Physics: general marking principles

National 3—Advanced Higher

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General marking principles

These general marking principles will be used in the marking of question papers in SQA qualifications in physics at National 5, Higher and Advanced Higher levels. It should be noted, however, that specific marking instructions may contain some moderation of the principles in the light of particular issues relating to the paper.

The marking principles described in this document will be applied in the verification of assessment judgements relating to the relevant outcomes of unit assessments. Teachers/lecturers should use these general instructions in marking candidate evidence.

Centres are advised to adopt these general instructions for the marking of prelim examinations and centre-devised assessments for any SQA physics courses.

Issue	Example	Instructions to markers
Standard 3 marker	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response** $V = IR$ or $I = \frac{V}{R}$ or $R = \frac{V}{I}$ $7 \cdot 5 = 1 \cdot 5 \times R$ $R = 5 \cdot 0\ \Omega$	1 mark for a selected relationship which could lead to the correct final answer. 1 mark for correct substitution. 1 mark for the correct final answer, including unit. **Award 3 marks**

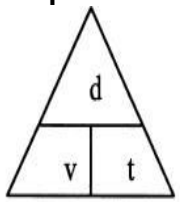
Issue	Example	Instructions to markers
1 **No working**	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response 1** '$R = 5{\cdot}0\ \Omega$' or '$5{\cdot}0\ \Omega$' alone	1 mark for implied selected relationship. 1 mark for implied substitution. 1 mark for correct final answer, including unit. **Award 3 marks**
	Response 2 '$R = 5{\cdot}0$' or '$R = 5{\cdot}0$ A' or '$5{\cdot}0$ A'	1 mark for implied selected relationship. 1 mark for implied correct substitution. Mark for final answer not awarded (incorrect/missing unit). **Award 2 marks**
	Response 3 '$R = 4{\cdot}0\ \Omega$' or '$R =$ Ω'	No evidence of implied selected relationship. **Award 0 marks**

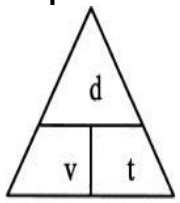
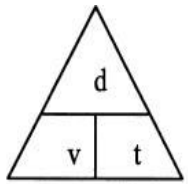
Issue	Example	Instructions to markers
2 Arithmetic error	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response 1** $V = IR$ $7 \cdot 5 = 1 \cdot 5 \times R$ $R = 4 \cdot 0\ \Omega$ **Response 2** $V = IR$ $7 \cdot 5 = 1 \cdot 5 \times R$ $R = 4 \cdot 0\ \text{A}$	1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded (incorrect value). **Award 2 marks** 1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded (incorrect value and incorrect unit). **Award 2 marks**

Issue	Example	Instructions to markers
	Response 3 $V = IR$ $R = 4 \cdot 0\ \Omega$	1 mark for selected relationship. There is no evidence for an implied correct substitution, and so this mark is not awarded. **Award 1 mark**
3 **Relationship only**	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response 1** $V = IR$ **Response 2** $V = IR \qquad P = I^2R$	1 mark for selected relationship. **Award 1 mark** Multiple relationships quoted, but unclear which relationship has been selected. **Award 0 marks**

Issue	Example	Instructions to markers
4 **Incorrect transposition**	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response 1** $V = IR$ $7 \cdot 5 = 1 \cdot 5 \times R$ $R = \frac{1 \cdot 5}{7 \cdot 5}$ $R = 0 \cdot 2\ \Omega$ **Response 2** $V = IR$ $R = \frac{I}{V}$ $R = \frac{7 \cdot 5}{1 \cdot 5} = 5 \cdot 0\ \Omega$	1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded. **Award 2 marks** 1 mark for selected relationship. Incorrect transposition so the mark for substitution is not awarded. The mark for the correct final answer cannot be accessed. **Award 1 mark**

