1 A beam is clamped at one end and an object X is attached to the other end of the beam, as shown in Fig. 1.1.

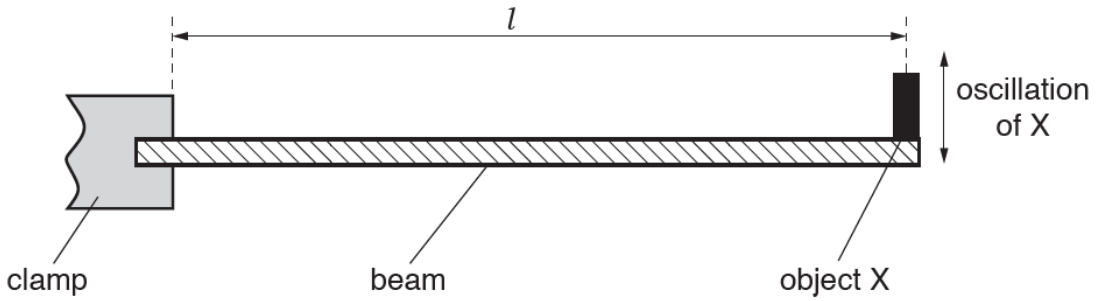

Fig. 1.1

The object X is made to oscillate vertically.

The time period T of the oscillations is given by

$$T = K\sqrt{\frac{Ml^3}{E}}$$

where M is the mass of X,
l is the length between the clamp and X,
E is the Young's modulus of the material of the beam and the unit is kg m^{-1} s^{-2}
and K is a constant.

(a) Determine the S.I. base units of K.

S.I. base units of K ..... [2]

(b) Data in S.I. units for the oscillations of X are shown in Fig. 1.2.

quantity	value	uncertainty
T	0.45	± 2.0%
l	0.892	± 0.2%
M	0.2068	± 0.1%
K	1.48×10^5	± 1.5%

Fig. 1.2

Calculate E and its actual uncertainty.

E ..... ± ..... kg m^{-1} s^{-2} [4]

[Total :6]