Version 1.0: 0906

General Certificate of Education

Physics 5451
Specification A

PHA3/P Practical Examination

Mark Scheme

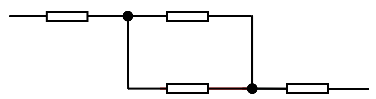
2006 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

PHA3/P: Practical Examination

Question 1	**AO3a: planning**		
	measurements (to measure the angle between AB and the surface of the table) use protractor (to determine the transit time of golf ball between B and edge of table) use of two light gates (or suitable sensors) connected to data logger or to a computer via an interface or to a stopwatch/stopclock [use of stopwatch for hand held method ✓]	✓ ✓ ✓	**3**
	strategy measure transit times between B and edge of table for different α plot graph of angle α against transit time read $\alpha_{t = min}$ from turning point of the line on graph	✓ ✓ ✓	**3**
	control release ball (at A) from rest sensible procedure described to release ball from rest at A maintain position of B (on table) sensible procedure e.g. mark table, to maintain position of B direction of AB relative to edge of table sensible procedure to ensure AB at 90º to edge of table	✓ ✓ ✓ ✓ ✓ ✓	**max 2**
	difficulties (*difficulty + how overcome = 2*) any **two** of the following reduce uncertainty in transit time between B and edge of table(✓) by making transit distance large (✓) or by repeat timing and averaging (✓) or sensible procedure to overcome parallax error (✓) reduce uncertainty in α (✓) by identifying a sensible measure to maintain position of track when carrying out experiment (✓) or by using large protractor (✓) or by establishing α by trigonometry (✓) or use of set square to ensure vertical measurement correct or use of plumb line to ensure horizontal measurement correct (✓) reduce uncertainty in determining angle for least transit time (✓) by increasing frequency of readings close to turning point on graph (✓)	✓✓✓✓	**max 4**
		Total	**max 8**

Question 2			
	AO3b: implementing		**8**
(a)	*accuracy* — E and V_0 recorded with unit, values sensible, with $0.4\,E < 0.8\,E$	✓	
(b)	*tabulation* — x/mm V/V	✓	
	readings — 5 sets of x and V (1 mark deducted for any missing set) (1 mark deducted for x range < 250 mm)	✓✓	
(a)/(b)	*significant figures* — all x to mm, E, V_0 and all V to 0.01 V	✓	
(b)	*quality* — 5 points to ± 2 mm of straight line (providing suitably scaled graph drawn)	✓	
(c)	*tabulation* — $\frac{E-V}{V}$ x/mm	✓	
	sig. fig — $\frac{E-V}{V}$ data to 3 s.f. or 4 s.f.	✓	
	AO3c : applying evidence and drawing conclusions **processing**		**8**
(c)	*axes* — marked $\frac{E-V}{V}$ /no unit and x/mm (½ mark deducted for each missing)	✓✓	
	scales — suitable (e.g. 8 × 8) [5 × 5, 2 × 8, 8 × 2]	✓✓	
	points — 5 points plotted correctly with straight best-fit line drawn	✓	
	deductions		
(d) (i)	G from suitable Δ (e.g. 8 × 8)	✓	
(ii)	$\frac{3(E-V)}{GV_0}$, to nearest cm, in range 0.40 m to 0.50 m [0.35 m to 0.55 m or 0.4 m or 0.5 m ✓]	✓✓	
	AO3d: evaluating evidence and procedures		**6**
(e) (i)	resistance = 0.5R	✓	
(ii)	resistance = 2R	✓	
(iii)	suitable diagram e.g. 	✓	
	resistances shown as 0.5R, 0.25R and 0.5R	✓	
	total resistance =1.25R	✓	
(iv)	claim could be correct e.g. idea that $2R - 1.25R = 1.25R - 0.5R$ or statement such as $1.25R$ is halfway between maximum and minimum values	✓	
	Total		**22**