ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme January 2002

GCE

Physics A

Unit PHA59P

Instructions to Examiners

1 Give due credit to alternative treatments which are correct. Give marks for what is correct; do not deduct marks because the attempt falls short of some ideal answer. Where marks are to be deducted for particular errors specific instructions are given in the marking scheme.

2 Do not deduct marks for poor written communication. Refer the script to the Awardsmeeting if poor presentation forbids a proper assessment. In each paper candidates may be awarded up to two marks for the Quality of Written Communication in cases of required explanation or description. However, no candidate may be awarded more than the total mark for the paper. Use the following criteria to award marks:

2 marks: Candidates write with almost faultless accuracy (including grammar, spelling and appropriate punctuation); specialist terms are used confidently, accurately and with precision.

1 mark: Candidates write with reasonable and generally accurate expression (including grammar, spelling and appropriate punctuation); specialist terms are used with reasonable accuracy.

0 marks: Candidates fail to reach the threshold for the award of one mark.

3 An arithmetical error in an answer should be marked 'AE' thus causing the candidate to lose one mark. The candidate's incorrect value should be carried through all subsequent calculations for the question and, if there are no subsequent errors, the candidate can score all remaining marks (indicated by ticks). These subsequent ticks should be marked 'CE' (consequential error).

4 With regard to incorrect use of significant figures, normally a penalty is imposed if the number of significant figures used by the candidate is one less, or two more, than the number of significant figures used in the data given in the question. The maximum penalty for an error in significant figures is **one mark per paper**. When the penalty is imposed, indicate the error in the script by 'SF' and, in addition, write 'SF' opposite the mark for that question on the front cover of the paper to obviate imposing the penalty more than once per paper.

5 No penalties should be imposed for incorrect or omitted units at intermediate stages in a calculation or which are contained in brackets in the marking scheme. Penalties for unit errors (incorrect or omitted units) are imposed only at the stage when the final answer to a calculation is considered. The maximum penalty is **one mark per question**.

6 All other procedures, including the entering of marks, transferring marks to the front cover and referrals of scripts (other than those mentioned above) will be clarified at the standardising meeting of examiners.

Units 5 – 9: Practical

1 ***Planning***

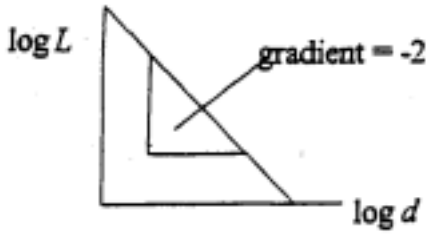
(to determine the illumination at points along axis of the lamp)
measure distance from LDR to lamp using metre rule/tape ✓
find resistance of LDR using ohmmeter [or *VI* method explained,
or potential divider method explained: must be from diagram] ✓
read illumination from (calibration) graph ✓
(light meter method, scores 2/3; single circuit method or
interchanged meters, scores 1/3)

diagram:
sensible diagram to include lamp, LDR (light meter) and suitable
means of resistance measurement: symbols must be correct ✓
distance, *d*, shown or means to measure it ✓

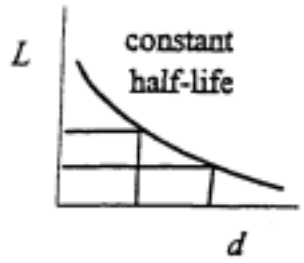
check for correct prediction by repeating at different distances ✓
plot a suitable graph to test prediction of **either** student,
with method of testing relationship explained ✓
(repeated calculations of L/d^2 and check for consistency is acceptable)

possible approaches for student A to test inverse-square variation:

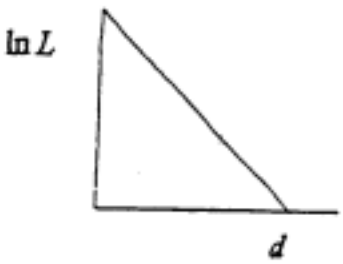
or



possible approaches for student B to test exponential variation:



or



control:
eliminate stray illumination by using blackout [or by collimating beam]
(subtracting background illumination not acceptable)
[or maintain intensity of spotlight by use of appropriate circuit] ✓

difficulties:
any <u>two</u> of the following: (look for *difficulty* + *how to overcome* = 2)

reduce uncertainty in <u>the graph</u> (✓)
by taking extra readings where the illumination changes

most rapidly with distance (✓)

reduce uncertainty in R (V and I) (✓)
by taking extra readings and <u>averaging</u> (✓)

overcome uncertainty in d (✓)
by measuring from specified point on lamp (✓)
[ensure that the LDR only moves along axis of the lamp]
[allow any other good relevant physics] ✓✓✓✓
(12 possible marks for) max *8*

8

2 ***Implementing***

(a)(i)	*accuracy*:	d recorded to 0.01 mm from nd where $\Sigma n \geq 3$ ✓		
(a)(ii)		<u>valid</u> deduction that wire is 28 s.w.g.	✓	
(b)	*tabulation*	l/mm m/g $\sqrt{m}$	✓✓	
	readings	6 sets of l and m	✓✓	
		(mark lost for any missing or if m range < 300 g)		
	significant figures	all l to mm, all $\sqrt{m}$ to 3 s.f.	✓	
(c)	*quality*	at least five points to ± 2 mm of straight line of positive gradient		
		(providing suitably-scaled graph drawn)	✓	*8*

Applying evidence and drawing conclusions

processing

(c)	*axes*	marked l/mm, $\sqrt{m}/g^{½}$	✓✓	
		(½ mark lost for each missing, rounding down)		
	scale	suitable (e.g. 8 × 8)	✓✓	
		(5 × 5, 2 × 8, 8 × 2, one ✓ only)		
	points	points plotted correctly with smooth best-fit line drawn	✓	

deductions

(d)(i)	G from suitable triangle (e.g. 8 × 8)		✓	
(d)(ii)	μ in range 0.82 to 1.10, 0.9, 1.0 g m^{-1}		✓✓	
	[0.67 to 1.25, 0.8, 1.1, 1.2 g m^{-1}]			*8*

Evaluating evidence and procedures

(e)(i) any <u>two</u> from:
repeat measurement of d (at different points) on the wire
(different orientations) and <u>averaged</u> (checked for consistency
check for (and take account of) any zero error on micrometer
jaws of micrometer not over-tightened i.e. use of ratchet ✓✓

(e)(ii) d is smaller (cross-sectional area smaller) ✓
μ is smaller (depends on d smaller) ✓
G is larger (depends on μ smaller) ✓
(d larger, μ larger, G smaller, scores 1/3)

(e)(iii) quotes new value of l that is twice the reading corresponding
to m = 100 g (can be from table or from graph) ✓ *6*

<u>22</u>