



2010 Physics

Standard Grade – General

Finalised Marking Instructions

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Common issues with candidates' 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 physics'.

One notable exception is for questions requiring the response 'reflection' or the response 'refraction'. The spelling of these two 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.

Units:

For **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:

'What is the correct unit for the activity of a radioactive source?' Answer: 'Becquerels'.

The answer: 'beckerels' would be acceptable.

Examples of other common mis-spellings: Seeverts, decibelles, Diopiters.

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

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.

It should be noted that, in any part of a question, multiple unit errors or conversion errors / omissions should only be penalised once (deduct maximum ½ mark).

e.g. when calculating speed from distance and time

$$\begin{aligned} \text{If } d &= 4 \text{ km} & v &= \frac{d}{t} & & (\frac{1}{2}) \\ t &= 2 \text{ minutes} & & & & \\ & & & = \frac{400}{2} & & (\frac{1}{2}) \\ & & & = 200 & & (\frac{1}{2}) \end{aligned}$$

Although the candidate has made three unit errors (not correctly converted distance or time and has omitted the final unit) this would only attract ½ **mark unit penalty**.

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.


Common units and abbreviations:	
<i>Acceptable unit/Abbreviation</i>	<i>NOT acceptable version</i>
second, s	sec, secs
ampere, amp, amps, A	
metres per second, m/s, m s ⁻¹ ,	mps, m/s ⁻¹
metres per second per second, m/s/s, m/s ² , ms ⁻²	mpsps, m/s ⁻²

Standard form:

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

For an answer $t = 400\,000\text{ s}$, then $t = 4 \times 10^5\text{ s}$ would be correct but $t = 4^5\text{ s}$ would be treated as an arithmetic error (deduct (1/2)).

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 $R = \frac{V}{I}$ to gain (1/2) mark.

‘Dotted line.’ :



A dotted line immediately above an answer in the MIs indicates that the answer requires an answer (or value) calculated or stated in a previous part of the question to be used.

If the candidate’s answer in the first part of the question is wrong, this wrong answer may be used by the candidate in the subsequent question. If the subsequent answer is correctly completed, then full marks may be awarded.

PART (c)

Part (c) below sets out how to apportion marks to answers requiring calculations.

These are the ‘**standard two 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 in **part (c)** are for use when marking partially correct answers.

Markers who are new to marking Standard Grade Physics should study these issues closely, since the guidance illustrates common faults in candidates’ answers to the ‘standard two 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 two marker’ type of response. Full guidance on how to apportion marks will be given in the MIs for that specific question.

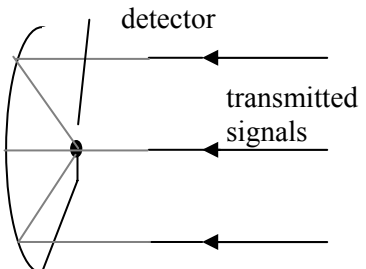
Part (c)**Physics – Marking Issues**

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.

	Answers	Mark + Comment	Issue
1.	$V=IR$ $7.5=1.5R$ $R=5.0 \Omega$	(½) (½) (1)	Ideal answer
2.	5.0 Ω	(2) Correct answer	GMI 1
3.	5.0	(½) Unit missing	GMI 2 (a)
4.	4.0 Ω	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0 \Omega$	(½) Arithmetic error	GMI 7
7.	$R = \frac{V}{I} = 4.0 \Omega$	(½) Formula only	GMI 4 and 1
8.	$R = \frac{V}{I} = \text{_____} \Omega$	(½) Formula only	GMI 4 and 1
9.	$R = \frac{V}{I} = \frac{7.5}{1.5} = \text{_____} \Omega$	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R = \frac{V}{I} = \frac{1.5}{7.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R = \frac{I}{V} = \frac{7.5}{1.5} = 5.0 \Omega$	(0) Wrong formula	GMI 5
14.	$V = IR \quad 7.5 = 1.5 \times R \quad R = 0.2 \Omega$	(½) Arithmetic error	GMI 7
15.	$V = IR$ $R = \frac{I}{V} = \frac{1.5}{7.5} = 0.2 \Omega$	(½) Formula only	GMI 20

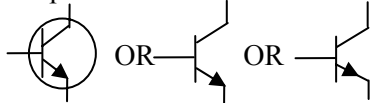
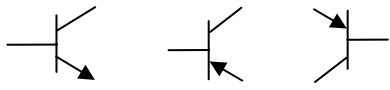
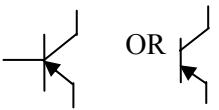
Part Two: Marking Instructions for each Question

