Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Mark Schemes

Q1.

(a) (a =) 9.81 sin30 = 4.9 ($m\ s^{-2}$) seen ✔

Allow g sin30
Accept cos60

1

(b) Substitutes into $v^2 = u^2 + 2as$ eg $v^2 = 2 \times 5 \times 0.3$

OR

Uses $\frac{v^2}{2} = g\ 0.3 \cos 60$ ✔

1.7 ($m\ s^{-1}$) ✔

Do not allow 9.81 for a in suvat equation.

2

(c) attempt to find area between 0.35 s (**B**) and 0.80 s (**C**) $_1$ ✔

*Max 1 for counting (small) squares **AND** a conversion factor of 2 N s stated*
Do not allow use of approximated shapes.
For $_1$ ✔ need to see working for at least one part of the area under the graph.
May see:
Triangle: 0.5 × 0.05 × 1100 = 27.5
Trapezium: 0.5 × (1100 + 1300) × 0.10 = 120
Trapezium: 0.5 × (1000 + 1300) × 0.15 = 172.5
Triangle: 0.5 × 0.15 × 1000 = 75

answer in range 390 to 400 (N s) $_2$ ✔

Treat "400" as a 2 sf answer.

2

(d) uses a relevant time in suvat equation(s) to get s $_1$ ✔

For $_1$ ✔ condone 9.81 for a.
Do not allow $_1$ ✔ or $_3$ ✔ for solutions that use u = 1.7 m s^{-1}
*For $_1$ ✔ allow 0.60 to 0.63 s for duration **C** to **D**.*

1. *Direct method:* $s = \frac{1}{2} at^2$

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2. a) Obtains u first using $v = u + at$ **OR**

$s = ut + \frac{1}{2} at^2$

2. b) Then s using $s = \frac{1}{2} (u + v)t$ **OR**

$v^2 = u^2 + 2as$

doubles their *s* **OR** halves their **C** to **D** duration $_3$ ✔

Expect to see u = 1.5 (m s^{-1})

answer that rounds to 0.5 (m) $_3$ ✔

For $_3$ ✔ accept 0.44 (m).

3

(e) reads resting force from graph = 360 N **OR** divides an incorrect reading by 5 (4.91 N/kg) $_1$ ✔

72 (kg) or 73 (kg) $_2$ ✔

*for $_1$ ✔ allow use of their **part (c)** with $\Delta v = 3.2$ m s^{-1}*

2

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Q2.

(a) Volume of A = area × length = 4.16×10^{-4} m^3

OR

Mass of A = W/g = 3.6 kg ✔

Condone POT error in MP1

Use density equation ✔

Do not allow use of weight in density equation

Compares

a calculated property of brass (e.g. weight, length or diameter) with A

OR

the calculated density of A with density of brass

Do not accept 8.3×10^3 for density of A .

OR

the calculated mass of A with the calculated mass of brass

Award zero marks for an unsupported answer "Brass"

and therefore brass ✔

Only award MP3 if answer "brass" given.

Example:

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Volume of A = area × length = 4.16×10^{-4} m^3 ✔
Mass if brass = density × volume = 3.58 kg ✔

Weight = 3.58 × 9.81 = 35 N (which is weight of A) and therefore brass is correct.

3

(b) Use of T = (35) cos 55 ✔
2 × their T (= 40 N) ✔

2

(c) Angle (to horizontal) decreases ✔

(Weight/tension in rope remains constant at 35 N)

So horizontal components (from tension in rope) increase ✔

Do not award MP2 if answer suggests that tension in rope increases.

(Therefore tension in cable must increase)

Do not allow "tension increases" for credit.

2

(d) Component of the force at right angle to door

= 41 cos (90−12) / 41 sin (12)

= 8.5 N ✔

Moment = 8.5 × 0.95 = 8.1 ($\mathrm{N\ m}$) ✔

Alternative:
Perpendicular distance = 0.95 sin (12)
= 0.198 m ✔
Moment = 41 × 0.198 = 8.1 ✔

Allow ecf from their value of weight component .

Allow ecf from their value of perpendicular distance.
(Calculator value is 8.098 160 3)

Award zero marks for simply multiplying 41 N × 0.95 m.

2

(e) ALTERNATIVE 1

Increase weight / density / mass / volume of **A** ✔

Increases tension (and therefore moment) ✔

ALTERNATIVE 2

Position pulley **R** further (out) from gate hinges / increase diameter of pulley **R**. ✔

Increases angle and therefore bigger perpendicular component (and therefore moment). ✔

Any 2 alternatives

ALTERNATIVE 3

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Decrease angle of rope eg by putting P and fixed point closer together / further to right. ✔

Increases tension (and therefore moment). ✔

If more than two answers given, mark first two. Ignore the 1 and 2 in answer lines.

ALTERNATIVE 4

Move **D** further from hinge/**R** OR make **C** longer. ✔

Increases perpendicular distance (and therefore moment). ✔

4

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