N5

National
Qualifications
2023

2023 Physics

National 5

Finalised Marking Instructions

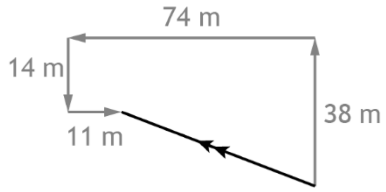
Marking instructions for each question

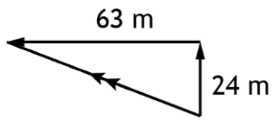
Section 1

Question	Answer	Mark
1.	D	1
2.	D	1
3.	C	1
4.	D	1
5.	B	1
6.	D	1
7.	A	1
8.	D	1
9.	E	1
10.	C	1
11.	D	1
12.	A	1
13.	C	1
14.	E	1
15.	C	1
16.	C	1
17.	B	1
18.	B	1
19.	A	1
20.	C	1
21.	B	1
22.	E	1
23.	A	1
24.	E	1
25.	B	1

Section 2

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>1.</td><td>(a)</td><td>(i)</td><td>Using Pythagoras:
resultant^2 = 24^2 + 63^2 (1)
resultant = 67 m (1)

Using scale diagram:


OR


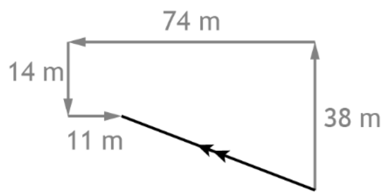
vectors to scale (1)
resultant = 67 m (1)
(allow ± 2 m tolerance)</td><td>2</td><td>Ignore any direction stated in the final answer in this part.

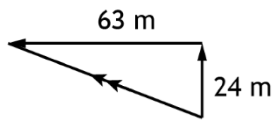
If clear arithmetic error shown in 38 – 14 = 24 or 74 – 11 = 63 then MAX (1) mark for substitution consistent with arithmetic error.

No requirement for arrows to be shown on diagram to calculate the magnitude of displacement.

Regardless of method, if a candidate shows a vector diagram (or a representation of a vector diagram ie a triangle with no arrows) and the vectors have been added incorrectly, eg head-to-head then MAX (1).

Accept:
70 m
67.4 m
67.42 m</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>1.</td><td>(a)</td><td>(ii)</td><td>
Using trigonometry:
$\tan\theta = \frac{63}{24}$ (1)
(θ = 69°)
direction = 291 (1)
Using scale diagram:


OR


vectors to scale (1)
direction = 291 (1)
(allow ± 2° tolerance)
</td><td>2</td><td>
Regardless of method, if a candidate shows a vector diagram (or a representation of a vector diagram ie a triangle with no arrows) and the vectors have been added incorrectly, eg head-to-head then MAX (1).

Alternative methods:
$\tan\theta = \frac{24}{63}$ (1)
(θ = 21°)
direction = 291 (1)
OR

Use of resultant value (and appropriate trigonometry) consistent with (a)(i),eg
$\sin\theta = \frac{63}{67}$ or $\sin\theta = \frac{24}{67}$

Ignore the degree symbol if the direction is stated as a bearing.

Accept:
21° North of West
69° West of North

Can obtain first mark for scale diagram method from suitable diagram in part (a)(i) if not drawn in this part. However, the candidate must attempt an answer in this part.

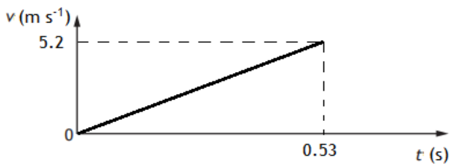
Ignore any magnitude stated in the final answer in this part.