Question			Expected Answer/s	Max Mark	Additional Guidance
1			D	1	
2			A	1	
3			C	1	
4			D	1	
5			B	1	
6	a	i	$f = \frac{20}{10}$ $= 2 \text{ hertz}$	1	Deduct (½) if wrong/missing unit If an arithmetic error is clearly seen then award (½) mark
6	a	ii	$v = f \lambda$ (½) $= 1.2 \times 2$ (½) $= 2.4 \text{ metres per second}$ (1)	2	Deduct (½) if wrong/missing unit
6	b		$2 \times 0.15 = 0.3 \text{ metres}$	1	Deduct (½) if wrong/missing unit If an arithmetic error is clearly seen then award (½) mark

Question		Expected Answer/s	Max Mark	Additional Guidance	
7	a	Time (for signals to travel from satellites to sat nav)	1	Accept 't'	
7	b	Radio signals are waves which transfer ... energy The radio signals travel at the speed of light, which is greater than the speed of sound.. The period of a satellite orbit depends on its height above the Earth.	3	(1) mark for each correct entry	
7	c		2	(1) mark for continuing signals to reflector (1) mark for showing reflection of signals to the detector Arrows not required to be shown, but if drawn and show wrong direction, deduct (1) mark Do not penalise if reflected signals are continued beyond (through) detector. Must show completion of at least 2 signals.	
8	a	i	0.2 ampere	1	Deduct (½) if wrong/missing unit Accept A, amps or amperes
8	a	ii	$\frac{12}{3}$ = 4 volts	1	Deduct (½) if wrong/missing unit If an arithmetic error is <u>clearly</u> seen then award (½) mark max

Question			Expected Answer/s	Max Mark	Additional Guidance												
8	b	i	<table border="1"> <thead> <tr> <th></th> <th>Lamp 1</th> <th>Lamp 2</th> <th>Lamp 3</th> </tr> </thead> <tbody> <tr> <td>Voltage (volts)</td> <td>4</td> <td>4</td> <td>8.0</td> </tr> <tr> <td>Current (amperes)</td> <td>0.2</td> <td>0.2</td> <td>0.4</td> </tr> </tbody> </table>		Lamp 1	Lamp 2	Lamp 3	Voltage (volts)	4	4	8.0	Current (amperes)	0.2	0.2	0.4	2	(½) for each correct entry
				Lamp 1	Lamp 2	Lamp 3											
			Voltage (volts)	4	4	8.0											
Current (amperes)	0.2	0.2	0.4														
8	b	ii	$P = IV$ (½) $P = 0.4 \times 8$ (½) $P = 3.2 \text{ watts}$ (1)	2	Deduct (½) if wrong/missing unit												
8			b			iii	electrical to light (energy)	1	(1) or zero, no (½) marks Accept 'electric' Do not accept 'electricity' If 'electric to light and heat (energy)' then zero marks Accept any indication of transformation eg dash, arrow, 'to', etc								
9	a	i		$t = \frac{E}{P}$ (½) $t = \frac{14400}{48}$ (½) $t = 300 \text{ seconds}$ (1)	2		Deduct (½) if wrong/missing unit Accept 5 minutes										
			9	a		ii		The current is in one direction	1								
			9					b			i	<table border="1"> <thead> <tr> <th>Appliance</th> <th>Power (watts)</th> </tr> </thead> <tbody> <tr> <td>Kettle</td> <td>2800</td> </tr> <tr> <td>Bedside lamp</td> <td>60</td> </tr> <tr> <td>Cooker</td> <td>8000</td> </tr> </tbody> </table>	Appliance	Power (watts)	Kettle	2800	Bedside lamp
Appliance	Power (watts)																
Kettle	2800																
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9	b	ii	(The earth wire is a) safety device	1	Explanation should include some indication that the earth wire is for safety. If additional information is given that includes wrong Physics, award (0) marks eg 'protects the appliance', 'prevents too much current'												

