2009 Physics

Standard Grade − General

Finalised Marking Instructions

Part One: General Marking Principles for Physics Standard Grade – General

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 specific Marking Instructions for each question.

(a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. 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/Principal Assessor. You can do this by posting a question on the Marking Team forum or by e-mailing/phoning the emarker Helpline. Alternatively, you can refer the issue directly to your Team Leader by checking the 'Referral' box on the marking screen.

(b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

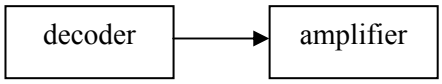
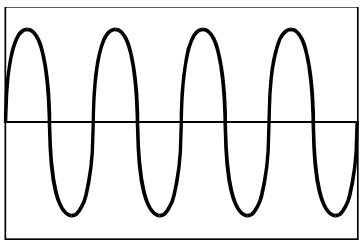
Physics – Marking Issues

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.	$V=IR$ $7{\cdot}5=1{\cdot}5R$ $R=5{\cdot}0\ \Omega$	(½) (½) (1)	Ideal answer
2.	$5{\cdot}0\ \Omega$	(2) Correct answer	GMI 1
3.	$5{\cdot}0$	(1½) Unit missing	GMI 2 (a)
4.	$4{\cdot}0\ \Omega$	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R=\frac{V}{I}=\frac{7{\cdot}5}{1{\cdot}5}=4{\cdot}0\,\Omega$	(1½) Arithmetic error	GMI 7
7.	$R=\frac{V}{I}=4{\cdot}0\,\Omega$	(½) Formula only	GMI 4 and 1
8.	$R=\frac{V}{I}=$ _____Ω	(½) Formula only	GMI 4 and 1
9.	$R=\frac{V}{I}=\frac{7{\cdot}5}{1{\cdot}5}=$ _____Ω	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R=\frac{V}{I}=\frac{7{\cdot}5}{1{\cdot}5}=4{\cdot}0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R=\frac{V}{I}=\frac{1{\cdot}5}{7{\cdot}5}=5{\cdot}0\,\Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R=\frac{V}{I}=\frac{75}{1{\cdot}5}=5{\cdot}0\,\Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R=\frac{I}{V}=\frac{7{\cdot}5}{1{\cdot}5}=5{\cdot}0\,\Omega$	(0) Wrong formula	GMI 5
14.	$V=IR\quad 7{\cdot}5=1{\cdot}5\times R\quad R=0{\cdot}2\ \Omega$	(1½) Arithmetic error	GMI 7
15.	$V=IR$ $R=\frac{I}{V}=\frac{1{\cdot}5}{7{\cdot}5}=0{\cdot}2\,\Omega$	(½) Formula only	GMI 20

Part Two: Marking Instructions for each Question

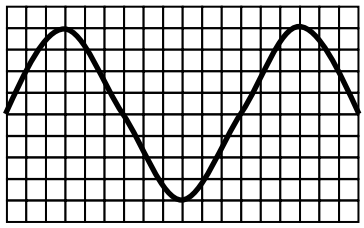
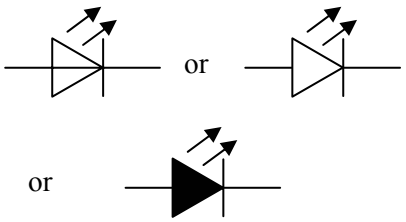
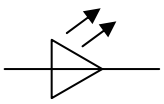
Question			Expected Answer/s	Max Mark	Additional Guidance
1			C	**1**	
2			B	**1**	
3			B	**1**	
4			C	**1**	
5			A	**1**	
6			C	**1**	

