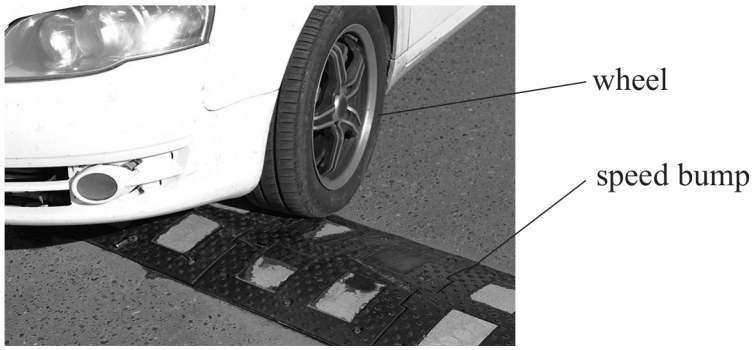
19 The suspension system of a car is a set of springs that allows the body of the car to move vertically up and down relative to the wheels.

A car is driven along a long straight road that has a series of 'speed bumps'. Speed bumps are raised parts in a road, as shown.



(Source: © Sergey Makarenko/Alamy Stock Photo)

At a particular speed of the car resonance occurs. The amplitude of vibration of the car body on the suspension system becomes much larger.

(a) Explain why the amplitude of vibration increases at a particular speed.

(2)

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(b) When a person of mass 65 kg steps into the car, the vertical height of the car above the road decreases by 2.5 cm.

Resonance occurs when the speed bumps are spaced 25 m apart.

Calculate the speed the car is driven along the road. You should consider the car as a mass-spring system.

mass of empty car = 1300 kg

(5)

Speed of car = ...

(c) Explain how damping reduces the large amplitude of vibration of the car on its suspension.

(2)

(Total for Question 19 = 9 marks)