

4. (II) A fisherman's scale stretches 3.6 cm when a 2.7 kg fish hangs from it. a) What is the spring stiffness constant and b) what will be the amplitude and frequency of vibration if the fish is pulled down 2.5 cm more and released so that it vibrates up and down?

$$a) \frac{F}{-x} = \frac{-kx}{-x}$$

$$k = -F/x$$

$$k = -(-9.806 \text{ m/s}^2 \cdot 2.7 \text{ kg}) / 0.036 \text{ m} = 735.45 \text{ N/m}$$

$$7.4 \times 10^2 \text{ N/m}$$

technically negative displacement, not force

$$b) A = 0.036 \text{ m} + 0.025 \text{ m} = 0.061 \text{ m}$$

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = \frac{1}{2\pi} \sqrt{\frac{735.45 \text{ N/m}^2}{2.7 \text{ kg}}} = \frac{1}{2\pi} (16.5 \text{ /s}) = 2.6 \text{ Hz}$$

$2.5 \times 10^{-2} \text{ m}$ (Sci. Notation)

0.036 m -

only stretch

2.5 cm

7. (II) A small fly of mass 0.25 g is caught in a spider's web. The web vibrates predominately with a frequency of 4.0 Hz. a) What is the value of the effective spring stiffness constant k for the web? b) At what frequency would you expect the web to vibrate if an insect of mass 0.50 g were trapped?

$$a) 4.0 \text{ Hz} = \frac{1}{2\pi} \sqrt{\frac{k}{0.25 \times 10^{-3} \text{ kg}}}$$

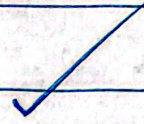
$$25.13 \text{ Hz}^2 = \sqrt{\frac{k}{0.25 \times 10^{-3} \text{ kg}}}$$

$$631.65 \text{ Hz}^2 = \frac{k}{0.25 \times 10^{-3} \text{ kg}}$$

$$k = 0.158 \frac{\text{kg}}{\text{s}^2} =$$

$$1.6 \times 10^{-1} \text{ kg/s}^2$$

$$b) f = \frac{1}{2\pi} \sqrt{\frac{1.6 \times 10^{-11} \text{ N s}^2}{5.0 \times 10^{-4} \text{ kg}}} = \frac{1}{2\pi} \cdot 17.77 \text{ s} = \boxed{2.8 \text{ Hz}}$$



Faded handwritten notes in red ink, possibly describing a physical system or derivation.

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