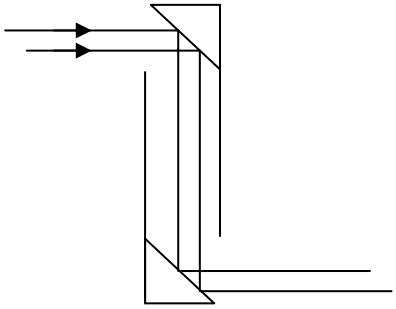
Question			Expected Answer/s	Max Mark	Additional Guidance
7	**a**		Electrical (energy) → Sound (energy)	**1**	(1) or (0) marks Accept electric but not electricity Accept any indication of transformation eg dash, arrow, 'to', etc
7	**b**		Stations transmit in different places/areas/parts of Scotland **OR** Borders and Central are far enough apart (not to interfere)	**1**	NOT any mention of different wavelengths
7	**c**	**i**		**1**	(½) each correct answer Accept 'amp' for amplifier
7	**c**	**ii**	Selects / picks/ finds: one frequency / radio wave / wavelength **/** **(**radio) station/ channel / signal/ carrier wave	**1**	NOT 'tunes into' NOT 'selects a programme' NOT 'wave' alone
8	**a**			**1**	Circle <u>or</u> any clear indication of intended answer
8	**b**			**2**	(1) mark for 4 waves (allow a small tolerance but must show 4 crests and 4 troughs, drawing may stray outside grid) (1) mark for amplitude unchanged at 2·5 boxes (allow some 'unevenness' for the amplitude but **must** stay between 2 and 3 divisions – allow for some y-shift)

Question			Expected Answer/s	Max Mark	Additional Guidance
9	**a**		I = 4·6 + 1·5 = 6·1 amperes	**1**	(½) only if wrong or missing unit NOT: $R_T = R_1 + R_2$
9	**b**		(Reading on ammeter) goes down/ reduces/decreases/falls (to 1·5 A)	**1**	Description of a change should indicate a reduction of the current NOT 'falls <u>to zero</u>' NOT '0 A' NOT any mention of voltage
9	**c**	**i**	(230) (a.c.) (1) (1)	**2**	Circle <u>or</u> any clear indication of intended answer
9	**c**	**ii**	(50)	**1**	Circle <u>or</u> any clear indication of intended answer
10	**a**		$R = \frac{V}{I}$ (½) $= \frac{24}{1 \cdot 25}$ (½) = 19·2 Ω (1)	**2**	Standard two marker (see page 4) Can be worked out by calculating voltage across one bulb, then working out the individual resistance and finally multiplying by 16 to get the total resistance. (½ for **all** formulae, ½ for **all** substitutions, 1 for final answer)
10	**b**		$V = \frac{24}{16}$ = 1·5 volts	**1**	(½) only if wrong or missing unit

Question			Expected Answer/s	Max Mark	Additional Guidance
10	**c**	**i**	Join/connect/etc probes **and** lamp should light/see if the lamp lights (1)	**1**	ALLOW 'connect probes to a conductor/wire' NOT 'connect it to a circuit/component that works/isn't faulty' Allow connect a voltmeter or ammeter if fully explained ie gives a reading
10	**c**	**ii**	Battery flat /voltage too low **OR** broken/loose wire **OR** open circuit **OR** lamp faulty/broken **OR** lamp short circuited	**1**	(1) for a correct answer **NOT** 'lamp blown' **NOT** 'short circuit' alone
10	**d**	**i**	A In the filament/wire B In the gas	**1** **1**	 NOT 'wire electrode' NOT 'in the tube'
10	**d**	**ii**	Discharge tubes are more efficient OR cost less to run in the long term OR more light for same power or converse OR save energy OR lasts longer OR produce less heat (and more light) (or similar)	**1**	NOT 'eco friendly' alone NOT 'cheaper' alone (cost more to buy) NOT '<u>no</u> heat from discharge tubes' Accept – government legislation
11	**a**		**same** speed OR **Travel at** speed of light **OR** **Travel at** 3×10^8 m/s / 300 000 000 m/s / 300 million m/s	**1**	NOT 'speed' alone NOT 'speed of light' alone NOT '3 x 10^8 m/s' alone
11	**b**		Detect/find broken bones OR take pictures/images of broken bones **OR** CT scans **OR** destroying tumours	**1**	(1) for a correct answer (use professional judgement) NOT 'to **see/look** inside the body' NOT 'to **see** broken bones'
11	**c**	**i**	Gamma can be detected outside the body **OR** alpha/beta are absorbed by the body **OR** gamma rays are very/more penetrating	**1**	(1) for a correct answer NOT answers related to the safety of alpha/beta NOT answers relating to 'strength'

