

Mark schemes

1.

- (a) arrow of equal size pointing vertically upwards

judged by eye

ignore horizontal arrows if equal and opposite

horizontal arrows of unequal length negates this mark

1

labelled 'upthrust'

ignore buoyancy

ignore 25 kN

1

- (b) weight = 25 kN

allow 24 to 25 kN inclusive

1

$$25\,000 = \text{mass} \times 9.8$$

or

$$m = \frac{25000}{9.8}$$

allow their W correctly converted and substituted

1

$$m = 2551 \text{ kg}$$

allow correctly calculated value using their converted W

allow a value correctly calculated with W in kN

1

$$m = 2600 \text{ kg}$$

allow a calculated answer correctly rounded to 2 significant figures

1

an answer of 2600 scores 4 marks

- (c) Newton's 3rd law (of motion)

1

- (d) vertical force (50 N) drawn
and
horizontal force (150 N) drawn to the same scale 1
- resultant tension force in the correct direction
shown by an arrowhead 1
- value of the tension force in the range 156 N–160 N
allow a calculated value of 158 1
- value of direction in the range 18°–20° (from the horizontal)
allow 70° to 72° (from the vertical)
allow a bearing in the range 288 to 290 1

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2.

- (a) arrow vertically down – same size as lift – labelled weight
judge by eye 1
- arrow to the left – same size as drag - labelled thrust
judge by eye
two correct arrows without labels gains 1 mark 1
- (b) $34^2 - (0^2) = 2 \times 4.0 \times s$ 1
- $\frac{34 \times 34}{8} = s$ 1
- $s = 144.5$ 1
- $s = 140$ (2 sig figs)
an answer of 140 scores 4 marks
an answer of 144.5 scores 3 marks 1

(c) tension force drawn to a suitable scale and in correct direction

1

triangle completed showing correct components

1

scale used to determine both component forces

1

horizontal component = 1900 N

vertical component = 680 N

allow 1850 to 1925 inclusive

allow 660 to 700 inclusive

1

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3.

(a) the forces are equal in size and act in opposite directions

1

(b) (i) forwards / to the right / in the direction of the 300 N force

answers in either order

1

accelerating

1

(ii) constant velocity to the right

1

(iii) resultant force is zero

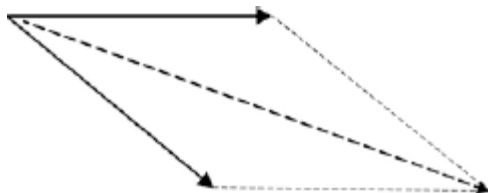
accept forces are equal / balanced

1

so boat continues in the same direction at the same speed

1

(iv) parallelogram or triangle is correctly drawn with resultant



3

value of resultant in the range 545 N – 595 N

parallelogram drawn without resultant gains 1 mark

If no triangle or parallelogram drawn:

*drawn resultant line is **between** the two 300 N forces gains 1 mark*

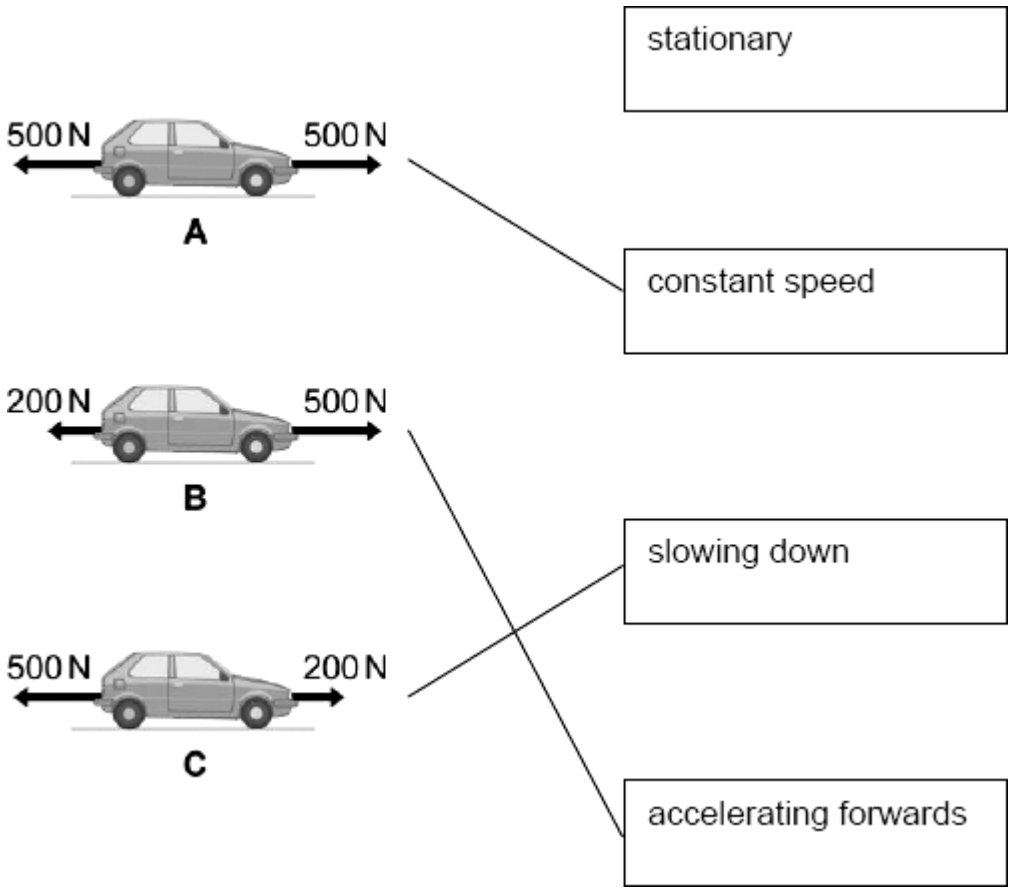
drawn resultant line is between and longer than the two 300 N forces gains 2 marks

1

[10]

4.

- (a) 3 lines drawn
all correct
allow 1 mark for each correct line
if two or more lines are drawn from any diagram then all these lines are incorrect



3

- (b) (i) horizontal arrow to the right
judge by eye
accept an arrow drawn outside the box if it is labelled correctly
- (ii) horizontal arrow to the left
judge by eye
accept an arrow drawn outside the box if it is labelled correctly
- (iii) equal to
- (iv) to measure the forces exerted on the dummy during the impact

1

1

1

1

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5.

- (a) (i) horizontal arrow pointing to the left
judge by eye
drawn anywhere on the diagram

1

(ii) 60 (N) 1
(at steady speed) resultant force must be zero
accept forces must balance/are equal
accept no acceleration
do not accept constant speed

(b) 1680 1
allow 1 mark for correct substitution, ie 60 x 28 provided no subsequent step shown

joule 2
accept J
do not accept j

[6]

6. (a) (i) 50 (N) 1
ignore any units

(ii) resultant force 1

(iii) 4000 2
accept their (a)(i) x 80 correctly calculated for 2 marks
allow 1 mark for correct substitution i.e. 50 x 80 or their (a)(i) x 80
ignore any units

(b) (i) joule 1

(ii) heat 1

[6]

7. (a) (i) a single force that has the same effect as all the forces combined 1
accept all the forces added / the sum of the forces / overall force

(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]