Issue	Example	Instructions to markers
5 **Omission**	**Question** The current in a resistor is 1·5 A when the potential difference across it is 7·5 V. Calculate the resistance of the resistor. **Response 1** $R = \frac{7 \cdot 5}{1 \cdot 5}$ $R = 5 \cdot 0\ \Omega$ **Response 2** $R = \frac{7 \cdot 5}{1 \cdot 5}$ $R = 0 \cdot 2\ \Omega$ **Response 3** $R = 0 \cdot 2\ \Omega$	Credit should be given where the omitted information **can be clearly implied from the response**. **Note: this does not apply to 'show' type questions in which the answer is given. (Issue 20)** 1 mark for the implied selected relationship. 1 mark for correct substitution into the relationship. 1 mark for correct final answer, including unit. **Award 3 marks** 1 mark for the implied selected relationship. 1 mark for correct substitution into the relationship. Mark for final answer not awarded. **Award 2 marks** A correct selected relationship is not implied by an incorrect final answer when a substitution is not shown. The marks for substitution and final answer cannot be accessed. **Award 0 marks**

Issue	Example	Instructions to markers
	Response 4 $1 \cdot 5 = 7 \cdot 5 \times R$ $R = 5 \cdot 0\ \Omega$	Selection of an incorrect relationship is implied by the substitution. The marks for substitution and correct final answer cannot be accessed. **Award 0 marks**
6 **Use of triangle relationship**	**Question** A car travels at a constant speed of 25 m s^{-1}. Calculate the distance the car travels in 40 s. **Response 1**  $d = 25 \times 40$ $d = 1000\,\text{m}$	Ignore any triangle written on the script. Start marking at the selected or implied relationship. 1 mark for selected relationship implied by the substitution. 1 mark for correct substitution. 1 mark for correct final answer, including unit. **Award 3 marks**

Issue	Example	Instructions to markers
	Response 2  $d = \frac{40}{25}$ $d = 1{\cdot}6\,\text{m}$ **Response 3**  	Selection of an incorrect relationship is implied by the substitution. The marks for substitution and final answer cannot be accessed. **Award 0 marks** Mark for selection of relationship not awarded. Marks for substitution and final answer cannot be accessed. **Award 0 marks**
7 **Squaring error** (This also applies to powers other than 2)	**Question** Calculate the kinetic energy of a 3·0 kg mass travelling at 2·0 m s^{-1}. **Response 1** $E_k = \frac{1}{2}mv^2$ $E_k = 0{\cdot}5 \times 3{\cdot}0 \times 2{\cdot}0^2$ $E_k = 3{\cdot}0\,\text{J}$	1 mark for the selected relationship. 1 mark for correct substitution into the relationship. Mark for final answer not awarded (incorrect value). **Award 2 marks**

Issue	Example	Instructions to markers
	Response 2 $E_k = \frac{1}{2}mv^2$ $E_k = 0{\cdot}5 \times 3{\cdot}0 \times 2{\cdot}0$ $E_k = 3{\cdot}0\,\text{J}$	1 mark for the selected relationship. Mark for substitution not awarded (squaring not shown). The mark for final answer cannot be accessed. **Award 1 mark**
	Response 3 $E_k = \frac{1}{2}mv^2$ $E_k = 0{\cdot}5 \times 3{\cdot}0 \times 2{\cdot}0$ $E_k = 6{\cdot}0\,\text{J}$	1 mark for the selected relationship Mark for substitution not awarded (squaring not shown). Mark for correct final answer cannot be accessed. **Award 1 mark – despite correct final answer.**
	Response 4 $E_k = \frac{1}{2}mv^2$ $E_k = 0{\cdot}5 \times 3{\cdot}0 \times 4{\cdot}0$ $E_k = 6{\cdot}0\,\text{J}$	1 mark for the selected relationship. 1 mark for correct substitution into the relationship (squared value has been substituted correctly). 1 mark for correct final answer, including unit. **Award 3 marks**

Issue	Example	Instructions to markers
8 **Incorrect substitution of a physical constant**	**Question** A ray of monochromatic light has a frequency of $4{\cdot}57 \times 10^{14}$ Hz. Calculate the wavelength of this light in air. **Response** $v = f\lambda$ $2{\cdot}00 \times 10^{8} = 4{\cdot}57 \times 10^{14} \times \lambda$ $\lambda = 4{\cdot}38 \times 10^{-7}\ \text{m}$	1 mark for a selected relationship. Mark for substitution not awarded (incorrect value substituted for *v*). Mark for final answer cannot be accessed. **Award 1 mark**
9 **Unit conversion error**	**Unit conversion error in final answer** **Question** Question where the correct final answer is $2{\cdot}2 \times 10^{-4}\ \text{m}$ **Final answer in response** $2{\cdot}2 \times 10^{-4}\ \text{m} = 22\ \text{mm}$	**Note: this does not apply to 'show' type questions in which the answer is given. (Issue 20)** The mark for a correct final answer is not awarded. **In a 'standard 3 marker', award a maximum of 2 marks, assuming a correct relationship(s) is selected and values are substituted correctly.**

