# A-LEVEL

# Physics

PHA5/2B – Medical Physics

Mark scheme

2450

June 2015

Version/Stage: 1 Final Mark Scheme

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 |
|---|---|---|---|---|
| 1ai | Ans C; Myopia or short sight | Auto marked | 1 | AO1 |
| 1aii | Concave/diverging lens drawn | | 1 | AO1 |
| 1aiii | Rays diverge at correcting lens<br>Rays converge at eye and are focussed at retina | | 1<br>1 | AO2<br>AO2 |
| 1bi | So that rays (from a distant object )appear to come from the far point (of the defective eye) | OR to form (virtual) image at the (unaided) far point | 1 | AO1 |
| 1bii | f = - 0.75<br>P = 1/f = - 1.3 (D) | Do not accept – 4/3 | <br>1 | <br>AO2 |
| 1biii | $1/u = 1/f - 1/v = \frac{1}{-0.75} - \frac{1}{-0.15}$<br>$u$ = 0.19 (m)<br>2 sig figs | | 1<br>1<br>1 | AO2<br>AO2<br>AO2 |
| **Total** | | | 9 | |

| Question | Answers | Additional Comments/Guidance | Mark | ID details |
|---|---|---|---|---|
| 2ai | The dB scale<br>Equal response across all frequencies | Allow decibel scale Not DB<br>Allow unaffected by / independent of frequency | 1<br>1 | AO1<br>AO2 |
| 2aii | The dBA scale<br>Response depends upon **frequency** as **ear's response** does | Allow adjusted/adapted decibel scale Not DBA | 1<br>1 | AO1<br>AO2 |
| 2bi | Point R has equal values on both scales (as 1kHz) is the frequency used to define threshold value. | Allow reference frequency for dBA scale | 1 | AO1 |
| 2bii | Point S is at (3kHz as this is) the frequency at which the ear is most sensitive. | Allow most sensitive as at peak of curve | 1 | AO1 |
| 2c | $I = 1.0 \times 10^{-12} \times 10^{9.5}$<br>$I = 3.2 \times 10^{-3}$ (W $m^{-2}$) | First mark for any correct initial equation<br>Only penalise 1 sig fig. | 1<br>1 | AO2<br>AO2 |
| **Total** | | | 8 | |

| Question | Answers | Additional Comments/Guidance | Mark | ID details |
|---|---|---|---|---|
| 3 | 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 student accurately describes measures to ensure good contact between the electrodes and the skin including the use of conducting gel. The student will mention the need for more than one electrode and the need for the patient to remain relaxed and still. They will need at least two properties of the amplifier. | Points which might be considered include<br><br>attach more than one electrode<br><br>To reduce contact resistance<br>• sandpaper skin to remove hairs and some dead skin<br>• apply conducting gel between electrode and skin<br>• securely attach electrode and stick/tape in place<br><br>To remove unwanted signals<br>• electrodes should be non-reactive<br>• patient to remain relaxed and still<br>• shielded leads/reducing interference from ac sources<br><br>Properties of amplifier<br>• large input impedance<br>• high gain<br>• low noise or differential amp | 6 | AO1 x 2<br>AO2 x 2<br>AO3 x 2 |

| | | | | |
|---|---|---|---|---|
| | 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. The student will include most measures to ensure good contact between electrodes and the skin. They should give a property of the amplifier and may mention the need for the patient to remain relaxed and still.<br><br>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. The student will mention electrodes connected to the skin and might make some other sensible comments on the arrangement. | | | |

| | | | |
|---|---|---|---|
| **Total** | | | 6 |

| Question | Answers | Additional Comments/Guidance | Mark | ID details |
|---|---|---|---|---|
| 4ai | Coherent – used to transfer/transmit image (out of body)<br>Coherent – same fibre arrangements **at both ends of bundle** | <br>Allow same relative position<br>Do not allow symmetrical | 1<br>1 | AO2<br>AO2 |
| 4aii | Non-coherent – used to transfer light into body (to illuminate)<br>Non-coherent – random fibre arrangement along bundle | <br>Do not allow not symmetrical | 1<br>1 | AO1<br>AO1 |
| 4b | $\sin \theta_c = 1.49/1.52$<br>$\theta_c = 79$ (degree) | | <br>1 | <br>AO2 |
| **Total** | | | 5 | |

| Question | Answers | Additional Comments/Guidance | Mark | ID details |
|---|---|---|---|---|
| 5ai | Fluorescent screen A – converts X-ray (photon) to light (photons)/lower energy photon(s) | | 1 | AO2 |
| 5aii | Photocathode – uses (energy of) each light photon to release an electron from surface of cathode | **Do not allow converts light/photon into electron** | 1 | AO2 |
| 5aiii | Anodes – accelerate (released) electrons<br>focuses electron beams | **Mention of negative anode disqualifies first mark awarded.**<br>**Do not accept direct towards the screen as focussing** | 2 | AO2 |
| 5aiv | Fluorescent screen B – converts energy of electron(s) into (many) light (photons) | **Do not allow converts electrons into light/photons** | 1 | AO2 |
| 5b | Without Barium poor contrast between area to be investigated and surrounding tissue.<br>Barium meal proves high proton number/ high density/high attenuation material at site to be investigated which provides much better contrast<br>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<br>This will gain the second mark<br>But this will get both marks | 1<br>1 | AO1<br>AO1 |
| **Total** | | | 7 | |