Question number	Answer		Mark
13	• Use of $\Delta E_{grav} = mg\Delta h$	(1)	
	• Idea that centripetal force at top of loop equals weight for minimum speed	(1)	
	• Use of $F = mv^2/r$	(1)	
	• Use of $E_k = ½ mv^2$	(1)	
	• Add E_{grav} at top of loop and required E_k **Or** Subtract E_{grav} at top of loop from E_{grav} at launch **Or** Subtract required E_k from E_{grav} at launch	(1)	
	• (ΔE_{grav} at start of) 0.081 J is less than 0.089 J (for sum of E_{grav} at top of loop and required E_k, so insufficient energy), so it does not complete the loop **Or** (Height required of) 0.275 m is greater than 0.25 m, (the height of launch position, so insufficient energy), so it does not complete the loop **Or** E_k at height of top of loop would be 0.0097 J which is less than the required 0.071 J (so insufficient energy), so it does not complete the loop **Or** v at height of top of loop would be 0.77 m s^{-1} which is less than the required 1.04 m s^{-1} so it does not complete the loop **Or** $mv^2/r = 0.18$ N which is less than weight of 0.32 N so it does not complete the loop	(1)	**6**
	Do **not** credit parts of calculation or derivation unambiguously using the formula for uniform acceleration $v^2 = 2as$, i.e. if the symbols are seen and substitution is from them and not from $mg\Delta h = ½ mv^2$		
	<u>Example of calculation</u> ΔE_{grav} at release point = 0.033 kg × 9.81 N kg^{-1} × 0.25 m = 0.0809 J W = 0.033 kg × 9.81 N kg^{-1} = 0.324 N At minimum speed $W = mv^2/r$ 0.324 N = 0.033 kg × v^2 / 0.11 m v = 1.04 m s^{-1} $E_k = ½ \times 0.033$ kg × (1.04 m s^{-1})^2 = 0.0178 J ΔE_{grav} at top of loop = 0.033 kg × 9.81 N kg^{-1} × 0.22 m = 0.0712 J Total energy required to complete loop = 0.0178 J + 0.0712 J = 0.089 J 0.0809 J < 0.089 J		
	Total for question 13		**6**