Commentary on candidate responses

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

Question /Response	Mark	Commentary
Q1(a)(i)(A)	**1**	
Response 1	**1**	The candidate has given an acceptable final answer.
Response 2	**1**	Despite missing the left hand side of the relationship, the candidate's final answer is correct.
Response 3	**0**	The candidate's final answer is acceptable, but there is a rounding error in the penultimate line, and so the mark is not awarded.
Q1(a)(i)(B)	**1**	
Response 1	**1**	The candidate has given a correct final answer.
Q1(a)(ii)	**3**	
Response 1	**3**	The candidate has selected an appropriate relationship, substituted correctly, and given an acceptable final answer.
Response 2	**1**	The candidate has selected an appropriate relationship, but has substituted incorrectly. The mark for the final answer cannot be accessed.
Response 3	**0**	The candidate has not selected an appropriate relationship. The marks for substitution and final answer cannot be accessed.
Q1(a)(iii)	**4**	
Response 1	**4**	The candidate has used a correct alternative method. An appropriate relationship is selected, with correct substitutions with negative signs consistent with the convention used. The addition and subtraction of heights is correct and the final answer is acceptable.
Response 2	**1**	The candidate has selected an appropriate relationship, but has substituted incorrectly ($t = 0·45$ s). The marks for any subsequent addition and for the final answer cannot be accessed.
Response 3	**0**	The candidate has not selected an appropriate relationship. The marks for substitution, for any subsequent addition, and for the final answer, cannot be accessed.
Q1(b)	**2**	
Response 1	**1**	The candidate has correctly stated that the horizontal and vertical components of velocity are greater. The subsequent explanation, although superficially appearing correct, does contain some incorrect statements and ideas, and so the second mark is not awarded.
Response 2	**0**	The candidate's response is incomplete, making no statement that the initial vertical speed or horizontal speed is greater.
Response 3	**0**	Again, the candidate's response is incomplete, making no statement that compares the initial vertical or horizontal speeds.

Question /Response	Mark	Commentary
Q2(a)(iii)	**2**	
Response 1	**2**	The candidate makes a correct statement describing the vertical motion of the drone near the end of the response. The justification is just sufficient, with the vectors in the free-body diagram implying that the upward force is greater than the weight.
Response 2	**2**	The candidate's statement describing the vertical motion of the drone is correct, and has been justified correctly by calculation.
Response 3	**2**	The candidate has given a correct description and justification.
Q2(b)	**4**	
Response 1	**1**	The candidate has correctly calculated the weight of the package, but has not determined the weight supported by each cord. In addition, the candidate has not substituted into an appropriate relationship.
Response 2	**4**	The candidate has correctly calculated the weight of the package, the weight supported by each cord, substituted correctly into the 'cosine' relationship and given an acceptable final answer.
Response 3	**4**	Again, the candidate has correctly calculated the weight of the package, the weight supported by each cord, substituted correctly into the 'cosine' relationship and given an acceptable final answer.
Q3(a)	**2**	
Response 1	**2**	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer.
Response 2	**2**	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer.
Response 3	**2**	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer.
Q3(b)	**3**	
Response 1	**2**	The candidate has selected an appropriate relationship, substituted correctly but given an incorrect final answer due to an arithmetic slip.
Response 2	**1**	The candidate has selected an appropriate relationship, but has not substituted correctly (should be $u = -0\cdot3$, using the candidate's sign convention). Even if the unit in the final answer had been correct, the mark for the final answer cannot be accessed.
Response 3	**3**	The selection of an appropriate relationship can be implied by the candidate's correct substitution of data. The candidate's final answer is correct.
Q3(c)	**2**	
Response 1	**2**	The candidate's explanation covers both the determination and correct comparison of the total kinetic energies before and after the interaction.

