Number (1) 1 1 (a) Calculation leading to $v = 18.1 \text{ (m s}^{-1})$ (1) 1 (A reverse argument gives 64.8 (km h ⁻¹) and scores the mark) Example of calculation $v = 65000 \text{ m} / 60 \times 60 \text{ s} = 18.06 \text{ m s}^{-1}$ (1) 1 (b)(i) Use of distance = speed × time (see the calculation or use of 3 km) (1) Use of difference between emissions at different speeds for 1 or 3 cars (1) (This mark may still be awarded if the difference is between a 5 m s ⁻¹ for 10 minutes journey and an 18 m s ⁻¹ for 10 minutes journey) (1) CO ₂ emission = 0.72 kg (1) 4 (allow range 0.63 kg to 0.81 kg) Journey 2 I car 1 km 0.08 kg 0.07 to 0.09 1 (MP3) 3 cars 1 km 0.24 kg 0.21 to 0.27 3 (MP1,2,&3) 1 car travelling for 10 (-) 1.164 1.02 to 1.31 3 (MP1,2,&3) 1 car travelling for 10 (-) 1.64 kg km ⁻¹) = 0.72 kg 1 1 Distance = 5 m s ⁻¹ × 10 × 60 s = 3000 m = 3 km 3 × 3 km × (0.26 kg km ⁻¹ - 0.18 kg km ⁻¹) = 0.72 kg 1 1 Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that the cyclist causes more CO ₂ emissions 0.72 kg 1 1 core class or to	Question						Mark
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Use of difference between emissions at different speeds for 1 or 3 cars (1) (This mark may still be awarded if the difference is between a 5 m s ⁻¹ for 10 minutes journey and an 18 m s ⁻¹ for 10 minutes journey) CO ₂ emission = 0.72 kg (1) (allow range 0.63 kg to 0.81 kg) $ \frac{1 \text{ car 1 km}}{1 \text{ car 1 km}} = 0.24 \text{ kg}} = 0.07 \text{ to } 0.09 \text{ I} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ I} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP3}) \text{ a cars 1 km}} = 0.24 \text{ kg} 0.21 \text{ to } 0.27 \text{ J} (\text{MP1}, 2, 3) \text{ a minutes at 5 m s^{-1} and \text{ kg}} = 0.24 \text{ kg} 0.21 \text{ to } 0.37 \text{ J} (\text{MP1}, 2, 3) \text{ a minutes at 5 m s^{-1}} \text{ and } \text{ kg}} = 0.24 \text{ kg} 0.21 \text{ to } 0.393 \text{ J} (\text{MP1}, 2, 3) \text{ a minutes at 5 m s^{-1}} \text{ and 18 m s^{-1}} = 0.72 \text{ kg}} = 0.72 \text{ kg}$		Use of emission = distance \times reading from graph (1)					
$\frac{1}{1} = \frac{1}{1} = \frac{1}$		Use of difference between emissions at different speeds for 1 or 2 correct (1)					
(This mark may still be awarded if the difference is between a 5 m s ⁻¹ for 10 minutes journey and an 18 m s ⁻¹ for 10 minutes journey)4CO2 emission = 0.72 kg(1)(1)(1)(1)Journey2 emissionRange minutes at 1 km(1)1 car 1 km0.24 kg0.21 to 0.27(MP3)3 cars 1 km0.24 kg0.21 to 0.27(MP1,2,&3)1 car 3 km0.24 kg0.21 to 0.273 (MP1,2,&3)1 car 1 are reling for 10 minutes at 5 m s ⁻¹ and kg3 (MP1,2,&3)1 car travelling for 10 minutes at 5 m s ⁻¹ (-) 3.49 kg3.06 to 3.933 (MP1,2,&3)Example of calculation Distance = 5 m s ⁻¹ × 10 × 60 s = 3000 m = 3 km 3 × 3 km × (0.26 kg km ⁻¹ - 0.18 kg km ⁻¹) = 0.72 kg1Qualitative comparison of values 0.72 kg and 0.54 kg to indicate that the cyclist causes more CO2 emissions Or qualitative statement e.g. more carbon dioxide emitted when he (1)11110 minutes at no not the consistent with their value from part (i)		Use of difference betwee		is at unificient s	peeds for 1 or 5 cars	(1)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(This mark may still be awarded if the difference is between a 5 m s ^{-1} for 10 minutes journey and an 18 m s ^{-1} for 10 minutes journey)					
