Cambridge Assessment International Education – Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:
Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:
Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:
Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1. Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.

2. The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.

3. Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane/ethene, glucagon/glycogen, refraction/reflection).

4. The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5. 'List rule' guidance (see examples below)

   For questions that require ***n*** responses (e.g. State **two** reasons…):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science

6. Calculation specific guidance

   Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

   For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

   For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

   Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7. Guidance for chemical equations

Multiples/fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Examples of how to apply the list rule

State **three** reasons…. [3]

A

1. Correct	✓	**2**
2. Correct	✓	
3. Wrong	×	

B (4 responses)

1. Correct, Correct	✓, ✓	**3**
2. Correct	✓	
3. Wrong	ignore	

C (4 responses)

1. Correct	✓	**2**
2. Correct, Wrong	✓, ×	
3. Correct	ignore	

D (4 responses)

1. Correct	✓	**2**
2. Correct, CON (of 2.)	×, (discount 2)	
3. Correct	✓	

E (4 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct, Wrong	✓	

F (4 responses)

1. Correct	✓	**2**
2. Correct	✓	
3. Correct CON (of 3.)	× (discount 3)	

G (5 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

H (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. CON (of 2.) Correct	(discount 2) ✓	

I (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. Correct CON (of 2.)	✓ (discount 2)	

Abbreviations

/	Alternative and acceptable answers for the same marking point.
( )	Bracketed content indicates words which do not need to be explicitly seen to gain credit but which indicate the **context** for an answer. The context does not need to be seen but if a context is given that is incorrect then the mark should not be awarded.
___	Underlined content must be present in answer to award the mark. This means either the exact word or another word that has the same technical meaning.

Mark categories

B marks	These are independent marks, which do not depend on other marks. For a **B** mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer.
M marks	These are method marks upon which **A** marks later depend. For an **M** mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer. If a candidate is not awarded an **M** mark, then the later **A** mark cannot be awarded either.
C marks	These are compensatory marks which can be awarded even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known them. For example, if an equation carries a **C** mark and the candidate does not write down the actual equation but does correct working which shows the candidate knew the equation, then the **C** mark is awarded. If a correct answer is given to a numerical question, all of the preceding **C** marks are awarded automatically. It is only necessary to consider each of the **C** marks in turn when the numerical answer is not correct.
A marks	These are answer marks. They may depend on an **M** mark or allow a **C** mark to be awarded by implication.

Annotations

✓	Indicates the point at which a mark has been awarded.
X	Indicates an incorrect answer or a point at which a decision is made not to award a mark.
XP	Indicates a physically incorrect equation ('incorrect physics'). No credit is given for substitution, or subsequent arithmetic, in a physically incorrect equation.
ECF	Indicates 'error carried forward'. Answers to later numerical questions can always be awarded up to full credit provided they are consistent with earlier incorrect answers. Within a section of a numerical question, ECF can be given after AE, TE and POT errors, but **not** after XP.

AE	Indicates an arithmetic error. Do not allow the mark where the error occurs. Then follow through the working/calculation giving full subsequent ECF if there are no further errors.
POT	Indicates a power of ten error. Do not allow the mark where the error occurs. Then follow through the working/calculation giving full subsequent ECF if there are no further errors.
TE	Indicates incorrect transcription of the correct data from the question, a graph, data sheet or a previous answer. For example, the value of 1.6×10^{-19} has been written down as 6.1×10^{-19} or 1.6×10^{19}. Do not allow the mark where the error occurs. Then follow through the working/calculation giving full subsequent ECF if there are no further errors.
SF	Indicates that the correct answer is seen in the working but the final answer is incorrect as it is expressed to too few significant figures.
BOD	Indicates that a mark is awarded where the candidate provides an answer that is not totally satisfactory, but the examiner feels that sufficient work has been done ('benefit of doubt').
CON	Indicates that a response is contradictory.
I	Indicates parts of a response that have been seen but disregarded as irrelevant.
M0	Indicates where an A category mark has not been awarded due to the M category mark upon which it depends not having previously been awarded.
^	Indicates where more is needed for a mark to be awarded (what is written is not wrong, but not enough). May also be used to annotate a response space that has been left completely blank.
SEEN	Indicates that a page has been seen.

