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**

$v = 1.06 \times 10^4$ ms^{-1} $\quad v^2 = u^2 + 2as$

$s = 215$ m $\quad (1.06 \times 10^4)^2 = 0^2 + 2 \times a \times 215$

$u = 0$ $\quad 1.1236 \times 10^{8} = 430a$

$a = ?$ $\quad a = 261302.33$ ms^{-2}

F=ma
v=u+at
$v^2 = u^2 + 2as$

(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 unsuitable because the forces of acceleration are too great. The number of g's experienced by the occupants would crush them during the acceleration making this method unsuitable for sending a live person to the moon. This force is many thousands times gravity and humans can only withstand a 10g force for short periods of time without injury.