a)
or
uneven
*do **not** allow reference to speed*

1

- (c) (i) as humidity increases mean distance decreases
accept speed for distance

1

- (ii) $71 \times 180 = 12780$
 $79 \times 162 = 12798$
 $87 \times 147 = 12789$
all three calculations correct with a valid conclusion gains 3 marks

or
find k from $R = k / d$
all three calculations correct gains 2 marks

or
 $87 / 71 \times 147 = 180.1 \sim 180$
 $87 / 79 \times 147 = 161.9 \sim 162$
two calculations correct with a valid conclusion gains 2 marks

conclusion based on calculation
one correct calculation of k gains 1 mark

3

- (iii) only three readings **or** small range for humidity
accept not enough readings
accept data from Internet could be unreliable
ignore reference to repeats

1

- (d) distance is a scalar **or** has no direction **or** has magnitude only

allow measurements from diagram of distance and displacement

1

displacement is a vector **or** has direction

1

[15]

M3.(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]

M4.(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]

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 2.4 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]

M6.(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]

M7. (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]