3 (a) (i) Define the *radian*.

.....

.....

.....[2]

(ii) State, by reference to simple harmonic motion, what is meant by *angular frequency*.

.....

.....[1]

(b) A thin metal strip, clamped horizontally at one end, has a load of mass *M* attached to its free end, as shown in Fig. 3.1.

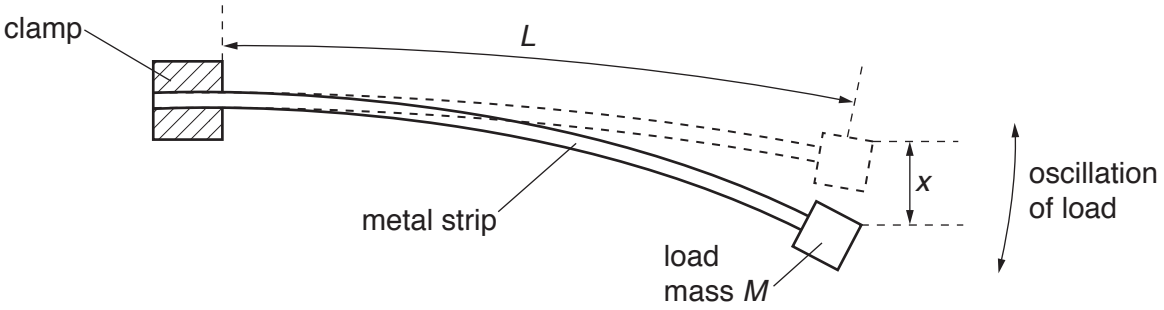

Fig. 3.1

The metal strip bends, as shown in Fig. 3.1.

When the free end of the strip is displaced vertically and then released, the mass oscillates in a vertical plane.
Theory predicts that the variation of the acceleration *a* of the oscillating load with the displacement *x* from its equilibrium position is given by

$$a = -\left(\frac{c}{ML^3}\right) x$$

where *L* is the effective length of the metal strip and *c* is a positive constant.

(i) Explain how the expression shows that the load is undergoing simple harmonic motion.

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.....

.....

.....[2]

(ii) For a metal strip of length L = 65 cm and a load of mass M = 240 g, the frequency of oscillation is 3.2 Hz.
Calculate the constant c.

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

[Total: 8]