

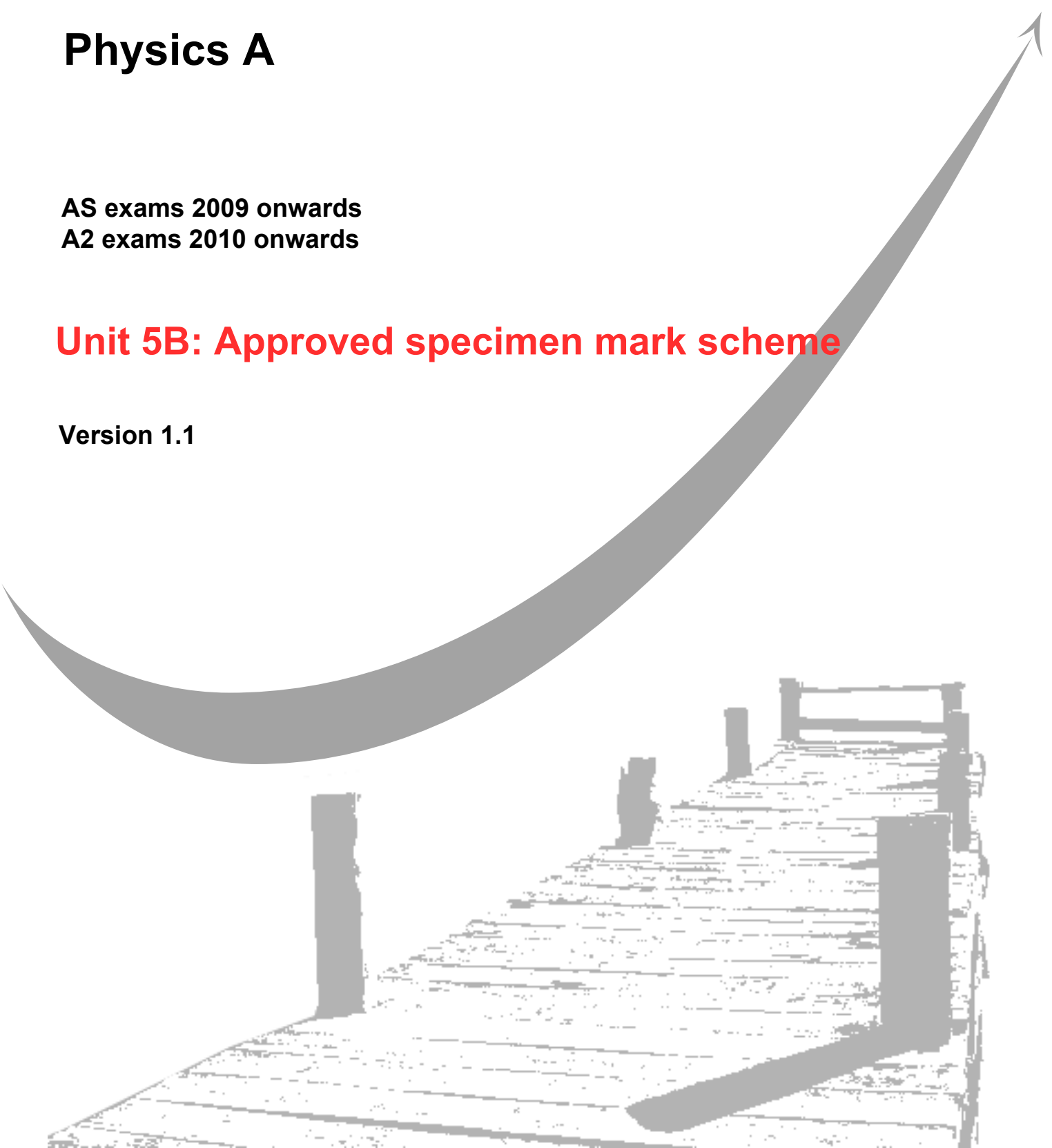
**GCE**  
**AS and A Level**

# **Physics A**

**AS exams 2009 onwards**  
**A2 exams 2010 onwards**

## **Unit 5B: Approved specimen mark scheme**

**Version 1.1**





## **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 the planned 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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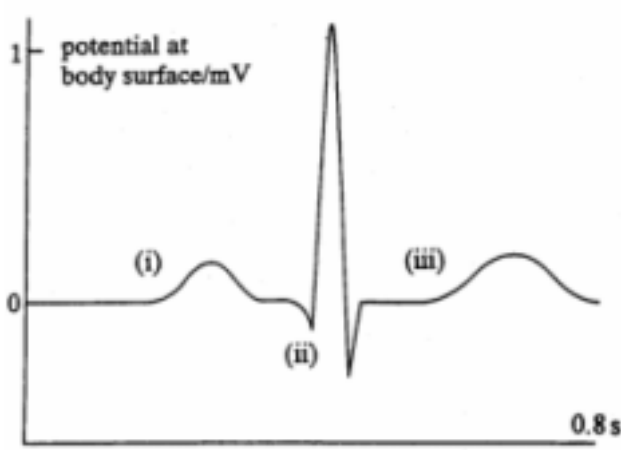
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## PHA5B: Medical Physics

<b>Question 1</b>		
(a)	diagram to show rays refracted inwards at cornea ✓ rays refracted inwards at lens ✓ rays focused at optic axis on retina ✓	<b>max 2</b>
(b)	only cones at fovea ✓ moving away from fovea, more rods, less cones ✓	<b>2</b>
(c)	(i) to control the intensity of light reaching retina ✓ (ii) forms a small pupil ✓	<b>2</b>
(d)	(i) 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]	<b>2</b>
(d)	(ii) changing the shape of the lens [or using the ciliary muscles] ✓	
	<b>Total</b>	<b>8</b>

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)	 <p data-bbox="1069 873 1276 985">for waveform: suitable scales ✓ correct shape ✓</p> <p data-bbox="414 1209 957 1433">for marking in correct position on waveform: atrial depolarisation (i) ✓ ventricular depolarisation (ii) ✓ ventricular repolarisation (iii) ✓</p>	5
	<b>Total</b>	<b>9</b>

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

<b>Question 4</b>		
(a)	1: vacuum/evacuated (tube) ✓ 2: lead (lined shield) ✓ 3: electrons (beam) ✓	<b>3</b>
(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] ✓ (ii) (bevelled edge) gives larger target area ✓ but small source area (to produce sharp image) ✓	<b>max 3</b>
(c)	(i) the fraction of X-rays removed per unit thickness of the material ✓ (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)) ✓	<b>max 2</b>
(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 $\mu$ ) $= 3.9 \text{ W m}^{-2}$ ✓	<b>3</b>
<b>Total</b>		<b>11</b>

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

<b>Summary</b>		
<i>Marks</i>	<i>Ability tested</i>	<i>%</i>
13	AO1 Knowledge and Understanding	37
20	AO2 Application	57
2	AO3 How Science Works	6

<b>Summary Common Section &amp; Section B Medical Physics</b>		
<i>Marks</i>	<i>Ability tested</i>	<i>%</i>
26	AO1 Knowledge and Understanding	35
44	AO2 Application	59
5	AO3 How Science Works	6