

**Oxford Cambridge and RSA Examinations**



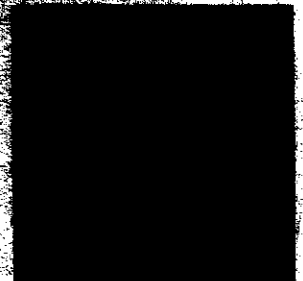
**ADVANCED GCE  
ADVANCED SUBSIDIARY GCE**

**A2 7888  
AS 3888**

**PHYSICS B**

**(ADVANCING PHYSICS)**

**COMBINED MARK SCHEME  
AND REPORT FOR THE UNITS  
JANUARY 2005**



3888/7888/MS/R/05J

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The mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

The report on the Examination provides information on the performance of candidates which it is hoped will be of use to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the operation of the scheme of assessment and of the approach to marking scripts.

Mark schemes and Reports should be read in conjunction with the published question papers.

OCR will not enter into any discussion or correspondence in connection with this mark scheme or report.

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## Physics B (Advancing Physics) mark schemes - an introduction

Just as the philosophy of the *Advancing Physics* course develops the student's understanding of Physics, so the philosophy of the examination rewards the candidate for showing that understanding. These mark schemes must be viewed in that light, for in practice the examiners' standardisation meeting is of at least equal importance.

The following points need to be borne in mind when reading the published mark schemes:

- Alternative approaches to a question are rewarded equally with that given in the scheme, provided that the physics is sound. As an example, when a candidate is required to "Show that..." followed by a numerical value, it is always possible to work back from the required value to the data.
- Open questions, such as the questions in section C permit a very wide variety of approaches, and the candidate's own approach must be rewarded according to the degree to which it has been successful. Real examples of differing approaches are discussed in standardisation meetings, and specimen answers produced by candidates are used as 'case law' for examiners when marking scripts.
- Final and intermediate calculated values in the schemes are given to assist the examiners in spotting whether candidates are proceeding correctly. Mark schemes frequently give calculated values to degrees of precision greater than those warranted by the data, to show values that one might expect to see in candidates' working.
- Where a calculation is worth two marks, one mark is generally given for the method, and the other for the evaluation of the quantity to be calculated.
- If part of a question uses a value calculated earlier, any error in the former result is not penalised further, being counted as *error carried forward*: the candidate's own previous result is taken as correct for the subsequent calculation.
- Inappropriate numbers of significant figures in a final answer are penalised by the loss of a mark, generally once per examination paper. The maximum number of significant figures deemed to be permissible is one more than that given in the data; two more significant figures would be excessive. This does not apply in questions where candidates are required to show that a given value is correct.
- Where units are not provided in the question or answer line the candidate is expected to give the units used in the answer.
- Quality of written communication will be assessed where there are opportunities to write extended prose.

### SECTION C

The outline mark schemes given here will be given more clarity by the papers seen when the examination is taken. Some of these scripts will be used as case law to establish the quality of answer required to gain the marks available.

It is not possible to write a mark scheme that anticipates every example which students have studied.

For some of the longer descriptive questions three marks will be used (in scheme called the 1/2/3 style).

1 will indicate an attempt has been made

2 will indicate the description is satisfactory, but contains errors

**Abbreviations, annotations and conventions used in the Mark Scheme**

m	= method mark
s	= substitution mark
e	= evaluation mark
/=	alternative and acceptable answers for the same marking point
;	= separates marking points
NOT	= answers which are not worthy of credit
( )	= words which are not essential to gain credit
<u>      </u>	= (underlining) key words which <b>must</b> be used to gain credit
ecf	= error carried forward
AW	= alternative wording
ora	= or reverse argument

Qn	Expected Answers	Marks	Additional guidance
	<b>Section A</b>		
1	steel = B ; biscuit = C ; cast iron = A	3	
2(a)	$400 \pm 100$ (m pixel <sup>-1</sup> ) 300 - 500	1	no method needed no method needed any sensible attempt to make physics "connect" NOT just icebergs moving
(b)	$25 \pm 10$ (km) 15 - 35	1	
(c)	Global warming / sea level rising / climate change / icebergs danger to shipping lanes etc.	1	
3(a)	<u>Area</u> of cross-section / circle	1	NOT just area accept labelled sketch
3(b)	$x \frac{1}{2}$ ; $x \frac{1}{4}$	2	accept halved; quartered
4(a)	<u>semiconductor(s)</u> ;	1	accept $1.1 \mu\Omega \text{ m}$
4(b)	$\rho = 1/\sigma$ / $= 1/9 \times 10^5 \text{ m} ; = 1.1 \times 10^{-6} \text{ e} ; \Omega \text{ m} / \text{S}^{-1} \text{ m}$	3	
5(a)	any 2 valid and distinct comparisons e.g. eee has higher frequencies / aaa has higher amplitude components / aaa has lower fundamental frequency / eee has more harmonics	2	
5(b)	consistent lower amplitude between 1V and 1.5V ; 1 reasonable sine wave per time division	1 1	by eye allow any phase
6(a)	$R_{\text{parallel}} = 50\Omega$ / $R_{\text{total}} = 100 + R_{\text{parallel}}$ m ; 150 ( $\Omega$ ) e	2	100.02( $\Omega$ ) scores 1
6(b)	$(I = V/R = 12/150) = 0.08 \text{ A}$ or 80 mA	1	evaluation only no method mark ecf from (a) on $R_{\text{total}}$
	Total section A	20	

