1 The world's tallest building is the Burj Khalifa in Dubai, UAE.

The viewing gallery for the public is on the 124th floor. The lift that visitors use takes 56 seconds to reach this floor. The motion of the lift can be divided into three parts:

- acceleration

- constant velocity of 10 m s^{-1}

- deceleration.

(a) Draw a free-body force diagram for the forces acting on a passenger as the lift rises.

(2)

(b) A physics student of mass 60 kg decides to measure the initial acceleration of the lift. She places a set of scales on the floor of the lift and steps onto them. Whilst the lift is accelerating upwards the reading on the scales increases to 73 kg.

(i) Show that the initial acceleration of the lift is about 2 m s^{-2}.

(3)

(ii) Near the end of the ascent, the velocity of the lift decreases from 10 m s^{-1} to rest in 5.3 seconds.

Calculate the deceleration.

(2)

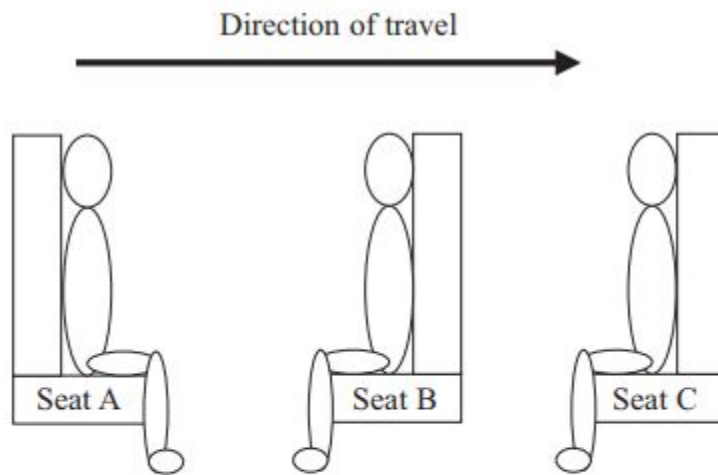Deceleration = ...

Direction of travel

The diagram shows three passengers sitting on a train that is travelling at a high speed in the direction shown. Seat belts are not used on trains.

With reference to one of Newton's laws of motion, explain why seat C is the safest seat for a passenger to be sitting on in the event of a rapid deceleration. You may assume that the seats all remain fixed firmly to the floor and do not break.

....

....

....

....

....

....

....

....

(Total for Question = 4 marks)

*3 During a lesson on Newton's laws of motion, a student says, "We don't really need to bother with Newton's first law because it is included in his second law".

State Newton's first two laws of motion and explain how Newton's second law includes the first law.

(5)

....

....

....

....

....

....

....

....

....

(Total for Question = 5 marks)