
A-LEVEL

Physics

PHA5/2B – Medical Physics
Mark scheme

2450
June 2017

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Further copies of this mark scheme are available from aqa.org.uk

Question	Answers	Additional Comments/Guidance	Mark	ID details
1 (a) (i)	At 1 Hz, individual flashes of light seen ✓ At some frequency the flashes appear to join to form continuous light so that no flashing seen at 40 Hz ✓	Need reference to change from flash to continuous around a given frequency	2	
1 (a) (ii)	Process is called persistence of vision ✓	Allow 'sight' for 'vision'	1	
1 (b)(i)	$(1/f = 1/u + 1/v)$ $2.10 = 1/0.250 + 1/v$ ✓ $v = (-)$ 52.6 cm ✓ 3 sig figs ✓	Sig fig mark stands alone. Allow 'x' for 'v'	3	
1 (b)(ii)	unaided near point ✓	Automarked question	1	
1 (c)	long sight / presbyopia / hypermetropia ✓		1	
1 (d)	1 correct ray ✓ 2nd correct ray with labelled image and foci ✓	Which refers to a virtual image	2	
Total			10	

Question	Answers	Additional Comments/Guidance	Mark	ID details
2 (a)	<p>The candidate's writing should be legible and the spelling, punctuation and grammar should be sufficiently accurate for the meaning to be clear. The candidate's answer will be assessed holistically. The answer will be assigned to one of three levels according to the following criteria.</p> <p>Good to Excellent The information conveyed by the answer is clearly organised, logical and coherent, using appropriate specialist vocabulary correctly. The form and style of writing is appropriate to answer the question.</p> <p><i>The candidate explains the principles of transfer of vibrations, from mechanical vibration of the ear drum, through mechanical oscillations of the malleus, incus and stapes acting as a lever system, producing mechanical vibration of the oval window and then pressure waves in the fluid in the cochlea. They use the correct names of the relevant parts of the ear.</i></p> <p><i>They then explain the increase in pressure with sensible use of numbers, reduction in area of about 20 and increase in force of about 1.5, resulting in pressure increase of about 30.</i></p> <p>Modest to Adequate The information conveyed by the answer may be less well organised and not fully coherent. There is less use of specialist vocabulary, or specialist vocabulary may be used incorrectly. The form and style of writing is less appropriate.</p> <p><i>The candidate explains some of the principles of transfer of vibrations and mentions some of the names of the relevant parts of the ear. They talk about the increase in pressure, but may fail to add relevant numbers</i></p> <p>Poor to Limited The information conveyed by the answer is poorly organised and may not be relevant or coherent. There is little correct use of specialist vocabulary. The form and style of writing may be only partly appropriate.</p>		<p>Mark range</p> <p>5-6</p> <p>3-4</p>	

	<p><i>The candidate explains a principle of transfer of vibrations or explains the increase in pressure and mentions at least one of the names of the relevant parts of the ear</i></p> <p>Incorrect, Inappropriate or No Response No answer at all or answer refers to unrelated, incorrect or inappropriate physics.</p> <p>The explanation expected could include the following: Outer ear acts as a funnel gathering waves into the ear canal pressure waves incident on eardrum eardrum vibrates, mechanical vibrations mechanical vibrations passed through a system of three bones acting as levers malleus, incus and stapes the last bone sets the oval window into mechanical vibration this produces pressure waves in the liquid in the cochlea. three bone lever system increase force by about 1.5 (1.3 to 1.7) times ✓ cross-sectional area of the oval window about 20 (15 to 25) times less than the cross-sectional area of the eardrum ✓ larger force / smaller area gives pressure about 30 times greater (any answer for pressure, to agree with other values quoted).</p>	<p>2-1</p> <p>0</p>		
2 (b)	<p>Intensity is the power per unit (cross-sectional) area (in path of the wave) ✓ At normal incidence ✓</p>		2	
2 (c)	<p>rearrange equation to give $I = \frac{P}{A}$ ✓ correct answer $3.2 \times 10^{-8} \text{ W m}^{-2}$ ✓</p>		2	
Total			10	

Question	Answers	Additional Comments/Guidance	Mark	ID details
3 (a)	electrical potential axis: mV: 0 where line starts to 1 at top of peak ✓ time axis: s: 0 at start to 0.8 at end of trace (tolerance 0.2) ✓		2	
3 (b)	depolarisation - potential across membrane going from - to +/or changes sign and repolarisation - potential across membrane going from + to - /or back to resting potential ✓ depolarisation due to movement of Na ⁺ ions into the cell ✓ repolarisation due to movement of K ⁺ ions out of cell ✓	If neither the 2 nd or 3 rd mark awarded, a single mark can be given if depolarisation due to movement of Na ⁺ ions and repolarisation due to movement of K ⁺ ions without direction of movement.	3	
3 (c)	P atrial depolarisation/signal from sinoatrial node, causes atria to contract ✓ Q (ventricular depolarisation) causes ventricles to contract and (atrial repolarisation allows) atria to relax ✓ T ventricular repolarisation allows ventricles to relax ✓		3	
Total			8	

Question	Answers	Additional Comments/Guidance	Mark	ID details
4 (a) (i)	Fluorescent screen A – converts X-ray (photon) to light (photons)/lower energy photon(s)		1	
4 (a) (ii)	Photocathode – uses (energy of) each light photon to release an electron from surface of cathode	Do not allow converts light/photon into electron	1	
4 (a) (iii)	Anodes – accelerate (released) electrons focuses electron beams	Mention of negative anode disqualifies first mark awarded. Do not accept direct towards the screen as focussing	2	
4 (a) (iv)	Fluorescent screen B – converts energy of electron(s) into (many) light (photons)	Do not allow converts electrons into light/photons	1	
4 (b)	Without barium poor contrast between area to be investigated and surrounding tissue. Barium meal proves high proton number/ high density/high attenuation material at site to be investigated which provides much better contrast Barium meal proves high proton number/ high density/high attenuation material at site to be investigated which provides much better contrast between area to be investigated and surrounding tissue.	This will get first mark This will gain the second mark But this will get both marks	2	
Total			7	