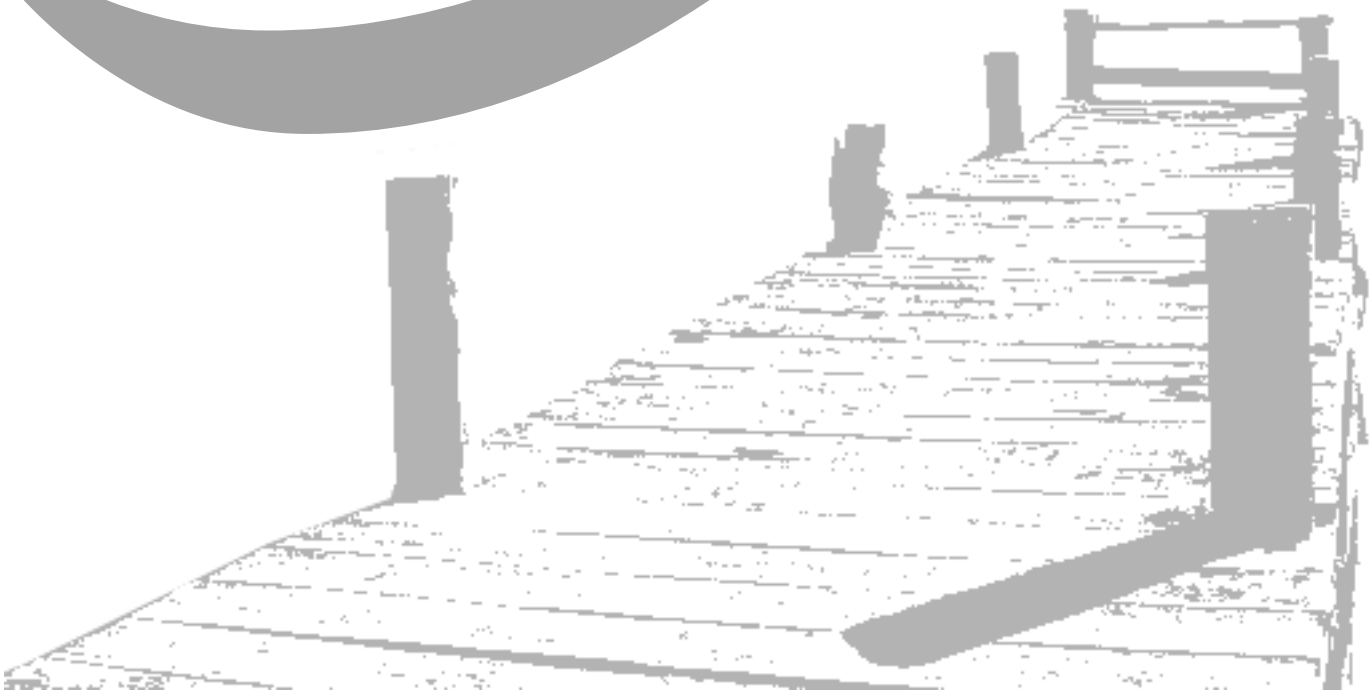
GCE
AS and A Level

Physics A

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 5B: Approved specimen mark scheme

Version 1.1



version : 1.1

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 2451

Specification A

PHA5B Medical Physics

Mark Scheme

The specimen assessment materials are provided to give centres a reasonable idea of the general shape and character of theplanned question papers and mark schemes in advance of the first operational exams.

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.

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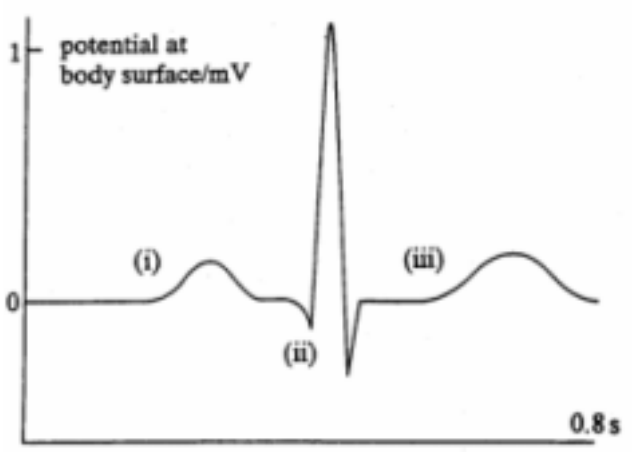
Dr Michael Cresswell Director General

