6. A van of mass 900 kg is moving along a straight horizontal road.

The resistance to the motion of the van is modelled as a constant force of magnitude 600 N.

The engine of the van is working at a constant rate of 24 kW.

At the instant when the speed of the van is $V\ \text{m s}^{-1}$, the acceleration of the van is $2\,\text{m s}^{-2}$

(a) Find the value of V

(4)

Later on, the van is towing a trailer of mass 700 kg up a straight road inclined at an angle θ to the horizontal, where $\sin\theta = \frac{1}{14}$

The trailer is attached to the van by a towbar, as shown in Figure 3.

The towbar is parallel to the direction of motion of the van and the trailer.

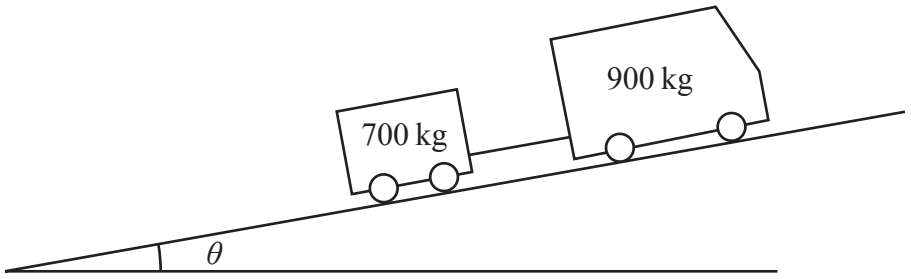


Figure 3

The resistance to the motion of the van from non-gravitational forces is modelled as a constant force of magnitude 600 N.

The resistance to the motion of the trailer from non-gravitational forces is modelled as a constant force of magnitude 550 N.

The towbar is modelled as a light rod.

The engine of the van is working at a constant rate of 24 kW.

(b) Find the acceleration of the van at the instant when the van and the trailer are moving with speed $8\,\text{m s}^{-1}$

(4)

At the instant when the van and the trailer are moving up the road at $9\,\text{m s}^{-1}$, the towbar breaks. The trailer continues to move in a straight line up the road until it comes to instantaneous rest.

The distance moved by the trailer as it slows from a speed of $9\,\text{m s}^{-1}$ to instantaneous rest is d metres.

(c) Use the work-energy principle to find the value of d.

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 6 continued

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 6 continued

(Total for Question 6 = 12 marks)