4 The piston in the cylinder of a car engine moves in the cylinder with simple harmonic motion. The piston moves between a position of maximum height in the cylinder to a position of minimum height, as illustrated in Fig. 4.1.
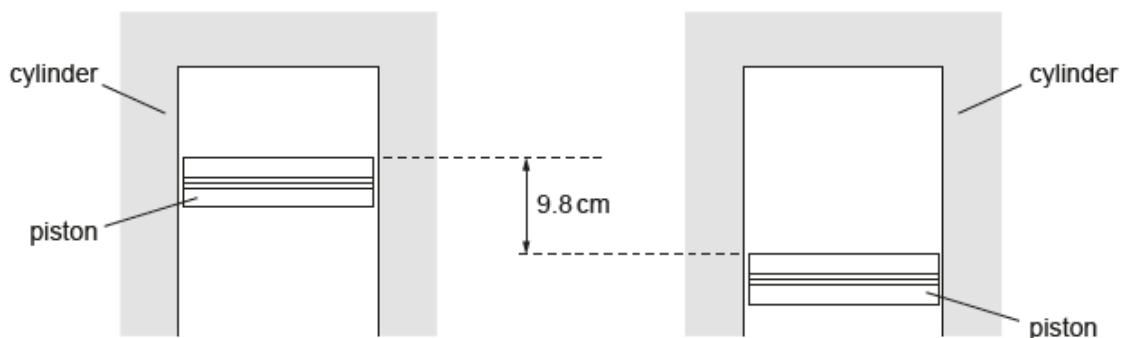

Fig. 4.1

The distance moved by the piston between the positions shown in Fig. 4.1 is 9.8 cm.

The mass of the piston is 640 g.

When the car is moving on the expressway, the piston completes 2700 oscillations in 1.0 minute.

(a) For the oscillations of the piston in the cylinder, determine

(i) the amplitude

amplitude = …………………… cm [1]

(ii) the frequency

frequency = …………………. Hz [1]

(iii) the speed of the piston when its top is 2.3 cm below its maximum height

speed = …………………. m s^{-1} [2]

(b) The acceleration of the piston varies.

Determine the resultant force on the piston that gives rise to its maximum acceleration.

force = …………………… N [2]

[Total: 6]