Question			Expected Answer/s	Max Mark	Additional Guidance
10	a	i	0 (decibels) only	1	unit not required but deduct ($\frac{1}{2}$) if wrong unit given – accept DB OR db OR Db or accept wrong spelling of unit if written in full if recognisable
10	a	ii	(Inside a) classroom	1	
10	b		Loud sounds can damage hearing OR Sounds above 80dB can damage hearing OR 102 dB sounds can damage hearing OR Can damage eardrum OR Causes deafness	1	Do NOT accept ‘loud sounds can damage ears’ - answer must refer to <i>hearing</i> . Do NOT accept answers relating to ‘affect hearing’ on its own.
10	c	i	Ultrasound OR ultrasonic	1	
10	c	ii	Obtaining images of unborn babies OR removal of kidney stones OR physiotherapy treatment	1	Accept any recognised acceptable use in medicine Do NOT accept ‘ultrasound scan’ or ‘scan’ alone Do NOT accept answers in terms of ‘looking at’ or ‘seeing’
11	a		less expensive/cheaper OR does not use hazardous chemicals OR image obtained in a shorter time	2	Max 2 marks Any two correct 1 mark for each correct answer Apply \pm rule if more than two answers given and additional answer(s) is/are incorrect
11	b	i	Turns film black/dark OR fogs OR clouds film	1	Not: Discolours Changes colour

Question			Expected Answer/s	Max Mark	Additional Guidance
11	b	ii	x-rays are dangerous OR for safety OR to monitor radiation exposure	1	Accept 'check radiation levels' NOT: 'check/detect radiation' alone Do NOT accept answers which imply protection from radiation eg 'protects the heart from radiation'.
11	c		Infrared OR IR OR heat (rays) OR thermal	1	Do NOT accept 'heat rays' or 'heat waves' since this is in the stem of the question.
12	a	i	(the voltage) increases OR 'gets bigger'	1	NOT: 'changes'
12	a	ii	Accept  OR  Accept no tails drawn. Do not accept  OR base connection must be drawn.	1	Accept pnp or npn transistor symbol Labels not required Accept symbol drawn in dotted box in circuit diagram if clearly correct
12	a	iii	(Electronic)switch OR 'to switch on the LED'	1	NOT: 'switches the <u>circuit</u> on or off'
12	b	i	Reading increases OR decreases OR changes	1	Accept any indication of a change

Question			Expected Answer/s	Max Mark	Additional Guidance															
12	b	ii	$I = \frac{V}{R} \quad (\frac{1}{2})$ $I = \frac{5}{1000} \quad (\frac{1}{2})$ $I = 0.005 \text{ ampere} \quad (1)$	2	Deduct (½) if wrong/missing unit															
13	a	i	LED connected the wrong way round (only answer)	1	Do not accept ‘because one may be broken’															
13	a	ii	To protect the LED OR limit the current in the LED OR reduce voltage across the LED	1	Do not accept ‘...voltage through...’ OR ‘...current across...’ in an answer															
13	b	i	<table border="1"> <thead> <tr> <th><i>Energy in</i></th> <th><i>Output device</i></th> <th><i>Energy out</i></th> </tr> </thead> <tbody> <tr> <td>electrical</td> <td>loud-speaker OR buzzer OR bell</td> <td>sound</td> </tr> <tr> <td>electrical</td> <td>LED</td> <td>Light</td> </tr> <tr> <td>electrical</td> <td>motor OR moving coil meter OR solenoid</td> <td>kinetic</td> </tr> <tr> <td>electrical</td> <td>heater</td> <td>heat</td> </tr> </tbody> </table>	<i>Energy in</i>	<i>Output device</i>	<i>Energy out</i>	electrical	loud-speaker OR buzzer OR bell	sound	electrical	LED	Light	electrical	motor OR moving coil meter OR solenoid	kinetic	electrical	heater	heat	1	max 1 mark (½) for each correct answer Do not accept system based answers eg Amplifier, RC car, TV etc
<i>Energy in</i>	<i>Output device</i>	<i>Energy out</i>																		
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electrical	motor OR moving coil meter OR solenoid	kinetic																		
electrical	heater	heat																		
13	b	ii	Buzzer OR LED / 7 segment display OR solenoid OR relay	1	Do not accept answers that describe systems eg digital clock, LCD TV etc															
14	a		(Forces are) balanced OR in equal and opposite directions	1	If ‘equal’ or ‘the same (size)’ alone then (0) marks															

