Question Number	Answer		Mark
17(a)	The hammer head is not in free fall **Or** Person is exerting a force on the hammer	**(1)**	
	Work is done on the hammer head by the person	**(1)**	
	So additional energy is transferred to kinetic energy (MP3 dependent on MP1 or MP2)	**(1)**	**3**
17(b)	Use of $\Delta W = F \Delta s$	**(1)**	
	Use of ε = (useful energy output) / (total energy input)	**(1)**	
	Use of $\Delta E_{grav} = m\ g\ \Delta h$ **Or** Use of $E_k = ½\ m\ v^2$ and valid *suvat* method	**(1)**	
	Δh = 1.9 m **Or** F_{req} = 83 N **Or** E_{req} = 4.0 J **and** E_{out} = 2.8 J	**(1)**	
	Conclusion consistent with student's calculation	**(1)**	**5**
	e.g. The cylinder won't hit the bell because 1.9 m < 2.7 m **Or** Force needed to hit bell = 83 N > 53 N so cylinder won't hit the bell **Or** Useful output = 2.8 J but energy needed to hit bell is 4.0 J so cylinder won't hit the bell		
	Example of calculation energy of hammer head = ΔW = 58 N × 1.2 m = 69.6 J useful energy output = 0.04 × 69.6 J = 2.78 J g.p.e. gained = 2.78 J = 0.15 kg × 9.81 N kg^{-1} × Δh Δh = 2.78 J ÷ 1.47 N = 1.89 m 1.9 < 2.7 ∴ no		
17(c)	($E_k = ½mv^2$ so) kinetic energy is proportional to square of velocity **Or** ($E_k = ½mv^2$ so) kinetic energy multiplies by four (if v doubles)	**(1)**	
	So cylinder could move through four times the distance	**(1)**	**2**
	Total for question 17		**10**