2 A light spring hangs vertically from a fixed point. A load of mass m is attached to the free end of the spring and slowly lowered until equilibrium is reached as shown in Fig. 2.1. The spring has then stretched elastically by a distance of x_0.

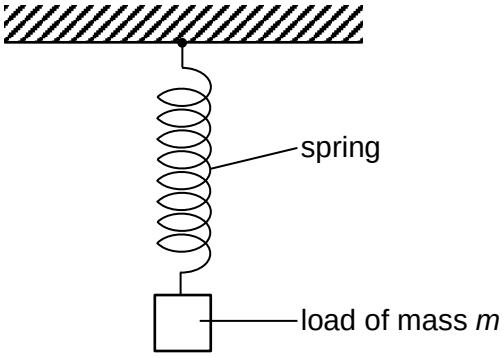

Fig. 2.1

(a) (i) Show, for the stretching of the spring, that the decrease in the gravitational potential energy of the mass is twice the increase in the elastic potential energy of the spring.

[2]

(ii) Account for the difference in the decrease in gravitational potential energy and the increase in elastic potential energy.

.....

..... [1]

(b) The load on the spring is now made to oscillate vertically in simple harmonic motion with amplitude x_0.

Take the lowest point of the oscillation as the position where the gravitational potential energy of the load is zero.

(i) Determine, in terms of m, x_0 and the acceleration of free fall g, the elastic potential energy of the spring when the load is at the lowest point of the oscillation.

elastic potential energy = ... [2]

(ii) Use your answers in **(a)(i)** and **(b)(i)** to draw, on the axes of Fig. 2.2, the variation with position of

1. the gravitational potential energy (label this line G.P.E.),

2. the elastic potential energy (label this line E.P.E.),

3. the kinetic energy (label this line K.E.),

4. the total energy (label this line T.E.).

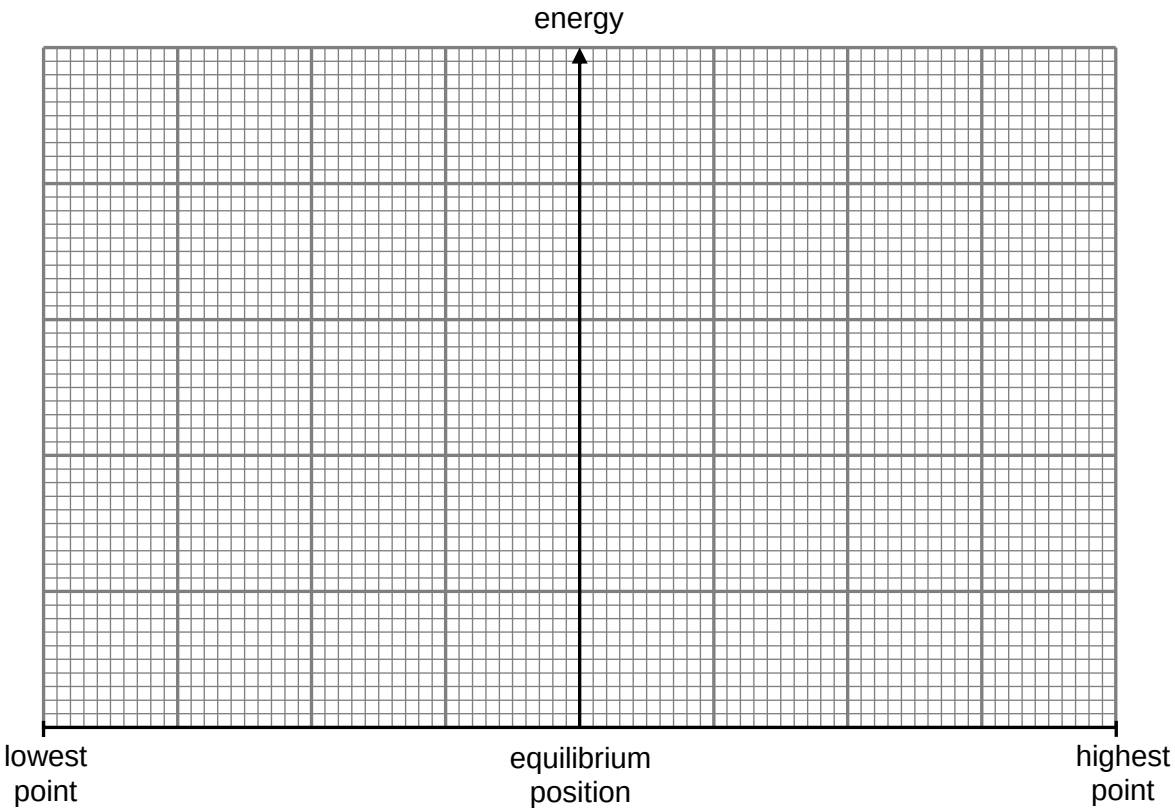

Fig. 2.2

[5]