

Commentary on candidate responses

The candidate evidence has achieved the following marks for each question of this course assessment component.

Question /Response	Mark	Commentary
Q8(a)(i)	1	
Response 1	1	The candidate has explained the production of bright spots using a diagram. This is acceptable, as described in <i>Physics: general marking principles</i> , issue 19. The diagram is clear without requiring labels.
Response 2	0	The candidate's response explains the production of an interference pattern, but is not specific to <i>bright spots</i> , and so the mark is not awarded.
Response 3	1	The candidate's explanation is acceptable.
Q8(a)(iii)	2	
Response 1	1	The candidate has given a correct statement, but their justification is incorrect.
Response 2	1	The candidate has given a correct statement, but their justification does not link the increased density of lines to a decrease in line spacing, and so is not sufficient for the second mark to be awarded.
Response 3	1	Again, the candidate has given a correct statement, but their justification does not state that slit separation decreases, and so is not sufficient for the second mark to be awarded.
Response 4	2	The candidate has given a correct statement, and an acceptable justification.
Q8(a)(iv)	1	
Response 1	0	The candidate's statement is incorrect.
Response 2	0	The candidate's statement is incorrect.
Response 3	0	The candidate's statement is incorrect. The word ' <i>same</i> ' is not an acceptable alternative to ' <i>constant</i> ' in this context.
Response 4	1	The candidate's statement is correct.
Q8(b)	1	
Response 1	0	The candidate's suggestion is not acceptable.
Response 2	1	The candidate's suggestion is acceptable.
Response 3	1	The candidate has given an acceptable suggestion (lines running vertically, horizontally). The addition of 'and diagonally' is not an incorrect suggestion.
Q9(a)	2	
Response 1	1	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer. The value stated in the penultimate line, however, is rounded incorrectly and so one mark is not awarded.
Response 2	2	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer. The value

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		stated in the penultimate line is truncated as indicated by the ellipsis (...). This is not treated as incorrect rounding.
Response 3	2	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer. Again, the value stated in the penultimate line is truncated as indicated by the ellipsis (...). This is not treated as incorrect rounding.
Q9(b)(i)	1	
Response 1	1	The candidate's statement is acceptable. The description of the angle of incidence in terms of 'the middle line' rather than the normal is not ambiguous in this case.
Response 2	0	The candidate's statement does not refer to the angle of incidence, and so is not acceptable.
Response 3	0	Again, the candidate's statement does not refer to the angle of incidence, and so is not acceptable.
Q9(b)(iii)	4	
Response 1	4	The candidate has shown total internal reflection with the correct angle of incidence (38°), refraction at the base of the triangle with the refracted ray changing direction away from the normal with the correct angles of incidence and refraction (22° and 45°).
Response 2	1	The candidate has shown the correct angle of incidence (38°), but has shown neither total internal refraction nor any refraction at the base of the triangle.
Response 3	3	The candidate has shown total internal reflection but has omitted the unit ($^\circ$) from the angle of incidence (38). They have also shown refraction at the base of the triangle with the refracted ray changing direction away from the normal with the correct angles of incidence and refraction (22° and 45°).
Response 4	3	The candidate has shown total internal reflection with the correct angle of incidence (38°), refraction at the base of the triangle with the refracted ray changing direction away from the normal with the correct angle of incidence (22°), but has omitted the angle of refraction (45°).
Q9(c)	1	
Response 1	0	The candidate's description 'higher up on the screen' is acceptable, but 'certain less colours' is incorrect. Issue 21 from the <i>Physics: general marking principles</i> (the +/- rule) applies, and the mark is not awarded.
Response 2	1	The candidate's descriptions 'less refracted' and 'red and violet light closer together' are both acceptable.
Response 3	1	The candidate's description is acceptable.
Response 4	0	The candidate's description is incorrect.
Q10(a)	2	

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Response 1	0	The candidate's statement does not make it sufficiently clear that the electrons occupy discrete energy levels/shells.
Response 2	2	Both of the candidate's statements are acceptable. The second statement 'orbiting electron shells' is accepted as loose language and taken to mean that the electrons orbit rather than the shells.
Response 3	1	The candidate's first statement is acceptable. The second statement is incorrect as referring to photon frequency.
Response 4	1	The candidate's first statement is acceptable. The second statement does not sufficiently describe the nucleus.
Q10(b)	3	
Response 1	1	The candidate has selected an appropriate relationship ($E = hf$), but has not substituted all the data correctly. ($E_3 = -1.36 \times 10^{-19} \text{ J}$). The mark for the final answer cannot be accessed.
Response 2	3	The candidate has selected an appropriate relationship, substituted correctly, and has given an acceptable final answer. The value stated in the penultimate line is truncated as indicated by the ellipsis (...). This is not treated as incorrect rounding.
Response 3	3	The candidate has selected an appropriate relationship, substituted correctly, and has given an acceptable final answer. Correct determination of the energy difference between E_3 and E_1 is implied by the substitution for 'E'.
Q10(c)	5	
Response 1	4	The candidate has selected two appropriate relationships and substituted data correctly into each. The final answer, however, is not in the 'acceptable' range due to rounding at an intermediate stage, and so the mark for the final answer is not awarded. The value stated in the penultimate line of the first calculation is truncated as indicated by the ellipsis (...). This is not treated as incorrect rounding.
Response 2	5	The candidate has selected two appropriate relationships and substituted data correctly into each. The final answer is in the 'acceptable' range, and the penultimate line shows that the candidate did not round at the intermediate stage.
Response 3	4	The candidate has selected two appropriate relationships and substituted data correctly into each. The final answer, however, is not in the 'acceptable' range due to rounding at an intermediate stage, and so the mark for the final answer is not awarded.
Response 4	4	The candidate has selected two appropriate relationships and substituted data correctly into each. The unit, however, has not been included in the final answer.
Q11(a)	1	
Response 1	0	The candidate's statement is incorrect.
Response 2	0	The candidate's statement is incorrect.
Response 3	0	The candidate's statement is incorrect.
Response 4	1	The candidate's statement is correct.

