Name of the Student:_____

Max. Marks : 23 Marks **Time : 23 Minutes**

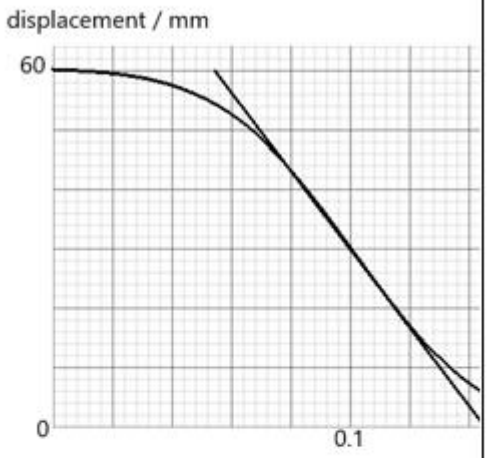
Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional guidance	Mark
	• When plank tips, support force at rock = 0 **(1)** **Or** When plank tips, clockwise moment is greater than anticlockwise moment **(1)** • Use of principle of moments • If person is at the end, clockwise moment = 770 N, anticlockwise moment due to weight is 270 Nm < 770 Nm so student is correct **(1)** **Or** Starts to tip when person is 0.49 m to the right of the wall, 0.49 m < 1.4 m so student is correct	Example of calculation 245 N × (2.5 – 1.4) m = 550 N × x x = 0.49 m < 1.4 m so tips **Or** 245 N × (2.5 – 1.4) m = 270 Nm 550 N × 1.4 m = 770 Nm 770 Nm > 270 Nm so it tips	3

Q2.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• uses ratio of lengths to determine p.d. across potentiometer • V = 9.6 (V)	(1) (1)	Example of calculation: p.d. across potentiometer = $\frac{115\text{ mm}}{60\text{ mm}} \times 5\text{ V} = 9.6\text{ V}$	2
(ii)	• determines p.d. across R • apply $V = IR$ to potentiometer to determine current **Or** uses ratio of resistances = ratio of p.d.s • $R = 3000\ \Omega$	(1) (1) (1)	Example of calculation: current in circuit = $\frac{9.6\text{ V}}{12000\ \Omega} = 8.0 \times 10^{-4}$ A p.d. across $R = 12 - 9.6 = 2.4$ V $R = {}^{2.4\text{ V}}/_{8.0 \times 10^{-4}\text{A}}$ R = 3000 Ω (show that value gives 2400 Ω)	3
(iii)	• A battery has internal resistance • There is a p.d. across the internal resistance • Terminal p.d. less (than e.m.f.) **Or** refers to $V = E - Ir$	(1) (1) (1)	Accept "lost volts" for MP2 V must be the subject	3

(iv)	• tangent drawn on the curve • uses a triangle base of at least 0.06 s • attempt to find a gradient • velocity = 0.68 m s^{-1} so velocity not exceeded allow range from to 0.60 m s^{-1} to 0.80 m s^{-1}	(1) (1) (1) (1)	MP2 dependent on MP1  v = gradient = $\frac{60 \text{ mm}}{0.144 - 0.056}$ v = 682 mm s^{-1}	4

Q3.

Question Number	Acceptable Answer	Additional Guidance	
(i)	• Wear safety glasses (to protect eyes from breaking wire) **Or** wear suitable footwear (to protect feet from falling masses) **Or** place sand tray under masses (to catch them if they fall)		1

Question Number	Acceptable Answer	Additional Guidance	
(ii)	• $\lambda = 2L$ substituted into $v = f\lambda$ (1) • v substituted into $v = \sqrt{\frac{T}{\mu}}$ (1) • Correct re-arrangement into $y = mx + c$ format (1)	$v = f\lambda$ and $\lambda = 2L$ so $v = 2fL$ $v = \sqrt{\frac{T}{\mu}}$, so $4f^2L^2 = \frac{T}{\mu}$ $L^2 = \left(\frac{T}{4\mu}\right).\frac{1}{f^2}$, so gradient is $\frac{T}{4\mu}$	3
(iii)	• Gradient calculated (1) • Use of gradient = $\frac{T}{4\mu}$ (1) • $\mu = 1.8$ (g m^{-1}) (1) • SWG consistent with their calculated value of μ (24 swg) (1)	Example of calculation gradient = $\frac{(0.043 - 0)\text{m}^2}{(15.0 - 0.0) \times 10^{-6}\text{s}^2} = 2.87 \times 10^3\text{m}^2\text{s}^{-2}$ $\mu = \frac{2.1\text{ kg} \times 9.81\text{ m s}^{-2}}{4 \times 2.87 \times 10^3\text{m}^2\text{s}^{-2}} = 1.79 \times 10^{-3}\text{ kg m}^{-1}$ $\therefore \mu = 1.79\text{ g m}^{-1}$	4