3 **(a)** Define *velocity*.

.....

.....[1]

(b) A car travels in a straight line up a slope, as shown in Fig. 3.1.

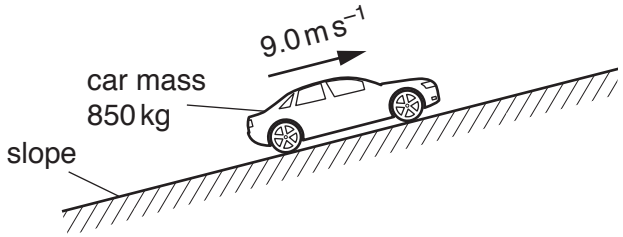

Fig. 3.1

The car has mass 850 kg and travels with a constant speed of 9.0 m s^{-1}. The car's engine exerts a force on the car of 2.0 kN up the slope.

A resistive force F_D, due to friction and air resistance, opposes the motion of the car.

The variation of F_D with the speed v of the car is shown in Fig. 3.2.

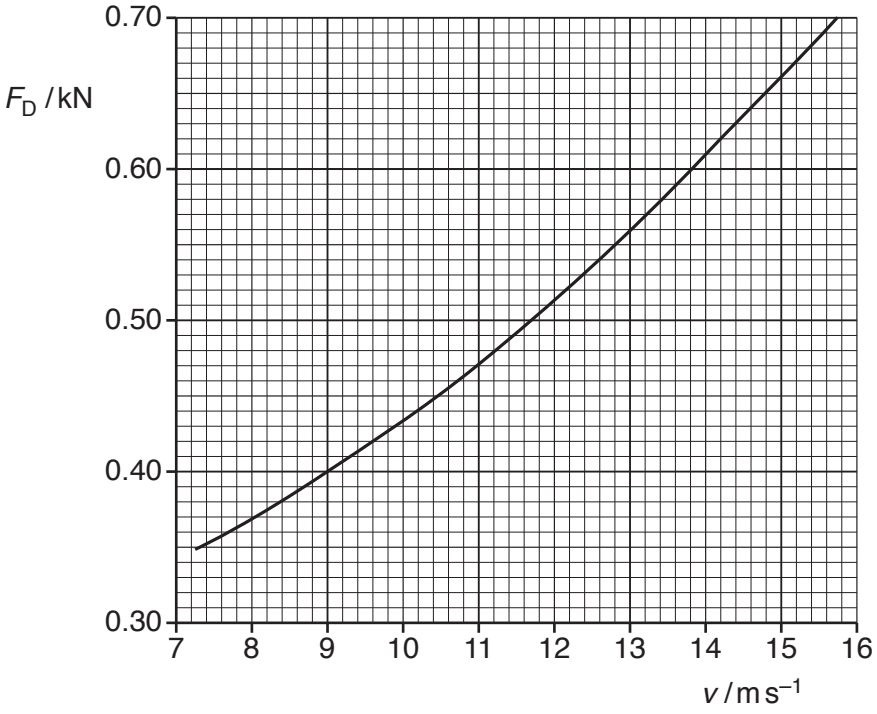

Fig. 3.2

(i) State and explain whether the car is in equilibrium as it moves up the slope.

.....

.....

.....[2]

(ii) Consider the forces that act along the slope. data from Fig. 3.2 to determine the component of the weight of the car that acts down the slope.

component of weight = ... N [2]

(iii) Show that the power output of the car is 1.8×10^4 W.

[2]

(iv) The car now travels along horizontal ground. The output power of the car is maintained at 1.8×10^4 W. The variation of the resistive force F_D acting on the car is given in Fig. 3.2.

Calculate the acceleration of the car when its speed is $15\,m\,s^{-1}$.

acceleration = ...$m\,s^{-2}$ [3]

[Total: 10]