Question /Response	Mark	Commentary
Q11(b)	3	
Response 1	0	The candidate's initial statement 'internal resistance = m' is incorrect.
Response 2	2	The candidate has substituted acceptable values into the gradient relationship (the omission of the ' $\times 10^{-6}$ ' from the values on the denominator could be consistent with a correct unit in the final answer). The calculated value of the gradient is acceptable, but the unit in the final answer is not consistent with the substitutions made, and so the mark for the final answer is not awarded (<i>Physics: general marking principles, issue 5a</i>).
Response 3	3	The candidate has used an acceptable alternative method to determine the internal resistance. Data selected from the graph is correct and the final answer acceptable.
Q11(c)	1	
Response 1	0	The candidate's explanation is not sufficiently clear.
Response 2	1	The candidate's suggestion is acceptable.
Response 3	1	Again, the candidate's suggestion is acceptable, being similar to the second alternative acceptable answer given in the marking instructions.
Q12(a)(ii)	3	
Response 1	2	An acceptable relationship is implied by correct substitution of data. The candidate has omitted a unit in the final answer, and so this mark is not awarded.
Response 2	0	Again, the candidate has not stated a selected relationship. An acceptable relationship cannot be implied by the candidate's incorrect substitution of data. The mark for the final answer cannot be accessed.
Response 3	3	The candidate has selected an appropriate relationship, substituted correctly and has given the correct final answer.
Q12(a)(iii)	2	
Response 1	1	The candidate's explanation acceptably covers one of the required elements of the answer (LEDs will light when they are forward biased), but not the other element (the change in polarity of voltage changes the biasing).
Response 2	0	The candidate's explanation does not satisfactorily cover either element of the answer.
Response 3	1	The candidate's explanation acceptably covers one of the required elements of the answer (LEDs will light when they are forward biased), but has not quite explained the other element (the change in polarity of voltage changes the biasing).
Response 4	0	The candidate's explanation does not satisfactorily cover either element of the answer.
Q12(b)	5	
Response 1	4	The candidate has used an alternative acceptable approach in answering the question. They have selected appropriate relationships, substituted correctly into each, but has not given an

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		acceptable final answer, possibly due to rounding at the intermediate stage. The mark for the final answer is not awarded.
Response 2	5	The candidate has selected appropriate relationships, substituted correctly into each, and given an acceptable final answer.
Response 3	3	By correct substitution of data, the candidate has implied an appropriate relationship ($V_{\text{peak}} = \sqrt{2}V_{\text{RMS}}$). The candidate has also stated an acceptable relationship for the second stage of the question, but has substituted data incorrectly. The mark for the final answer cannot be accessed.
Response 4	4	As in response 1, the candidate has used an alternative acceptable approach in answering the question. They have selected appropriate relationships, substituted correctly into each, but has not given an acceptable final answer, possibly due to rounding at the intermediate stage. The mark for the final answer is not awarded.
Q13(b)	(i) 3 (ii) 2 (iii) 2	
Response 1 (i)	3	The candidate has linear scales and appropriate labels and units on the axes of the graph, has plotted the data points accurately, and drawn an acceptable line of best fit.
(ii)	1	The candidate has correctly substituted data into the relationship to calculate the gradient of the line of best fit, but has given an incorrect unit in the final answer.
(iii)	1	The candidate has correctly substituted data into the given relationship, but again has given an incorrect unit in the final answer.
Response 2 (i)	3	The candidate has linear scales and appropriate labels and units on the axes of the graph, has plotted the data points accurately and drawn an acceptable line of best fit.
(ii)	0	The candidate has not correctly substituted data into the relationship to calculate the gradient of the line of best fit. The data point used (0.5, 6.2) does not lie on the line of best fit, even when the $\pm \frac{1}{2}$ box tolerance is applied. The mark for the final answer cannot be accessed.
(iii)	2	The candidate has selected a data point from the line of best fit, (0.40, 4.9) which is within the $\pm \frac{1}{2}$ box tolerance, substituted the data correctly into the given relationship, and given an acceptable final answer.
Response 3 (i)	1	The candidate has linear scales but not appropriate labels and units on the axes of the graph. The unit of depth ($h?$) is incorrect. The candidate has plotted the data points accurately. The line of best fit is not acceptable at this level.
(ii)	2	The candidate has correctly substituted data into the relationship to calculate the gradient of the line of best fit, and has given an acceptable final answer. The data point selected are correct within the $\pm \frac{1}{2}$ box tolerance.

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(iii)	1	The candidate has selected a data point from the line of best fit, (0·10, 1·2) which is within the $\pm \frac{1}{2}$ box tolerance, substituted the data correctly into the given relationship, but has given an incorrect unit (not consistent with the substitution of 1·2 rather than 1200) in the final answer.
Response 4 (i)	2	The candidate has linear scales and appropriate labels and units on the axes of the graph, has plotted the data points accurately but the line of best fit is not acceptable at this level.
(ii)	0	The candidate has selected appropriate data points from their line of best fit, but has substituted the data incorrectly into the gradient relationship. The mark for the final answer cannot be accessed.
(iii)	0	The candidate has transposed the given relationship incorrectly prior to the substitution of data. The mark for substitution and the mark for the final answer cannot be accessed.