

Resultant Forces

Mark Scheme 1

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

Time Allowed: 53 minutes

Score: /53

Percentage: /100

Grade Boundaries:

M1.(a) (produces) a force from water on the boat

1

in the forward direction

accept in the opposite direction

this must refer to the direction of the force not simply the boat moves forwards

an answer produces an (equal and) opposite force gains 1 mark

1

(b) (i) 1.5

*allow 1 mark for correct substitution, ie $\frac{16-4}{8}$ or $\frac{12}{8}$
provided no subsequent step shown
ignore sign*

2

m/s²

1

(ii) 102 ~~or~~ their (b)(i) \times 68 correctly calculated

allow 1 mark for correct substitution, ie 1.5×68

or their (b)(i) \times 68

provided no subsequent step shown

2

(iii) greater than

reason only scores if greater than chosen

1

need to overcome resistance forces

accept named resistance force

accept resistance forces act (on the water skier)

do **not** accept gravity

1

[9]

M2.

(a) **A** constant speed / velocity

accept steady pace

do **not** accept terminal velocity

do **not** accept stationary

1

B acceleration

accept speeding up

1

C deceleration

accept slowing down

accept accelerating backwards

accept accelerating in reverse

do **not** accept decelerating backwards

1

(b) (i) the distance the car travels under the braking force

accept braking distance

1

(ii) speed/velocity/momentum

1

(c) (i) 5000 (N) to the left

both required

*accept 5000(N) with the direction indicated by an arrow
drawn pointing to the left*

*accept 5000(N) in the opposite direction to the force of the
car (on the barrier)*

accept 5000(N) towards the car

1

(ii) to measure/detect forces exerted (on dummy / driver during the collision) 1

(iii) 4
allow 1 mark for showing a triangle drawn on the straight part of the graph
or correct use of two pairs of coordinates 2

m/s²
do **not** accept mps² 1

[10]

M3.(a) (i) 120 1

(ii) 20
accept 140—their (a)(i) provided answer is not negative 1

(iii) as speed increases 1

drag force / water resistance / friction / **D** increases 1

(until) **D** = 140 N or (until) **D** = **T**
forces balance is insufficient 1

(b) (i) (average) speed (of swimmer)

1

(ii) any **two** from:

- more data
accept results for data
do **not** accept more accurate data
- force may vary (a lot) / change
- give more reliable average
ignore references to anomalies
ignore accurate / precise

2

(iii) examples of acceptable responses:

- most / some females produce smaller forces
do **not** accept all females produce smaller forces
- most / some males produce larger forces
do **not** accept all males produce larger forces
- some females swim as fast as males but use a smaller force
- most of the faster swimmers are male
do **not** accept all males swim faster
- most of the slower swimmers are female
do **not** accept all females swim slower
- range of the (average) speed of males is smaller than the range of the (average) speed of females
- range of the (average) force of the males is greater than the range of the (average) force of the females

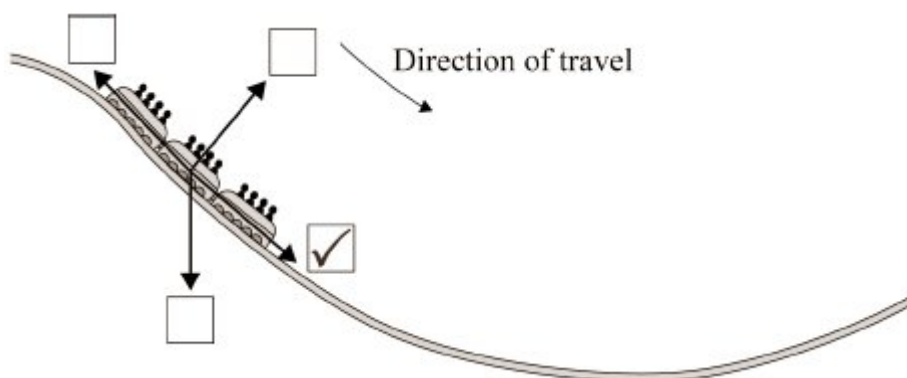
1

(iv) exert maximum (hand) force (throughout the swim / stroke)
accept (any method to) increase (hand) force
practise more is insufficient

1

[10]

M4. (a) correct box ticked



1

(b) each passenger has a different mass

accept weight for mass

ignore other irrelevant factors about the person e.g. mass and height

do not accept a list with incorrect factors e.g. mass and position

accept passengers started with different (gravitational) potential energy

1

(c) (i) 29.4

ignore added units

1

(ii) 2400

accept their (c)(i) $\times 80$ correctly calculated for both marks

allow 1 mark for correct substitution of their (c)(i) and 80

an answer of 800 gains 1 mark only if answer to (c)(i) is not 10

2

[5]

- M5.** (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]

- M6.** (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 = $\frac{\text{change in velocity}}{\text{time (taken)}}$

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

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

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]

- M7. (a) air(resistance) has greatest effect on paper

1

- (b) paper **or** both fall faster

1

(both) fall together
accept same speed **or** rate

1

[3]

M8. (a) up
for 1 mark

1

(b) (i) increased
for 1 mark

1

(ii) more water displaced; ship heavier
either for 1 mark

1

[3]