Do not accept incorrect statements of trig functions at substitution stage, eg
$\tan = \frac{24}{63}$

Accept:
70° W of N 290
69.1° W of N 290.9
69.15° W of N 290.85
</td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
1.	(b)	(i)	$s = \bar{v}t$ **(1)** $67 = \bar{v} \times 31$ **(1)** $\bar{v} = 2.2$ ms^{-1} at 291 **(1)**	3	Or consistent with (a)(i) and/or (a)(ii) Bar not required above v. Accept $d = vt$ provided it is followed by a substitution of the value for displacement. Direction required for final mark Accept: 2 2.16 2.161
		(ii)	distance is greater (than displacement) **(1)** same time for both **(1)**	2	Or by calculation of speed showing correct substitution for distance (1) and time (1) ie $v = \frac{d}{t}$ $v = \frac{137}{31}$ **(1)+(1)** $(v = 4.4$ $ms^{-1})$ Note: any arithmetic, rounding or unit error in this calculation MAX (1)
	(c)	(i)	$E_P = mgh$ **(1)** $E_P = 0.0025 \times 9.8 \times 7.5$ **(1)** $E_P = 0.18$ J	2	**'Show' question** Final answer of 0.18 J including unit, must be shown or MAX (1)

Question			Expected response	Max mark	Additional guidance
1.	(c)	(ii)	$E_k = \frac{1}{2}mv^2$ **(1)** $0.18 = \frac{1}{2} \times 0.0025 \times v^2$ **(1)** $v = 12\ \text{ms}^{-1}$ **(1)**	3	Accept: 10 12.0 12.00 **Alternative method 1:** $v = \sqrt{2gh}$ (1) $v = \sqrt{2 \times 9.8 \times 7.5}$ (1) $v = 12\ \text{ms}^{-1}$ (1) **Alternative method 2:** $mgh = \frac{1}{2}mv^2$ (1) $0.0025 \times 9.8 \times 7.5 = \frac{1}{2} \times 0.0025 \times v^2$ (1) $v = 12\ \text{ms}^{-1}$ (1) Accept for these alternative methods: 10 12.1 12.12
		(iii)	energy lost (as heat) due to air resistance/friction	1	Do not accept: energy lost alone air resistance/friction alone

Question			Expected response	Max mark	Additional guidance
2.	(a)		correct curved path shown	**1**	Do not accept indication of curve rising above horizontal
	(b)	(i)	$a = \frac{v-u}{t}$ **(1)** $(-)9.8 = \frac{v-0}{0.53}$ **(1)** $v = (-)5.2 \text{ m s}^{-1}$ **(1)**	**3**	Accept: 5 5.19 5.194 Accept: $a = \frac{\Delta v}{t}$ Do not accept a response starting with: $v = at$ or $a = \frac{v}{t}$
		(ii)	 correct shape - straight line with positive gradient starting at origin **(1)** graph ends at (0.53, 5.2) **(1)**	**2**	or consistent with (b)(i) independent marks

Question			Expected response	Max mark	Additional guidance
2.	(b)	(iii)	$s =$ area under graph **(1)** $s = \frac{1}{2} \times 0.53 \times 5.2$ **(1)** $s = 1.4$ m **(1)**	3	or consistent with (b)(i) or (b)(ii) If incorrect substitution then MAX (1) for implied relationship Accept: 1 1.38 1.378 Accept: $s = \overline{v}t$ or $d = \overline{v}t$ Accept: $s = vt$ or $d = vt$ provided it is followed by a substitution of the average vertical velocity **Alternative method:** $mgh = \frac{1}{2}mv^2$ (1) $m \times 9.8 \times h = \frac{1}{2} \times m \times 5.2^2$ (1) $h = 1.4$ m (1) Note: m may be cancelled or a value substituted Accept for this method: 1.380
	(c)	(i)	$F = 54 - 22$ **(1)** $(F = 32$ N$)$ $F = ma$ **(1)** $32 = 74 \times a$ **(1)** $a = 0.43$ ms^{-2} **(1)**	4	Calculation of unbalanced force may be implied by correct substitution. If no attempt to calculate unbalanced force then MAX (1) for relationship. If clear arithmetic error in calculation of unbalanced force then MAX (3). Accept: 0.4 0.432 0.4324
		(ii)	reduces friction/air resistance **(1)**	1	Accept: wind resistance Do not accept: no friction/no air resistance 'slipstreaming' alone 'resistance' alone

