Mechanics 2 Work, Energy, Power

1(a)	$KE = \frac{1}{2} \times 0.4 \times 8^2 = 12.8$ J	M1 A1	2	Use of KE formula. Correct KE
(b)(i)	$KE = 12.8 + 0.4 \times 9.8 \times 6 = 36.32$ J AG	M1 A1	2	Calculation of GPE Correct KE from correct expression (Allow use of CA equations in solutions)
(ii)	$\frac{1}{2} \times 0.4v^2 = 36.32$	M1 A1		Two term energy equation Correct energy equation
	$v = \sqrt{\frac{36.32 \times 2}{0.4}} = 13.5 \text{ ms}^{-1}$	A1	3	Correct speed
(iii)	No air resistance No resistance forces Weight is the only force	B1	1	Appropriate assumption
	Total		**8**	

2(a)	$\text{KE} = \frac{1}{2} \times 0.6 \times 14^2 = 58.8$ J	M1 A1	2	use of KE formula correct energy
(b)	$0.6 \times 9.8h = 58.8$	M1		two term energy equation involving PE and previous energy
	$h = \frac{58.8}{0.6 \times 9.8} = 10$ m	A1 A1	3	correct equation correct height Note: Constant acceleration methods not accepted.
(c)(i)	WD against resistance $= 58.8 - 0.6 \times 9.8 \times 8$ $= 11.76 = 11.8$ J (to 3 sf)	M1 A1 A1	3	three term energy equation correct equation correct value
(ii)	$8F = 11.76$ $F = 1.47$ N	M1 A1ft	2	using work done = Fd with $d = 8$ correct force accept 1.48
(d)	The magnitude of the force would vary with the speed of the ball.	B1	1	appropriate explanation
	Total		**11**	

1(a)	$\frac{1}{2} \times 35 \times v^2 = 35 \times 9.8 \times 10$	M1 A1		Energy method
	$v = 14$ (ms^{-1})	A1	3	
(b)	Air resistance or friction	B1	1	
(c)	Energy lost =			
	$35 \times 9.8 \times 10 - \frac{1}{2} \times 35 \times 12^2 \quad (=910)$	M1 A1		Difference attempted ±
	Work done: $F \times 20 \qquad (=910)$	m1		
	$20F = 910 \qquad F = 45.5(\text{N})$	A1	4	$F > 0$
	Total		**8**	

1(a)	Kinetic energy $= \frac{1}{2} \times 5 \times 10^2$	M1		Full method
	$= 250$ J	A1	2	
(b)	Using conservation of energy: KE when box hits ground			
	= Initial KE + Change in potential energy	M1		Could have sign errors
	$= 250 + 5 \times 30 \times g$	A1ft		
	$= 1720$ J	A1	3	AG; SC2 $5 \times 35.1 \times g = 1720$. ...
(c)	$\frac{1}{2}mV^2 = 1720$	M1		
	$V^2 = 688$	A1		
	∴ Speed is 26.2 m s^{-1}	A1	3	CAO; accept $\sqrt{688}$ or $4\sqrt{43}$; SC2 26.3
(d)	No air resistance	E1		Or no resistance forces
	Box is a particle	E1	2	Deduct 1 mark for unacceptable third reason
	Total		**10**	