Question Number	Answer	Mark
20(a)	Stress (or strain) value at/beyond which a material/object undergoes a sudden or large plastic deformation **(1)**	**1**
20(b)(i)	The force/tension from/in the cable (on the actor) is greater than the weight of the actor **(1)** (So) there is a resultant/net/unbalanced force (upwards) **(1)**	**2**

20(b)(ii)	Use of $W = m\,g$ **(1)** Use of $\Sigma F = m\,a$ **(1)** Tension = 917 (N) **(1)** Example calculation $W = 77\text{ kg} \times 9.81\text{ N kg}^{-1} = 755\text{ N}$ $T - 755\text{ N} = 77\text{ kg} \times 2.1\text{ m s}^{-2}$ $T = 162\text{ N} + 755\text{ N} = 917\text{ N}$	**3**
20(b)(iii)	Use of $A = \pi r^2$ **(1)** Use of $\sigma = F \div A$ (ecf from (b)(ii)) **(1)** Allowed stress (15% yield stress of steel) = 3.8×10^7 Pa **and** $\sigma = 2.0 \times 10^7$ Pa **Or** $(15\%)^{-1}$ of cable stress = 1.3×10^8 Pa **Or** Max safe tension = 1.7×10^3 N **Or** Min safe diameter = 5.6×10^{-3} m **Or** Percentage of yield stress = 8% **Or** Max safe acceleration = 12.3 m s^{-2} **(1)** Valid conclusion by comparison of relevant student values **(1)** Example calculation $A = \frac{\pi d^2}{4} = \frac{\pi \times (7.6 \times 10^{-3}\text{m})^2}{4} = 4.54 \times 10^{-5}\text{ m}^2$ $\sigma = \frac{917\text{ N}}{4.54 \times 10^{-5}\text{m}^2} = 2.02 \times 10^7$ Pa (show that value gives 2.03×10^7 Pa) $0.15 \times 2.5 \times 10^8\text{ Pa} = 3.75 \times 10^7\text{ Pa}$ $2.03 \times 10^7\text{ Pa} < 3.75 \times 10^7\text{ Pa}$ so it is safe.	**4**
20(c)	New cable has a greater cross sectional area, (but same breaking stress) so a greater force is required **(1)** Because new cable has smaller Young modulus, there is a greater strain for the same stress **(1)** So (at breaking stress) there will be a greater extension (because cables are the same length) [dependent on MP2] **Or** Smaller Young modulus implies greater extension (at breaking stress, because cables are the same length) [independent mark] **(1)** (And as) force and extension both increase, work done to break the new cable is greater than that for the original cable [independent mark] **(1)**	**4**
	Total for question 20	**14**