Question			Expected response	Max mark	Additional guidance
3.	(a)		Astra 1KR **(1)** it is a geostationary satellite **OR** it has an orbital period of 24 hours **OR** it is at an orbital altitude of 36 000 km **(1)**	**2**	**MUST JUSTIFY** Satellite correct + justification correct (2) Satellite correct + justification incomplete (1) Satellite correct + justification incorrect (wrong physics) (0) Satellite correct + no justification attempted (0) Incorrect or no satellite stated, regardless of justification (0)
	(b)		$W = mg$ **(1)** $W = 3.5 \times 7.7$ **(1)** $W = 27$ N **(1)**	**3**	Accept: 30 27.0 26.95 Do not accept: $F = ma$
	(c)		any single value greater than 101 minutes and less than 676 minutes	**1**	Unit required Can be expressed in other units of time, eg seconds or hours Do not accept an answer that includes/implies a range of values

Question			Expected response	Max mark	Additional guidance
4.			**Award 3 marks** where the candidate has demonstrated a good understanding of the physics involved. They show a good comprehension of the physics of the situation and provide a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks. **Award 2 marks** where the candidate has demonstrated a reasonable understanding of the physics involved. They make some statement(s) that are relevant to the situation, showing that they have understood the problem. **Award 1 mark** where the candidate has demonstrated a limited understanding of the physics involved. They make some statement(s) that are relevant to the situation, showing that they have understood at least a little of the physics within the problem. **Award 0 marks** where the candidate has not demonstrated an understanding of the physics involved. There is no evidence that they have recognised the area of physics involved, or they have not given any statement of a relevant physics principle. Award this mark also if the candidate merely restates the physics given in the question.	3	Candidates may use a variety of physics arguments to answer this question. Award marks based on candidates demonstrating overall good, reasonable, limited, or no understanding.

Question			Expected response	Max mark	Additional guidance
5.	(a)		not affected by weather **OR** no (distortion from) atmosphere **OR** no light pollution **OR** can use telescope during the day	1	Accept any other reasonable answer Accept: to see further Do not accept: 'clearer' alone closer (neither would negate a correct response) Apply +/- rule for surplus answers
	(b)		hydrogen and calcium	1	Must have both Any additional elements (0) marks Accept correct chemical symbols
	(c)		$d = vt$ **(1)** $d = 3.0 \times 10^8 \times (343 \times 365.25 \times 24 \times 60 \times 60)$ **(1)** $d = 3.2 \times 10^{18}$ m	2	**'Show' question** Accept use of $d = st$ for relationship, provided use is clarified by substitution. Calculation can be carried out in steps, but all steps must be shown for the substitution mark to be awarded. Final answer of 3.2×10^{18} m, including unit, must be shown or MAX (1). Accept use of 365 days

Question			Expected response	Max mark	Additional guidance
6.	(a)		Total $R = 36 + 24$ **(1)** $(= 60\ \Omega)$ $V = IR$ **(1)** $12 = I \times 60$ **(1)** $I = 0.20$ A **(1)**	4	Calculation of total resistance may be implied by correct substitution. If no attempt to calculate total resistance then MAX (1) for relationship. If clear arithmetic error in calculation of total resistance then MAX (3). **Alternative methods:** (1) for calculation of total resistance (1) for all required relationships (1) for all substitutions (1) for final answer including unit Accept: 0.2 0.200 0.2000
	(b)	(i)	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ **(1)** $\frac{1}{R_T} = \frac{1}{36} + \frac{1}{36}$ **(1)** $(R_T = 18\ \Omega)$ $R_T = 18 + 24$ **(1)** $R_T = 42\ \Omega$ **(1)**	4	Do not accept wrong relationship eg $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + R_3$ **OR** $R_T = \frac{1}{R_1} + \frac{1}{R_2}$ **OR** $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ (0) marks Accept imprecise working towards a value for parallel resistance. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{36} + \frac{1}{36} = 18\,\Omega$ accept If arithmetic error in parallel resistance calculation, can still access mark for adding the 24 Ω resistance, ie MAX (3).

