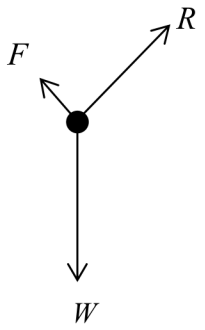
Question Number	Answer		Mark
18(a)	• Weight/W/mg labelled • (Normal) reaction/contact force (accept R/N/C) • Friction/F • Lengths $R<W$ **and** $F<W$ (-1 off total for each additional arrowed line and MP4 conditional on MP1, 2 **and** 3) (do not accept components of forces, even if both given and accept correct direction/size by eye)  	**(1)** **(1)** **(1)** **(1)**	**4**
18(b)(i)	• Initially friction/drag negligible/small/less (as the velocity is low) • See $mg\sin\theta$ **Or** $W\sin\theta$ • $mg\sin\theta = ma$ and the masses cancel (so a independent of m)	**(1)** **(1)** **(1)**	**3**
18(b)(ii)	• As velocity increases, air resistance increases • Until frictional forces = component of weight down slope • Resultant force = 0 **and** there is no more acceleration (at max velocity) (MP2 allow frictional forces = $mg\sin\theta$)	**(1)** **(1)** **(1)**	**3**
18(b)(iii)	• A larger person would have a greater area/volume • The air resistance would be greater (accept drag)	**(1)** **(1)**	**2**

18(c)(i)	See $\theta = \tan^{-1} 0.2$ **and** $\theta = 11.3°$ **Or** see $\tan\theta = 0.2$ **and** $\theta = 11.3°$ **(1)**	**1**
18(c)(ii)	**Either** (Energy) Use of $E_k = ½ mv^2$ **(1)** Use of trig to determine the component of weight along the slope or the vertical height in terms of L **(1)** Use of $E_{grav} = mg\Delta h$ (to determine E_{grav}) **Or** use of $W = F\Delta s$ **(1)** Use of of $E_k = E_{grav} + W$ (to determine **(1)** $L = 120$ m **(1)** **Or** (forces) Use of trig to determine the component of weight along the slope or the vertical height in terms of L **(1)** Use of resultant force = $mg\sin 11.3° + 240$ N **(1)** Use of $\Sigma F = ma$ to determine a **(1)** Use of $v^2 = u^2 + 2as$ with their a (not 9.81) to determine s **(1)** $L = 120$ m **(1)** Example of calculation $E_k = ½ \times 95 \text{ kg} \times (33 \text{ m s}^{-1})^2 = 51728$ J $51728 \text{ J} = (95 \text{ kg} \times 9.81 \text{ N kg}^{-1} \times \sin 11.3° \times L) + (240 \text{ N} \times L)$ $L = 122$ m	**5**
	Total for question 18	**18**