

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 $1.06 \times 10^4 \text{ m s}^{-1}$. 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

$$v = u + at \quad a = \frac{1.06 \times 10^4}{215 \times 10^{-2}}$$

$$a = \frac{v - u}{t} \quad a = 4.930 \times 10^2 \text{ m s}^{-2}$$

- (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

As the value exceeds $10g$ ($10 \times 9.8 \text{ m s}^{-2}$) it is unsuitable for humans to travel. Human capabilities limit, things cannot survive at high accelerations due to acceleration stress.