# A-LEVEL
# PHYSICS A

## PHA5B – Medical Physics
## Mark scheme

2450
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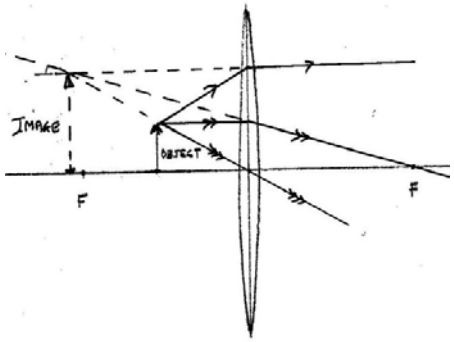
Version: 1.0 Final

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) | At 1Hz, individual flashes of light seen ✓<br>At some frequency the flashes appear to join to form continuous light so that no flashing seen at 40Hz ✓<br>Process is called persistence of vision ✓ | Need reference to change from flash to continuous around a given frequency<br><br>Allow 'sight' for 'vision' | 3 | |
| 1 (b)(i) | ($1/f = 1/u + 1/v$ ) 1.75 = 1/0.250 + $1/v$ ✓<br>$v$ = ( - ) 44.4 cm ✓ 3 sig figs ✓ | Sig fig mark stands alone. Allow 'x' for 'v' | 3 | |
| 1 (b)(ii) | this is the (defective eye's) unaided near point ✓ | Allow uncorrected near point | 1 | |
| 1 (c) | long sight / presbyopia / hypermetropia ✓ | | 1 | |
| 1 (d) | 1 correct ray ✓<br>2nd correct ray with labelled image and foci ✓ | Which refers to a virtual image | 2 | |

| | | | | |
|---|---|---|---|---|
| |  | | | |
| 2 (a) | Minimum intensity heard by normal/average ear ✓<br>At frequency of 1kHz ✓ | | 2 | |
| 2 (b) | Response of ear is logarithmic ✓<br>Allows very large range of intensities to be on sensible scale ✓ | | 2 | |
| 2 (c)(i) | Ageing; loss increases as f increases ✓ | Allow higher frequencies are lost | 1 | |
| 2 (c)(ii) | Noise; loss increases up to 4 kHz ✓<br>then decreases after this frequency ✓ | Allow loss increases and then decreases for 1 mark<br>Allow greatest loss at 4kHz for 2 marks | 2 | |

| question | answers | extra information | mark |
|---|---|---|---|
| 3 | | **The candidate's writing should be legible and the spelling, punctuation and grammar should be sufficiently accurate for the meaning to be clear.**<br>The candidate's answer will be assessed holistically. The answer will be assigned to one of three levels according to the following criteria. | 6 |

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

| 0 marks | Level 1 (1–2 marks) | Level 2 (3–4 marks) | Level 3 (5–6 marks) |
|---|---|---|---|
| | **Low Level (Poor to limited): 1 or 2 marks**<br>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. There will be a few of the guidance points mentioned, but there will be little cohesion in the writing. | **Intermediate Level (Modest to adequate): 3 or 4 marks**<br>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.<br>The answer may discuss the direction of blood flow, the delay from SA to SV and the need for valves or the compression and relaxation processes. | **High Level (Good to excellent): 5 or 6 marks**<br>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.<br>The answer will discuss the direction of blood flow and will mention the correct chambers, the time of the delay from SA to SV and the need for valves. They should write about compression and the relaxation processes. The names of valves may be included, but the use of the valves should be explained. |

| examples of the points made in the response | extra information |
|---|---|
| **The explanation expected in a competent answer should include a coherent selection of the following points concerning the physical principles involved and their** | |

| | |
|---|---|
| **consequences in this case.**<br>pulse passes over both atria and causes them to contract<br>forces blood into ventricles<br>pulse passes to AV node and delayed for about 0.1 s<br>AV node fires and causes ventricles to contract forcing blood around the body and to the lungs: atria relax<br>Bicuspid and tricuspid valves prevent blood backflow from ventricles into atria<br>as atria chambers relax draws blood into the atria<br>Ventricles relax<br>Semilunar valves stop blood backflow from body into ventricles<br>right chambers deal with de-oxygenated blood from body to lungs<br>left chambers deal with oxygenated blood from lungs to body<br>depolarisation and reverse polarisation from movement of $Na^+$ into axon cause contraction<br>Repolarisation of $K^+$ out of axon cause relaxation<br>-70mV to +30mV | |

| Question | Answers | Additional Comments/Guidance | Mark | ID details |
|---|---|---|---|---|
| 4 (a)(i) | Provide aperture through which X-rays may pass, stopping others ✓ | Alternatives: provides collimation; produces narrow beam of X-rays; protects areas of the body not being scanned | 1 | |
| 4 (a)(ii) | Filters out (most) low energy photons( but allows high energy photons to pass through) ✓ | Allow 'soft' or underpower' for low energy<br>Allow only high energy photons pass through | 1 | |
| 4 (b) | $I/I_0 = 0.917$ ✓<br>$\ln (0.917) = -\mu \times 2.7 \times 10^{-3}$ ✓<br>$\mu = 32.1$ ✓ | If 0.083 or 91.7 used, final 3 calc marks can be given<br>If 0.83 or 8.3 or 9.17 used, final 2 calc marks can be | 5 | |

| | | | | |
|---|---|---|---|---|
| | $\mu_m = \mu / 2700 = 0.012$ ✓<br>$m^2 kg^{-1}$ ✓ | given<br>Unit mark is independent mark | | |
| 5 (a) | any **three** points from:<br><br>supplied radio pulse excite H **nuclei**<br><br>when H nuclei de-excite/change spin/change alignment they emit radio photon/signal/em radiation<br><br>these signals are detected and passed to computer<br><br>gradient in static magnetic field<br><br>to allow location to be determined<br>or magnetic field aligns nuclei | Allow Hydrogen protons for nuclei | Max 3 | |
| 5 (b) | **any two reasons**, eg<br>(non-ionising) so no known harm caused to unborn baby,<br>gives good images of soft tissue,<br>relatively cheap | Accept correct reverse arguments for X-rays<br><br>Do not allow better resolution | 2 | |
| | | | | |
| **Total** | | | **35** | |