Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) (i) Weight / *W* / *mg* − vertically downwards from some point on the body

B1

Friction − vertically upwards and touching both the wall and the body

B1

Centripetal force / normal reaction / R − horizontally to the left from the body
Each must be correct and correctly labelled
Minus one for each additional inappropriate force

B1
3

(ii) Centripetal force / reaction / R is smaller

B1

Frictional force reduces
Frictional force is less than weight
Resultant force is downward
Friction is proportional to (normal) reaction

B1
2

(b) (i) $r\omega^2 = 29$ or
$v^2 / r = 29$

B1

Use of correct radius leading to 3.590 (rad s^{-1}) to at least 3 sig figs
2.54 using wrong r = 1 mark

B1
2

(ii) Angular acceleration, $\alpha = 3.6 / 20$ OR 3.59 / 20 or 0.18 or 0.1795

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C1

3.8 (3.77, 3.78) × 10^4 cao

A1

N m or kg m^2 s^{-2}

B1
3

(iii) 2200 N cao

B1
1

(c) (i) C

B1
1

(ii) Speed greatest (as all PE turned to KE)

B1

Total reaction force = $mr\omega^2 + mg$ or $v^2 / r + mg$ or R is largest or
$R = ma + mg$
OR
Acceleration = v^2 / r

B1
2

[14]

Q2.

(a) (i) (vertically) downwards [**or** top to bottom, or down the page] **(1)**

1

(ii) force on sphere F (= kx) = 0.24 × 18 × 10^{-3} **(1)** (= 4.32 × 10^{-3} N)

1

(iii) **use of** $F = EQ$ gives $E = \frac{4.32 \times 10^{-3}}{41 \times 10^{-9}}$ **(1)** (= 1.05 × 10^5 V m^{-1})

use of $E = \frac{v}{d}$ gives separation $d = \frac{5.0 \times 10^{-3}}{1.05 \times 10^5}$ **(1)**

= 4.8 × 10^{-2} (m) **(1)** (4.76 × 10^{-2})

3

(b) (i) electric field becomes zero (or ceases to exist) **(1)**

flow of charge (or electrons) from one plate to the other [**or** plates discharge] **(1)**

(until) pd across plates becomes zero [**or** no pd across plates, **or** plates at same potential] **(1)**

max 2

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(ii) net downward force on sphere (when *E* becomes zero)
[**or** gravitational force acts on sphere, **or** force is weight] **(1)**

this force extends spring **(1)**

force (or acceleration) is proportional to (change in)
extension of spring **(1)**
acceleration is in opposite direction to displacement
(or towards equilibrium) **(1)**

for shm, acceleration $\propto$ (−) displacement
[**or** for shm, force $\propto$ (−) displacement] **(1)**

max 3

[10]

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