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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 5451
Specification A

PHA3/P Practical Examination

Mark Scheme

2006 examination – January 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 horizontal displacement of the water stream at the sink, *w*) use a ruler or millimetre scale ✓ (to determine the inclination of the thread to the vertical, α), use a protractor ✓	**2**
	strategy locate and mark position of undeviated water stream, so *w* measured ✓ establish vertical by suitable method (e.g. plumbline) so *α* can be measured (use of rod of retort stand as reference not acceptable) ✓ [for trig method, award mark if qualifying statement of how associated linear measurements are made] measure and record *w* for different values of α ✓ plot graph (*w* vs *α*) to show which model is correct ✓	**4**
	control keep (mass/volume)flow rate constant ✓ maintain (vertical) distance between ball and sink ✓ maintain (vertical) distance between tap and ball ✓ } (max 1)	**2**
	difficulties (*difficulty* + *how overcome* = 2) reduce uncertainty in *w* (✓) by making distance between ball and sink large (✓), and/or by using a low flow rate (✓), and/or by making measurements when ball is steady (✓) reduce uncertainty in α (✓) by using table tennis ball of low mass (✓) and/or by using a protractor of large diameter (✓) and/or by making measurements when ball is stationary (✓) and/or by establishing α by trigonometry (✓) (correct explanation required; ball staying in same place, thus $\sin\alpha = \frac{\text{distance S is moved}}{\text{length of thread}}$) and/or if determining angle using trig. make distance between S and ball large (✓) ✓✓✓✓	**Max 4**
	Total	**Max 8**

Question 2			
		AO3b: Implementing	
(a)	(i)	*accuracy* D in range 188 to 190 mm ✓	
	(ii)	(initial) x = 59 or 60 mm ✓	
(b)		*tabulation* y z /mm ✓✓	
		readings 6 sets of y and z, ✓✓ (1 mark deducted for any missing set) (1 mark deducted for each set where y > (x) > z) (1 mark deducted if smallest recorded y > 15 mm) (maximum deduction 2 marks)	**8**
		significant figures readings in (a) for D and x, and in (b) for y and z all to mm ✓	
(c)		*quality* 5 points to ± 2 mm of straight line (providing suitably scaled graph drawn) ✓	
(c)		**AO3c: Applying Evidence and Drawing Conclusions Processing**	
		axes marked z/mm and y/mm ✓✓ ($^1/_2$ mark deducted for each missing)	
		scale suitable (e.g. 8 × 8) ✓✓ [5 × 5, 2 × 8, 8 × 2 ✓]	**8**
		points 6 points plotted correctly with straight best-fit line drawn ✓	
(d)		**deductions** G from suitable Δ (e.g. 8 × 8) ✓ G in range 2.12 to 2.38 [2.00 to 2.50 ✓] ✓✓	
(e)		**AO3d: Evaluating Evidence and Procedures**	
	(i)	locate and mark centre of circle at mid-point of diameter ✓ position the block (perpendicular to marked diameter) with aid of a set-square ✓ applies some logical measurement to ensure centre of flat edge coincides with centre of circle/marked point/intersection of printed and marked diameters ✓	**6**
	(ii)	incident ray does not enter at centre of flat edge [block is not correctly positioned] ✓ internal ray has not travelled along a radius of the block ✓ refraction has taken place as ray leaves block ✓	
		Total	**22**