1 **(a)** A cyclist travels at constant speed along horizontal ground. Frictional forces oppose the motion of the cyclist.

Use Newton's first law of motion to explain why the cyclist travels at constant speed.

……..

……..

……..

…….. [2]

(b) The drag force F acting on the cyclist at speed v is given by

$$F = \frac{1}{2} c_D \rho A v^2$$

where c_D is the drag coefficient, ρ is the density of air and A is the frontal area of the cyclist.

Data for the moving cyclist is shown in Table 1.1.

Table 1.1

quantity	magnitude	uncertainty
F / N	23	±2
c_D	0.88	±0.01
ρ / kg m^{-3}	1.2	±0.1
A / m^2	0.32	±0.02

Determine the speed of the cyclist, with its actual uncertainty. Give your answer to an appropriate number of significant figures.

speed = …….. ± ..... m s^{-1} [4]

(c) (i) Derive, from the definition of work done, an expression for power output for the cyclist in terms of velocity v.

[2]

(ii) Calculate the power output P of the cyclist at the speed calculated in **(b)**.

P = …… W [1]