Question Number	Answer		Mark
21(a)(i)	Recognises that wavelength = 2 × length of recorder **Or** recognises that length of recorder = $\lambda/2$ **Or** see that λ used is 47.2 cm / 0.472 m	(1)	
	Use of $v = f\lambda$ with $v = 330\ \text{m s}^{-1}$	(1)	
	$f = 700$ Hz	(1)	**3**
	Example of calculation Wavelength = 2 × length of recorder = 2 × 0.236 m = 0.472m $v = f\lambda$ so $f = 330\ \text{m s}^{-1} / 0.472\ \text{m} = 699$ Hz		
21(a)(ii)	To keep same frequency, wavelength would need to increase	(1)	
	So length of recorder needs to increase **Or** so length of air column needs to increase	(1)	
	This is achieved by sliding the recorder sections further apart **Or** this is achieved by loosening the sections of the recorder	(1)	**3**
	(Do not award MP2 or MP3 if clearly linked to a decrease in wavelength)		
21(b)	See $v = f\lambda$ and $v = \sqrt{(T/\mu)}$	(1)	
	Combines equations to show that $f \propto \sqrt{T}$ **or** $T = \text{k}f^2$ **Or** recognises that $T_2/T_1 = (f_2/f_1)^2$ **Or** see $\frac{(440)^2-(432)^2}{(432)^2}$	(1)	
	Percentage increase in T is 3.7%	(1)	**3**
	Example of calculation $f\lambda = \sqrt{(T/\mu)}$ so $T = \text{k}f^2$ $T_2/T_1 = (f_2/f_1)^2$ so $T_2/T_1 = (440\ \text{Hz}/432\ \text{Hz})^2 = 1.037$ Percentage increase in T is 3.7%		
	Total for Question 21		**9**