4. (II) A fisherman's scale stretches 3.6cm 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 2.5cm more and released so that it vibrates up and down?

a) $F = -kx$

$-x \quad -x$

$k = -F/x$

$k = -(-9.80\ N/kg \cdot 2.7\ kg) / 0.036\ m = 735.45\ N/m$

technically negative displacement, not force

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

b) $A = 0.036\ m + 0.025\ m = \boxed{0.061\ m}$ → at equilibrium - no need to add

0.036m - only stretch

2.5 cm

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

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

7. (II) A small fly of mass 0.25g 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 0.50g were trapped?

a) $4.0\ Hz = \frac{1}{2\pi}\sqrt{\frac{k}{0.25\times10^{-3}\ kg}}$

$\cdot 2\pi \quad \cdot 2\pi$

$25.13\ Hz^2 = \frac{k}{0.25\times10^{-3}\ kg}$ ✓

$631.65\ Hz^2 = \frac{k}{0.25\times10^{-3}\ kg}$

$\cdot 0.25\times10^{-3}\ kg \quad \cdot 0.25\times10^{-3}\ kg$

$k = 0.158\ \frac{kg}{s^2} = \boxed{1.6\times10^{-1}\ kg/s^2}$

b) $f = \frac{1}{2\pi}\sqrt{\frac{1.6\times10^{-1}\ N/m^2}{5.0\times10^{-4}\ kg}} = \frac{1}{2\pi} \cdot 17.77\ s = \boxed{2.8\ Hz}$

✓