Question			Expected response	Max mark	Additional guidance
6.	(b)	(ii)	(Ammeter reading will be) greater **(1)** Total circuit resistance will be less **(1)**	**2**	or consistent with (a) and (b)(i) **MUST JUSTIFY** First mark can only be awarded if a justification is attempted. Effect correct + justification correct (2) Effect correct + justification incomplete (1) Effect correct + justification incorrect (wrong physics) (0) Effect correct + no justification attempted (0) Incorrect or no effect stated regardless of justification (0) It must be clear that it is the resistance of the whole circuit that is less. If candidate tries to justify this by calculation, then the substitution must be correct or (0) marks. Note: any rounding error in the calculation would be treated in the same way as an incomplete justification, so the mark for the effect can still be awarded

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Suitable scales, labels, and units **(1)** All points plotted accurately to ± half a division **(1)** Best fit curve **(1)**	**3**	A non-linear scale on either axis prevents access to any marks (0) Allow broken axes from origin (with or without symbol), but scale must be linear across data range. A bar chart can obtain MAX (1) for scales, labels, and units. Axes can be transposed.
		(ii)	74×10^{-12} C **(1)**	**1**	**Must** be consistent with the line the candidate has drawn. If the candidate has not shown a curve or line in (b)(i) this mark cannot be accessed. If the candidate has used a non-linear scale in (b)(i) this mark cannot be accessed. ± half a division tolerance
	(b)		Any two of the following for **(1)** mark each: Repeat measurements and average Repeat measurements to identify outliers/rogue points Increase the range of distances Increase the number of different distances	**2**	Apply +/- rule for surplus answers Do not accept: 'repeat measurements' alone 'more readings' alone

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	$E_h = cm\Delta T$ **(1)** $E_h = 532 \times 1.90 \times 10^{-2} \times (235 - 25)$ **(1)** $E_h = 2120$ J **(1)**	3	Value of ΔT may be substituted directly as 210 °C. If clear arithmetic error in calculation of ΔT then MAX (2). Accept: 2100 2123 2122.7
		(ii)	Heat (energy) lost to the surroundings.	1	Do not accept 'heat loss' alone – it must be clear where it is going.
	(b)		different (specific) heat capacity **(1)** different mass **(1)**	2	Accept: different (thermal) conductivity different rate of heat loss Must indicate a change. Apply +/- rule for surplus answers

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Force per unit area	1	Do not accept: $p = \frac{F}{A}$ or pressure $= \frac{\text{force}}{\text{area}}$ alone Accept: Force per m^2.
		(ii)	$p_1V_1 = p_2V_2$ **(1)** $101\times10^3 \times 2.3\times10^{-3} = 92\times10^3 \times V_2$ **(1)** $V_2 = 2.5\times10^{-3}\ \text{m}^3$ **(1)**	3	Accept: 3×10^{-3} 2.53×10^{-3} 2.525×10^{-3}
		(iii)	The (gas) particles collide with the walls (of the crisp packet). **(1)**	1	Ignore any extraneous information. Accept 'atoms'/'molecules' in place of 'particles'
	(b)		$\dot{H} = \frac{H}{t}$ **(1)** $6.0 = \frac{H}{3.5}$ **(1)** $H = 21\ \mu\text{Sv}$ **(1)**	3	Accept: 20 21.0 21.00 Treat conversion of time to minutes or seconds as a unit conversion error.

