Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) Distance to centre of mass of counterweight from pivot = 2.9 m ✔

Moment = (f ×d = 50×2.9 =)145 (N m) ✔

No credit for use of 3.2 m (or 2.6 m) here, but maybe ecf later

2

(b) mass of water = 0.08 × 1000 (= 80 kg)✔

total weight of bucket + water = 80g + 120 (= 905 N)✔

moment of bucket + water = 905 × 1.4 = 1270 (N m)✔

905 × 1.4 = 145 + F×3.2 ✔

350 (N)✔

No credit for 1000 × 1.6 here
Allow ecf from any mass
*Ecf from part **(a)***

5

(c) Weight of beam acts to right of the pivot / centre of mass is to the right of the pivot ✔

provides an additional **clockwise moment** ✔

Therefore the value calculated in part **(b)** would be less to have equilibrium ✔

Need "moment" and some sense of direction
No credit for unsubstantiated statement of change of force.

3

[10]

Q2.

(a) m = 16 g = 0.016 kg r = 0.008 m

Use of $V = 4 / 3\ \pi\ r^3$ to give $V = 4 / 3\ \pi\ (0.008)^3$

= $2.1 \times 10 - 6\ m^3$✓

The first mark is for calculating the volume

1

Use of density = m / V to give density = $0.016 / 2.1 \times 10^{-6}$✓

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The second mark is for substituting into the density equation using the correct units

1

Density = 7.4×10^3 kg m^{-3} ✓

The final mark is for the answer.

1

(b) Use of $v^2 = u^2 + 2as$ to give $v^2 = 2\ (9.81)\ (1.27)$ ✓

(allow use of $mg\Delta h = ½\ mv^2$)

$v^2 = 25\ (24.9)$

The first mark is for using the equation

1

$v = 5.0\ (m\ s^{-1})$ ✓

The second for the final answer

1

(c) Use of $v2 = u2 + 2as$ to give $0 = u^2 + 2\ (-9.81)\ (0.85)$ ✓

The first mark is for using the equation

1

$u^2 = 17\ (16.7)$

$u = 4.1\ m\ s^{-1}$ ✓

The second for the final answer

1

(d) Change in momentum = $mv + mu = 0.016 \times 5 + 0.016 \times 4.1$✓

The first mark is for using the equation

1

$= 0.15\ (0.146)\ kg\ m\ s^{-1}$ ✓

The second for the final answer

1

(e) Use of Force = change in momentum / time taken

$= 0.15 / 40 \times 10^{-3}$✓

The first mark is for using the equation

1

$= 3.6\ N$ ✓

The second for the final answer

1

(f) Impact time can be increased if the plinth material is not stiff✓

Alternative

A softer plinth would decrease the change in momentum of the ball (or reduce the height of rebound) ✓

1

Increased impact time would reduce the force of the impact. ✓

Smaller change in momentum would reduce the force of impact ✓

1

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