Issue	Example	Instructions to markers
	Error in converting a non SI unit **Question** A car travels at an average speed of 8·0 m s^{-1} for 1·5 minutes. Calculate the distance travelled by the car in this time. **Response** $d = 8 \cdot 0 \times 1 \cdot 5$ $d = 12\,\text{m}$	1 mark for the implied selected relationship 1 mark for substitution is awarded even though the substitution for time is not an SI unit. The mark for the final answer cannot be accessed. **Award 2 marks**
	Error in converting an SI unit **Question** An aeroplane travels 6·0 km in 12 s. Calculate its average speed. **Response** $v = \frac{s}{t}$ $v = \frac{6 \cdot 0}{12}$ $v = 0 \cdot 50\,\text{m}\,\text{s}^{-1}$	1 mark for selected relationship. 1 mark for substitution. Mark for final answer not awarded due to incorrect unit for the values substituted. **Award 2 marks (Note: 0·50 km s^{-1} would be awarded 3 marks.)**

Issue	Example	Instructions to markers
10a Significant figures in final answer	**Question** Calculate the kinetic energy of a 0·950 kg ball travelling at 2·35 m s^{-1}. **Response** $E_k = \frac{1}{2}mv^2$ $E_k = 0\cdot5 \times 0\cdot950 \times 2\cdot35^2$ $E_k = 2\cdot6231875$ $E_k = 2\cdot62\,\text{J}$ **If the final answer in the Response is** 3 J, 2·62319 J, 2·623188 J or 2·6231875 J **Question** An unbalanced force of 4·0 N is applied to a 6·0 kg mass. Calculate the acceleration of the mass. **Response** $F = ma$ $4\cdot0 = 6\cdot0 \times a$ $a = 0\cdot6\dot{6}\,\text{m s}^{-2}$	In rounding to an expected number of significant figures, the mark can be awarded for answers which have up to two figures more or one figure less than the number in the data with the fewest significant figures. 1 mark for selected relationship. 1 mark for correct substitution. 1 mark for the correct final answer, including unit. (2·6 J, 2·623 J and 2·6232 J are also acceptable) **Award 3 marks** Mark for final answer is not awarded. **Award a maximum of 2 marks** 1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer is not awarded. (Use of the recurrence dot implies an infinite number of significant figures.) **Award 2 marks**

Issue	Example	Instructions to markers
10b Significant figures in intermediate calculations	**Question** In a ripple tank, a wave generator produces 9 waves in 27 seconds. The wavelength of the waves is 4·5 cm. Determine the speed of the waves. **Response** $f = \frac{N}{t}$ $f = \frac{9}{27}$ $f = 0 \cdot 3$ $v = f\lambda$ $v = 0 \cdot 3 \times 4 \cdot 5$ $v = 1\ \text{cm}\,\text{s}^{-1}$	In numerical calculations involving intermediate stages, candidates should not round intermediate values. If intermediate rounding leads to a final answer which is incorrect then treat as an arithmetic error. (Issue 2) 1 mark for selected relationship. 1 mark for correct substitution. 1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded (rounding of *f* at an intermediate stage has resulted in an incorrect final answer). (Final answer should be 2 cm s^{-1} rounded from 1·5 cm s^{-1}.) **Award 4 marks**

Issue	Example	Instructions to markers
11 Rounding errors	**Correct rounding** If the digit immediately following the least significant digit is less than 5 then round down. If the digit immediately following the least significant digit is 5 or more then round up. **Question** In a ripple tank, a wave generator produces 31waves in 65 seconds. The wavelength of the waves is 4·5 cm. Determine the speed of the waves. **Response** $f = \frac{N}{t}$ $f = \frac{31}{65}$ $f = 0 \cdot 47$ $v = f\lambda$ $v = 0 \cdot 47 \times 4 \cdot 5$ $v = 2 \cdot 1 \text{ cm s}^{-1}$	Any incorrect rounding, whether it appears in the final answer or at an intermediate stage, should be treated as an arithmetic error. (Issue 2) 1 mark for selected relationship. 1 mark for correct substitution. 1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded. (The final answer is correct, but there is incorrect rounding of *f* at an intermediate stage.) **Award 4 marks**

