1	[7.3 sinα = 5.5]	M1		For using $R_y = 0$
	α = 48.9	A1		
	[R = 6.8 – 7.3 cos48.9°]	M1		For using $R = R_x$
	Magnitude of resultant is 2 N	A1		
			[4]	
2	[1.2 – 0.24t = 0.6]	M1		For using a = dv/dt and attempting to solve a = 0.6
	t = 2.5	A1		
	[$s = 0.6t^2 – 0.04t^3$]	M1		For using $s = \int v dt$
	$s = (0.6 \times 2.5^2 – 0.04 \times 2.5^3) – (0 – 0)$	DM1		For using limits 0 to 2.5 or equivalent (dependent on integration)
	Displacement is 3.125 m	A1		Accept 3.12 or 3.13
			[5]	
3	**(i)** [WD = 25 × 40 cos30°]	M1		For using WD = Fdcosθ
	Work done is 866 J	A1		
			[2]	
	(ii) [50 × 40 cos30° = 866 + KE gain]	M1		For using WD by P = WD against resistance + KE gain
	KE gain is 866 J	A1ft		ft incorrect ans **(i)**
		M1		For using KE gain = ½ m($v^2 – u^2$)
	½ 35($v^2 – 1.2^2$) = 866	A1ft		ft incorrect KE
	Speed is 7.14 ms^{-1}	A1		
			[5]	
				SR (max 2/3 for the last three marks) for using Newton's second law and constant acceleration formula 50 cos30° – 25 cos30° = 35a and $v^2 = 1.2^2 + 2 \times 40a$ M1 ➔ speed is 7.14 ms^{-1} A1
4	**(i)** 0.36g sin60° – T = 0.36 × 0.25	B1		
	Tension is 3.03 N	B1		AG
			[2]	
	(ii)	M1		For applying Newton's second law to B.
	T ± F – 0.24g sin60° = 0.24 × 0.25	A1		
	F = 3.03 – 0.24g sin60° – 0.24 × 0.25 (F = 0.889)	A1		
	R = 0.24g cos60° (R = 1.2)	B1		
		M1		For using μ = F/R
	Coefficient is 0.74	A1		
			[6]	
5	**(i)**			For using s = ½ (u + v)t to find AB
	[s = ½ (1.4 + 1.1) × 1.2; 1.1 = 1.4 + (–d) × 1.2]	M1		**or** v = u + at to find d
	AB = 1.5 m **or** d = 0.25	A1		
	d = 0.25 **or** AB = 1.5 m	B1ft		
			[3]	

	(ii)	$[0 = u^2 + 2(-0.25)2;$ $2 = 0 - ½(-0.25)t^2]$	M1		For using $0 = u^2 + 2(-d)s$ to find u **or** $s = 0 - ½(-d)t^2$ to find t
		Speed is 1 ms^{-1} **or** time is 4 s	A1		
		Time is 4 s **or** speed is 1 ms^{-1}	B1ft		
				[3]	
	(iii)	For line joining (0, 1.4) and (1.2, 1.1)	B1		
		For line joining (1.2, –1) and (5.2, 0)	B1ft		ft wrong answer(s) in **(ii)**
				[2]	
					SR (max 1/2) For two correct lines and values missing B1ft
6	**(i)**	$[2a = 3.5]$	M1		For using $v = 0 + at$
		Acceleration is 1.75 ms^{-2}	A1		
		$[1.75 = g\sin\alpha]$ or	M1		For using $a = g\sin\alpha$
		$[0.5 \times 3.5^2 = gh;$ $s = 0.5 \times 3.5 \times 2$ and $\sin\alpha = h/s]$			or for using $½mv^2 = mgh$, $s = ½vt$ and $\sin\alpha = h/s$
		Angle is 10.1^o or 0.176^c	A1		
				[4]	
	(ii)	$[s_P = ½ a2^2 + \{(a2)t + ½ at^2\}]$ or $[s_P = ½ a(t + 2)^2]$	M1		For constructing an expression in t for s_p
		$[s_P - s_Q = ½ a2^2 + (a2)t + ½ at^2 - ½ at^2]$	M1		For constructing an expression in t for $s_P - s_Q$
		$2 \times 1.75 + 2 \times 1.75t$	A1		Correct expression for $s_P - s_Q$
		$[4.9 = 2a + 2at]$	M1		For using $s_P - s_Q = 4.9$ to construct an equation in t
		$t = 0.4$	A1		
				[5]	
7	**(i)**	R = 4500 N	B1		
		$3150 = \mu 4500$	M1		For using limiting equilibrium of boxes ➔ $P = \mu R$
		Coefficient is 0.7	A1		
				[3]	
	(ii)		M1		For resolving forces horizontally on A when A is about to slide
		$0.2 \times 200g = 200a$	A1		AG
		No sliding ➔ $a \leqslant 2$	A1		
				[3]	
	(iii)	$[P - F = 450a;$ $P - F - F_2 = 250a]$	M1		For applying Newton's second law to A and B combined or to B
		$P_{max} = 3150 + 450 \times 2$ or $P_{max} = 3150 + 0.2 \times 2000 + 250 \times 2$	A1		
		$P_{max} = 4050$ N	A1		
				[3]	