Section B			
7(a)	elastic ; tough	2	
(b)	$A = F / \sigma_B / 550 / 2 \times 10^9 \text{ m} ; = 2.8 \times 10^{-7} \text{ e}$	2	accept $2.75 \times 10^{-7}$ or better
(c)	Permanent stretch / yield AW	1	
(ii)	$(E = \sigma / \epsilon =) 1.6 \times 10^9 / 0.35 \text{ m} ; = 4.6 \times 10^9 \text{ e}$	2	by number substitution 2 or 3 SF otherwise SF penalty
(d)	molecule(s) tangled / twisted / coiled / zig-zagged	1	accept $4.57 \times 10^9$
	molecule(s) untangled / untwisted / uncoiled / straighter	1	stick / ball+stick / line
	molecule(s) untangled / untwisted / uncoiled / bond rotation allows different shapes / effect of cross-links / effect of side chains	<u>1</u> 10	quality mark could come from good labels
8(ai)	$\mathcal{E}$ rises as $T$ rises / starts proportionally ; slight upward curve / increase in gradient AW	1 1	
(ii)	method (such as $\Delta$ or gradient = $0.23 \text{ mV} / 40^\circ\text{C}$ ) ; evaluation = $5.8 \pm 0.3 (\mu\text{V} / ^\circ\text{C})$	1 1	Accept $6 \mu\text{V} / ^\circ\text{C}$
(b)	e.g. $V = \mathcal{E} - \mathcal{E} \{r / (R+r)\} ; V = \mathcal{E}(R+r - r) / (R+r) = \dots$	2	1 <sup>st</sup> mark for valid subn $V = IR$ route scores 1
(ii)	$V = \mathcal{E} \{10 / 10.2\} ; = 0.98 (\mathcal{E})$	2	
(c)	any <b>two</b> reasons for moving coil or against the other instruments: e.g. gives a measurable deflection (65 mm) / meter resistance only affects emf by 2% / c.r.o. deflection too small (0.7 mm) / DVM is overloaded with $700 \mu\text{V}$	<u>2</u> 10	NOT low resistance NOT more or most sensitive
9(ai)	sampling ; levels ; further quality e.g. binary levels labelled 000 to 111 / quantisation errors indicated / regular sampling	2 1	credit annotated diagram / description or 1/2/3 style
(ii)	$(2^{10}) = 1024$	1	accept 1023
(iii)	resolution = p.d. / intervals / = $9 / 1023 \text{ m} ; = 8.8 \text{ mV e}$	2	accept 1024/ ecf (ii)
(b)	4 sensors x (10/8) bytes x (4 x 24 x 30) samples $\text{m} ;$ 14.(4) kbytes $\text{e} /$ accept 115200 bits	1 1	method in words / numbers
(c)	$t = Q / I / = 500 / 0.02 \text{ m} ;$ $= 25000 \text{ s e} ; = 25000 / (60 \times 60) \text{ hrs} = 6.9 \text{ hrs}$ / 0.29 days $\text{e}$	1 <u>2</u> 11	ora $30 \text{ d} \approx 2.6 \times 10^6 \text{ s}$ ora $Q = 51840 \text{ C}$ scores 3 marks
10ai)	F where rays parallel to principal axis meet	1	if principal focus OK
(ii)	rays cross over at F or better	1	
(bi)	straight line through points by eye	1	
(ii)	intercept = 0.1 (m)	1	allow $\pm 0.01 \text{ (m)}$
(iii)	it is the closest to the lens a real image can be formed / object at $\infty / 1/v = 1/f /$ incoming waves zero curvature $= 1 / -0.2 (= -5.0 \text{ D})$	1 1	AW NOT $h = 0$ NOT $v = f$
(ci)	$1/v = 1/u + P = 5 / 1/v = -5 + 10 = (+) 5 ;$	1	method in words or number
(ii)	$\therefore v = 1/5 = 0.20 \text{ m e}$	1	
(iii)	$v = u /$ (magnification =) $v/u = 1 /$ object at $2f$	<u>1</u> 9	
	Total section B	40	