PHA5B: Medical Physics

Question 1		
(a)	diagram to show rays refracted inwards at cornea ✓ rays refracted inwards at lens ✓ rays focused at optic axis on retina ✓	**max 2**
(b)	only cones at fovea ✓ moving away from fovea, more rods, less cones ✓	**2**
(c) (i) (ii)	to control the intensity of light reaching retina ✓ forms a small pupil ✓	**2**
(d) (i) (d) (ii)	accommodation: ability of the eye/lens to (change and) focus on different object distances ✓ [adjustment of the eye/lens to form a clearly focused image on the retina] changing the shape of the lens [or using the cillary muscles] ✓	**2**
	Total	**8**

Question 2		
(a)	electrodes made from a material which does not become polarised electrodes coated with conductive gel hair and dead skin removed any two ✓✓	**2**
(b)	high gain high input impedance low noise any two ✓✓	**2**
(c)	 for waveform: suitable scales ✓ correct shape ✓ for marking in correct position on waveform: atrial depolarisation (i) ✓ ventricular depolarisation (ii) ✓ ventricular repolarisation (iii)✓	**5**
	Total	**9**

Question 3			
(a)		3 kHz ✓	**1**
(b)	(i)	(age related) as *f* increases, loss increases ✓	**2**
	(ii)	(noise related) loss is maximum at 4 kHz✓	
(c)	(i)	(use of *intensity level* = 10 log $\frac{I}{I_0}$ gives) $I = 1.0 \times 10^{-12} \times 10^{86/10}$ ✓ $= 3.98 \times 10^{-4}\,\text{W m}^{-2}$ ✓	**4**
	(ii)	(use of same equation gives) intensity level = 10 log $\left(\frac{3.98\times10^{-4} - 7.0\times10^{-5}}{1.0\times10^{-12}}\right)$ ✓ $= 85(.2)\,\text{dB}$ ✓ (allow CE for incorrect *I* from (i))	
		Total	**7**

Question 4			
(a)		1: vacuum/evacuated (tube) ✓ 2: lead (lined shield) ✓ 3: electrons (beam) ✓	**3**
(b)	(i)	heat is spread over a greater volume/area/section ✓ thus allows more energetic X-rays to be produced [or allows X-rays to be generated for longer] ✓	**max 3**
	(ii)	(bevelled edge) gives larger target area ✓ but small source area (to produce sharp image) ✓	
(c)	(i)	the fraction of X-rays removed per unit thickness of the material✓	**max 2**
	(ii)	the thickness of the material which will reduce the intensity to half its original level✓ for a specified energy of the X-rays (in either (i) or (ii)) ✓	
(d)		(use of $\mu = \frac{\ln 2}{X_{1/2}}$ gives) $\mu = \frac{\ln 2}{3.2} = 0.22\,\text{mm}^{-1}$ $(0.217\,\text{mm}^{-1})$ ✓ (use of $I = I_0\,e^{-\mu x}$ gives) $I = 6.0 \times e^{-0.217 \times 2}$ ✓ (allow CE for value of μ) $= 3.9\,\text{W m}^{-2}$ ✓	**3**
		Total	**11**

		Assessment Objectives	
Question No		*Ability tested*	*Marks*
1	(a)	AO2	**2**
	(b)	AO1	**2**
	(c)	AO2	**2**
	(d)	AO1/AO2	**2**
		Question Total	**8**
2	(a)	AO1	**2**
	(b)	AO2	**2**
	(c)	AO1/AO2	**5**
		Question Total	**9**
3	(a)	AO1	**1**
	(b)	AO3	**2**
	(c)	AO2	**4**
		Question Total	**7**
4	(a)	AO1	**3**
	(b)	AO2	**3**
	(c)	AO1	**2**
	(d)	AO2	**3**
		Question Total	**11**
		Total	**35**

	Summary	
Marks	*Ability tested*	*%*
13	AO1 Knowledge and Understanding	37
20	AO2 Application	57
2	AO3 How Science Works	6

	Summary Common Section & Section B Medical Physics	
Marks	*Ability tested*	*%*
26	AO1 Knowledge and Understanding	35
44	AO2 Application	59
5	AO3 How Science Works	6