Question	Answer	Marks	Guidance
1(a)	only ampere and kelvin underlined	B1	If none of the five words are underlined, then allow an alternative method of indication (e.g. circling or ticking)
1(b)	initial speed/velocity is zero (magnitude of) acceleration is constant/uniform	B1 B1	Ignore just '*u*' is zero, but allow this if '*u*' is then explained as being the initial speed/velocity. Allow 'moves from rest' or 'initially stationary' Allow 'resultant/net force' is constant/uniform Ignore just 'straight line velocity/motion/acceleration' as 'straight line' given in question. The List Rule applies.
1(c)(i)	$a = 2.75^2 / (2 \times 3.89)$ $= 0.97\ \text{m s}^{-2}$	A1	Allow 2 or more SF
1(c)(ii)	percentage uncertainty = (2 × 0.8) + 0.5 = 2.1%	C1 A1	Allow 2 or more SF. Allow 1/2 if see %*v* not doubled to give final answer 1.3%.
1(c)(iii)	absolute uncertainty = (2.1 / 100) × 0.97 $= 0.02\ \text{m s}^{-2}$	A1	Allow ECF from (c)(i) and (c)(ii) Allow final answer to 1 or more SF (as candidates are taught to present absolute uncertainties to 1SF) Method in left-hand column gives 0.020 (2SF) or 0.0204 (3SF) <u>Alternative Methods</u>: max $a = 2.772^2 / (2 \times 3.871) = 0.99$ so absolute uncertainty = $0.99 - 0.97 = 0.02\ \text{m s}^{-2}$ (A1) Allow max *a* to 3SF, so abs uncertainty = 0.993 – 0.97 = 0.023 or min $a = 2.728^2 / (2 \times 3.909) = 0.95$ so absolute uncertainty = $0.97 - 0.95 = 0.02\ \text{m s}^{-2}$ (A1) Allow min *a* to 3SF, so abs uncertainty = 0.97 – 0.952 = 0.018 ?? Discuss at STM if should automatically allow any 3SF answer that is between 0.018 and 0.023

Question	Answer	Mark	Guidance
2(a)(i)	$E = \sigma / \varepsilon$ or $E = F / A\varepsilon$ $A = 1.4 \times 10^4 / (2.2 \times 10^{11} \times 0.0012)$ $= 5.3 \times 10^{-5}$ m^2	C1 A1	Allow any subject. Allow word equation. Allow W or T for F. Allow $E = FL / Ax$ or FL / Ae or $FL / A\Delta L$
2(a)(ii)	$(\Delta)h = 0.64 \times 0.49$ $(\Delta)E = mg(\Delta)h$ or $W(\Delta)h$ $= 1.4 \times 10^4 \times 0.64 \times 0.49$ $= 4.4 \times 10^3$ J	C1 C1 A1	The first two marks may be scored independently of each other.
2(b)	$P = Fv$ or W / t $= 1.4 \times 10^4 \times 0.64$ or $4.4 \times 10^3 / 0.49$ $(= 9.0 \times 10^3)$ input power $= 9.0 \times 10^3 / 0.56$ $= 1.6 \times 10^4$ W	C1 C1 A1	Allow T or W or mg instead of F. Allow $P = (\Delta)E / t$ Possible ECF from (a)(ii)
2(c)	$W - T = ma$ $1.4 \times 10^4 - T = (1.4 \times 10^4 / 9.81) \times 1.3$ $T = 1.2 \times 10^4$ N	C1 C1 A1	Allow any subject. Allow mg instead of W. Allow $g = 10$ as gives same final answer to 2SF. Discuss at STM: $T - W = ma$ leading to $T = (-)1.2 \times 10^4$ N.
2(d)	From t_X to t_Y: an upward sloping straight line from $(t_X, 0)$ From t_Y to t_Z: an upward sloping curve with decreasing magnitude of gradient (that is horizontal at t_Z)	B1 B1	 The line between t_Y to t_Z must start at the end of the line between t_X to t_Y, but allow a slight 'kink' where they join at t_Y. Allow the line to be sloping upwards at t_Z, but do not allow any downward slope.