(allow range 0.63 kg to 0.81 kg) $ \begin{array}{ c c c c c c c } \hline Journey & 2 & Range & M & \\ \hline 1 car 1 km & 0.08 kg & 0.07 to 0.09 & 1 & (MP3) & \\ \hline 3 cars 1 km & 0.24 kg & 0.21 to 0.27 & 1 & (MP3) & \\ \hline 1 car 3 km & 0.24 kg & 0.21 to 0.27 & 3 & (MP1,2,&3) & \\ \hline 1 car travelling for 10 & (-) 1.164 & 1.02 to 1.31 & 3 & (MP1,2,&3) & \\ \hline 1 car travelling for 10 & (-) 1.164 & 1.02 to 1.31 & 3 & (MP1,2,&3) & \\ \hline 3 cars travelling for & (-) 3.49 kg & 3.06 to 3.93 & 3 & (MP1,2 & 3) & \\ \hline 0 minutes at 5 m s^{-1} & (-) 3.49 kg & 3.06 to 3.93 & 3 & (MP1,2 & 3) & \\ \hline \\ \hline$		CO_2 emission = 0.72 kg	1			(1)	4
Journey2 emissionRangeM M1 car 1 km0.08 kg0.07 to 0.091(MP3)3 cars 1 km0.24 kg0.21 to 0.271(MP3)1 car 3 km0.24 kg0.21 to 0.273(MP1,2,&3)1 car travelling for 10 minutes at 5 m s ⁻¹ and 18 m s ⁻¹ (-) 1.1641.02 to 1.313(MP1,2,&3)3 cars travelling for 10 minutes at 5 m s ⁻¹ and 18 m s ⁻¹ (-) 3.49 kg3.06 to 3.933(MP1,2,&3)Example of calculation Distance = 5 m s ⁻¹ × 10 × 60 s = 3000 m = 3 km $3 \times 3 \text{ km} \times (0.26 \text{ kg km}^{-1} - 0.18 \text{ kg km}^{-1}) = 0.72 \text{ kg}$ 1 (b)(ii)Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that the cyclist causes more CO2 emissions Or qualitative statement e.g. more carbon dioxide emitted when he cycles candidates answer must be consistent with their value from part (i)1		(allow range 0.63 kg to 0.81 kg)					
$\frac{1 \text{ car 1 km}}{3 \text{ cars 1 km}} = \frac{0.08 \text{ kg}}{0.21 \text{ to } 0.27 \text{ to } 0.09 \text{ 1} (\text{MP3})}{1 \text{ (MP3)}}$ $\frac{3 \text{ cars 1 km}}{3 \text{ cars 1 km}} = \frac{0.24 \text{ kg}}{0.21 \text{ to } 0.27 \text{ 1} (\text{MP3})}$ $\frac{1 \text{ car 3 km}}{1 \text{ car 3 km}} = \frac{0.24 \text{ kg}}{0.21 \text{ to } 0.27 \text{ 3} (\text{MP1,2,&3})}$ $\frac{1 \text{ car travelling for 10}}{1 \text{ car travelling for 10}} (-) 1.164 \text{ 1.02 to } 1.31 \text{ 3} (\text{MP1,2,&3})$ $\frac{1 \text{ car s travelling for }}{10 \text{ minutes at 5 m s}^{-1} \text{ and } \text{ kg}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93 \text{ 3} (\text{MP1,2,&3})}$ $\frac{\text{Example of calculation}}{10 \text{ minutes at 5 m s}^{-1}} (-) 3.49 \text{ kg} 3.06 \text{ to } 3.93 \text{ 3} (\text{MP1,2,&3})$ $\frac{1 \text{ car s travelling for }}{10 \text{ minutes at 5 m s}^{-1} (-) 1.8 \text{ kg km}^{-1} = 0.72 \text{ kg}}$ $\frac{1 \text{ Quantitative comparison of values } 0.72 \text{ kg and } 0.54 \text{ kg to indicate that the cyclist causes more CO2 emissions}$ $Or qualitative statement e.g. more carbon dioxide emitted when he (1) \text{ cycles candidates answer must be consistent with their value from part (i)}$		Journey	² emission	Range	М		
$\frac{1}{3 \text{ cars } 1 \text{ km}} = \frac{102 \text{ kg}}{1024 \text{ kg}} = \frac{1022 \text{ kg}}{1024 \text{ kg}} = 1022 \text{ k$		1 car 1 km	0.08 kg	0.07 to 0.09	1 (MP3)		
$\frac{1}{1 \text{ car 3 km}} = \frac{0.24 \text{ kg}}{0.24 \text{ kg}} = \frac{0.21 \text{ to } 0.27}{3} (\text{MP1,2,&3)}$ $\frac{1}{1 \text{ car travelling for 10}}{1 \text{ car travelling for 10}} = \frac{(-) 1.164}{1.02 \text{ to } 1.31} = \frac{3}{3} (\text{MP1,2,&3)}$ $\frac{18 \text{ m s}^{-1}}{3 \text{ cars travelling for 10}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93} = \frac{3}{3} (\text{MP1,2,&3)}$ $\frac{10 \text{ minutes at 5 m s}^{-1}}{1 \text{ and } 18 \text{ m s}^{-1}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93} = \frac{3}{3} (\text{MP1,2,&3)}$ $\frac{10 \text{ minutes at 5 m s}^{-1}}{3 \text{ cars