ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics A

Unit PHA3/P

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Unit 3

1 **AO3a :** ***planning*****:**

measurements:

(to determine the transit time of the falling cake-case)
use a <u>stopwatch</u> (**not** from rest) (✓)
(to determine (vertical) distance fallen)
use a (metre) ruler or tape measure (**not** from rest) (✓)
(to determine mass (weight) of cake-case)
measure with <u>balance</u> (not scales) (✓)
(to determine the cross-sectional area of the cake-case)
measure the (mean) diameter/radius using (300 mm) ruler (✓)
any three ✓✓✓

strategy:

find v using correct physics e.g. $\dfrac{\text{(vertical) distance}}{\text{transit time}}$ (✓)
(no credit for measuring vertical distance in a certain time)
find A from $\dfrac{\pi(\text{diameter})^2}{4}$ (✓)
D is same as weight (mg) (when falling at terminal velocity) (✓)
repeat either using different weights (e.g.stacked cases) or
paper cases of different diameters (cross-sectional areas) (✓)
shape factor found by graphical method: expect explanation,
suitable graph e.g. D against $\rho A v^2$; <u>determine gradient</u> (✓)
any four ✓✓✓✓

control:

any sensible e.g. avoid draughts ✓

difficulties:

(*difficulty + how overcome* = 2)
any **two** of the following

reduce uncertainty in timing
by making cases fall through large distance (e.g. ≥ 2 m) and/or
by repeating readings and <u>averaging</u>
by avoiding parallax error (viewing at eye level)

reduce uncertainty in diameter/radius
by mea`suring across several diameters and <u>averaging</u>

reduce uncertainty in vertical distance
by ensuring ruler is vertical: expect description of how this is done
✓✓✓✓ max*(8)*
(8)

2	**AO3b : *implementing***			
(a)(i)	*accuracy*	w to nearest mm, sensible value	✓	
		θ_1 and θ_2 to nearest °, $\theta_1 - \theta_2 \geq 25°$	✓	
(a)(ii)		n, no unit, in range 1.35 to 1.65	✓	
(b)	*tabulation*	s/mm θ_1/° θ_2/°	✓	
	readings	5 sets of s, θ_1 and θ_2, s range ≥ 10.0 cm (mark deducted for each missing set or poor range)	✓	
(c)	*tabulation*	(s cos θ_2) sin ($\theta_1 - \theta_2$)	✓	
(b)	*significant figures*	all s to nearest mm, all θ_1 and θ_2 to nearest °,		
(c)		both sets of derived data to 3 s.f. or 4 s.f.	✓	
(c)	*quality*	4 of 5 points to ± 2 mm of straight line of positive gradient (providing suitably-scaled graph drawn)	✓	(*8*)
3	**AO3c : *applying evidence and drawing conclusions* *processing***			
(c)	*axes*	marked s cos θ_2)/mm and sin ($\theta_1 - \theta_2$)/(no unit) (deduct ½ for each missing, rounding down)	✓✓	
	scale	suitable (e.g.8 × 8) [5 × 5, 2 × 8, 8 × 2 ✓]	✓✓	
	points	5 points plotted correctly with straight best-fit line drawn	✓	
	deductions			
(d)		G from suitable Δ (e.g. 8 × 8)	✓	
		$G = w \pm 10\%$ [± 20% ✓]	✓✓	(*8*)
4	**AO3d : *evaluating evidence and procedures***			
(e)(i)	θ_1 (and/or θ_2) larger		✓	
	so uncertainty in θ reduced		✓	
(e)(ii)	measured (between emergent ray and projection of incident ray) at two places [repeated readings accepted]		✓	
	use of set-square or protractor to ensure perpendicular distance is measured		✓	
(e)(iii)	range of s decreased (not s smaller)		✓	
	range of θ_1 and θ_2 reduced		✓	(*6*) (*22*)