National Qualifications 2019

2019 Practical Electronics

National 5

Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

General marking principles for National 5 Practical Electronics

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 general marking principles and the detailed marking instructions (MIs) 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.

When marking National 5 Practical Electronics, there are some common issues which arise when considering candidates' answers.

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

The answers given in the MIs represent ideal answers.

Additional acceptable answers are also given in the MIs to offer guidance to assist interpreting candidates' answers.

Also, advice on answers which are NOT acceptable or only attract partial marks may also be given in the MIs for some questions.

Markers are reminded that marks for each candidate response must always be assigned in accordance with the general marking principles and the specific marking instructions for the relevant question

(d) There are **no half marks** awarded.

(e) **In calculations**, marks should be awarded 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.

(f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units if required) on its own.

(g) Marks are provided for knowledge of relevant formulae alone. When a candidate writes down several formulae and does not select the correct one to continue with, for example by substituting values, no mark can be awarded.

(h) Where a wrong answer to part of a question is carried forward and the wrong answer is then used correctly in the following part, the candidate should be given credit for the subsequent part or 'follow on'.

(i) 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. (Note: the use of a recurrence dot, eg $3\dot{}$, would imply an infinite number of significant figures and would therefore not be acceptable.)

(j) 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.

(k) 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;
- **draw,** they must provide or complete a drawing, eg a circuit diagram, layout diagram or logic diagram;
- **complete**, they must complete the response, eg completing a truth table, layout diagram, checklist, etc;
- **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 electronics (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 electronics to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of electronics.

Common issues with candidate responses:

Spelling

The incorrect spelling of technical terms should be ignored and candidates should be awarded the relevant mark. If answers can be interpreted and understood without any doubt as to the meaning, then the answer should be marked according to the MIs.

However, care should be taken to ensure that the incorrect spelling does not make the response ambiguous, leading to possible 'wrong electronics'. For example 'use a smaller resistor' instead of 'use a smaller resistance' is ambiguous, since a smaller resistor may not have a smaller resistance.

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.

Units

Use of R notation is acceptable eg 270R, 4k7, 6M8, etc.

For **numerical** and **non-numerical** answers which require a unit to be **stated** in an answer, the incorrect spelling of the unit is not usually penalised (if the unit can be clearly identified).

eg 'State the unit of capacitance.' Answer: 'farad'. The answer: 'farrads' would be acceptable.

Also for **numerical** and **non-numerical** answers, do not penalise upper/lower casing when the abbreviated version is given eg v, f, hZ.

Ohms (Ω) is an exception, ω would not be an acceptable abbreviation.

However, for **numerical answers**, care must be taken to ensure the unit has the correct prefix, eg for an answer t = 0·005 seconds, t = 5 ms is acceptable but NOT t = 5 Ms.

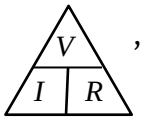
Some common units often attract wrong abbreviations in answers to numerical questions. When the abbreviation can be confused with a different unit then this would attract a unit penalty, eg sec or secs as an abbreviation for seconds is NOT acceptable.

Standard form:

Candidates may fail to express an answer in standard form correctly.

For an answer t = 400 000 s, then t = 4×10^5 s would be correct but t = 4^5 s would be treated as an arithmetic error and the final mark would not be awarded.

Relationship (equation) selection:

No marks should be awarded if a 'magic triangle', eg 

, was the only statement in a candidate's response.

The correct relationship must be stated, eg $V = IR$ or $R = \frac{V}{I}$, to gain (1) mark.

Incorrect answer carried forward:

Where an incorrect answer to a part of a question is carried forward

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

this should incur no further penalty, provided that it is used correctly.

Where a question requires a data value and the candidate has selected the wrong value, then either the candidate's wrong value may be used OR the correct data value in the subsequent answer and the response could gain full marks if correctly completed.

Example:

(a) State the tolerance in the resistance of a resistor with a gold tolerance band.

Candidate's answer: 2%. This answer would attract zero marks.

(b) Calculate the maximum and minimum possible resistances of the resistor.

Candidate may use either the value given in part (a) OR the correct value for the tolerance and could gain full marks if correctly completed.

The 'Additional guidance' column of the MIs would indicate the comment 'or consistent with part...' to indicate that an incorrect answer may be carried forward.

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.

Unless a numerical question specifically requires evidence of working to be shown, full marks should be given for a **correct** answer to a numerical question even if the steps are not shown explicitly. The individual marks shown below are for use when marking partially correct answers.

Markers who are new to marking SQA Practical Electronics exams should study these issues closely, since the guidance illustrates common faults in candidates' answers to the 'standard three marker' type of question. Items 1–15 below illustrate how to apportion marks accordingly.

Experienced markers should also re-acquaint themselves with these examples before marking.

For some questions requiring numerical calculations, there may be alternative methods (eg alternative relationships) which would lead to a correct answer. These alternative methods of reaching the answer and how to apportion marks are also included in the specific MIs for these questions.