travelling for 10}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93} = \frac{3}{3} (\text{MP1,2,&3)}$ $\frac{10 \text{ minutes at 5 m s}^{-1}}{3 \text{ cars travelling for 10}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93} = \frac{3}{3} (\text{MP1,2,&3)}$ $\frac{10 \text{ minutes at 5 m s}^{-1}}{3 \text{ and } 18 \text{ m s}^{-1}} = \frac{(-) 3.49 \text{ kg}}{3.06 \text{ to } 3.93} = 3 \text{ km}$ $\frac{3 \times 3 \text{ km} \times (0.26 \text{ kg km}^{-1} - 0.18 \text{ kg km}^{-1}) = 0.72 \text{ kg}}{3 \times 3 \text{ km} \times (0.26 \text{ kg km}^{-1} - 0.18 \text{ kg km}^{-1}) = 0.72 \text{ kg}}$ $\frac{1}{(\text{b)(ii)}}$ $\frac{1}{\text{ Quantitative comparison of values } 0.72 \text{ kg and } 0.54 \text{ kg to indicate that the cyclist causes more CO2 emissions}$ $\frac{1}{\text{ or qualitative statement e.g. more carbon dioxide emitted when he}{(1)}$ $\frac{1}{1} \text{ cycles}$ $\frac{1}{\text{ candidates answer must be consistent with their value from part (i)}$		3 cars 1 km	0.24 kg	0.21 to 0.27	1 (MP3)		
$\frac{1 \text{ cat 5 km}}{1 \text{ car travelling for 10}} = \frac{0.24 \text{ kg}}{1.02 \text{ to } 0.27 \text{ b} (M11,2,43)} = \frac{1 \text{ car travelling for 10}}{1 \text{ car travelling for 10}} = \frac{1.02 \text{ to } 0.27 \text{ b} (M11,2,43)}{1.02 \text{ to } 1.31} = \frac{3 \text{ (MP1,2,43)}}{3 \text{ (MP1,2,43)}} = \frac{1.02 \text{ to } 1.31 \text{ s} (M21,2,43)}{3 \text{ cars travelling for 10}} = \frac{1.02 \text{ to } 1.31 \text{ s} (M21,2,43)}{3 \text{ cars travelling for 10}} = \frac{1.02 \text{ to } 1.31 \text{ s} (M21,2,43)}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = \frac{1.02 \text{ to } 3.49 \text{ kg}}{1.00 \text{ minutes at 5 m s}^{-1}} = 0.72 \text{ kg}}$ 1 Quantitative comparison of values 0.72 \text{ kg and } 0.54 \text{ kg to indicate that the cyclist causes more CO ₂ emissions Or qualitative statement e.g. more carbon dioxide emitted when he (1) 1 \text{ to cycles candidates answer must be consistent with their value from part (i)}		1 car 3 km	0.24 kg	0.21 to 0.27	3 (MP1 2 & 3)		
$\frac{1}{1} \begin{array}{c} \text{car travelling for 10} (-) \ 1.164 \\ \text{minutes at 5 m s}^{-1} \text{ and } \\ \text{kg} \\ 18 \text{ m s}^{-1} \\ 3 \text{ cars travelling for } \\ 10 \text{ minutes at 5 m s}^{-1} \\ \text{and 18 m s}^{-1} \\ \end{array} \begin{array}{c} (-) \ 3.49 \text{ kg} \\ 3.06 \text{ to } 3.93 \\ 3 \\ \end{array} \begin{array}{c} \text{(MP1,2 \& 3)} \\ \text{(MP1,2 \& 3)} \\ \end{array} \end{array}$			() 1 1 c 4	1.02 (1.21	3 (MD1 2.82)		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		1 car travelling for 10 minutes at 5 m s ^{-1} and 18 m s ^{-1}	(-) 1.164 kg	1.02 to 1.31	3 (MP1,2,&3)		
Example of calculation Distance = 5 m s ⁻¹ × 10 × 60 s = 3000 m = 3 km $3 × 3 \text{ km} × (0.26 \text{ kg km}^{-1} - 0.18 \text{ kg km}^{-1}) = 0.72 \text{ kg}$ 1 (b)(ii)Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that the cyclist causes more CO2 emissions Or qualitative statement e.g. more carbon dioxide emitted when he cycles candidates answer must be consistent with their value from part (i)1		3 cars travelling for 10 minutes at 5 m s ^{-1} and 18 m s ^{-1}	(-) 3.49 kg	3.06 to 3.93	3 (MP1,2 &3)		
1Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that(b)(ii)Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that(b)(ii)Or qualitative statement e.g. more carbon dioxide emitted when he(1)1cycles(1)candidates answer must be consistent with their value from part (i)		Example of calculation Distance = 5 m s ¹ × 10 3×3 km × (0.26 kg km	$0 \times 60 \text{ s} = 30 \text{ m}^{-1} - 0.18 \text{ kg}$	000 m = 3 km g km ⁻¹) = 0.72	kg		
 (b)(ii) the cyclist causes more CO₂ emissions Or qualitative statement e.g. more carbon dioxide emitted when he (1) 1 cycles candidates answer must be consistent with their value from part (i) 	1	Quantitative comparison of values 0.72 kg and 0.54 kg to indicate that					
Or qualitative statement e.g. more carbon dioxide emitted when he (1) 1 cycles candidates answer must be consistent with their value from part (i) 1	(b)(ii)	the cyclist causes more	CO_2 emissio	ons		(4)	
cycles candidates answer must be consistent with their value from part (i)		Or qualitative statement e.g. more carbon dioxide emitted when he (1)				1	
candidates answer must be consistent with their value from part (1)		cycles candidates answer must be consistent with their value from part (i)					
Total for question		Total for question				6	

Question	Answer	Mark		
Number				
2(a)	Temperature (of gas) [treat references to oil/room as neutral](1)(1)			
	Mass of air/gas Or number of atoms/molecules/moles of air/gas [accept amount of air/gas, number of particles of air/gas]			
2(b)	Assumption: idea that volume occupied by trapped air \propto length of air in tube [e.g. volume = cross-sectional area × length] (1)			
	pL = a constant [accept pV = a constant] Or if p doubles, L halves (1)			
	At least 2 pairs of p , L values correctly read from graph (1)			
	Readings show that $pL = 4500$ (kPa cm) [± 100 kPa cm]	4		
	Or Readings show that p doubles when L is halved(1)[Accept references to V instead of L]			
	Example of calculation			
	$p = 400 \text{ kPa}, L = 11.0 \text{ cm}$ $pL=400 \times 11.0$ $= 4400$ $p = 200 \text{ kPa}, L = 23.0 \text{ cm}$ $pL=200 \times 23.0$ $= 4600$			
2(c)	Use of $pV = NkT$ [Allow use of $pV = nRT$ and $N = n.N_A$] (1)			
	Conversion of temperature to kelvin (1) $N = 8.4 \times 10^{20}$ [Accept answers in range 8.1×10^{20} to 8.4×10^{20}] (1)	3		
	[Answer in range but with an incorrect temperature conversion score max 2]			
	Example of calculation			
	$N = \frac{450 \times 10^{3} \text{Pa} \times 0.10 \text{m} \times 7.5 \times 10^{-5} \text{m}^{2}}{1.38 \times 10^{-23} \text{JK}^{-1} \times (273 + 20) \text{K}} = 8.35 \times 10^{20}$			
2(d)(i)	No change (1)	1		
2(d)(ii)	Similar curve (1)	_		
	Shifted higher Or shifted to the right(1)[an annotated diagram can score full marks]	2		
	Total for question	12		

Question	Answer		Mark
Number			
3 (a)	Credit any sensible limitation	(1)	
	Examples include:		
	• blunt pencil,		
	 protractor divisions only to one degree, 		
	 protractor of limited radius 		
	• method requires rays to be marked and then drawn on		
	Limited precision – linked to limitation	(1)	2
3(b)	Use of refractive index = ratio of speeds	(1)	
	Speed = $2.0 \times 10^{\circ} \text{ m s}^{-1}$	(1)	2
	Example of calculation		
	speed in plastic = $3.0 \times 10^{\circ}$ m s ⁻¹ ÷ 1.52		
	$= 1.97 \times 10^{\circ} \text{ m s}^{\circ}$		
3(b)(ii)	Use of sin $c = 1/\mu$, sin $c = 1/n$ (or equivalent, but must allow full solution if used		
	correctly without further equations)	(1)	•
	critical angle = 41°	(1)	2
	Example of coloulation		
	$\frac{12xample of calculation}{xin c = 1/1.52}$		
	$\sin c = 1/1.52$ $c = -1/10^{\circ}$		
*3(c)	OWC – Work must be clear and organised in a logical manner using		
