Question 21 (4 marks)

In his science fiction novel *From the Earth to the Moon*, Jules Verne describes how to launch a capsule from a cannon to land on the moon. To reach the moon, the capsule must leave the cannon with a speed of 1.06×10^4 m s^{-1}. The cannon has a length of 215 m, over which the capsule can be assumed to accelerate constantly.

(a) Calculate the magnitude of the acceleration required to achieve this speed using this cannon. **2**

$v = \frac{r}{t}$ $\therefore t = \frac{r}{v} = \frac{215}{1.06\times10^4} = 0.02\ s$ $v = 1.06\times10^4$ m/s

$v = u + at$ $l = 215$ m

$1.06\times10^4 = 0 + a \times (0.02)$ $\therefore a = 5.23\times10^5$ m/s^2

(b) Referring to your answer in part (a), explain why Jules Verne's method is unsuitable for sending a living person to the moon. **2**

At such a large acceleration, a living person would not be able to survive the g forces created by the thrust. (It would exceed 3g)