

Experiment  
Q2 Wave pulses in a magnetically active fluid  
Marking Scheme

				TOTALS
A1	0.3	0.1	Ferrofluid in container	1.3
		0.1	Light position and direction shown	
		0.1	Includes at least one of camera, wooden base and hand to drive pulses	
A2	0.8	0.2	Sketch at least one pair of frames with important features and measurements	
		0.2	3 data points, raw data (0.1 for 2 data points)	
		0.2	Calculate speed in m/s - including converting from whatever units were measured in the video	
		0.2	$v = 0.25 - 0.30 \text{ m/s}$	
A3	0.2	0.1	Reasonable approach/formula	
		0.1	Up to 15% and consistent with method used.	
B1	0.3	0.1	Diagram	
		0.1	Measurements of $h$ and $l$ - no uncertainties no mark	
		0.1	$d(y) = y \tan \theta$ in terms of measured value of $\tan \theta$	
B2	0.3	0.1	A + B marked	
		0.1	Curve shape	
		0.1	Origin and axis orientation indicated somehow.	
B3	0.3	0.2	Relationship	
		0.1	V marked on B2 diagram	
B4	1.2	0.2	Diagram including set up for diffuse lighting	
		0.2	Choosing to fix $t$ , as there is higher resolution in $x$ and $y$	
		0.4	At least 10 coordinate pairs (0.2 for 6 coordinate pairs, 0.1 4 coordinate pairs)	
		0.2	Uncertainties on data	
		0.2	Sketch of key frame with curve and coordinates marked	
B5	1.3	0.1	Convert to SI units	
		0.1	Choice of origin - $x = 0$ is not the edge of the container	
		0.1	Calculations of values to graph	
		0.4	Useful graph, accurate plotting, suitable labels (0.2 if $t$ is not fixed on graph)	
		0.2	Uncertainties calculated and graphed	
		0.2	$\kappa = 4 - 7 \text{ m}^{1/2}\text{s}^{-1}$	
		0.1	Calculation of uncertainties	
		0.1	Uncertainty less than 15%	

C1	1.8	0.2	Sketch - showing two pulses, one catching the one in front, with perturbations around magnets	1.8
		0.3	2. over magnets, 6D. when fronts catch each other, 1. reflection off ends	
		0.2	Sketch - one pulse being refracted by two magnets	
		0.3	2. over magnets, 1. reflection off ends, 5. diffraction through gap	
		0.4	Sketch - sidewall reflection, lump refraction, interference everywhere, diffraction between lumps	
		0.4	1, 2, 5, 6d	
D1	0.2	0.2	More circular shape, and reflection off walls	3.5
D2	0.8	0.1	Diagram of set up, similar to A	
		0.1	Sketch at least one pair of frames with important features and measurements	
		0.2	3 data points, raw data	
		0.1	Calculations	
		0.1	Uncertainty in speeds	
		0.2	Speeds in range 0.26-0.31 m/s	
D3	0.4	0.2	Sketch with similar form to D1 before where the pulse crosses the region with the magnet	
		0.2	In region where it has crossed the magnet pulse should be ahead of where it would otherwise be	
D4	0.3	0.1	Diffuse lighting (or direct lighting, but only if the sketches of frames demonstrate it was appropriately aligned).	
		0.1	Graticule aligned with wave propagation direction.	
		0.1	Wooden base, fluid and magnets marked.	
D5	1	0.2	Sketches of frames with magnet lump region identified.	
		0.2	At least 3 data sets.	
		0.1	Calculations of time from frames	
		0.4	Time is in range 0.06 to 0.12 s	
		0.1	Uncertainty in time	
D6	0.8	0.1	Simple model of lump, e.g. cylinder.	
		0.3	Good estimates of dimensions of lump and depth of bulk fluid,	
		0.2	Calculation	
		0.2	Conclusion - probably ambiguous.	
TOTAL:				10