Sometimes, a question requires a calculation which does not fit into the 'standard three marker' type of response. Full guidance on how to apportion marks will be given in the MIs for that specific question.

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)

	Candidate answer	**Mark + Comment**
1.	$V = IR$ $7{\cdot}5 = 1{\cdot}5R$ $R = 5{\cdot}0\ \Omega$	1 mark: formula 1 mark: substitution 1 mark: correct answer
2.	$5{\cdot}0\ \Omega$	3 marks: correct answer
3.	$5{\cdot}0$	2 marks: unit missing
4.	$4{\cdot}0\ \Omega$	0 marks: no evidence, wrong answer
5.	$\_\_\ \Omega$	0 marks: no working or final answer
6.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} = 4{\cdot}0\ \Omega$	2 marks: arithmetic error
7.	$R = \frac{V}{I} = 4{\cdot}0\ \Omega$	1 mark: formula only
8.	$R = \frac{V}{I} = \_\_\ \Omega$	1 mark: formula only
9.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} = \_\_\ \Omega$	2 marks: formula and substitution, no final answer
10.	$R = \frac{V}{I} = \frac{7{\cdot}5}{1{\cdot}5} = 4{\cdot}0$	2 marks: formula and substitution, wrong answer
11.	$R = \frac{V}{I} = \frac{1{\cdot}5}{7{\cdot}5} = 5{\cdot}0\ \Omega$	1 mark: formula but wrong substitution
12.	$R = \frac{V}{I} = \frac{75}{1{\cdot}5} = 5{\cdot}0\ \Omega$	1 mark: formula but wrong substitution
13.	$R = \frac{I}{V} = \frac{1{\cdot}5}{7{\cdot}5} = 5{\cdot}0\ \Omega$	0 marks: wrong formula
14.	$V=IR$ $7{\cdot}5 = 1{\cdot}5 \times R$ $R = 0{\cdot}2\ \Omega$	2 marks: formula and substitution, arithmetic error
15.	$V=IR$ $R = \frac{I}{V} = \frac{1{\cdot}5}{7{\cdot}5} = 0{\cdot}2\ \Omega$	1 mark: formula correct but wrong rearrangement of symbols

Marking instruction for each question

Question			Expected response	Max mark	Additional guidance
1.	(a)		Switch electrical **(1 mark)**  **(1 mark)** FUSE **(1 mark)**	**3**	
	(b)	(i)	1M2 **OR** 1·2MΩ **OR** 1,200,000Ω	**1**	Also accept scientific notation with unit
		(ii)	Minimum 588Ω **OR** 588R **(1 mark)** Maximum 612Ω **OR** 612R **(1 mark)**	**2**	
2.	(a)		(When switch closed) current flows through electromagnet/coil **(1 mark)** The iron bar is attracted by magnetism to the electromagnet/ coil **(1 mark)**	**2**	
	(b)	(i)	Heat shrink (tubing)	**1**	Not sleeving Accept flying leads
		(ii)	To avoid short circuiting the LDR/ stop the bare wires touching	**1**	If flying leads then for remote connection to other parts of circuitry

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	18Ω	**1**	Accept $18R$
		(ii)	$V = IR$ **(1 mark)** $9 = I \times 18$ **(1 mark)** $I = 0{\cdot}5\ A$ **(1 mark)**	**3**	Accept answer consistent with 3(a)(i) Answer must have unit
		(iii)	$P = I^2 R$ **(1 mark)** $P = 0{\cdot}5^2 \times 8$ **(1 mark)** $P = 2W$ **(1 mark)**	**3**	Accept answer consistent with 3(a)(ii) Answer must have unit Accept P=IV =v2/R if full working given
	(b)		$\frac{1}{R_T} = \frac{1}{R_2} + \frac{1}{R_3}$ **(1 mark)** $\frac{1}{R_T} = \frac{1}{10} + \frac{1}{15}$ **(1 mark)** $R_T = 6\Omega$ **(1 mark)**	**3**	$R_T = \frac{R_2 R_3}{R_2 + R_3}$ Is an acceptable alternative method If wrong equation used, eg $R_T = \frac{1}{R_2} + \frac{1}{R_3}$ then (0) marks. Accept imprecise working towards a final answer. $\frac{1}{R_T} = \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{15} + \frac{1}{10} = 6\Omega$ accept Accept = 6 R Accept any subscript on component resistors

