2.

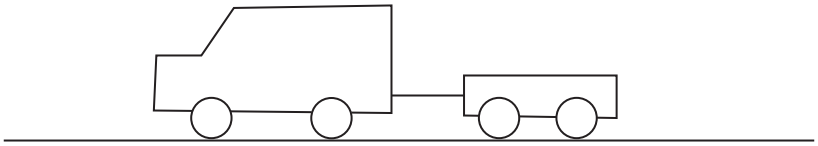


Figure 2

A van of mass 900 kg is moving along a straight horizontal road.
The van is towing a trailer of mass 300 kg.
The trailer is attached to the van by a rigid towbar which is parallel to the direction of motion of the van and the trailer, as shown in Figure 2.

The resistance to the motion of the van is modelled as a constant force of magnitude 500 N.
The resistance to the motion of the trailer is modelled as a constant force of magnitude 200 N.
The towbar is modelled as a light rod.

The engine of the van is working at a constant rate of 18 kW.

At the instant when the speed of the van is $12\,\text{m s}^{-1}$, the tension in the towbar has magnitude T newtons.

(a) Find the value of T

(7)

Later, the van is towing the trailer up a straight road inclined at an angle α to the horizontal, where $\sin\alpha = \frac{1}{15}$
The towbar is still parallel to the direction of motion of the van and the trailer.

The resistance to the motion of the van from non-gravitational forces is modelled as a constant force of magnitude 500 N.
The resistance to the motion of the trailer from non-gravitational forces is modelled as a constant force of magnitude 200 N.
The towbar is again modelled as a light rod.

When the van is travelling with a constant speed of $v\,\text{m s}^{-1}$, the engine of the van is working at a constant rate of 18 kW.

(b) Find the value of v

(4)

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Question 2 continued

(Total for Question 2 is 11 marks)