Answer **all** the questions in the spaces provided.

1 **(a)** A mass m is suspended from a vertical spring attached to a fixed support. The mass is pulled down and held at a vertical displacement of 0.16 m from its equilibrium position, as shown in Fig. 1.1.

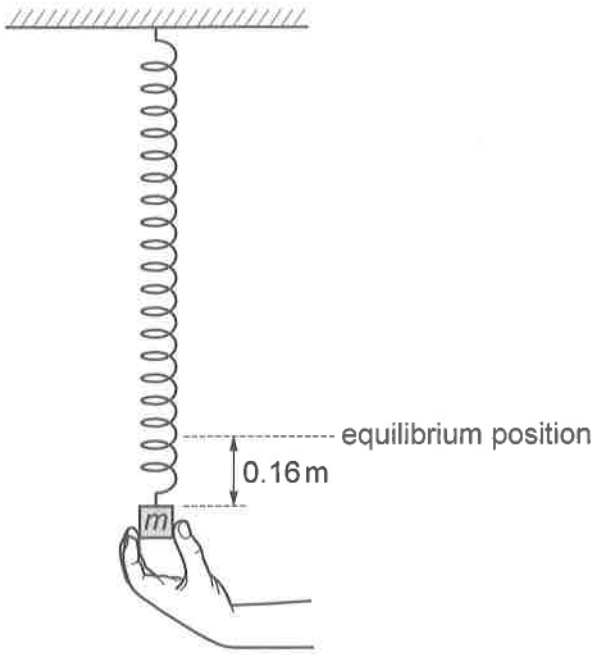

Fig. 1.1

The mass is released.

Ten oscillations are timed using a stop-watch.

The data for the mass and the time, together with their uncertainties, are shown in Table 1.1.

Table 1.1

time for 10 oscillations / s	7.2 ± 0.2
m / g	120 ± 1%

The period T of the oscillations of the mass is given by:

$$T = 2\pi\sqrt{\frac{m}{k}}$$

where T is in s, m is in kg and k is the spring constant in $\mathrm{N\,m^{-1}}$.

Determine the value of k together with its **actual** uncertainty.
Give your answer to an appropriate number of significant figures.

k = ... ± ..... $N m^{-1}$ [4]

(b) The variation with vertical displacement x of the velocity v of the mass on the spring in **(a)** is shown in Fig. 1.2.

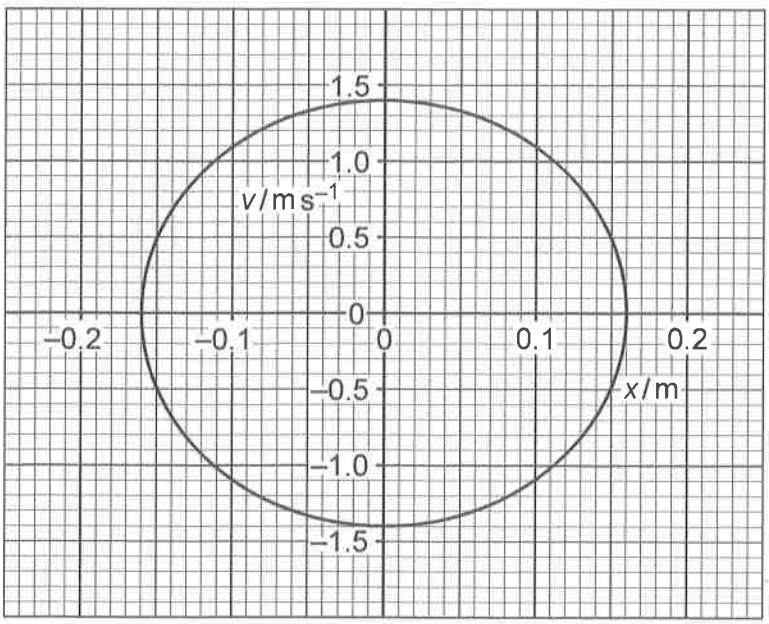

Fig. 1.2

(i) Determine the maximum acceleration a of the mass.

a = ... m s^{-2} [3]

(ii) A light piece of card is attached to the bottom of the mass so that the oscillations are lightly damped.
The mass is displaced vertically and then released as in **(a)**.

On Fig. 1.2, draw the variation of v with x to show the first complete cycle of these damped oscillations. [2]

[Total: 9]