Question			Expected response	Max mark	Additional guidance
10.	(a)		$t=\dfrac{0.015}{2}$ **(1)** $=(0.0075\text{ s})$ $d=vt$ **(1)** $d=340\times0.0075$ **(1)** $d=2.6\text{ m}$ **(1)**	4	**Alternative method:** $d=vt$ **(1)** $d=340\times0.015$ **(1)** $(d=5.1\text{ m})$ $d=\dfrac{5.1}{2}$ **(1)** $d=2.6\text{ m}$ **(1)** The mark for division of time or distance by two is an independent mark. It is incorrect physics to divide the speed by two. Accept: 3 2.55 2.550
	(b)	(i)	$f=\dfrac{N}{t}$ **(1)** $f=\dfrac{9}{2.0\times10^{-4}}$ **(1)** $f=45\,000\text{ Hz}$	2	**'Show' question** Final answer of 45 000 Hz (or its numerical equivalent) must be shown, otherwise MAX (1) **Alternative method:** $f=\dfrac{1}{T}$ (1) $f=\dfrac{1}{\left(\frac{2.0\times10^{-4}}{9}\right)}$ (1) $f=45\,000\text{ Hz}$ For the second mark to be awarded it must be shown how the period is calculated.
		(ii)	Speed (of sound in air) is the same **OR** The distance is the same	1	

Question			Expected response	Max mark	Additional guidance
11.	(a)		P: ultraviolet/UV Q: infrared/IR	**1**	Both required
	(b)		Radio (waves) **(1)** Have the longest wavelength **(1)**	**2**	**'Justify' question** Accept: lowest frequency Do not accept: 'longest' alone 'largest' alone
	(c)	(i) (A)	$v = f\lambda$ **(1)** $3.0 \times 10^8 = 2.42 \times 10^9 \times \lambda$ **(1)** $\lambda = 0.12$ m	**2**	**'Show' question** Final answer of 0.12 m must be shown, otherwise MAX (1)
		(i) (B)	microwaves	**1**	
		(ii) (A)	$D = \frac{E}{m}$ **(1)** $5.0 \times 10^{-6} = \frac{E}{4.5}$ **(1)** $E = 2.3 \times 10^{-5}$ J **(1)**	**3**	Accept: 2×10^{-5} 2.25×10^{-5} 2.250×10^{-5}
		(ii) (B)	$H = Dw_r$ **(1)** $H = 5.0 \times 10^{-6} \times 1$ **(1)** $H = 5.0 \times 10^{-6}$ Sv **(1)**	**3**	Accept: 5×10^{-6} 5.00×10^{-6} 5.000×10^{-6}

Question			Expected response	Max mark	Additional guidance
12.			**Award 3 marks** where the candidate has demonstrated a good understanding of the physics involved. They show a good comprehension of the physics of the situation and provide a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks. **Award 2 marks** where the candidate has demonstrated a reasonable understanding of the physics involved. They make some statement(s) that are relevant to the situation, showing that they have understood the problem. **Award 1 mark** where the candidate has demonstrated a limited understanding of the physics involved. They make some statement(s) that are relevant to the situation, showing that they have understood at least a little of the physics within the problem. **Award 0 marks** where the candidate has not demonstrated an understanding of the physics involved. There is no evidence that they have recognised the area of physics involved, or they have not given any statement of a relevant physics principle. Award this mark also if the candidate merely restates the physics given in the question.	3	Candidates may use a variety of physics arguments to answer this question. Award marks based on candidates demonstrating overall good, reasonable, limited, or no understanding.

<table>
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<tr><td>13.</td><td>(a)</td><td></td><td>Y (1)

Sheet of paper absorbs alpha radiation, (reducing the count rate). (1)

(8 mm of) lead absorbs (some of the) gamma radiation, (reducing the count rate further).
OR
(Some) gamma radiation is able to penetrate (8 mm of) lead
OR
The gamma radiation is able to penetrate the (3mm of) aluminium
OR
(Source) Y is the only source with a (significant) reduction in count rate due to paper (1)</td><td>3</td><td>'Justify' question - must have correct source identified or (0) marks

Can also be justified by explaining why it cannot be source X or source Z. (1) mark for each source explained correctly.

Must associate absorber with type of radiation for justification marks.