Question	Answer	Mark	Guidance
3(a)	resultant force (in any direction) is zero. resultant moment/torque (about any point) is zero	B1 B1	allow 'net force is zero' allow 'sum of forces is zero' or '$\Sigma F = 0$' allow 'sum of vertical forces = 0 and sum of horizontal forces = 0' Ignore 'forces are balanced' and 'forces cancel' Ignore 'there is no force' or 'force is zero' allow 'net moment is zero' allow 'sum of moments is zero' allow 'sum of CW moments = sum of ACW moments' allow 'sum of CW and ACW moments is zero' allow 'torque' instead of 'moment' Ignore 'there is no moment' or 'moment is zero' For either marking point, ignore 'no acceleration / constant velocity / stationary'. The List Rule applies.
3(b)	(component =) $17\sin 50° = 13$ (N) or $17\cos 40° = 13$(N)	A1	It is a show that question and so the calculation and the answer must both be shown. Allow answer to more than 2SF provided it is equal to 13 when rounded by the examiner to 2SF. Allow '$T = 17\sin 50 = 13$' (BOD).
3(c)	$(W \times 0.25)$ or (12×0.35) or (13×0.50) $(W \times 0.25) + (12 \times 0.35) = (13 \times 0.50)$ $W = 9.2$ N	C1 A1	First mark is for one correct moment. Not ECF from (b).
3(d)	$F = 9.2 + 12 - 13$ $= 8$ N	A1	Possible ECF from (c), but not ECF from (b). Allow ±8 N. Allow 1 or more SF (provided answer rounds to 8 to 1SF)
3(e)	decrease	B1	

Question	Answer	Mark	Guidance
4(a)	$E = ½mv^2$ $p = mv$ $m = 0.37^2 / (2\times0.30)$ or $0.37/1.6$ or $(0.30\times2)/1.6^2$ $= 0.23$ kg	C1 C1 A1	First two marks are independent of each other. Allow both C1 marks for $E = p^2/2m$ Allow both C1 marks if calculates $v = 1.6(2)$.
4(b)	$0.37 - 0.65 = -0.13 - p$ $p = 0.15$ kg m s^{-1}	 A1	 Allow ±0.15 kg m s^{-1}
4(c)	$7.7 = (0.13 + 0.37) / (\Delta)t$ or $7.7 = (0.65 - 0.15) / (\Delta)t$ time = 0.065 s	 C1 A1	Allow any subject Possible ECF from (b) <u>Special Cases</u>: Allow 1/2 for time = (0.37 – 0.13) / 7.7 = 0.031 s Allow 1/2 for time = (0.65 + 0.15) / 7.7 = 0.10 s (ECF fm (b)).

