2 **(a)** State the two conditions for a system to be in equilibrium.

1. .....

.....

2. .....

.....

[2]

(b) A paraglider P of mass 95 kg is pulled by a wire attached to a boat, as shown in Fig. 2.1.

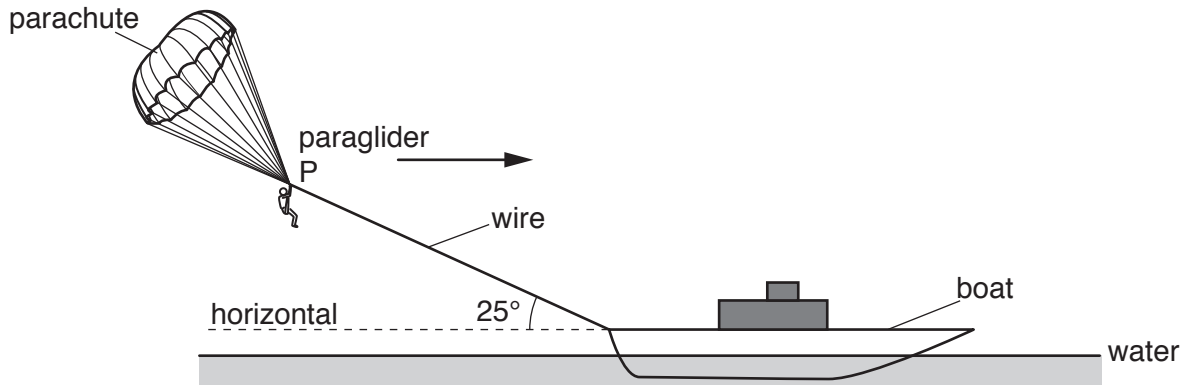

Fig. 2.1

The wire makes an angle of 25° with the horizontal water surface. P moves in a straight line parallel to the surface of the water.

The variation with time t of the velocity v of P is shown in Fig. 2.2.

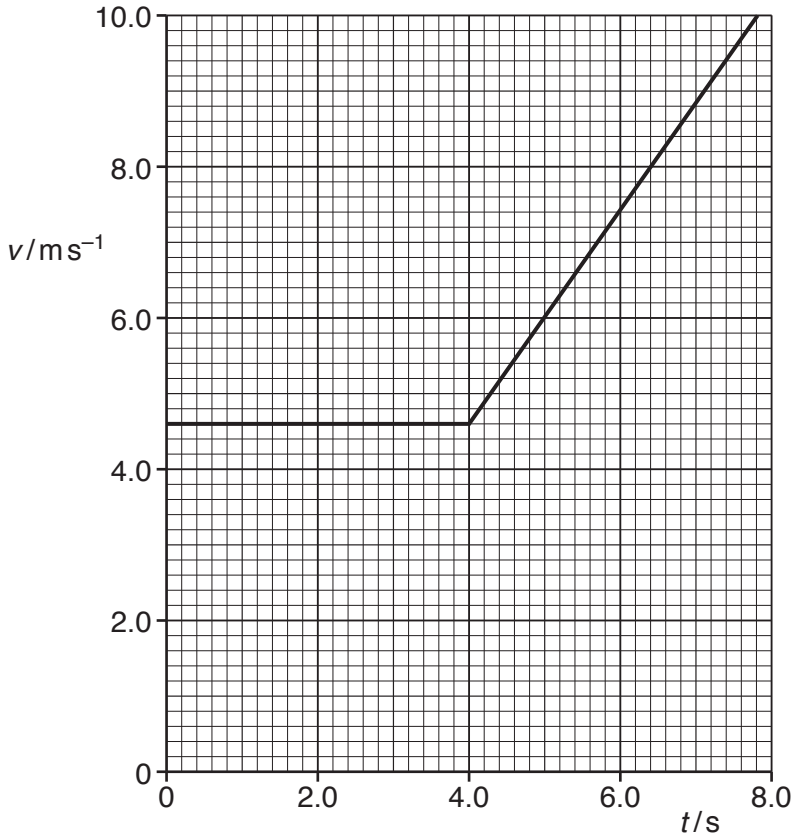

Fig. 2.2

(i) Show that the acceleration of P is $1.4\,m\,s^{-2}$ at time $t = 5.0\,s$.

[2]

(ii) Calculate the total distance moved by P from time $t = 0$ to $t = 7.0\,s$.

distance = ...m [2]

(iii) Calculate the change in kinetic energy of P from time $t = 0$ to $t = 7.0\,s$.

change in kinetic energy = ...J [2]

(iv) The tension in the wire at time $t = 5.0\,s$ is 280 N.

Calculate, for the horizontal motion,

1. the vertical lift force F supporting P,

F = ... N [3]

2. the force R due to air resistance acting on P in the horizontal direction.

R = ... N [3]

[Total: 14]