AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.2

Series and parallel circuits

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**10**
Available paper years	**2005–2021**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.2.2 Series and parallel circuits

Answer 01 · Mark scheme

June 2005 | 3451 | Original Q9 | Legacy

The full source mark scheme begins on page 20. Follow original question 9 in that document.

4.2.2 Series and parallel circuits

Answer 02 · Mark scheme January 2009 | PHY2F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	voltmeter	and no other do **not** accept voltage	1
4(b)(i)	variable resistor		1
4(b)(ii)	0.10 – 0.30	accept 0.1 – 0.3 accept 0.3 – 0.1 accept 0.30 – 0.10	1
4(b)(iii)	3.3 (W)	allow **1** mark for correct data choice allow ***2*** marks for substitution of correct data i.e. 0.30 × 11.0 the following answers gain **2** marks 0.10 / 0.30 / 0.80 / 1.75 allow **1** mark for substitution of incorrect of data incorrectly calculated e.g. 0.20 × 4.0 = 0.6 scores **1** mark	3
4(c)	increases		1
Total			**7**

4.2.2 Series and parallel circuits

Answer 02 · Mark scheme

January 2009 | PHY2F | Original Q4 | Legacy

PHY2F

4.2.2 Series and parallel circuits

Answer 03 · Mark scheme

June 2010 | PHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2	**L** **N** **M** **K**	all four in the correct order **2** marks for 2 correct **1** mark for 1 correct	3
Total			**3**

4.2.2 Series and parallel circuits

Answer 03 · Mark scheme June 2010 | PHY2F | Original Q2 | Legacy

PHY2F

4.2.2 Series and parallel circuits

Answer 04 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	25(Ω)		1
3(b)(i)	2(V)	allow **1** mark for showing a correct method, ie 6/3	2
3(b)(ii)	equal to		1
Total			**4**

4.2.2 Series and parallel circuits

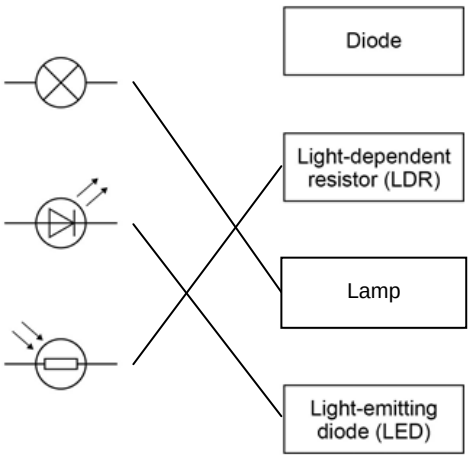
Answer 04 · Mark scheme

January 2013 | PH2FP | Original Q3 | Legacy

PH2FP

4.2.2 Series and parallel circuits

Answer 05 · Mark scheme June 2014 | PH2FP | Original Q3 | Legacy

3(a)		allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong	3	AO1 2.3.2
3(b)(i)	half		1	AO1 2.3.2k
3(b)(ii)	3(V)		1	AO2 2.3.2k
3(b)(iii)	V_1		1	AO2 2.3.2k

Question 3 continues on the next page . . .

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(c)(i)	potential difference / voltage of the power supply	accept the power supply accept the voltage / volts accept number of cells / batteries accept (same) cells / batteries do not accept same ammeter / switch / wires	1	AO3 2.3.2i
3(c)(ii)	bar drawn – height 1.(00)A	ignore width of bar allow **1** mark for bar shorter than 3rd bar	2	AO2 2.3.2i
3(c)(iii)	as the number of resistors increases the current decreases		1	AO3 2.3.2i
Total			**10**	