Do not accept:
(8 mm of) lead absorbs/blocks all gamma</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>When an (uncharged) <u>atom</u> gains or loses an electron/electrons.
OR
When an (uncharged) <u>atom</u> gains an electron/electrons.
OR
When an (uncharged) <u>atom</u> loses an electron/electrons.</td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
13.	(b)	(ii)	alpha (radiation) **(1)** Alpha radiation only has a short range (in air) **OR** Fewer alpha particles would reach the spark counter at increased distance. **(1)**	**2**	**MUST JUSTIFY** First mark can only be awarded if a justification is attempted. Effect correct + justification correct (2) Effect correct + justification incomplete (1) Effect correct + justification incorrect (wrong physics) (0) Effect correct + no justification attempted (0) Incorrect or no effect stated regardless of justification (0) Responses only in terms of the ionisation effect of alpha are incomplete.

Question			Expected response	Max mark	Additional guidance
13.	(b)	(iii)	$Q = It$ **(1)** $Q = 0.12 \times 10^{-6} \times 60$ **(1)** $(Q = 7.2 \times 10^{-6}\ \text{C})$ for one spark: $Q = \frac{7.2 \times 10^{-6}}{96}$ **(1)** $Q = 7.5 \times 10^{-8}\ \text{C}$ **(1)**	4	**Alternative method 1:** time for one spark $= \frac{60}{96}$ (1) $(t = 0.625\ \text{s})$ $Q = It$ (1) $Q = 0.12 \times 10^{-6} \times 0.625$ (1) $Q = 7.5 \times 10^{-8}\ \text{C}$ (1) **Alternative method 2:** number of sparks in one second $= \frac{96}{60} (= 1.6)$ (1) calculation of charge in one second $Q = It$ (1) $(Q = 0.12 \times 10^{-6} \times 1)$ $(Q = 0.12 \times 10^{-6}\ \text{C})$ $\frac{0.12 \times 10^{-6}}{1.6}$ (1) $= 7.5 \times 10^{-8}\ \text{C}$ (1) Division of the current by the number of sparks and then multiplying by the time is wrong physics, MAX (1) for relationship

Question			Expected response	Max mark	Additional guidance
14.	(a)	(i)	background count (rate)	**1**	Do not accept: ‘background radiation’ alone
		(ii)	60 days	**1**	Unit must be stated ±5 days tolerance
		(iii)	3 half-lives identified **(1)** (3 × 60 days) 180 days **(1)**	**2**	Or consistent with (a)(ii) Accept: evidence of halving three times for the first mark, eg 1→½→¼→⅛ Accept use of graph to determine the time between a value and ⅛th of that value, tolerance of ±5 days.
		(iv)	4000 counts per minute	**1**	Or consistent with (a)(ii) **Alternative Method:** Extrapolation of graph Accept any value between 3800 and 4800 counts per minute, consistent with extrapolated line. There must be evidence of extrapolation to award the mark for this method. Accept: cpm for counts per minute Unit must be stated.
	(b)		any suitable use (eg tracers/sterilisation/smoke detectors/measuring thickness of paper)	**1**	Must be a use of nuclear radiation Accept: generation of electricity Do not accept: answers relating to killing cancer cells or radiotherapy, as this is the use given in the stem of the question, but would not negate a correct response. Do not accept: ‘power’ alone ‘generation of power’ alone ‘power source’ alone ‘nuclear bombs/weapons’ alone Apply +/- rule for surplus answers

[END OF MARKING INSTRUCTIONS]

General marking principles for National 5 Physics

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must **always** be assigned in line with these marking principles, the Physics: general marking principles (GMPs) ([Physics: general marking principles - National 3 to Advanced Higher (sqa.org.uk)]) and the detailed marking instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

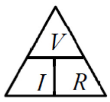
(d) Where a candidate answers part of a question incorrectly and carries the incorrect answer forward in the following part, award marks if the incorrect answer has then been used correctly in the subsequent part or 'follow-on'. (GMP 16)

(e) Award marks for non-standard symbols where the symbols are defined and the relationship is correct, or where the substitution shows that the relationship used is correct. This must be clear and unambiguous. (GMP 20)

(f) Award full marks for a correct final answer (including units if required) on its own, unless a numerical question specifically requires evidence of working to be shown, eg in a 'show' question. (GMP 1)

(g) Award marks where a diagram or sketch conveys correctly the response required by the question. It will usually require clear and correct labels (or the use of standard symbols). (GMP 19)

