Question Number	Answer	Mark
1(a)	Use of spring constant = gradient **Or** use of $F = k\Delta x$ using a pair of values from the graph **(1)** Spring constant = (3.5 to 3.6) × 10^4 N m^{-1} **(1)** Example of calculation Gradient = $\frac{3.6 \times 10^3 \text{ N}}{10.2 \times 10^{-2} \text{ m}}$ Spring constant = 3 5300 N m^{-1}	**2**
1(b)(i)	Use of E = ½ $F\triangle x$ **Or** use of work done = area under graph **(1)** Using the correct region of the graph (trapezium under graph from 3 to 9 cm) **(1)** Work done by the child on the spring = 126 -128 (J) **(1)** Example of calculation Work done in compressing spring = (½ × (3.2× 10^3 N) × (9 × 10^{-2} m)) - (½ × (1.05 × 10^3 N) × (3 × 10^{-2} m)) Work done by the child on the spring = 128 J	**3**
1(b)(ii)	Elastic potential energy to kinetic energy **(1)** and gravitational potential energy **(1)** (accept EPE, E_{el}, GPE, E_{grav}, KE, E_k) (only penalise once the omission of potential from gravitational or elastic potential energy)	**2**
1(b)(iii)	Use of $E_{grav} = mgh$ **(1)** Use of work done by child on spring = $E_{grav} + E_k$ **(1)** Use of E_k = ½ mv^2 **(1)** v = 2.5 m s^{-1} (ecf from part (b)(i)) **(1)** Example of calculation E_{grav} = 35 kg × 9.81 N kg^{-1} × 0.06 m = 20.60 J E_k = 128 J – 20.60 J = 106.4 J $v = \sqrt{\frac{2 \times 106.4 \text{ J}}{35 \text{ kg}}}$ v = 2.48 m s^{-1}	**4**
***1(c)**	**(QWC – work must be clear and organised in a logical manner using technical terminology where appropriate)** (The pogo-stick pushes down on the ground and) by N3 the ground exerts an upwards force on the pogo-stick **(1)** Upwards force on pogo-stick > weight of pogo-stick **Or** there is an unbalanced upwards force on the pogo-stick **(1)** Due to N1/ N2 the pogo-stick accelerates (upwards) **(1)**	**3**
	Total for Question	**14**