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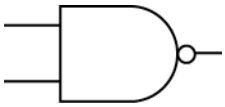
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>4.</td><td>(a)</td><td></td><td>  </td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>NOR (gate)</td><td>1</td><td></td></tr>
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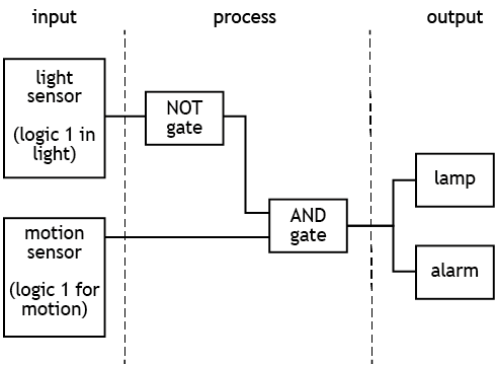
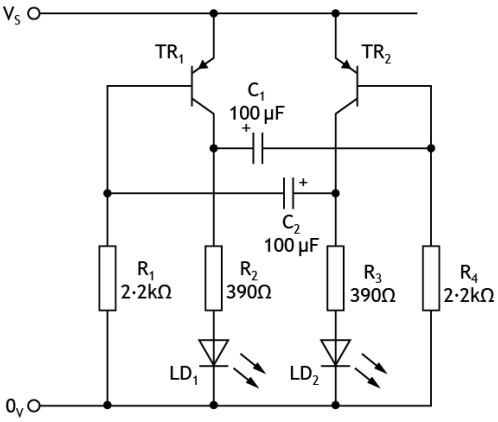
Question			Expected response	Max mark	Additional guidance
5.	(a)		Error: meter on incorrect scale/ range/setting **(1 mark)** Error: probe 1 in wrong socket **(1 mark)** **OR** probe 1 should be in VΩmA socket **OR** middle/centre socket	**2**	Accept Meter on ampere/current scale Multi-meter should be set to $V^{\overline{\overline{\cdots}}}$ or V~ Probe must be identified as probe 1
	(b)		Connect probe 1 to middle socket/ VΩmA socket. (Probe 2 to the COM socket) **(1 mark)** Set scale to Ω/ohms/resistance **(1 mark)** Start at highest resistance range and work down until display reads 1 then go up one range. **(1 mark)**	**3**	Accept range/scale as interchangeable Accept: probe 1 => COM Probe 2 => VΩmA Or until measured resistance is bigger than the next smallest scale/range
6.	(a)		Period t = 400ms or 0·4s **(1 mark)** $f = \frac{1}{T}$ **(1 mark)** $f = \frac{1}{0 \cdot 4}$ $f = 2 \cdot 5Hz$ **(1 mark)**	**3**	Must have unit If incorrect setting chosen from oscilloscope award a maximum of 1 mark for the formula. If period incorrect then award a maximum of 1 mark for the formula. If milli omitted from the period of the wave, treat as a unit error and award a maximum of 2 marks, unless final answer is then quoted as 0·0025 kHz, in which case 3 marks may be awarded.
	(b)		Analogue (signal)	**1**	

Question			Expected response	Max mark	Additional guidance
7.	(a)		$V_x = \frac{R_2}{R_1 + R_2} \times V_S$ **(1 mark)** $V_x = \frac{4000}{5000} \times 6$ **(1 mark)** $V_x = 4.8V$ **(1 mark)**	**3**	Accept (4/5) x 6. 1 mark for Ohm's Law anywhere. 1 mark for both substitutions. 1 mark for final answer including unit. Or by voltage ratio method. If correct answer given with no working award 3 marks.
	(b)		20K or 20kΩ or 20,000Ω	**1**	Must have unit or be in R notation
	(c)		As temperature decreases thermistor resistance increases. **(1 mark)** As thermistor resistance increases the voltage across the thermistor increase. **(1 mark)** When voltage across thermistor = Vx then LM741/comparator/IC/op amp switches on **(1 mark)**	**3**	Accept V ref = Vx = trigger voltage = switch on voltage = threshold (voltage) Accept buzzer/alarm sounds in place of LM741 switching on but not bell
8.	(a)		Any three from • check diode orientation • check LED orientation • correct value of resistors • both ICs are the same type • both potentiometers are of the same type (linear or log) • both potentiometers have same maximum resistance • check power supply connected correctly/right way round	**3**	Do not accept variable resistors.
	(b)		Voltage supply rails are reversed/ wrong way around **(1 mark)** Incorrect logic gate used **(1 mark)** R_3 resistance too large **(1 mark)** Using diode not LED **(1 mark)**	**4**	Accept using a NOR gate Accept not using a LED Not resistor too big/large If power not identified then accept diode/led wrong way round

Question			Expected response	Max mark	Additional guidance
9.			**1 mark** for selecting both inputs **1 mark** for selecting correct gates **1 mark** for selecting both outputs **1 mark** for correctly linking inputs to gates **1 mark** for linking AND gate to outputs **1 mark** correctly identifying the three sections of the system diagram	**6**	 All selected elements must be shown as part of a system/block diagram. (arrows are NOT required on the connections).
10.			Both power rails labelled with nodes **(1 mark)** Transistor positions and type (pnp used) **(1 mark)** Base to 0v via 2K2 resistors **(1 mark)** Collector to 0v via 390R resistor with LED correct orientation **(1 mark)** Both capacitor orientation and connections **(1 mark)** All components labelled (either values or identifiers) **(1 mark)**	**6**	 If npn used and other connections are in comparable places then treat as repeated error and deduct 1 mark for transistor position/type Accept a mixture of identifiers and values.

[END OF MARKING INSTRUCTIONS]