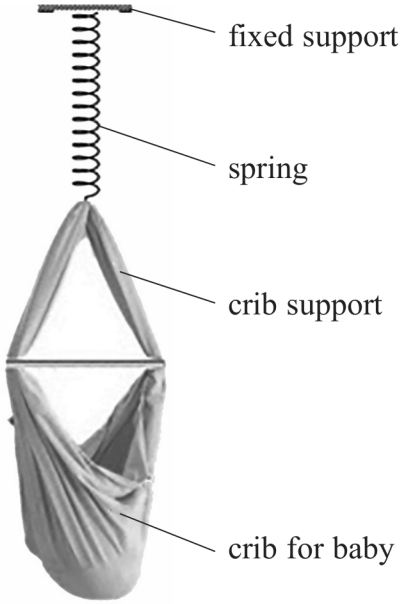
18 A website advertises a baby crib that can be hung from a spring. The crib can be set into vertical oscillation.



The instructions for the crib state that the crib can support a maximum mass of 15.0 kg.

(a) (i) When the crib supports a mass of 15.0 kg the spring extends by 42.5 cm.

Show that the stiffness of the spring is about 350 N m^{-1}.

(2)

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(ii) A baby is placed in the crib and the spring extends to bring the system to equilibrium. The crib is displaced through a small vertical displacement and released.

State why the crib will oscillate with simple harmonic motion.

(2)

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(iii) The baby has a mass of 7.25 kg.

Calculate the period of oscillation of the crib.

mass of crib = 2.55 kg
stiffness of spring = 350 N m^{-1}

(2)

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Period of oscillation of crib = ...

(b) The maximum mass that the spring can support before being damaged is 25.0 kg.

Explain why the instructions state that the maximum mass is only 15.0 kg.

(2)

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(Total for Question 18 = 8 marks)