

Question Number	Answer	Additional guidance	Mark
4(a)	An explanation linking: make the distance between students larger (1) OR viable alternative method such as use microphones / sound sensors / datalogger (to start and stop timer) (1) with: to give a more measurable time (1) OR to remove (variable) reaction times (at start and end) / to reduce effect of reaction times / improve accuracy of timing (1)	50 m is too short (a distance to produce a measurable time) gives a longer time – more accurate measurement do not accept 'more accurate' without qualification for either method	(2)

Question Number	Answer	Additional guidance	Mark
4(b)	A description including <u>particles</u> (at end) vibrate (more) (about fixed positions) (1) cause neighbouring particles to vibrate (more) (1)	allow atoms / ions / molecules for particles vibrations passed along OR reference to longitudinal waves / compressions and rarefactions	(2)

Question Number	Answer	Additional guidance	Mark
4(c)	single straight line in upper right quadrant (1) direction change towards the normal (1)	ignore arrow direction conditional on first mark point	(2)

Question Number	Answer	Additional guidance	Mark
4(d)	using cold row: evaluate (K=)376 (1) using warm row: substitute K and ρ $\frac{376}{\sqrt{1.16}}$ OR 349.10... (1) 349 (m/s) to 3 sig figs (1)	other K from earlier calculation $\sqrt{1.16}$ any answer to 3 sig figs 349.10... scores MP1 and MP2 award full marks for the correct answer without working	(3)

(Total for Question 4 = 9 marks)