4.2.2 Series and parallel circuits

Answer 05 · Mark scheme

June 2014 | PH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

4.2.2 Series and parallel circuits

Answer 06 · Mark scheme June 2016 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	20		1	AO2 2.4.1b
2(b)	50		1	AO1 2.4.1c
2(c)(i)	115		1	AO2 2.3.2k
2(c)(ii)	230		1	AO1 2.3.2l
2(c)(iii)	if one goes out the other still works **or** brighter	accept power (output) is greater can be switched on/off independently is insufficient	1	AO2 2.3
2(d)	the outside/casing is plastic and plastic is an insulator	there is plastic around the wires is insufficient it is plastic is insufficient an answer the light fitting is double insulated gains both marks	1 1	AO1 2.4.1j
2(e)	(residual current) circuit breaker	accept RCCB accept RCBO accept RCCD accept RCB accept miniature circuit breaker / MCB trip switch is insufficient breaker is insufficient do not accept earth wire	1	AO1 2.4.1i
Total			**8**	

4.2.2 Series and parallel circuits

Answer 06 · Mark scheme

June 2016 | PH2FP | Original Q2 | Legacy



4.2.2 Series and parallel circuits

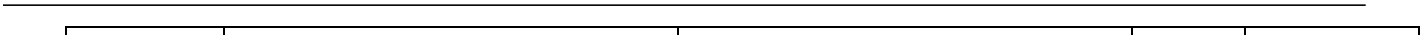
Answer 07 · Mark scheme June 2017 | PH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	2.16	allow **1** mark for correct substitution ie V = 0.12 x 18 provided no subsequent step	2	AO2 2.3.2h
3(a)(ii)	4.5 - **V**		1	AO2 2.3.2k
3(b)(i)	C		1	AO1 2.3.2m
3(b)(ii)	A		1	AO1 2.3.2n
Total			**5**	

4.2.2 Series and parallel circuits

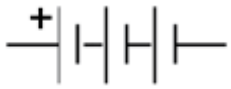
Answer 07 · Mark scheme

June 2017 | PH2FP | Original Q3 | Legacy



4.2.2 Series and parallel circuits

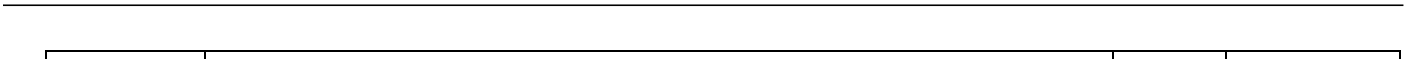
Answer 08 · Mark scheme June 2018 | 8463/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	correct circuit symbol 3 cells joined in series in correct orientation eg 	 ignore absence of + symbol	1 1	AO1 4.2.1.1
03.2	$R = \frac{12}{1.6}$ R = 7.5 (Ω)	an answer of 7.5 (Ω) scores **2** marks	 1 1	AO2 4.2.1.3
03.3	4.0 (Ω)	allow their answer to question **03.2** − 3.5 correctly calculated	1	AO2 4.2.2
03.4	it decreases the current would be higher (for the same p.d.) **or** more than one path for charge to flow **or** total resistance is always less than the smallest individual resistance	 reason only scores if correct box is chosen allow current for charge	1 1	AO1 4.2.2
Total			**7**	

4.2.2 Series and parallel circuits

Answer 08 · Mark scheme

June 2018 | 8463/1F | Original Q3



4.2.2 Series and parallel circuits

Answer 09 · Mark scheme

November 2020 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$R = \frac{36.0}{3}$ R = 12.0 (Ω)		1 1	AO2 4.2.2 RPA 3
04.2	0.1 Ω		1	AO3 4.2.2 RPA 3
04.3	The measurements are grouped closely together		1	AO3 4.2.2 RPA 3
04.4	The results give a straight line that would go through the origin.		1	AO2 4.2.2 RPA 3
04.5	84 (Ω)	allow an answer between 83 and 85 (Ω) inclusive	1	AO3 4.2.2 RPA 3
04.6	decreases decreases		1 1	AO1 4.2.2 RPA 3
Total			**8**	

4.2.2 Series and parallel circuits

Answer 10 · Mark scheme

November 2021 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	increased decreased stayed the same		1 1 1	AO3 4.2.1.3 4.2.2
04.2	random error		1	AO3 4.2.1.3 4.2.2
04.3	A_2 = 0.12 (A) A_5 = 0.36 (A)		1 1	AO1 4.2.2
04.4	$P = 0.12^2 \times 15$ P = 0.216 (W)		1 1	AO2 4.2.4.1
Total			**8**	