5(0)	(QVC - Work must be clear and organised in a logical mainter using technical wording where appropriate)		
	teennear wording where appropriate,		
	The light strikes the sides at an angle greater than the critical angle	(1)	
	It undergoes total internal reflection	(1)	
	It is reflected again	(1)	
	It strikes the other end at less than the critical angle Or It is transmitted at the final	` '	
	boundary Or the ray has zero angle of incidence at the first end and is transmitted		
	undeviated	(1)	4
	Total for question		10

Question	Answer		Mark
Number		(4)	-
4(a)	Operable circuit with bulb and power supply variable to 12 V (ignore meters)	(1)	
	Ammeter correctly positioned	(1)	
	Voltmeter correctly positioned	(1)	
			3
	(voltmeter may be across ammeter as well, or whole circuit – but not across		
	any additional resistive components such as a variable resistor)		
4(b)(i)	The gradient of this graph is the rate of change of current with p.d.	(1)	
	Resistance is the ratio of pd/current		
	Or It is calculated using a value of $pd \div$ the corresponding value of current		
	Or it isn't a straight line so the gradient is not <i>R</i>	(1)	2
	(credit <i>R</i> not constant, so value at 6 V isn't applicable to other voltages)		
4(b)(ii)	Use of $R = V/I$	(1)	
	$R = 4.76 \Omega$	(1)	2
	Example of calculation		
	R = 6.00 V / 1.26 A		
	$R = 4.76 \Omega$		
*4(c)	(OWC – Work must be clear and organised in a logical manner using		
	technical wording where appropriate)		
	The resistance increases	(1)	
	(Because) the temperature increases (accept heats up)	(II)	
	Increasing the amplitude of the oscillation of the lattice ions	(1)	
	Leading to more (frequent) collisions of electrons with lattice ions	(n)	4
		(=)	-
	Allow converse marks for an explanation explicitly based on decreasing		
	potential difference		
	Total for question		11

Question	Answer		Mark
Number	(OWC Work must be clean and arganized in a logical monnon using		
*5(a)	(QWC – Work must be clear and organised in a logical manner using tochnical wording where appropriate)		
	technicalwording where appropriate)		
	a standing/stationary wave	(1)	
	Waves from the generator are reflected at the end		
	Or waves are travelling in both directions	(1)	
	(When the two) waves (meet they) superpose/undergo superposition	(1)	
	(when the two) waves (meet they) <u>superpos</u> e/undergo <u>superpos</u> ition	(1)	
	Producing points where the waves are in phase and points where they are in		
	antiphase		
	Or producing points of zero amplitude and points of maximum amplitude OR		
	producing nodes and antinodes	(1)	4
51)		(1)	
5 D)	Wavelength = 2×1.8 m	(1)	
	Use of speed = wavelength x frequency Speed = 1200 m s^{-1}	(1)	2
	Speed – 1200 m s	(1)	3
	Example of calculation		
	$\lambda = 2 \times 1.8 \text{ m}$		
	$v = 330 \text{ Hz} \times 3.6 \text{ m}$		
	$v = 1188 \text{ m s}^{-1}$		
5(c)(i)	Point is a node, so zero amplitude OR Point is a node, so string not moving	(1)	
		(1)	•
	So no energy absorbed Or waves continue to move after superposition	(1)	2
5(c)(ii)	(Original frequency x 2) = 660 Hz	(1)	1
		(-)	-
5(c)(iii)	Captured twice per cycle = 1320 Hz (allow ecf from (c) (iii))	(1)	
	If more than 1320 Hz will be captured at points other than max amplitude	(1)	2
5(d)	Scale divisions of 20 Hz Or Wide pointer Or nominal output (only)	(1)	
		(4)	
	Lack of precision (scale related) Or Lack of accuracy (output related)	(1)	2
	Total for question		14