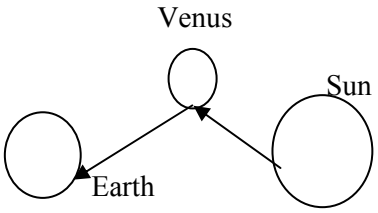
Question			Expected Answer/s	Max Mark	Additional Guidance
11	**c**	**ii**	Becquerels **OR** Bq	**1**	Ignore upper/lower case Ignore prefixes Accept any passable spelling eg Beckerells Ignore numbers in front of unit eg 10 Bq
11	**d**		Laser scalpel for cutting tissue **OR** eye surgery **OR** removing tattoos **OR** (surface) tumour removal **OR** remove birthmarks **OR** sealing blood vessels etc	**1**	(1) for a correct answer (use professional judgement)
11	**e**	**i**	different lens thickness **OR** lens A thicker than lens B (or converse) **OR** beads closer in B (or converse) **OR** beads are at different distances **OR** lenses are different sizes	**1**	(1) for a correct answer NOT area/length/width NOT 'beads in different places/positions'
11	**e**	**ii**	causes skin cancer **OR** sunburn **OR** skin damage **OR** causes eye damage (eg cataracts) **OR** kills skin cells	**1**	(1) for a correct answer NOT 'cancer' alone NOT 'harmful'
12	**a**	**i**	Piano	**1**	Only acceptable answer
12	**a**	**ii**	$\lambda = \frac{v}{f}$ (½) $= \frac{340}{523}$ (½) $= 0{\cdot}650$ metres (1)	**2**	Ignore significant figure issues Any rounding of answer must be correct – treat as arithmetic error
12	**b**		decibel **OR** dB	**1**	Ignore upper/lower case Ignore numbers in front of unit eg 10 dB Accept 'bel' Accept any passable spelling eg decibelle

Question			Expected Answer/s	Max Mark	Additional Guidance
13	**a**		Buzzer **OR** (loud)speaker **OR** (alarm) bell	**1**	(1) for a correct answer. NOT siren (just repeating question)
13	**b**	**i**	(screen) 1	**1**	Any clear indication of screen 1 eg circled/underlined/etc
13	**b**	**ii**		**2**	(1) for correct number of waves (allow a small tolerance but must show 2 crests and 1 trough, drawing may stray outside grid) (1) for increased amplitude (must be greater than 2 boxes for amplitude) (allow for some y-shift)
14	**a**		(push) switch	**1**	NOT '(push)button' NOT 'pressure sensor' NOT 'finger'
14	**b**		AND	**1**	Ignore upper/lower case Accept the correct symbol for AND gate
14	**c**	**i**		**1**	(1) for correct symbol Must have connecting wires at both ends Accept no line through middle Accept black (fill) triangle Arrows could be either side but must point away from diode symbol If any other symbol shown eg resistor in series with LED, then apply +/- rule (0 marks) NOT 
14	**c**	**ii**	Protect the LED OR prevent damage to the LED OR limits the current OR reduces voltage <u>across</u> LED	**1**	(1) for a correct answer. NOT 'voltage <u>through</u> LED.' NOT 'to stop LED <u>blowing</u>'

Question			Expected Answer/s	Max Mark	Additional Guidance
14	**d**		7 segment display OR LCD OR an array of LEDs	**1**	NOT LED(s) NOT 'digital display/screen/monitor/clock'
15	**a**		Clear indication of the following: • Measure length/distance of **track /one lap** • Time (for) one lap • Use formula $v = \frac{d}{t}$ (to calculate average speed) OR divide the distance by time	**3**	(1) for each point (independent marks) **NOT** 'measure one lap' **NOT** 'measure the track' Accept S = D/T Accept d = vt av. speed = $\frac{\text{length of one lap}}{\text{time for one lap}}$ (3 marks)
15	**b**	**i**	Speed in metres per second (or m/s), time in seconds (or s) (½ each) Uniform scales on both axes (½ each) (accept any reasonable scale) Correct plotting of t=4s, v=12m/s (½) for *both*. Straight line from origin to (4, 12) (½)	**3**	 Deduct (½) mark for origin not labeled If candidates plot speed (12) on x-axis and time (4) on y-axis then max 1 mark for units correctly labeled Ignore additional points/lines beyond 4 s.
15	**b**	**ii**	a = $\frac{v-u}{t}$ or $a = \frac{\Delta v}{t}$ (½) = $\frac{12-0}{4}$ (½) = 3 metres per second per second (1)	**2**	Accept m s^{-2} or m/s/s or m/s^2 **NOT** mpsps or mps/s If either equation is written then substitution line can be 12/4 If no equation is included and candidates go straight to a = 12/4 then (0 marks) **NOT** $a = \frac{v}{t}$ (0 marks)
15	**c**			**1**	(½) for reflections at mirrors (½) for straight lines deduct (½) if additional arrows included but in wrong direction **BOTH** rays must be completed **NOT** zigzags (0 marks)