Version 1.0: *27092005*

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.2.2 Series and parallel circuits

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of **two** points	1
total			8

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.2.2 Series and parallel circuits

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest half-life	accept the others have longer half-lives	1
total			7

4.2.2 Series and parallel circuits

3451/F Q8

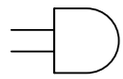
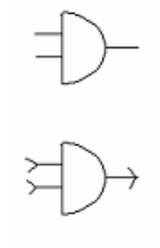
question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

3451/F Q9

question	answers	extra information	mark
(a)	capacitor	accept condenser	1
	LDR	**or** light dependent resistor accept 'ldr', 'Ldr' etc.	1
	relay (normally open)	do **not** accept 'relay normally closed'	1
(b)(i)	battery	accept '(battery of) cells' do **not** accept 'battery / cell'	1
(ii)	LED	**or** light emitting diode accept 'led' or 'Led' do **not** accept just 'diode'	1
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do **not** accept 'C is on and B is off'	1
(iv)	any **one** from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow **1** mark	1
(c)(i)	first input / second input / output 0 / 0 / **0** 1 / 0 / **0** 0 / 1 / **0** 1 / 1 / **1**	**all** correct allow: OFF NO OFF NO OFF NO ON YES	1
(ii)	truth (table)		1

cont…

3451/F Q9 cont…

(iii)		a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction allow 	1
(d)	light sensor	**or** light dependent resistor **or** LDR accept 'ldr', Ldr' etc allow solar cell, photo cell	1
	NOT gate	accept 'Not gate' **or** 'not gate' if both correct but in the wrong order credit with **1** mark	1
total			12

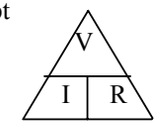
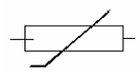
4.2.2 Series and parallel circuits

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	**or** focal (point)	1
(iii)	converging	**or** convex	1
(b)(i)	**A**		1
(ii)	rays seem to come from this point	**or** words to this effect **or** shows this on the diagram	1
(iii)	diverging	**or** concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any **three** from: • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross	allow film allow real image has light travelling through it **or** virtual image is where rays seem to come from	3
total			13

4.2.2 Series and parallel circuits

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or 	accept correct circuit symbol allow phonetic spelling	1
	resistance goes down (as temperature of thermistor goes up)	do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

4.2.2 Series and parallel circuits

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.2.2 Series and parallel circuits

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q14

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

3451/F Q14 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.2.2 Series and parallel circuits

3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball **and** at right angles to the string **and** in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do **not** accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all **three** correct any two correct for **1** mark otherwise **0** marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do **not** accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do **not** accept just 'centripetal'	1
total			10

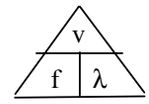
4.2.2 Series and parallel circuits

3451/F Q16

question	answers	extra information	mark
(a)(i)	**X** at the centre of the lifebelt	measuring from the centre of **X**, allow 2 mm tolerance in any direction	1
(ii)	any **two** from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below **Y**' accept 'in the middle' **or** (because) the mass / weight is evenly distributed	2
(b)	Nm **or** newton metre(s) 750	accept Newton metre(s) do **not** accept any ambiguity in the symbol ie NM, nM or nm (moment) = force × (perpendicular) distance (between line of action and pivot) **or** (moment) = 500 × 1.5 gains **1** mark	1 2
(c)	**Quality of written communication**: any **three** connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for **2** of the underlined terms used in the correct context **or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground **or** less <u>unstable</u> accept 'less likely to overturn' do **not** accept 'will not fall over' **or** so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

4.2.2 Series and parallel circuits

3451/F Q17

question	answers	extra information	mark
(a)	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing **Quality of written communication**	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark all emboldened terms in candidate's answer used correctly	2 1
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8