

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - TRIPLE SCIENCE

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P5 - TEST 6

FORCES

Advanced

## 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

[11]

2.

- (a) the distance travelled under the braking force 1
- (b) the reaction time will increase 1
- increasing the thinking distance (and so increasing stopping distance)  
*(increases stopping distance is insufficient)* 1
- (c) No, because although when the speed increases the thinking distance increases by the same factor the braking distance does not. 1
- eg
- increasing from 10 m / s to 20 m / s increases thinking distance from 6 m to 12 m but the braking distance increases from 6 m to 24 m 1
- (d) If the sled accelerates the value for the constant of friction will be wrong. 1
- (e) only a (the horizontal) component of the force would be pulling the sled forward 1
- the vertical component of the force (effectively) lifts the sled reducing the force of the surface on the sled 1
- (f)  $-u^2 = 2 \times -7.2 \times 22$   
*award this mark even with  $0^2$  and / or the negative sign missing* 1
- $u = 17.7(99)$  1

*allow 18 with no working shown for 3 marks*  
*allow 17.7(99) then incorrectly rounded to 17 for 2 marks*

1

[11]

3.

- (a) air molecules colliding with a surface create pressure

1

at increasing altitude distance between molecules increases

**or**

at increasing altitude fewer molecules (above a surface)

1

so number of collisions with a surface decreases

**or**

or so always less weight of air than below (the surface)

1

- (b) atmospheric pressure = 20 kPa from graph **and** conversion of  $810 \text{ cm}^2$  to  $0.081 \text{ m}^2$   
*allow ecf for an incorrect value clearly obtained from the graph*

1

$$5 \times 10^4 = \underline{F}$$

$$0.081$$

1

$$F = 5 \times 10^4 \times 0.081$$

1

$$4050$$

1

$$4100 \text{ (N)}$$

1

*allow 4100 (N) with no working shown for 5 marks*

*allow 4050 with no working shown for 4 marks*

- (c) force from air pressure acting from inside to outside bigger than force acting inwards

1

so keeps the window in position

1

[10]

4.

- (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

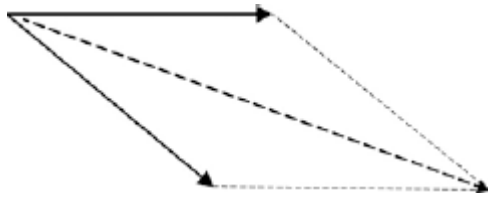
*accept forces are equal / balanced*

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]

5.

- (a) (i) momentum before = momentum after  
*accept no momentum is lost*  
*accept no momentum is gained*

**or**

(total) momentum stays the same

1

- (ii) an external force acts (on the colliding objects)

*accept colliding objects are not isolated*

1

- (b) (i) 9600

*allow 1 mark for correct calculation of momentum before or after ie 12000 or 2400*

**or**

*correct substitution using change in velocity = 8 m/s  
ie 1200 × 8*

2

kg m/s

or

Ns

*this may be given in words rather  
than symbols  
do **not** accept nS*

1

- (ii) 3 or their (b)(i)  $\div$  3200 correctly calculated  
*allow 1 mark for stating momentum before = momentum after*

or

clear attempt to use conservation of momentum

2

[7]

6.

- (a) (i) turning  
*accept turning ringed in the box*

1

- (ii) point at which mass (or weight) may be thought to be concentrated  
*accept the point from which the weight appears to act  
allow focused for concentrated  
do **not** accept most / some of the mass  
do **not** accept region / area for point*

1

- (b) 600 (Nm)  
*400  $\times$  1.5 gains 1 mark provided no subsequent steps shown*

2

- (c) (i) plank rotates clockwise  
*accept girl moves downwards  
do **not** accept rotates to the right*

1

(total) CM > (total) ACM  
*accept moment is larger on the girl's side*

1

weight of see-saw provides CM  
*answer must be in terms of moment  
maximum of 2 marks if there is no reference to the weight of the  
see-saw*

1

(ii)  $W = 445 \text{ (N)}$

$W \times 1.5 = (270 \times 0.25) + (300 \times 2.0)$  gains **2** marks

allow for **1** mark:

total CM = total ACM either stated or implied

**or**

$(270 \times 0.25) + (300 \times 2.0)$

if no other marks given

3

[10]

7.

(a) speed

must be in correct order

1

direction

1

(b)

Quantity	Scalar	Vector
Momentum		✓
Acceleration		✓
Distance	✓	
Force		✓
Time	✓	

any three correct scores **2** marks

any two correct scores **1** mark

only one correct scores zero

3

(c) (i) 16 and 2

16 **or** 2 scores **2** marks

allow 1 mark for correct substitution, ie

$8 \times 2$

**or**

$4 \times 0.5$

3

kg m / s **or** N s

1

(ii) 1.5 (m / s)  
**or**  
 their  $p_A + p_B = 12 \times v$  correctly calculated  
*allow 2 marks for correct substitution, ie*  
 $18 = 12 \times v$   
**or**  
 their  $p_A + p_B = 12 \times v$   
*18 or their  $p_A + p_B$  scores 1 mark if no other mark awarded*

3

(iii) 14 (kg m / s)  
**or**  
 their  $p_A - p_B$

1

16.5 (J)

1

[14]

8.

(a) (i) decreases (to zero)

1

resultant force acts in opposite direction to motion  
*accept air resistance and weight for resultant force*  
*accept resultant force acts downwards*  
*do **not** accept air resistance increases*

1

(ii) velocity includes direction  
**or**  
 velocity is a vector (quantity)

1

(b) (i) 3.6  
*allow 1 mark for correct substitution i.e.*  
 $\frac{1}{2} \times 0.05 \times 12^2$  provided no subsequent step

2

(ii) 3.6 **or** their (i)

1

(iii) 7.2  
**or**  
 their (ii)  $\div 0.5$  correctly calculated  
*allow 1 mark for correct substitution i.e.*  
 $3.6$  or their (ii)  $= 0.05 \times 10 \times h$

2

(iv) **B**

1



(c) range increases up to  $45^\circ$

1

range decreases from  $45^\circ$

*the range is a maximum at  $45^\circ$  gains both marks*

*for any two angles that add up*

*to  $90^\circ$  the range is the same gains both marks*

*the range increases then decreases gains 1 mark*

1

**[11]**