3 A cyclist is moving up a slope that has a constant gradient. The cyclist takes 8.0 s to climb the slope. The variation with time t of the speed v of the cyclist is shown in Fig. 3.1.

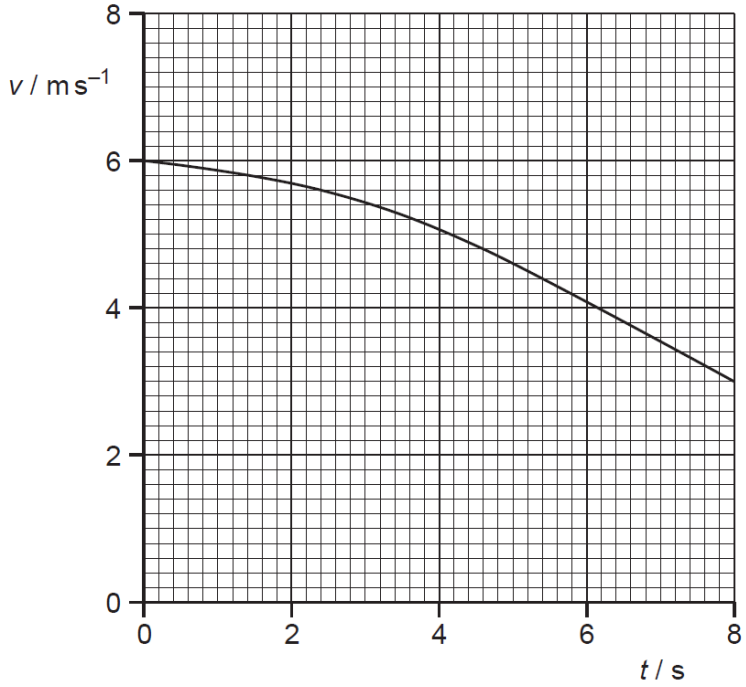

Fig 3.1

(a) Use Fig. 3.1 to estimate the total distance moved up the slope.

total distance = ... m [1]

(b) The bicycle and cyclist have a combined mass of 92 kg. The vertical height through which the cyclist moves is 1.30 m.

For the movement of the bicycle and cyclist between t = 0 and t = 8.0 s,

(i) use Fig. 3.1 to calculate the change in kinetic energy.

change in kinetic energy = ... J [1]

(ii) calculate the change in gravitational potential energy.

change in gravitational potential energy = ... J [1]

(iii) calculate the useful work done by the cyclist to climb the slope, assuming that he pedals continuously so that the useful power delivered to the bicycle is 75 W.

work done = ... J [1]

(c) In reality, some energy is used to overcome frictional forces.

(i) Use your answer in **(b)** to determine the total energy converted in overcoming frictional forces.

total energy to overcome frictional forces = ... J [2]

(ii) Hence, determine the average magnitude of the frictional forces.

average frictional force = ... N [1]

(d) Suggest why the magnitude of the total resistive force would not be constant.

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..... [2]