4 **(a)** A mass undergoes simple harmonic motion.

State, for the motion of the mass, what is meant by the *amplitude*.

……..……
…..

……..……
... [1]

(b) A light helical spring has a natural length of 25.0 cm and a length of 30.0 cm when it is suspended vertically and supporting a 0.25 kg block at its lower end.

A student then pulled down further by a further 5.0 cm.

(i) Determine the spring constant of the light helical spring.

spring constant = …… N m^{-1} [2]

(ii) Hence, calculate the work done by the student.

work done = …… J [2]

(iii) State the total energy of the oscillation.

total energy = …… J [1]

(iv) The student then releases the mass.

The period of the oscillations, T, is given by the following relationship:

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

where m is the mass of the block and k is the spring constant.

Calculate the speed of the mass when it is 2.0 cm below the equilibrium position.

speed = …… m s^{-1} [3]