

- 2 (a) Define simple harmonic motion.

.....  
.....  
.....

[1]

- (b) Calculate the gain in potential energy when a mass of 150 g is raised vertically through 1.0 mm.

gain in potential energy = ..... J [2]

- (c) A simple pendulum consists of a light inextensible string and a bob of mass 150 g attached. The variation of the potential energy  $V_p$  with the horizontal displacement of the bob  $x$  is shown in Fig. 2.1.

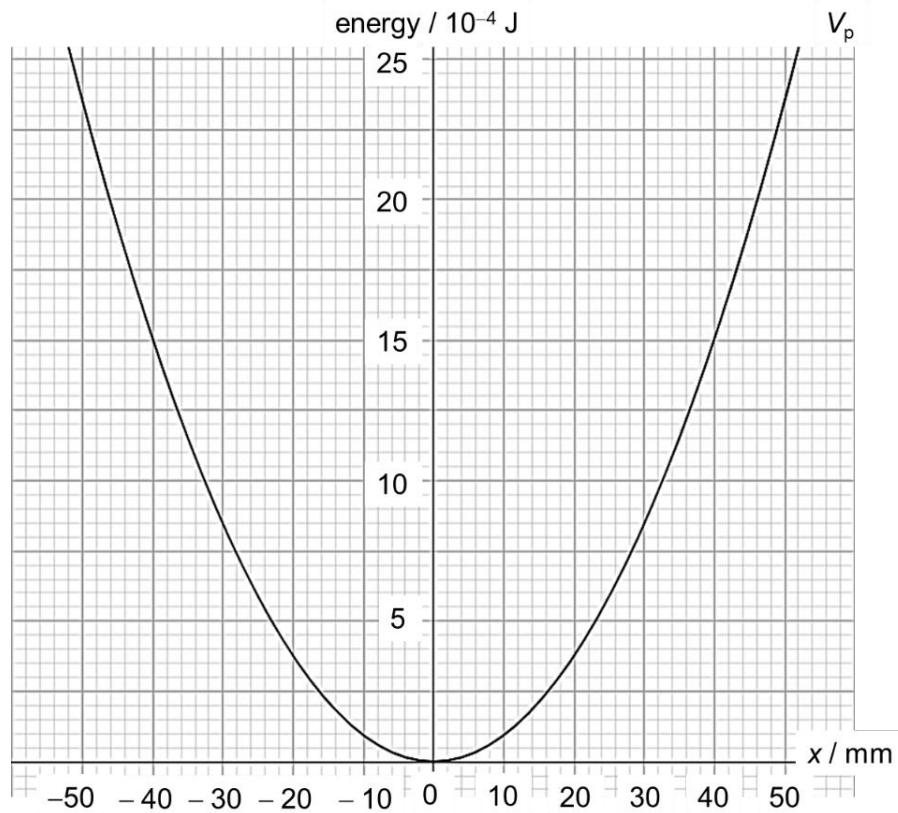


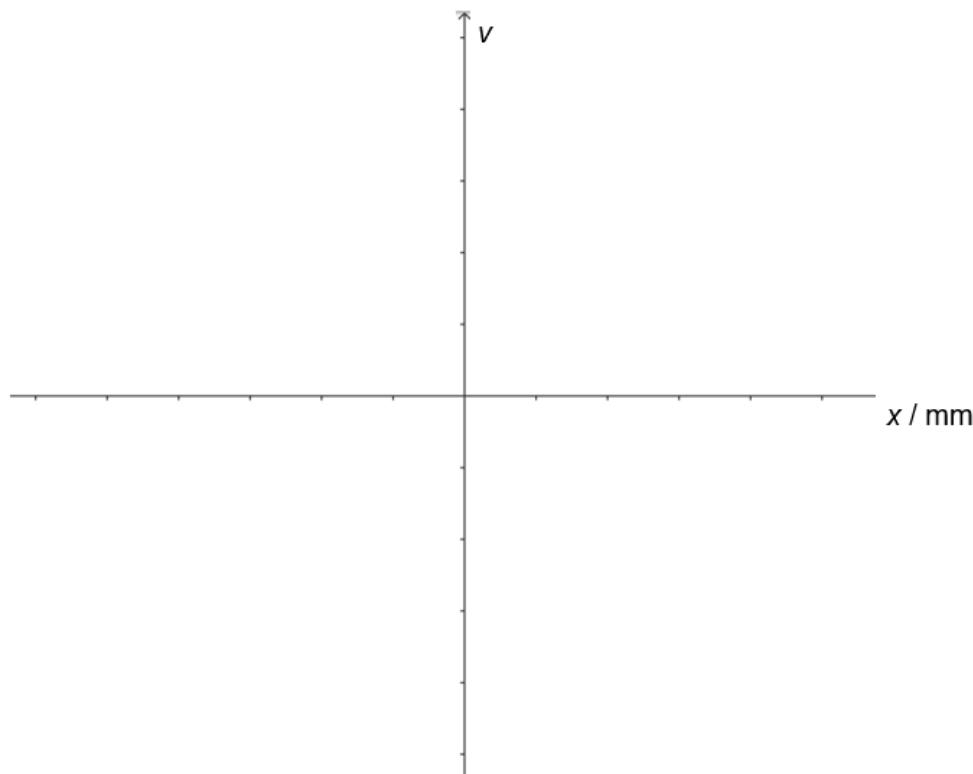
Fig. 2.1

To set the pendulum into oscillation, the bob is displaced sideways (keeping the string taut) until its centre of mass is raised vertically through 1.0 mm and then released. Using your answer in (b), sketch labelled graphs on the axis of Fig. 2.1 to show the variation, as the pendulum oscillates ideally, of  $x$  with

- (i) the total energy. Label it TE. [1]
- (ii) the kinetic energy. Label it KE. [2]
- (d) By reference to Fig. 2.1, or otherwise, write down the amplitude of oscillation of the pendulum.

$$\text{amplitude of oscillation} = \dots \text{mm} \quad [1]$$

- (e) The pendulum achieves velocity  $v$  in the horizontal direction during its oscillation. Using the axis of Fig. 2.2, sketch the variation as the pendulum oscillates, of  $v$  with  $x$ , as air resistance is no longer negligible, starting from initial release position until the pendulum comes to a rest, after 2 cycles.



**Fig. 2.2**

[2]