Question			Expected Answer/s	Max Mark	Additional Guidance
16	**a**		550 N **OR** (same as) her weight	**1**	**NOT** 551 N Deduct (½) if wrong or missing unit
16	**b**		$E_W = F \times d$ (½) $= 550 \times 20$ (½) $= 11000$ joules (1)	**2**	Can use $E_p = mgh$ to calculate E_w but watch for 550 x 10 x 20 (incorrect substitution) Can use E = Wh (weight x height) Can use 550 N even if (a) is incorrect
16	**c**		$P = \frac{E}{t}$ (½) $= \frac{11000}{40}$ (½) $= 275$ watts (1)	**2**	
16	**d**		Increase friction (between hands and wall) **OR** reduces moisture (which causes slipping) **OR** Increase grip **OR** Stop slipping	**1**	(1) for correct answer NOT 'to stop them falling' NOT 'grip' or 'gives grip' alone
17	**a**		Conduction: double glazing Convection: loft insulation Radiation: foil-backed plasterboard	**2**	All correct (2) Two correct (1½) One correct (1)
17	**b**		(0)6:00 or 6 am or '6 (o'clock) in the morning'	**1**	± 1 hour tolerance **NOT** '6 o'clock' or '6' alone

Question			Expected Answer/s	Max Mark	Additional Guidance
18	**a**		(Fossil fuels) will run out **OR** have a finite supply **OR** are non renewable **OR** cause pollution/greenhouse gases/global warming	**1**	(1) for a correct answer. **NOT** 'eco friendly'
18	**b**		*Renewable* *Non-renewable* Hydroelectric coal Solar gas Wind nuclear	**2**	All correct 2 marks 5 correct 1½ marks 4 correct 1 mark 3 correct ½ mark 2, 1 or 0 correct 0 marks
18	**c**	**i**	A generator B reactor	**1** **1**	+/- rule if more than one answer given +/- rule if more than one answer given
18	**c**	**ii**	Uses cheap off-peak power to store energy behind the dam for generating the next day (or similar) OR The water is pumped back up into the upper reservoir to be reused (or similar)	**1**	(1) for a correct answer Use professional judgement but answer should refer to **storing energy** rather than storing water **NOT** 'water reused' alone
18	**c**	**iii**	number of stations = $\frac{\text{total power}}{\text{power per station}}$ $= \frac{1 \cdot 5}{0 \cdot 25}$ = 6 (stations)	**1**	Equation not required

Question			Expected Answer/s	Max Mark	Additional Guidance
19	**a**		Prism **OR** grating **OR** spectroscope **OR** spectrometer	**1**	(1) for a correct answer Accept a description or labelled drawing of a prism eg glass triangle or glass 
19	**b**	**i**	Rigel **OR** blue	**1**	(1) for a correct answer
19	**b**	**ii**	hotter	**1**	(1) for a correct answer
19	**c**		Any waves from EM spectrum except visible (light)	**1**	(1) for a correct answer Accept heat instead of IR
19	**d**			**2**	(1) for rays joined from Sun to Earth via Venus ± rule applies eg if also include a ray direct from Sun to Earth (allow some tolerance in incident and reflected rays joining) (1) for showing direction of rays from Sun to Venus **and** Venus to Earth

Question			Expected Answer/s	Max Mark	Additional Guidance
20	**a**		Planet, Moon	**1**	(½) for each correct answer Circle or any clear indication of intended answer
20	**b**		Solar system, 8 minutes	**1**	(½) for each correct answer Circle or any clear indication of intended answer
20	**c**		The Sun, universe	**1**	(½) for each correct answer Circle or any clear indication of intended answer

[END OF MARKING INSTRUCTIONS]