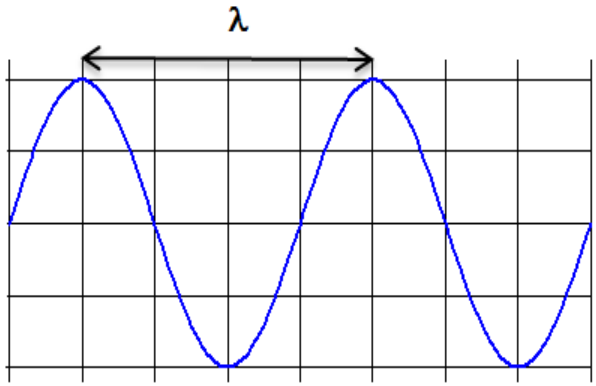
Issue	Example	Instructions to markers
12 **Vulgar fractions**	**Question** Calculate the acceleration of a 2·0 kg mass when an unbalanced force of 1·0 N acts on it. **Response** $F = ma$ $1 \cdot 0 = 2 \cdot 0 \times a$ $a = \frac{1}{2}\,\mathrm{m\,s^{-2}}$	Final answers should always be given in decimal notation with the appropriate number of significant figures. Two examples of exceptions to this would be a final answer expressing phase difference in terms of a fraction of π (eg π/4, 3π/2) or the charge on a quark (eg +2/3 e). 1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded. **Award 2 marks**
13 **Use of incorrect index notation**	**Question** A car travels at a constant speed of 75 m s^{-1}. Calculate the distance it travels in 240 s. **Response** $d = \bar{v}t$ $d = 75 \times 240$ $d = 1 \cdot 8^{4}\,\mathrm{m}$ or $1 \cdot 8\ 10^{4}\,\mathrm{m}$	1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded. **Award 2 marks**

Issue	Example	Instructions to markers
14 **Multiple errors in final answer**	An arithmetic, a significant figure, a rounding, a vulgar fraction, an index notation, and a unit error appear in the final answer.	If any, or all, of these errors are present in the final answer, the mark for the final answer is not awarded. **In a 'standard 3 marker', award 2 marks, where a suitable relationship is selected and substitution is correct.**
15 **Additional calculations beyond the required answer**	**Question** A golf ball is struck with an initial vertical velocity of 9·9 m s^{-1}. Calculate the maximum height of the ball. **Response** $v^2 = u^2 + 2as$ $0 = 9 \cdot 9^2 + 2 \times 9 \cdot 8 \times s$ $s = 5 \cdot 0$ m so maximum height $= 2 \times 5 \cdot 0 = 10$ m	1 mark for selected relationship. 1 mark for correct substitution. Mark for final answer not awarded. (Candidate's final answer continues beyond the required answer.)

Issue	Example	Instructions to markers
16 **Application of wrong physics**	**Question 1** The bob of a simple pendulum has angular frequency 11 rad s^{-1}. The bob is released from a vertical amplitude of 0·16 m. Calculate the speed of the bob at its lowest position. **Response** $v^2 = u^2 + 2as$ $v^2 = 0 + 2 \times 9 \cdot 8 \times 0 \cdot 16$ $v = 1 \cdot 8\,\mathrm{m\,s^{-1}}$ **Question 2** A mass on the end of a string is being swung in a circle. Its angular velocity increases uniformly from 4 rad s^{-1} to 10 rad s^{-1} in a time of 6 s. Calculate the angular acceleration of the mass. **Response** $a = \frac{v-u}{t}$ $a = \frac{10-4}{6}$ $a = 1\,\mathrm{rad\,s^{-2}}$	0 marks are awarded in **part** of a question following the application of wrong physics or the use of a relationship which could not lead to the final answer. A response selecting the equations of motion could obtain a numerically correct answer but should be awarded 0 marks as the selected relationship is not valid for the motion of a pendulum bob. (The bob does not travel in a straight line / its acceleration is not uniform.) **Award 0 marks** Again, a response using the equations of linear motion could obtain a numerically correct answer but should be awarded 0 marks as the selected relationship is not valid for circular motion. **Award 0 marks** **Note: markers should not necessarily stop marking at the application of wrong physics. For example, data marks may be accessed when allocated in specific marking instructions. (Issue 21)**

