Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Further Mechanics

Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) T = power/ω

Torque = 2500/0.47

5320 N m value to 2 or more sf needed

3

(b) (i) Deceleration= 0.47/34= 0.0138 (rad s^{-2})

moment of inertia = torque / angular deceleration
=5000/0.0138 = 3.57×10^5

kg m^2 (Allow N m s^2)
3.8×10^5 if 5320 used

3

(ii) Suitable equation of motion used with correct data but omitted minus sign

8.0 radian Allow (their $\omega/2\pi$)

1.27 revolutions
Condone 1 revolution
(allowed for thinking question refers to complete revolutions)

3

(c) (i) $F = 65 \times 2.2 \times 0.47^2$

32(31.6 N)

2

(ii) Force produced by friction between the feet and the roundabout

Centripetal force has to act through the centre of mass of the operator
or
The resultant of the frictional force and normal reaction has to pass through the centre of mass
Any indication (eg on diagram) of wrong direction = 0

2

(iii) Ticks 4th box

1

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Q2.

(a) (i) for one spring, change in force $\Delta F = k\Delta L = 30 \times 60 \times 10^{-3}$

= 1.8 (N) ✓

resultant force (= $[F + \Delta F] - [F - \Delta F]$) = $2\Delta F$ ✓

(= 3.6 N)

alternative using answer from (b) (ii)

$a = (2\pi f)^2 x = (2\pi \times 1.38)^2 \times 60 \times 10^{-3} = 4.51$ (m s^{-2}) ✓

resultant force = ma = 0.80 × 4.51 (= 3.6 N)

2

(ii) acceleration a $\left(= \frac{F}{M}\right) = \frac{3.6}{0.8} = 4.5$(m s^{-2}) ✓
to the right ✓

alternative for first mark using answer from (b) (ii)

$a = (2\pi f)^2 x = (2\pi \times 1.38)^2 \times 60 \times 10^{-3} = 4.5$ (m s^{-2}) ✓

2

(b) (i) acceleration is proportional to displacement
(from equilibrium position) ✓

acceleration is in opposite direction to displacement
[**or** acceleration is towards a fixed point/equilibrium position] ✓

2

(ii) $f = \frac{1}{2\pi}\sqrt{\frac{2 \times 30}{0.80}}$ ✓ = (1.38 Hz)

period T $\left(= \frac{1}{f}\right) = \frac{1}{1.38}$ = 0.73 (0.726) ✓ [or 730]

s ✓ [ms]

3

(c) (i) $f = \left(= \frac{1}{2\pi}\sqrt{\frac{2k}{m}}\right) = \frac{1}{2\pi}\sqrt{\frac{2 \times 200}{1.0 \times 10^{-25}}} = 1.0(1) \times 10^{13}$ (Hz) ✓

1

(ii) v_{max} $(= 2\pi fA) = 2\pi \times 10^{13} \times 10^{-11} = 630$ (628) (m s^{-1}) ✓

1

(iii) max E_K $(= \frac{1}{2} mv_{max}^2) = \frac{1}{2} \times 1.0 \times 10^{-25} \times 628^2 = 2.0 \times 10^{-20}$ (J) ✓

[or using $\frac{1}{2} kA^2$ approach]

1

[12]