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

$$a = \frac{v^2}{u^2 + 2s} \implies \frac{(1.06E^4)^2}{0^2 + 2 \times 215} = 261302 \, ms^{-2} \; (\text{nearest ms})$$

$$= 261302.3256\ldots$$

(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

It is unreasonable to send humans to the moon using this method, because accelerations of such magnitude are too great for the human body to withstand.