

UNIT 12 AG Marking Scheme.

p. 12-14.

- a) $\omega = \omega_0 + \alpha t$
- b) $\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$
- c) $\omega^2 = \omega_0^2 + 2\alpha\theta$

/3 (-1.5 for no derivation)

p. 12-16

- b) data /2 /4
- c) $F_1 d_1 = F_2 d_2$ /1
- d) $\tau_1 = \tau_2$ for all data points. /1

p. 12-20

- a) $M r^2$ /1
- b) $M r^2$
- c) $M r^2$
- d) $M r^2$
- e) $M r^2$ /1

}

/3

p. 12-21

- a) hoop. mass dist. away from rot. axis. /1
- b) hoop. (larger I). /1
- c) disk (smaller I, less resistance to τ). /1
- d) disk faster. /1

/4

p. 12-23

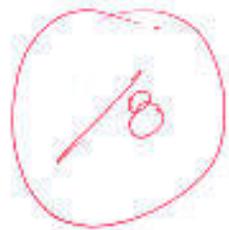
- a) $I = 1.69 \times 10^{-4} \text{ kg m}^2$. /1
- b) $\pi r_i^2 - \pi r_{i-1}^2$
 $\Delta I_i = \frac{A_i}{A} \cdot M r_i^2$ /3
- $I = \sum_i \Delta I_i$ /pt if calcs not general.
- c) spreadsheet.
 $\Delta A_i \quad \Delta I_i \quad I$ /3
- d) $\frac{\text{numerical}}{\text{theo.}} \times 100\%$. /1
- e) /1
 (more rings
 neither use $r_i = \text{avg of } r_{\text{outer}} \text{ \& } r_{\text{inner}}$
 0.5

- f) $k = \sqrt{\frac{I}{M}} = 9.2 \times 10^{-3} \text{ m}$. /1
 UNITS -0.5

/10

$$p. 12-26.$$

UNITS, -0.5
Conversion -0.5



a) CD's

$$r_d = 0.06 \text{ m} \quad M_d = 0.060 \text{ kg}$$

$$I_d = \frac{1}{2} MR^2 = \frac{1}{2} (0.060)(0.06)^2 = 1.08 \times 10^{-4} \text{ kg m}^2$$

hole

$$r_h = 0.007 \text{ m}$$

$$M_h = \frac{A_{\text{hole}}}{A_{\text{disk}}} \cdot M_d = \frac{0.007^2 \pi}{0.06^2 \pi} \cdot 0.060 \text{ kg} = 8.17 \times 10^{-4} \text{ kg}$$

$$I_h = \frac{1}{2} MR^2 (8.17 \times 10^{-4})(0.007)^2 = 2.0 \times 10^{-8} \text{ kg} \quad \leftrightarrow I_h \ll I_d$$

$$\Rightarrow I_{\text{CD}} = I_d - I_h = 1.08 \times 10^{-4} \text{ kg m}^2$$

b) $r_s = 0.025 \text{ m} \quad M_s = 0.006 \text{ kg}$

$$I_s = \frac{1}{2} MR^2 = \frac{1}{2} (0.006)(0.025)^2 = 1.88 \times 10^{-6} \text{ kg m}^2$$

c) $I = I_{\text{CD}} + I_s = 1.1 \times 10^{-4} \text{ kg m}^2$

(or: $I \approx I_{\text{CD}} = 1.08 \times 10^{-4} \text{ kg m}^2$).

d) $m = 0.05 \text{ kg} \quad r_s = 0.025 \text{ m}$

(SP12-4 assumption)

OK $\Rightarrow \omega = \frac{v}{r} \approx \frac{mgr}{I}$

but Bonus +2 pts

e) $\tau = I\alpha$

$$\tau = rF$$

$$mg - F_T = ma = m\alpha r$$

$$\Rightarrow \alpha = \frac{mgr}{mr^2 + I} = \frac{(0.05)(9.8)(0.025)}{(0.05)(0.025)^2 + 1.1 \times 10^{-4}}$$

$\approx \frac{1}{2} MR^2 = 87 \text{ rad/s}^2$

/2

p. 12-28

- experimental procedure - enough details to repeat. /2
- data: /2
- Calculations:
 α from slope of ω vs t . /2

16

p. 12-29

a) $\alpha_{th} =$

$\alpha_{exp} =$ should be close if correct eqn's were used.

Correspondence

/2

UNITS
-0.3

BONUS (+2)

$$\sigma_{exp} = \sqrt{\frac{\sum (\chi_i - \langle \chi \rangle)^2}{N-1}}$$

b) Yes or No + reasonable justification.

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