(h) Marks are allocated for knowledge of relevant relationships alone. Do not award a mark when a candidate writes down several relationships and does not select the correct one to continue with, for example by substituting values. (GMP 1c)

(i) Do not award marks if a 'magic triangle', eg , 

is the only statement in a candidate's response. To gain the mark, the correct relationship must be stated eg $V = IR$ or $R = \frac{V}{I}$. (GMP 2)

(j) In rounding to an expected number of significant figures, award the mark for correct answers that have up to two figures more or one figure less than the number in the data with the fewest significant figures. (GMP 6)
(Note: the use of a recurrence dot, eg $0.\dot{6}$, would imply an infinite number of significant figures and would therefore not be acceptable.)

(k) The incorrect spelling of technical terms should usually be ignored and candidates should be awarded the relevant mark, provided that answers can be interpreted and understood without any doubt as to the meaning.
Where there is ambiguity, do not award the mark. Two specific examples of this would be when the candidate uses a term:

- that might be interpreted as *reflection*, *refraction* or *diffraction*, eg 'defraction'
- that might be interpreted as either *fission* or *fusion*, eg 'fussion'

The spelling of these words is similar, but the words have totally different meanings. If the spelling (or handwriting) in an answer makes it difficult for you to interpret a candidate's intention, then do not award the mark. (GMP 22)

(l) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify**, **name**, **give**, or **state**, they need only name or present in brief form.
- **describe**, they must provide a statement or structure of characteristics and/or features.
- **explain**, they must relate cause and effect and/or make relationships between things clear.
- **determine** or **calculate**, they must determine a number from given facts, figures or information.
- **estimate**, they must determine an approximate value for something.
- **justify**, they must give reasons to support their suggestions or conclusions, eg this might be by identifying an appropriate relationship and the effect of changing variables.
- **show that**, they must use physics (and mathematics) to prove something, eg a given value. All steps, including the stated answer, must be shown.
- **predict**, they must suggest what may happen based on available information.
- **suggest**, they must apply their knowledge and understanding of physics to a new situation. A number of responses are acceptable: award marks for any suggestions that are supported by knowledge and understanding of physics.
- **use your knowledge of physics or aspect of physics to comment on**, they must apply their skills, knowledge and understanding to respond appropriately to the problem/situation presented, for example by making a statement of principle(s) involved and/or a relationship or equation, and applying these to respond to the problem/situation. Candidates are given credit for the breadth and/or depth of their conceptual understanding.

Common issues with candidate responses

When marking National 5 Physics, there are some common issues that arise when considering candidates' answers.

There is often a range of acceptable responses that would sensibly answer a particular question. However, it is often difficult to anticipate all correct or partially correct responses to questions.

The detailed marking instructions contain ideal answers, and examples of other acceptable answers, which offer guidance for interpreting candidates' responses. They may also contain advice on answers that are **not** acceptable, or only attract partial marks.

Units

Do not penalise use of upper/lower case when the abbreviated version is given, as long as it can be clearly identified, eg DB, sV, hZ, bq.

However, take care to ensure the unit has the correct prefix, eg for an answer t = 0.005 seconds, t = 5 ms is acceptable but t = 5 Ms is not.

Where a candidate makes multiple unit errors or conversion errors/omissions in any part of a question, penalise once only. For example, when calculating speed from distance and time, and the answer is required to be in m s^{-1}.

If d = 4 km and t = 2 minutes

$$v = \frac{d}{t} \qquad \textbf{(1)}$$

$$v = \frac{400}{2} \qquad \textbf{(1)}$$

$$v = 200 \qquad \textbf{(0)}$$

Although the candidate has made three unit errors, (not correctly converted distance or time and has omitted the final unit), do not award the final mark only.

Some common units often attract incorrect abbreviations in answers to numerical questions.
When the abbreviation can be confused with a different unit then the final mark cannot be awarded, eg sec or secs as an abbreviation for seconds is **not** acceptable.