Question	Answer	Mark	Guidance
5(a)(i)	$T = 1/5000$ $(= 2.0 \times 10^{-4})$ time-base setting = $1.5 \times 2.0\times10^{-4} / 6.0$ or $2.0\times10^{-4} / 4.0$ $= 5.0 \times 10^{-5}$ s cm^{-1}	C1 A1	 Allow 1 or more SF. Answer must be in units of s cm^{-1}
5(a)(ii)	new trace drawn with same period as original trace new trace drawn with amplitude greater than 1.0 cm new trace drawn with amplitude of 1.7 cm	B1 M1 A1	Check period where trace crosses dashed centre line. Allow any period in range of 19.0 to 21.0 small squares. Allow trace drawn not in phase with original trace. Trace must touch/cross dashed line at least three times. Check amplitude at all peak(s) and trough(s). All amplitudes must be within 2 small squares of each other. Allow amplitude to be in range of 1.6 cm to 1.8 cm. Amplitude must be correct for all peak(s) and trough(s). For M1 and A1 marks the trace must show at least one peak and one trough.
5(b)(i)	path difference (from slits to P) is zero or phase difference (between waves at P) is zero (so constructive interference)	B1	Allow 'difference in path lengths (from slits to P) is zero' Allow 'paths (from slits to P) are the same length' Allow '(waves) in phase (at P)'. Ignore path difference = $n\lambda$ unless also says $n = 0$ Ignore phase difference = $360n$ unless also says $n = 0$
5(b)(ii)	$\lambda = ax/D$ $D = (3.6\times10^{-4} \times 4.0 \times 10^{-3}) / 630\times10^{-9}$ $= 2.3$ m	C1 C1 A1	Allow any subject. Allow 'y' or 'w' for 'x'. Allow 'd' for 'D'. Second mark is for full substitution of values (any subject). no or wrong conversion of nm to m is POT error.
5(c)	Upward sloping straight line starting from a non-zero value of x at $\lambda = 400$ nm.	B1	STM to discuss minimum horizontal range of the line (? past the right-hand side of unit nm?). Ignore any values of x given on the vertical axis.

Question	Answer	Mark	Guidance
6(a)	energy (transferred from electrical to other forms) / charge	B1	allow 'energy (transferred) per (unit) charge' allow 'work (done)' instead of 'energy transferred' allow 'energy over charge' allow 'ratio of energy and charge' not 'energy (transferred) by unit charge' (no ratio) not 'energy per coulomb' ignore just symbols unless symbols fully explained
6(b)(i)	(resistance is) infinite / very high	B1	ignore just 'constant' or just 'high'.
6(b)(ii)	(resistance) decreases (as V increases)	B1	
6(c)(i)	current = 2.7 – 1.5 = 1.2 A	 A1	
6(c)(ii)	12 = (1.5 × 5.0) + (1.5 × R) or R = (12/1.5) – 5.0 R = 3.0 Ω	C1 A1	Allow any subject Allow 1SF
6(c)(iii)	$V_{(XZ)}$ = (1.6 / 2.0) × 12 (= 9.6) $V_{(XW)}$ = 1.5 × 5.0 (= 7.5) potential difference = 9.6 – 7.5 = 2.1 V or $V_{(ZY)}$ = (0.4 / 2.0) × 12 (= 2.4) $V_{(WY)}$ = 1.5 × 3.0 (= 4.5) potential difference = 4.5 – 2.4 = 2.1 V	C1 C1 A1 (C1) (C1) (A1)	 Allow 1/3 for 9.6 or 7.5 given as final answer. Allow ±2.1V. Possible ECF from (c)(ii) Allow 1/3 for 2.4 or 4.5 given as final answer. Allow ±2.1V
6(c)(iv)	current in fixed resistor / variable resistor decreases current in resistance wire is unchanged (so) current in battery decreases (, same emf,) so power decreases	B1 B1 B1	Allow 'current in fixed/variable resistor < 1.5A' Allow 'current in lowest branch/part decreases'. Allow 'current in resistance wire still 1.2A' (ECF). Allow 'same current in middle branch/part'. Allow 'total current / overall current / sum of currents' instead of 'current in battery'. The full line is needed for the third B1 mark.

Question	Answer	Mark	Guidance
7(a)(i)	X has same number of protons as Y (and so) charge of X is the same as the charge of Y	B1	Statement and explanation both needed. Allow just 'same number (of protons) so same charge'
7(a)(ii)	X has (one) more proton (than Z) (so) X has greater charge (than Z)	M1 A1	Allow 'X has greater number (of protons)' Allow 'Z has (one) less proton (than X)' Allow 'Z has less charge (than X)' Allow 'it' to mean nucleus X. If unclear which nucleus a comment refers to, then assume it refers to X
7(b)(i)	meson(s)	B1	
7(b)(ii)	one quark and one antiquark	B1	Allow $q\bar{q}$. Ignore specific examples of mesons e.g. $u\bar{d}$.