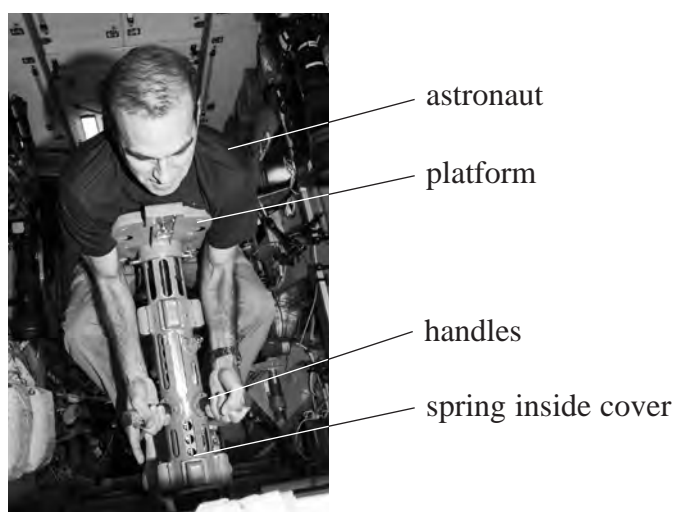


16 On the International Space Station (ISS), astronauts measure their mass once a month using a Body Mass Measurement Device (BMMD).

The BMMD is constructed from a large spring attached to the floor of the ISS, with a platform and handles attached to the spring. The spring is compressed and the astronaut puts his body onto the platform and holds onto the handles, as shown.



(Source: <https://www.nasa.gov/content/nasa-astronaut-rick-mastracchio-3>)

The spring is released and the astronaut and platform oscillate with simple harmonic motion.

An astronaut used the BMMD. The frequency of oscillation was 0.34 Hz.

(a) Determine the mass of the astronaut.

spring constant = 350 N m^{-1}
mass of platform = 5.7 kg

(4)

(b) The distance between the upper and lower points of the first oscillation is 0.29 m.

(i) Calculate the magnitude of the maximum acceleration of the astronaut.

(4)

Magnitude of maximum acceleration =

(ii) Calculate the speed of the astronaut 3.5 s after the start of the oscillations.

(2)

Speed =