Common units and abbreviations	
Acceptable unit and abbreviation	*unacceptable version*
second, s	sec, secs
hours, h	hr, hrs
ampere, amp, amps, A, a	
metres per second, m s^{-1}, m/s	mps, m/s^{-1}
metres per second per second, m s^{-2}, m/s^2	m/s/s, mpsps, m/s^{-2}
joules per kilogram per degree celsius, J kg^{-1} $°C^{-1}$, J/kg °C	J/kg/°C

Standard form

Where a candidate fails to express an answer in standard form correctly, treat it as an arithmetic error and do not award the final mark. For example:

For an answer t = 400 000 s, then $t = 4\times10^5$ s would be correct but $t = 4^5$ s would be treated as an arithmetic error. (GMP 10)

Incorrect answer carried forward (GMP 16)

Do not apply a further penalty where a candidate carries forward an incorrect answer to part of a question, and uses that incorrect answer correctly:

- within that part of the question, eg from (a)(i) to (a)(ii)
- or to the next part of the question, eg from (a) to (b).

Similarly, if a candidate has selected the wrong value in a question that requires a data value, then award full marks in the subsequent answer for a correct response that uses **either** the candidate's wrong value **or** the correct data value. For example:

(a) State the speed of microwaves in air.
Candidate's answer: *240 m* s^{-1}. This answer would attract zero marks.

(b) Calculate the distance travelled by these microwaves in 0.34 seconds.
The candidate may use **either** the value given in part (a) **or** the correct value for the speed, and could gain full marks if correctly completed.

Where an incorrect answer may be carried forward, this is indicated in the additional guidance column of the detailed marking instructions by the comment 'or consistent with part...'.

Standard three marker

The examples below set out how to apportion marks to answers requiring calculations. These are the 'standard three marker' type of questions.

Award full marks for a correct answer to a numerical question, even if the steps are not shown explicitly, **unless** it specifically requires evidence of working to be shown.

For some questions requiring numerical calculations, there may be alternative methods (eg alternative relationships) that would lead to a correct answer.

Sometimes, a question requires a calculation that does not fit into the 'standard three marker' type of response. In these cases, the detailed marking instructions will contain guidance for marking the question.

When marking partially correct answers, apportion individual marks as shown over the page.

Example of a 'standard three marker' question
The current in a resistor is 1.5 amperes when the potential difference across it is 7.5 volts. Calculate the resistance of the resistor. (3 marks)

	Example response	Mark and comment
1.	$V = IR$ $7.5 = 1.5R$ $R = 5.0\ \Omega$	1 mark: relationship 1 mark: substitution 1 mark: correct answer
2.	$5.0\ \Omega$	3 marks: correct answer
3.	5.0	2 marks: unit missing
4.	$4.0\ \Omega$	0 marks: no evidence, wrong answer
5.	$\_\_\ \Omega$	0 marks: no working or final answer
6.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0\ \Omega$	2 marks: arithmetic error
7.	$R = \frac{V}{I} = 4.0\ \Omega$	1 mark: relationship only
8.	$R = \frac{V}{I} = \_\_\ \Omega$	1 mark: relationship only
9.	$R = \frac{V}{I} = \frac{7.5}{1.5} = \_\_\ \Omega$	2 marks: relationship and substitution, no final answer
10.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0$	2 marks: relationship and substitution, wrong answer
11.	$R = \frac{V}{I} = \frac{1.5}{7.5} = 5.0\ \Omega$	1 mark: relationship but wrong substitution
12.	$R = \frac{V}{I} = \frac{75}{1.5} = 5.0\ \Omega$	1 mark: relationship but wrong substitution
13.	$R = \frac{I}{V} = \frac{1.5}{7.5} = 5.0\ \Omega$	0 marks: wrong relationship
14.	$V = IR$ $7.5 = 1.5 \times R$ $R = 0.2\ \Omega$	2 marks: relationship and substitution, arithmetic error
15.	$V = IR$ $R = \frac{I}{V} = \frac{1.5}{7.5} = 0.2\ \Omega$	1 mark: relationship correct but wrong rearrangement of symbols