Question			Expected Answer/s	Max Mark	Additional Guidance
14	b		$a = \frac{\Delta v}{t} \text{ OR } a = \frac{v-u}{t} \quad (\frac{1}{2})$ $= \frac{14}{2.5} \quad (\frac{1}{2})$ $= 5.6 \text{ metres per second per second} \quad (1)$	2	Deduct ($\frac{1}{2}$) if wrong/missing unit If either equation is written then substitution line can be $a = 14/2.5$ If no equation is written and candidates go straight to $a = 14/2.5$ then (0 marks) NOT $a = \frac{v}{t}$ (0) marks
14	c		$v = \frac{d}{t} \quad (\frac{1}{2})$ $= \frac{720}{100} \quad (\frac{1}{2})$ $= 7.2 \text{ metres per second} \quad (1)$	2	Deduct ($\frac{1}{2}$) if wrong/missing unit
15	a	i	It has wheels OR rollers	1	NOT streamlined
15	a	ii	To reduce the pulling force OR make it easier to pull	1	
15	b		$E_w = Fd \quad (\frac{1}{2})$ $= 20 \times 15 \quad (\frac{1}{2})$ $= 300 \text{ joules} \quad (1)$	2	Deduct ($\frac{1}{2}$) if wrong/missing unit
15	c	i	$E_p = mgh \quad (\frac{1}{2})$ $= 16 \times 10 \times 0.4 \quad (\frac{1}{2})$ $= 64 \text{ joules} \quad (1)$	2	Deduct ($\frac{1}{2}$) if wrong/missing unit
15	c	ii	$w = mg \quad (\frac{1}{2})$ $= 16 \times 10 \quad (\frac{1}{2})$ $= 160(\text{N}) \quad (\frac{1}{2})$ <p style="text-align: right;">unit not required</p> No ($\frac{1}{2}$)	2	If answer 'NO' is given without any justification then award zero marks. However, if justification is wrong then can still award ($\frac{1}{2}$) mark for 'NO' Unit not required in final answer (given in question) but if wrong unit given then unit penalty-deduct ($\frac{1}{2}$)
16	a	i	Thermal = $100 - 40 = 60$ (%)	1	unit not required but deduct ($\frac{1}{2}$) if wrong unit given
16	a	ii	$50 + 30 = 80$ (%)	1	unit not required but deduct ($\frac{1}{2}$) if wrong unit given

Question			Expected Answer/s	Max Mark	Additional Guidance
16	b	i	Switch off lights OR do not leave appliances on stand-by OR fit draught proofing OR use energy saving light bulbs OR ...	1	Accept any recognised energy saving method in the home—not specifically related to saving electrical energy
16	b	ii	car share OR use public transport OR use more fuel efficient vehicles	1	Accept any recognised energy saving method in transport.
17	a		To change the size of the (ac)voltage OR To reduce power/energy loss	1	Accept ‘to step-up voltage’ OR ‘to step down’ voltage
17	b	i	132 000 volts	1	(1) or zero marks unit required
17	b	ii	33 000 volts	1	(1) or zero marks unit required
17	b	iii	$\frac{n_s}{n_p} = \frac{V_s}{V_p} \quad (\frac{1}{2})$ $\frac{n_s}{6000} = \frac{33000}{132000} \quad (\frac{1}{2})$ $n_s = 1500 \text{ (turns)}$	2	Accept wrong answers from b(i) and/or b(ii) in calculation. Unit not required, but if wrong unit given then deduct (½) eg not ‘volts’.
18	a		Lens X Eyepiece Lens Y Objective	2	(1) mark for each correct answer NOT: ‘eye lens’
18	b		The Earth is turning/rotating OR the Moon is moving/orbiting	1	
18	c		Planet Solar System Galaxy Universe	2	(½) for each entry in the correct position

Question			Expected Answer/s	Max Mark	Additional Guidance
19	a	i	The water exerts an upward force on the air/rocket/bottle	1	Do NOT accept 'thrust/upward force' alone
19	a	ii	$a = \frac{F}{m}$ (½) $a = \frac{2 \cdot 1}{0 \cdot 70}$ (½) a = 3 metres per second per second (1)	2	Deduct (½) if wrong/missing unit
19	b		Gravitational pull is less (than on Earth) OR Gravitational field strength is less OR Weight (of rocket) is less	1	Do not accept: 'no air/atmosphere on moon' – at launch this has no effect
19	c	i	Weight OR (The force/pull of) gravity	1	Accept 'gravitational force' Do NOT accept 'gravity' alone
19	c	ii	Friction OR air resistance OR drag	1	

[END OF MARKING INSTRUCTIONS]