Question /Response	Mark	Commentary
Response 2	0	The candidate neither states nor implies that the *total* kinetic energies of the system before and after the interaction should be determined and compared, and so the marks are not awarded.
Response 3	2	Through their description, the candidate implies the determination of the total kinetic energies of the system before and after the interaction. The comparison is also correct.
Q5(a)	**1**	
Response 1	0	The candidate's response 'red shift' alone is not a sufficient piece of evidence for the Big Bang theory.
Response 2	0	The candidate's first answer (*Cosmic microwave background radiation*) is acceptable, but their second answer (*redshift of light from planets*) is not acceptable. The second answer negates the first. This is commonly known as the '+/- rule' and is explained in the *Physics: general marking principles*, issue 21.
Response 3	0	In their attempt to explain redshift, the candidate does not mention *light*, or relate redshift to the movement of stars, and so their response is not acceptable.
Q5(b)(i)	**2**	
Response 1	2	The candidate has correctly substituted data into the given relationship and calculated the correct final answer.
Response 2	0	The candidate has not shown the substitution of data into the given relationship, and has given an incorrect final answer. The correct substitution cannot be implied from an incorrect final answer, and so the marks are not awarded.
Q5(b)(ii) A	**1**	
Response 1	0	The candidate's calculation of the Hubble constant is correct for the line of best fit that has been drawn, and so the candidate's statement 'Hubble's constant is not as accurate' is both ambiguous and insufficient to fully answer the question.
Response 2	1	The candidate's statement is taken as equivalent to the first of the possible acceptable answers given in the marking instructions.
Response 3	1	The candidate's statement is taken as the equivalent to the fourth of the possible answers in the marking instructions.
Response 4	0	The candidate's statement is not acceptable.
Response 5	0	The candidate's statement is not acceptable.
Q5(b)(ii) B	**1**	
Response 1	1	The candidate's suggestion is acceptable, being similar to the second possible acceptable answer given in the marking instructions.
Response 2	1	The candidate's suggestion is acceptable.
Response 3	1	Again, the candidate's suggestion is acceptable, being similar to the second possible acceptable answer given in the marking instructions.
Response 4	0	The candidate's response is not acceptable.

Question /Response	Mark	Commentary
Q5(c)	**1**	
Response 1	**0**	The candidate's response is incorrect.
Response 2	**1**	The candidate's response is correct.
Response 3	**0**	Again, the candidate's response is incorrect.
Q6(a)(i)	**2**	
Response 1	**0**	The candidate has not explicitly stated an appropriate relationship, and so cannot access the mark for substitution of data. A correct relationship cannot be implied by 'correct' substitution of data in a 'show' type question. In addition, the candidate has not included the unit in the final answer.
Response 2	**2**	The candidate has explicitly stated an appropriate relationship and substituted data correctly, stating the given final answer.
Q6(a)(ii)	**3**	
Response 1	**2**	The candidate has selected an appropriate relationship, substituted correctly but has not included the correct unit in the final answer.
Response 2	**2**	The candidate has selected an appropriate relationship, substituted correctly but has made an incorrect statement, $\sqrt{5\cdot71} \times 10^{14} = 2\cdot3891448\cdot62$, and so the mark for the final answer is not awarded.
Response 3	**3**	The candidate has selected an appropriate relationship, substituted correctly and has given an acceptable final answer.
Q6(b)	**2**	
Response 1	**0**	The candidate has not suggested an observed change. The mark for justification cannot be accessed.
Response 2	**0**	The candidate's suggested observed change is incorrect. Again, the mark for justification cannot be accessed.
Response 3	**1**	The candidate's suggested observed change is acceptable, but their justification does not imply an increase in the *rate* of electrons hitting the screen.
Response 4	**1**	Again, the candidate's suggested observed change is acceptable, but their justification does not imply an increase in the energy *of the electrons* hitting the screen.
Q7(a)	**1**	
Response 1	**0**	In their response, the candidate confuses 'protons' with photons, also suggesting that protons are ejected from the plate.
Response 2	**0**	The candidate does not include 'the energy of photons' in their response.
Response 3	**0**	The candidate's response suggests that electrons are ejected from the gold leaf, rather than from the plate of the electroscope.
Response 4	**0**	The candidate's response suggests that the gold leaf is made to deflect by the ultraviolet light.

Question /Response	Mark	Commentary
Q7(b)(i)	**1**	
Response 1	**0**	The candidate's response would have been acceptable if the correct energy had been quoted ($6 \cdot 94 \times 10^{-19}$ J).
Response 2	**0**	The candidate's statement is incorrect.
Response 3	**0**	The candidate's statement defines work function, but does not answer the question.
Q7(b)(ii)	**2**	
Response 1	**1**	The candidate's statement is correct, but their justification is not sufficient for the second mark to be awarded.
Response 2	**1**	The candidate's statement is correct, but their justification is not sufficient for the second mark to be awarded. Justification has to be in terms of photon energy.
Response 3	**2**	The candidate's statement is correct and their justification is acceptable.
Q7(c)	**2**	
Response 1	**1**	The candidate has shown a lower threshold frequency, but the gradient of their line is not the same as the given line.
Response 2	**2**	The candidate has shown a lower threshold frequency, and the gradient of their line is acceptable as the same as the given line.
Response 3	**2**	The candidate has shown a lower threshold frequency. Although not drawn using a ruler the line is acceptable and shows the same gradient as the given line.
Q7(d)	**1**	
Response 1	**1**	The candidate's explanation is acceptable.
Response 2	**1**	The candidate's explanation is acceptable, being sufficiently close to the alternative acceptable explanation on the right hand side of the marking instructions.
Response 3	**0**	The candidate's explanation is not acceptable.