5. A cyclist is travelling on a straight horizontal road and working at a constant rate of 500 W.

The total mass of the cyclist and her cycle is 80 kg.

The total resistance to the motion of the cyclist is modelled as a constant force of magnitude 60 N.

(a) Using this model, find the acceleration of the cyclist at the instant when her speed is $6\,\text{m s}^{-1}$

(4)

On the following day, the cyclist travels up a straight road from a point A to a point B.

The distance from A to B is 20 km.

Point A is 500 m above sea level and point B is 800 m above sea level.

The cyclist starts from rest at A.

At the instant she reaches B her speed is $8\,\text{m s}^{-1}$

The total resistance to the motion of the cyclist from non-gravitational forces is modelled as a constant force of magnitude 60 N.

(b) Using this model, find the total work done by the cyclist in the journey from A to B.

(5)

Later on, the cyclist is travelling up a straight road which is inclined at an angle α to the horizontal, where $\sin\alpha = \frac{1}{20}$

The cyclist is now working at a constant rate of P watts and has a constant speed of $7\,\text{m s}^{-1}$

The total resistance to the motion of the cyclist from non-gravitational forces is again modelled as a constant force of magnitude 60 N.

(c) Using this model, find the value of P

(4)

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Question 5 continued

(Total for Question 5 is 13 marks)