Issue	Example	Instructions to markers
17a **Carry forward of an incorrect final answer from a previous question**	**Question** A car of mass 450 kg accelerates uniformly from rest to 15 m s^{-1} in 9·0 s. (a) Calculate the acceleration of the car. (b) Calculate the unbalanced force acting on the car. **Response** (a) $a = \frac{v-u}{t}$ $a = \frac{15-0}{5\cdot0}$ $a = 3\cdot0\,\text{m s}^{-2}$ (b) $F = ma$ $F = 450 \times 3\cdot0$ $F = 1400\,\text{N}$	An incorrect final answer can be carried forward and, if used correctly in a subsequent part of the question, full marks may be awarded for the subsequent part. 1 mark for selected relationship. Mark for substitution not awarded. The mark for final answer cannot be accessed. **Award 1 mark** 1 mark for selected relationship. 1 mark for correct substitution (allowing incorrect final answer from (a) to be carried forward). 1 mark for final answer, including unit. **Award 3 marks** **The carry forward of an incorrect response from (a) correctly in (b) would be indicated by a wavy line under the answer to (b).** **The exception to this is where a candidate is given the required numerical value or required relationship in one part of the question (possibly a 'show' type question) that is to be used in a subsequent part.** **In this case the GIVEN value or relationship MUST be used in the subsequent part.**

Issue	Example	Instructions to markers
17b **Carry forward of an incorrect value within a question**	**Question** A car of mass 450 kg travels at a steady speed. It travels 550 m in 25 s. Calculate its kinetic energy. **Response** $v = \frac{s}{t}$ $v = \frac{550}{20}$ $E_k = \frac{1}{2}mv^2$ $E_k = 0 \cdot 5 \times 450 \times \left(\frac{550}{20}\right)^2$ $E_k = 1 \cdot 7 \times 10^5 \text{ J}$	A wrong answer within **the same part** of a question could be awarded partial marks provided it is highlighted in the specific marking instructions. **This is indicated by a dotted line in the specific marking instructions, eg** $v = \frac{s}{t}$ 1 $v = \frac{550}{25}$ 1 --- $E_k = \frac{1}{2}mv^2$ 1 $E_k = 0 \cdot 5 \times 450 \times \left(\frac{550}{25}\right)^2$ 1 $E_k = 1 \cdot 1 \times 10^5 \text{ J}$ 1 1 mark for selected relationship Mark for correct substitution not awarded. Further marks may be accessed because of dotted line in the marking instructions. 1 mark for selected relationship 1 mark for correct substitution of mass and of incorrect value carried forward. 1 mark for final answer, including unit. **Award 4 marks**

Issue	Example	Instructions to markers
18 **Wrong experiment**	**Question** Describe an experiment which demonstrates the interference of sound. **Response** Candidate describes an experiment which demonstrates the interference of light.	**Award 0 marks**
19 **Solution by diagram**	**Question** State what is meant by the wavelength of a transverse wave. **Response** 	Credit should be given where a diagram or sketch, appropriately labelled, conveys correctly the response required by the question. Care should be taken with judgement of the accuracy of sketching. **Award the mark allocated**

Issue	Example	Instructions to markers
20 **'Show' questions**	**Question** An object of mass *m* is dropped from a height *h*. Show that its maximum speed is given by $v = 2\sqrt{gh}$ **Response** $E_k = \frac{1}{2}mv^2,\ E_p = mgh$ $E_k = E_p$ $\frac{1}{2}mv^2 = mgh$ $v = \sqrt{2gh}$ **Question** The mass of the water in a washing machine is 6·00 kg. Show that the minimum energy required to increase the temperature of the water from 15·0 ºC to 40·0 ºC is 627 000 J. **Response** $E_h = 4180 \times 6 \cdot 00 \times 25 \cdot 0$ $E_h = 627000\,\text{J}$	Where the final numerical answer to a question is given, or the derivation of a given relationship required, then **all steps** must be clearly and explicitly shown, including: (i) a statement of the relationship(s) selected from the Relationships Sheet (ii) substitution of data into the relationship, equating of relationships or algebraic manipulation, even those that might seem quite obvious (iii) a statement of the final numerical answer or relationship **Full credit given** **0 marks are awarded since the response does not start with an appropriate relationship.**

