Question Number	Answer		Mark
16(a)	Resolves velocity to find vertical component	**(1)**	
	Use of $v = u + a\,t$	**(1)**	
	Time to max height = 3.3 (s)	**(1)**	**3**
	Example of calculation		
	$u_v = 50$ m s^{-1} sin (40°) = 32.1 m s^{-1}		
	$v = u + a\,t$ with $v = 0$		
	$t = 32.1$ m s^{-1} ÷ 9.81 m s^{-2} = 3.28 s		
16(b)	Use of $v_H = v \cos\theta$	**(1)**	
	Use of $s = u\,t$ to calculate horizontal distance	**(1)**	
	Use of $s = u\,t + \frac{1}{2}\,a\,t^2$ to calculate maximum height or other *suvat* equation	**(1)** **(1)**	
	Maximum height = 53 m (allow ecf from (a))	**(1)**	
	Use of tan θ to calculate vertical height of hill	**(1)**	
	Compares height of hill with maximum height (accept conclusion based on candidate's values).		
	Or		
	Use of $v_H = v \cos\theta$	**(1)**	
	Use of $s = u\,t$ to calculate horizontal distance	**(1)**	
	Use of $s = u\,t + \frac{1}{2}\,a\,t^2$ to calculate maximum height or other *suvat* equation	**(1)** **(1)**	
	Maximum height = 53 m (allow ecf from (a))	**(1)**	
	Use of tan θ to calculate minimum angle of hill for a hit	**(1)**	
	Compares angle of hill with minimum angle (accept conclusion based on candidate's values).		
	Or	**(1)** **(1)**	
		(1)	
	Use of $v_H = v \cos\theta$	**(1)**	
	Use of $s = u\,t$ to calculate horizontal distance	**(1)**	
	Use of $s = u\,t + \frac{1}{2}\,a\,t^2$ to calculate maximum height or other *suvat* equation	**(1)**	**6**
	Maximum height = 53 m (allow ecf from (a))		
	Use of tan θ to calculate horizontal distance to 52.6 m height along hill		
	Compares horizontal distances (accept conclusion based on candidate's values).		
	Example of calculation		
	$v_H = 50$ m s^{-1} × cos (40°) = 38.3 m s^{-1}		
	$s_H = v_H \times t$		
	$s_H = 38.3$ m s^{-1} × 3.28 s = 125 m		
	maximum height of rock = $s_V = u_V\,t + \frac{1}{2}\,a\,t^2$ with $a = -g$		

	s_V = 32.1 m s^{-1} × 3.28 s − ½ × 9.81 m s^{-2} × (3.28 s)^2 = 52.6 m	
	vertical height of hill at horizontal distance of 125 m = 125 m × tan (20°)	
	= 45.7 m	
	45.7 m < 52.6 m, so no	
	Total for question 16	**9**