Experiment: "Electrical conductivity in two dimensions"
Marking Scheme

Part				Maximum points		Total points
A: Four-point-probe (4PP) measurements						1.2
A1	Value		$1.9 < s < 2.1$	0.1	0.6	
	Table and Graph		I and V are measured at 4 or more points	0.3		
			Points are properly marked using the majority part of the graph	0.2		
			If I > V	-0.1		
			Missing or incorrect units (either or both)	-0.1		
			Missing axis labels (either or both)	-0.1		
A2	Calculation		1000 Ohm < R < 1200 Ohm with units	0.2	0.2	
A3	Calculation		Either: extremal lines with slopes, error= difference of slopes, or numerical regression analysis. If the dispersion of measurements from the mean line not visible, error propagation from instrument error is allowed or a conclusion that error is negligible.	0.4	0.4	
			Missing or incorrect units (either or both)	-0.1		
B: Sheet resistivity						0.3
B1	Calculation		$\rho_\square$ calculation is consistent with A2	0.3	0.3	
			Missing or incorrect units (either or both)	-0.1		
C: Measurements for different sample dimensions						
C1	Measurements		4 values w/s, ≥ 4 data points per w/s	3	3	3.2
			3 values 4 w/s	2		
			2 or less values 4 w/s	0		
			4 or 3 values w/s, ≥ 3 data points per w/s	-0.5		
			4 or 3 values w/s, ≥ 2 data points per w/s	-1		
			4 or 3 values w/s, ≥ 1 data points per w/s	-1.5		

Part			Maximum points		Total points
		Missing or incorrect units (either or both)	-0.1		
C2	Calculation	*f(w/s) for ≥ 3 values*	0.2	0.2	
		f(w/s) for 1 or 2 values	0.1		
D: Geometrical correction factor					1.9
D1	Graph	Choice of appropriate graph and axis values, so that the marks should lie on a line.	0.8	1	
		Points are properly marked using the major part of the graph; irrespective of graph used	0.2		
		Missing or incorrect labels (either or both)	-0.1		
		Missing or incorrect units (either or both)	-0.1		
D2		Reasonable fit over all marks	0.3	0.9	
		$2.2 < a < 3.6$	0.3		
		$1.8 < a < 2.2, 3.6 < a < 4$	0.2		
		$-2 < b < -1$	0.3		
		Missing or incorrect labels (either or both)	-0.1		
		Missing or incorrect units (either or both)	-0.1		
E: The silicon wafer and van der Pauw-method					3.4
E1	Table	0.1 per I and V measurement; max 0.4 points	0.4	0.4	
		Missing or incorrect units (either or both)	-0.1		
E2	Graph and Calculation	Points are properly marked using the majority part of the graph	0.1	0.4	
		Reasonable fit over all marks	0.1		
		R_{4PP} according to the wafer table ± 15 %, if wafer number is not known use $R_{4PP} = 55\ \Omega$	0.2		

Part			Maximum points	Total points
		R_{4PP} according to the wafer table 15.1 30 %, if wafer number is not known use $R_{4PP} = 55\ \Omega$	0.1	
		Missing or incorrect labels (either or both)	-0.1	
		Missing or incorrect units (either or both)	-0.1	
E3	Calculation	Consistent calculation of f(w/s) with D2	0.2	0.2
E4	Calculation	$\rho_\square$(4PP)	0.1	0.1
		No or incorrect units	-0.1	
E5	Sketch and table	Sketch present and makes sense	0.2	0.6
		6 different I and V values are taken	0.4	
		5 different I and V values are taken	0.3	
		4 different I and V values are taken	0.2	
		3 different I and V values are taken	0.1	
		2 or less different I and V values are taken	0	
		V points are extremely unequally spaced	-0.1	
		Missing or incorrect units (either or both)	-0.1	
E6	Sketch and table	Sketch should be perpendicular to F5, otherwise the whole part gets 0 points		0.6
		Sketch present, makes sense and perpendicular to the sketch of F5	0.2	
		6 different I and V values are taken	0.4	
		5 different I and V values are taken	0.3	
		4 different I and V values are taken	0.2	
		3 different I and V values are taken	0.1	
		2 or less different I and V values are taken	0	
		V points are extremely unequally spaced	-0.1	
		Missing or incorrect units (either or both)	-0.1	

Part			Maximum points		Total points
E7	Graph	Points are properly marked using the majority part of the graph	0.1	0.5	
		Reasonable fit over all marks	0.1		
		$\langle R \rangle$ = vdPauw resistance of wafer table ± 10 %, if wafer number is not known use $\langle R \rangle$ = 42 Ω	0.3		
		$\langle R \rangle$ = vdPauw resistance of wafer table ± 10.1 to 20 %, if wafer number is not known use $\langle R \rangle$ = 42 Ω	0.2		
		$\langle R \rangle$ = vdPauw resistance of wafer table ± 20.1 to 30 %, if wafer number is not known use $\langle R \rangle$ = 42 Ω	0.1		
		Missing or incorrect labels (either or both)	-0.1		
		Missing or incorrect units (either or both)	-0.1		
E8	Solve Eqn.	$\rho_{\square} = \frac{\pi}{\ln 2} \langle R \rangle$ formula is present	0.3	0.4	
	Calculation	Consistent calculation $\rho_{\square}$	0.1		
		Missing or incorrect units	-0.1		
E9	Calculation	Value is written with correct units (fraction, decimal and % are accepted)	0.1	0.1	
E10	Calculation	Consistent calculation ρ	0.1	0.1	
		Missing or incorrect units	-0.1		

Total number of points		10