Issue	Example	Instructions to markers
21 **Data mark**	**Question** Calculate the electric field strength at a point 0·060 m from a point charge of +4·0 nC. (specific marking instructions indicate a 'standard 3 marker' with an additional mark for selecting the correct value of the permittivity of free space). **Response 1** $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$ $E = \frac{1}{4\pi\varepsilon_0}\frac{4\cdot0\times10^{-9}}{6\cdot0\times10^{-2}}$ $E = 6\cdot0\times10^{2}\ \mathrm{N\,C^{-1}}$ **Response 2** $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$ $E = \frac{1}{4\pi\times8\cdot85\times10^{-12}}\times\frac{4\cdot0\times10^{-9}}{6\cdot0\times10^{-2}}$ $E = 6\cdot0\times10^{2}\ \mathrm{N\,C^{-1}}$	A mark for selecting the correct data from the data sheet can be awarded **if indicated in the specific marking instructions**. This mark can be accessed independently i.e. the data mark can be awarded for the selection of correct data, even if it is selected after the application of wrong physics. Incorrect relationship is selected. Marks for substitution and final answer cannot be accessed. Value for ε_0 not selected. **0 marks awarded** Incorrect relationship is selected. Marks for substitution and final answer cannot be accessed. Correct value for ε_0 shown. 1 mark for data. **1 mark awarded**

Issue	Example	Instructions to markers
22 **Use of non-standard symbols**	**Question** A car is travelling at an average speed of 8 m s^{-1} for a time of 10 s. Calculate the distance it travels. **Response 1** $S = \frac{D}{T}$ $8 = \frac{D}{10}$ $D = 80\,\text{m}$ **Question** The potential difference across a parallel plate capacitor is 9·0 V when the charge stored on its plates is 22 μC. Calculate the capacitance of the capacitor. **Response** $C = FV$ $2 \cdot 2 \times 10^{-5} = F \times 9 \cdot 0$ $F = 2 \cdot 4\ \mu\text{F}$	Candidates are expected to select the appropriate relationship from the Relationships Sheet. Any exceptions to this will be detailed in the specific marking instructions. The substitution of the values for speed and time clarify that the candidate is using S for speed and T for time. 1 mark is awarded for the relationship. 1 mark for substitution. 1 mark for final answer, including unit. **3 marks awarded** **In this example, the use of C to represent charge is ambiguous as C should represent capacitance.** **0 marks awarded**

Issue	Example	Instructions to markers
23 **Surplus answers**	**Question** State one detector of infrared radiation. **Response** **CCD and Geiger-Muller tube.**	Where a question asks for or requires a specific number of reasons, examples, points, etc. and the candidate provides more than the required number of responses then each incorrect response negates a correct response. (This is commonly known as the +/- rule.) **0 marks** are awarded since there is one correct and one incorrect response. **This principle is not applied to open ended questions.**
24 **Open ended questions**		This type of question is identified by the phrase 'Using your knowledge …' and should be marked **holistically**, with the mark awarded considered after reading the candidate response in its entirety. Tally marks for each good point made should **not** be used. **A variety of physics arguments can be used to answer open-ended questions.** **Marks are awarded on the basis of whether the response overall demonstrates:** ♦ **good understanding 3 marks** ♦ **reasonable understanding 2 marks** ♦ **limited understanding 1 mark** ♦ **no understanding 0 marks** **More detailed marking guidance is given in the specific marking instructions.**

Issue	Example	Instructions to markers
25 Incorrect spelling		Incorrect spelling can be accepted if the word is easily identified and used correctly. However, when the meaning of an incorrectly spelled word is unclear, full credit is not given. Care should be taken to ensure that the incorrect spelling does not make the response ambiguous, leading to possible 'wrong physics'. Notable examples are for questions requiring the response 'reflection', 'refraction' or 'diffraction' and also 'fission' or 'fusion'. The spelling of these words is similar, but the words have totally different meanings.
	Response 1 Candidate uses the words 'aceleration' and 'velosity'.	The meaning of the incorrectly spelled words is clear. These incorrect spellings are accepted.
	Response 2 Candidate uses the words 'fussion', 'defraction' and 'rifraction'.	The meaning of the incorrectly spelled words is unclear. This incorrect spelling is not acceptable.